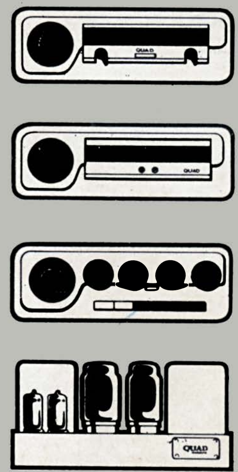
HiFi YEAR BOOK

1965/6



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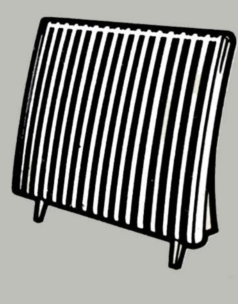

PICKUPS · MOTORS · TUNERS · SPEAKERS · AMPLIFIERS · MICROPHONES · RECORDERS

12/6

Hi-Fi Year Book

1965–1966

Editor - - MILES HENSLOW

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INTRODUCTION

It was 10 years ago ($\pm$ a few weeks) that we approached our first contributor-to-be, Stanley Kelly, and asked him if he would write an article for the first "*Hi-Fi Year Book*"—a survey of the scene as it was in 1956, from studio to disc and home listening. We thought it would make an interesting 10-year landmark if we repeated the request for this 1965/1966 edition; and so, on page 5, Stan Kelly writes again.

The scene has changed dramatically since the first edition of "*Hi-Fi Year Book*" appeared; but, more important than 2-gramme stylus pressures, stereo discs, transistors, nation-wide FM radio, extra-thin tapes and pint-sized speaker enclosures, is the overwhelming demand for high fidelity standards of sound reproduction in the home. The relatively small number of hi-fi enthusiasts of 1956 have merged with the really large audience of music lovers, and the average quality of reproduced music has improved enormously as the result.

Growth, but not all change

The growth and changes in all sections of the audio industry have been reflected in (and have dictated the size of) "*Hi-Fi Year Book*" from edition to edition. And to us, as its publishers, it is always an experience punctuated with points of surprise and pleasure when the occasion demands a reference to past numbers, or a thumbing back through old pages. It is particularly pleasing to note the continuity of names and design, and even to see some of the same items, almost unchanged over the whole period.

After eight editions of "*Hi-Fi Year Book*" had been produced in the Spring of the year, timed to coincide with the Audio Show, it was decided to try an experiment with the 1964 edition. There is something about annual fairs or shows which seems to create "panic". Everyone works with increasing tempo until the very last minute in order to get the very latest of everything on show. This is understandable, but it often results in such changes of design at a later stage that the specification, and even the appearance, is different from the original. And from a publisher's point of view it makes the production of an accurate reference book an almost impossible task.

Autumn Publication

So it was that last year we decided to change the publication time from Spring to Autumn. And as a result (so we are told) the book was a much more useful reference work. From the manufacturer's viewpoint there was more time for the provision of pictures and reliable data. From the reader's viewpoint the overall picture was not only more up-to-date, but it was also presented at a more sensible time of the year—when people had returned from their Summer holidays and, after a good period for reflection, were ready to buy what they wanted for the months ahead.

Because of the success of the change we have decided to keep to Autumn publication, and "*Hi-Fi Year Book*" is planned for September/October each year in future. Further, to bring the cover into line with this later date, we have altered the heading to read 1965/1966, and (next edition) 1966/1967, for the book will of course be in circulation for a full 12 months each year. In point of fact the two-year date-line is far more suitable, and over the years numerous readers have urged us to adopt it. for, as they so rightly pointed out—"A 1962 book which is still selling in the middle of 1963 gives the impression that the items listed in it may well be out of date, whereas in fact many of them have only just managed to get into full production".

Hi-Fi Furniture

A look through the past editions of the Year Book shows a fairly steady increase in the number of pages with each succeeding volume, and although the size of this edition has not yet revealed itself as these introductory columns are written, all the indications are that it will exceed the length of its predecessor. In the main, the directory sections cover the same broad field as the 1964 edition, but this volume (again as a result of readers' requests) opens a new section for *Hi-Fi cabinets and furniture.* It is certainly long overdue, but it was by no means the easiest of sections to compile.

How this new section will develop in future editions depends very largely upon the co-operation that is forthcoming from suppliers. Not the least of the difficulties was the really large range of illustrations compared with the comparatively short and often confusing variety of specifications. However, the main point—the inclusion of this important range of products—has been established, and readers will at least be in touch with a wider choice of possibilities than before. We feel certain that the section will be of great use, and we hope to be able to improve it as we progress.

Many Thanks!

We thank our readers for the many kind remarks about "*Hi-Fi Year Book*" received over the past 12 months, and particularly for the suggestions for its improvement. Some of these, although we would like to incorporate them, are not practicable at this stage. Others we have taken up and are working on. Two, already mentioned here, we have adopted. Another, which could introduce a further new section, is under consideration for the 1966/1967 edition, but since the final decision rests upon the wishes of the manufacturers concerned with it, any further comment at this stage would be premature.

The last ten years have certainly been full of interest and activity, and those enthusiasts who recall the first Audio Fair of 1956—with the first electrostatic speaker, the foretaste of stereo on disc, and the first sampling (by many) of FM as a new source of hi-fi programme material—have plenty to remember. We recall with particular emphasis the remark by a sincerely troubled man when he had read the first of our hi-fi publications. "Very useful and most interesting: but what on earth are you going to use for new material in future editions?"

Perhaps, after 10 years, the audio industry may not trot out quite so many major developments in the next 10 as it has done in the past, but we feel that there are still quite a few hi-fi rabbits to be pulled from the hat.

And on that note we will sign off, handing over to the various authors who have plenty to say in their introductory articles to the various directories in the book. We hope that this edition will be found both interesting and useful. Every possible care has been taken to ensure accuracy, but no responsibility can be accepted by the publishers for errors or omissions.

HIGH FIDELITY REPRODUCTION

by Stanley Kelly

TEN years ago almost to the day, we started collecting material for the first edition of the *Hi-Fi Year Book*. At that time, 'hi-fi' (so we thought) was just emerging from the lunatic fringe type of hobby. Equipment was then being designed and produced which could be operated with some guarantee of success by the uninitiated and although theoretically at least results were extremely good, there was still considerable room for improvement. The bombshell of stereo disc had not then disturbed the orderly progress of development, and the advantages of UHF FM broadcasting were becoming apparent. The subsequent Year Books have accurately chronicled progress but for the newcomer, before attempting to assess the state of the art today, it may be wise to put things in perspective by (somewhat sketchily) tracing in the historical background.

Audio in 1925

The genesis of 'hi-fi' truly started about forty years ago with the almost simultaneous development of electric recording, mains-operated amplifiers, and moving coil loudspeakers. At that time, in this country at least, construction kits were all the rage, and the greybeards amongst us will remember the Cossor Melody Maker, the GEC Music Magnet, the Mullard kits, *et al.* These were all 'grid leak' detector, followed by one or two LF stages, with maximum output of the order of 50 to 100 milliwatts; grid bias arrangements were rudimentary, but the distortion went unnoticed because the response of the average loudspeaker consisted essentially of a large peak at 1,000 c/s, and subsidiary peaks in the 2–3 Kc/s region. Response below 1 Kc/s fell off alarmingly in the horn type loudspeaker, although the balanced armature type unit driving a variety of cones extended the response to a few hundred cycles. Record reproduction was via acoustic gramophones, sound-boxes depending on multiple resonances for output, horns following any but the correct law—but they provided music for the millions.

Electric recording developed in 1924–25 along parallel lines in the United States and England. The Bell Telephone Laboratories in the United States, and Voigt in Britain, produced their first electrically operated cutter heads during 1925, whilst Maxfield and Harrison of Bell Telephone Laboratories developed the electro-acoustic analogue for the design of an acoustic sound-box and logarithmic horn which extended the gramophone's range of reproduction to a range of 125 c/s to 4,500 c/s ± 10 dB!

The introduction of the mains operated valve removed the power limitation on the output stage; it should be remembered that high tension batteries were rated at 60, 90 and 120 volts, and it was only the 'super' powered sets that used the 120-volt battery with a maximum current drain limitation of 10 to 15 milliamps. The price of energy from the dry batteries worked out at about 50s. per unit, so economy in current consumption was mandatory.

Parallel with the introduction of mains operation was the successful exploitation of the moving coil principle (originally invented by Siemens in 1874 and developed by Lodge in 1898) by Rice and Kellogg. Their basic premise of a mass controlled radiator driven by a coil carrying a current in a constant magnetic field still holds today, and the improvements in moving coil loudspeakers over these forty years have been in detail only. I was listening recently to an original BTH RK unit; the bass and the mid frequencies were as smooth as in modern units, although one could still detect rather pronounced 3 Kc/s peak, which was characteristic of all the early loudspeakers (and a lot of modern ones!).

The first commercial record player, the 'Panatrope', made its early appearance with an electrically-driven turntable, a magnetic pickup with a playing weight of 4 oz, and an output of approximately 1 volt. There was a 12-watt amplifier feeding either two RK speakers or a Western Electric 555W drive unit coupled to an 18-ft horn. These installations could hardly be called 'portable', but supplied music principally to skating rinks, dance halls, etc.

Wide Range Reproduction, 1935

The introduction of the talking film was another fillip, and by 1935 good-quality reproduction was firmly established, frequency re-

Fig. 1 *24-channel stereo mixer*

sponse of amplifiers was 30 to 10,000 c/s$\pm$2 dB, with outputs of 5 to 20 watts at 2 per cent distortion. The main limitations were high frequency response of speakers and pickups. Medium wave broadcasting with stations spaced 9 Kc/s also tended to restrict high frequency response. (It may be mentioned in parenthesis that the engineering standards of radio receivers have never been equalled since, and the modern domestic radio receiver performance is a travesty compared with that of thirty years ago.) EMI, amongst others, had produced some magnificent radiograms, with frequency response extending from 30 c/s to beyond 8 Kc/s. Elaborate electrical networks were used to compensate for the pickup resonances, the speakers were correctly loaded acoustically, and the radio receiver with a one-microvolt sensitivity had such features as automatic frequency control, variable selectivity, and inter-station noise suppression, etc.

Telefunken introduced the first modern concept of pickup design, using a lightweight armature and sapphire stylus, whilst Voigt developed his 'long coil' moving coil pickup. Gilbert Briggs with his Wharfedale range was already very active; Goodmans, Rola, Magnavox, and Celestion (to mention a few only) had a wide range of moving coil speakers, and one company, Epoch (now alas defunct), were producing 18-inch-diameter monsters for cinema and public address use. Their 8-inch unit was used by the Post Office Research Department as a standard speaker (because of the exceptionally smooth response from 200 to 4,000 c/s) for microphone testing until the 1950's.

Voigt had produced his Corner Horn, and his basic unit is still being produced today with little other than detail modification apart from the application of permanent magnets to the motor unit. Blümlein had demonstrated stereo on disc in 1931, and had laid down the basic principles from which all stereo records are being produced today, and to which even the Americans pay grudging lip service, but because of the high background noise of the shellac record, heavyweight pickups, steel needles, etc., the time was not yet ripe for commercial exploitation of the ideas.

The next ten years obviously showed spasmodic development because of the interruption by World War II. Hunt investigated the basic causes of distortion in record reproduction, showing the effects of tracing distortion and 'pinch' effect, and during this investigation developed the first pickup with appreciable vertical compliance. Just after the end of the war, Williamson developed his high fidelity amplifier, which was probably the first to exemplify overall negative feedback, whilst concurrently, Leak, working on a parallel idea, produced his Point One series of amplifiers.

Post War Developments

During the war, Decca had evolved a system of wide range recording (termed *ffrr*) using a moving coil cutter head with feedback over the

Fig. 2 *Decca main studio*

whole electro-mechanical system; the frequency range of the system was from 30 c/s to above 30 Kc/s. The results were the magnificent *ffrr* mono 78 rpm records. It was also made the basis of a stereo system using a 'carrier' for one channel—i.e. 30 c/s to 14 Kc/s for, say, LF, the right-hand channel being converted to 16,030 to 30 Kc/s. The parallel development by Teldec using the Blümlein system finally won the day because of the simpler replay amplifier requirements.

The development of the vinyl copolymers resulted in a new resin ideally suited for quantity production of gramophone records; it was tough, virtually unbreakable, had a low co-

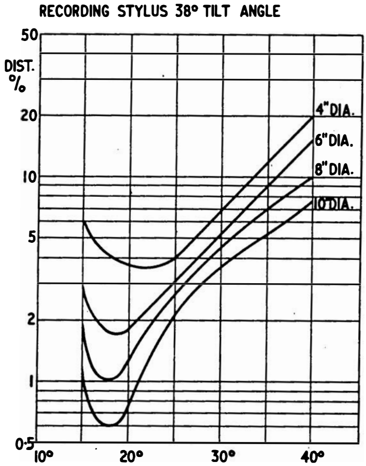


FIG. 3.

VERTICAL TRACKING ANGLE

efficient of friction, needed no fillers, and was relatively cheap to produce. More important, its characteristics were such that it could be processed on the same equipment and by the same techniques as those used for shellac records. The absence of a filler (slate powder on shellac records) resulted in reduced stylus wear, the signal to noise ratio also being considerably increased.

Columbia in the United States were quick to seize on the possibilities of this new material, utilising the high inherent signal to noise ratio of the material and applying pre-amphasis to the upper frequencies, with subsequent de-emphasis in the reproducing chain. This enabled the rotational speed of the record to be reduced from 78 rpm to 33⅓ rpm and still have an improvement of approximately 20 dB of signal to noise ratio over the 78 rpm shellac disc. This lower rotational speed demanded a smaller stylus radius, and the optimum dimensions were accordingly reduced from 2½ thou for 78 rpm to 1 thou for 33⅓ rpm, and sapphire or diamond styli became mandatory.

In 1949, RCA took advantage of these new techniques and, making a virtue out of necessity, mathematically proved that tracing distortion on a 7-inch 45 rpm disc would be lower than either 78 or 33⅓ rpm 10- and 12-inch records. It was stated that over 70 per cent of all classical items in their catalogue of recorded music was of less than 5 minutes' duration, and therefore 7-inch 45 rpm records would give optimum playing time and therefore maximum utilisation of record material. It is ironic that the maximum utilisation should be the propagation of 'Pops'.

At this time, Corrington re-analysed Hunt's original Paper on tracing distortion and laid down the basic precepts for distortion analysis for both lateral and vertical modulated discs which are still in current use! The introduction of 'fine groove' records gave a tremendous fillip to the technical side (not to mention the commercial) of the industry, and there was a spate of new pickups: magnetic, moving coil, ribbon, and crystal. The next ten years to 1955 saw the consolidation and gradual crystallisation of what we now term 'hi-fi'.

At the turn of the century, Vladimir Poulsen developed a system of magnetic recording, but like many other inventions it was several decades before its time. During the 1930's, the Germans applied Poulsen's concepts to current techniques and the Blattnerfon was the result; continuing development during the Second World War, they improved the system still further by using a thin coating of magnetic oxide on a paper tape instead of the steel ribbon used hitherto, also the introduction of high frequency bias eliminated the inherent distortion in unbiassed magnetic circuits. The subsequent use of plastic-based tapes and an improvement in size and composition of the magnetic film together with micro-gapped heads have now resulted in a flexible compact recording system with none of the disadvantages of direct recording on disc.

It was soon realised that here was a well nigh perfect method of recording large symphonic works in that any small errors in interpretation or other blemishes could be edited out of the tape easily and replaced with correct passages. Starting in the early 1950's, the use of tape for primary recording continued to develop until today it has ousted all competition from the field. The use of multi-track tape *(present-day recorders using 1-inch-wide tape have up to eight channels)* made it possible to use localised microphones for soloists or sections of the orchestra and then at a later stage to mix them to give optimum overall performance. The fidelity of modern tape equipment is such that on A-B switching from 'record' to 'replay' it is well nigh impossible to say which is the original and which the recorded signal. Such magnificent records as Decca's stereo *'Götterdamerung'* would have been an impossibility but for the skilful use of the tape medium.

The Last Ten Years

Transistors made their appearance and the end of valve amplifiers in the immediate future was confidently re-predicted at yearly intervals, and still continues! The publication in 1954 by Professor Hunt of his monograph 'Electro-acoustics', announced Bocciarelli's theory of the constant charge electrostatic loudspeaker, although the circuitry (but not the advantages of constant charge) had been disclosed in Riegger's German Patent in 1920. In England, Peter Walker developed the first, and so far as the author is aware, still the only full range electrostatic loudspeaker.

The premature introduction of stereo disc by an American *entrepreneur* in 1956 threw the whole industry into an uproar which took the best part of five years to sort out. Mono cartridges of advanced design, having the attributes of high compliance, low stylus mass, adequate vertical compliance and low tracing distortion, were now common, but the introduction of stereo with its concomitant requirements of two separate generating systems adequately electrically and mechanically decoupled from each other, proved initially an almost insurmountable barrier to the pickup manufacturer and the run-of-the-mill cartridges produced in the next few years were, compared with their mono partners, about a decade behind the times.

Since 1958, development of pickups and recording techniques have progressed enormously and within the last year, RCA announced the 'Dynagroove' system of reducing tracing distortion by pre-distorting the signal fed to the cutting head.

'Hi-Fi' Today

(1) *Recording:* The purpose of high fidelity equipment is to create an exact illusion of the original sound in the mind of the listener. This, of course, is a practical impossibility; even were the whole of the recording and reproducing chain completely free from distortion, the acoustic conditions of the original performance in the studio are generally completely different from those of the listening room, with different reverberation times, eigentones, etc.—the tone colours of the two auditoria are therefore bound to be different. In addition, the acoustic characteristics of the listening room become 'additive' to those of the studio during reproduction. It is the prime job of the control engineer in either the broadcast or recording studio, to give an overall tonal balance to the transmission which, in his opinion, will give the most satisfactory performance to the ears of the listener.

The majority of 'hi-fi' listening programme material is either music or operatic, and the size of the studio is determined almost wholly by the magnitude of the work being performed. For solo instruments, chamber music and small ensembles, small live studios are used, generally with a volume below 3,000 cu ft, and a reverberation time of 0·5 seconds. Microphone placing is critical, because the ratio of direct to reverberant sound must be lower than for direct listening; in addition, there is the added ambience of the listening room. In the case of larger works, more imposing studios are used, with much longer reverberation times, and for the largest symphonies venues such as Kingsway Hall, the Walthamstow Town Hall, the Main Studio at Maida Vale, are representative examples.

The majority of present-day recordings of serious music is two-channel (i.e. stereo). There are several schools of thought as to the correct microphone techniques; using (a) the original Blümlein method of coincident pressure gradient microphones with their responsive axes at 90°; (b) the side and middle microphone technique, again using co-incident microphones with different directivity patterns; (c) spaced microphones in which the spacing may be between 1 and 10 ft; (d) a number of microphones (up to 24 in extreme cases) each adjacent one or more instrumentalists, which are then mixed to give the correct tonal balance. Sometimes as many as eight tape channels may be used, which are then further mixed to give the correct stereo presentation; and (e) a mixture of any or all of the foregoing.

There are violent clashes of opinion as to the relative merits of the various systems and it is rare for two recording engineers to agree as to which is the correct or even the best method of obtaining the final intelligence. The listener has the ultimate choice and must, willy-nilly, become the final arbiter.

Although the BBC generally use ribbon microphones for their sound broadcasting, the majority of recording microphones are condenser, generally of variable field pattern, in which the microphone will behave as a pressure, pressure gradient, or cardioid unit, by altering the polarising voltage of one element: two such transducers are mounted in the same case, the angular position of one being capable of variation relative to the other unit. Pre-amplifiers (generally valve, although transistorised versions are now making their appearance) are built into the base of the microphone, and the low impedance output can be run for several hundred feet to the mixing amplifiers.

Most broadcast and all disc material is initially recorded on tape. Speeds of 15 or 30 ips are normally used, and the current tape recording machines will accept up to 1-inch-wide tape and a maximum of eight channels. The tape recorders are a miracle of ingenuity, the tension of the tape is kept automatically constant within 0·1 of a gramme, irrespective of spool diameter, this being effected by a servo system, in which the voltage applied to the take up and feed spool motors are independently controlled to maintain exact tension. Wow and flutter are incredibly low, usually less than 0·01 per cent, under all conditions of service. Frequency response is genuinely ± 1 dB from 30 to 15,000 c/s, with signal to noise ratios of 60 dB or more. (Note this, in contrast with domestic tape recorders which have claimed frequency responses considerably in excess of the above figures but generally within ± 3 dB limits and signal to noise ratios 20 dB worse than those mentioned above.) These latest recorders are not cheap, £3,000 being the average price per unit.

The recording lathe is likewise fabricated to the same precision limits, and nowadays is completely automatic in operation. The various sequences, scrolling in, scrolling out, recording, etc., are predetermined, set up on a control panel, the tape replay mechanism is started, and the control system takes over. In order to maximise the playing time of a disc, variable groove spacing and depth are used. With this, a signal is obtained from a separate head on the tape replay mechanism, spaced in time one revolution ahead of the replay head. The amplitude, frequency content, and ratio of vertical to lateral modulation depth is then used to control the speed of the lead screw carrying the recording head, and also the absolute depth of the cutting stylus. The effect of this is that during loud passages the groove is cut deeper and spaced further apart from its neighbours than during quiet passages. This brilliant invention, due to Arthur Haddy of Decca, has resulted in an increase in the dynamic range of up to 20 dB and an increase in playing time of up to 25 per cent in standard orchestral works.

The cutting heads are of the moving coil type, of which the Western Electric 3D and the Teldec are the most widely used. Both are 'feedback' type, in which a voltage, theoretically proportional to the velocity of the cutting stylus, is generated and fed back to one of the early amplifying stages, phase correcting networks being applied where necessary to maintain complete stability.

In the Western Electric head, the two driving coils are mounted at 45° to the horizontal, and connected through long cantilevers to the stylus support. The feedback coils, which are adjacent the driving coils, are thus spaced some distance from the cutting stylus and due to the compliance and mass of the links, together with another mechanical mesh of the stylus support, do not exert appreciable control at frequencies over about 7 Kc/s. The lack of feedback control at high frequencies manifests itself as 'wiggles' in the response; these are not necessarily as serious as would appear at first sight because they can be equalised by electric networks, but the frequency and amplitude of these 'wiggles' is dependent to some extent on the conditions of the lacquer of the master disc at the time of recording.

In the Teldec unit, the driving coils are parallel and the system rocks about its centre of gravity. The cutting stylus is very rigidly connected to the driving coils, and the two feedback coils are relatively close to the stylus tip. The feedback is applied to an early stage of the amplifier, as in the Western Electric system. Because of the smaller overall dimensions, and absence of coupling links, adequate feedback control is obtained at substantially higher frequencies than in the Western Electric system; the response of the cutter is better than ± 1 dB from 30 to 15,000 c/s.

There are two important differences in these systems. In the Teldec system, the cutting stylus is substantially vertical and moves in a vertical plane, and the modulation angle of the groove is substantially vertical. In the Western Electric system, the plane of the cutting stylus is 23° from the vertical, and it was tacitly assumed that the modulation angle of the groove would likewise be 23°. It was subsequently found that because of stylus longitudinal compliance and spring back of the lacquer, the effective angle of the recorded groove is vertical.

In the United States, the majority of Hi Fi pickups are of the moving magnet type, and have tracking angles that vary between 5° and 45° from the vertical. This tracking angle error results in intermodulation distortion. In order to rationalise this state of affairs, the Americans have now fixed an effective angle of 15° for the reproducing stylus system, and have accordingly adjusted the effective angle of their cutting heads to give the same effective angle (15°) on the record groove. The fact of the matter is that the situation is chaotic! records have been cut with modulation angles varying from a lead of 10° to lags of anything up to 20°, and pickups have had trailing angles of from zero to 45°.

It is fortunate (?) that it is only very recently that the reduction of distortion to microscopical values in other parts of the chain has made this latest nightmare apparent. Be that as it may, 99 per cent of all distortions are still in the reproducing rather than the recording or transmission side of the business. Graph, **fig. 3** shows the distortion caused by vertical tracking angle error. A Westrex cutter was used with an actual angle of 38°, minimum distortion occurs when the tracking angle of the replay stylus is 17°. The numbers on the curves relate to groove diameter and it is seen that distortion increases towards the centre of the record. The distortion figures relate to total harmonic distortion of a 400 c/s wave at an rms velocity of 8·8 cm/sec.

Reproduction by means of a gramophone record unfortunately suffers from a number of basic distortions which have no counterpart in recording/reproducing systems of other types. These distortions, due to the geometry of the system, are the result of cutting the groove with a flat-faced chisel and reproducing it from a hemisphere. Although modern stereo records are recorded in what is known as the 45°/45° method (that is, the left- and right-hand information is carried by the independent modulation of each groove wall), it can also be thought of as a combination of lateral and hill and dale modulations. This latter system is more amenable to a mathematical investigation into the various forms of distortion mentioned above. These distortions are summarised here, and graph, **fig.** 3 shows the total effect of these distortions. They represent the most serious form of distortion in the reproducing system today.

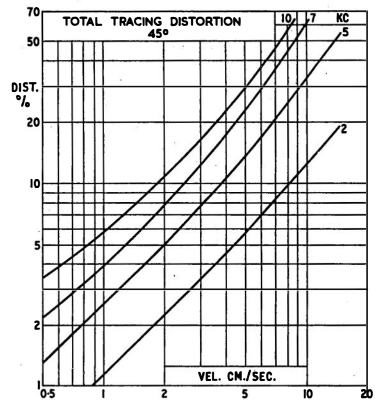


FIG.4.

Recorded signal	*Description of distortions*	*Order of harmonics*	*Direction of distortions during replay*
Vertical	Tracing distortions	2f, 3f, 4f, 5f, 6f	Vertical components
Lateral	Tracing distortions	3f, 5f	Lateral components
Lateral	Pinch effect distortions	2f, 4f, 6f	Vertical components

The basic method of alleviating the distortion is to reduce the stylus tip radius. There is, unfortunately, a lower limit determined by the 'sharpness' of the 'Vee' at the bottom of the record groove, and also by the greatly increased attrition of the stylus point as the radius is reduced.

One method, which has a fair measure of success, is to use a stylus tip of elliptical form, in which the major radius is perpendicular to the groove direction, and the minor radius parallel to it. The net effect is that the stylus point is supported well clear of the groove bottom by means of the major radius, but the effective radius to the groove modulation is the minor one. Optimum values are major radius of 0·7 thou, and minor radius of 0·3 thou. Unfortunately, when these elliptical styli were first used, a number of manufacturers in their enthusiasm specified values of 0·9 thou for the major radius; this is too large, because the minimum groove width under maximum modulation can be less than 2 thou, and the maximum tip radius should not exceed 0·7 thou if it is not to ride on the 'horns' which appear at the interface between the groove and the record surface and result in an extra form of distortion. For this reason, microgroove tips of nominal 1 thou radius should not be used for stereo reproduction, entirely apart from increased tracing distortion.

As mentioned earlier, thought has been given to reducing the effect of the various tracing distortions by 'pre-distorting' the signal by an equal and opposite amount to that generated in the reproducing process, thus cancelling the distortion. It was first propounded by MacNair in 1938, but recording techniques were insufficiently advanced at that time to take advantage of it. Later, Fox and Woodward of RCA investigated this theory, produced an electrical analogue which compensated for the second harmonic components of tracing distortions in stereo records. In this case, the recording signals were phase modulated by means of a delay line, the time of which alters depending on the instantaneous value of the recording amplitude and the groove radius. (It will be remembered that the longitudinal velocity of the groove decreases as it approaches the centre of the record.) Thus, the 'Dynagroove' recording system was born. It does improve the quality by reducing second harmonic distortion, but as shown in the table above, in addition to the second, odd and even harmonics up to the sixth are important.

Last year, Reddlich and Klemp of Teldec described a new simulator which corrected for the squared and cubed components of tracing distortion in both lateral and vertical directions: briefly, the method was to matrix the signal into vertical and lateral components, generate the square and cube harmonics for both the lateral and vertical signals, correct the phase, re-mix, reform the matrix into two 45° channels, and apply to the recording head. The result is that when replay stylus of the correct dimensions is used, the second and third harmonics are reduced by 15 and 12 dB respectively. Quite obviously, in this or in any other system of tracing distortion reduction, if a stylus of other dimensions is used, compensation will not hold. However, using normal commercial limits on styli, the debasement of harmonic reduction is only 3 dB. When correctly applied, the maximum tracing distortion is reduced from approximately 30 or 40 per cent at peak levels to 2 or 3 per cent, which is more than comparable to the inherent distortions of the rest of the system.

The BBC's FM transmissions are now firmly established, and though the upper frequency response is still somewhat limited by landlines and BBC policy, and though multiplex stereo transmissions are still on an experimental basis only, the freedom from distortion and extremely good musical balance leave little to be desired.

(2) *Reproducing:* FM receivers today tend to become simpler, but the second detector still generates a relatively large amount of distortion when compared with the rest of the electronic system. What is mandatory is that an effective antenna system be used with the FM receiver in order that adequate limiting be obtained to ensure optimum signal to noise ratio and correct operation of the second detector.

The present tendency for high fidelity systems is to commence with the record reproducer unit, amplifier and speakers, with the FM tuner noted above as a first priority addition; a tape recorder coming somewhat lower on the list of priorities.

Starting with the record reproducer, if classical music only is to be played, the gramophone turntable requires only one speed ($33\frac{1}{3}$ rpm), or two speeds if the 45 rpm 'Pops' are wanted. The writer can see no justification whatever for producing gramophone turntables with $16\frac{2}{3}$ and 78 rpm positions on the speed control. In ten years he has only come across one $16\frac{2}{3}$ rpm record (*Tales of Mystery and Imagination* by Edgar Allen Poe) and the technical performance was only matched by the contents! There are no 78 rpm records being commercially pressed for issue in England today, and most of the major historic 78 rpm performances have been re-issued on LP.

Although leading manufacturers have issued alleged 'hi-fi' record changers, the writer can find no justification for altering his statement of ten years ago that 'it (the turntable) should be without automatic stop and should most certainly not be a record changer'. Apart from attrition of the centre hole of the record, slip and dust damage the record surfaces and most important is the change in effective vertical angle of the stylus and its concomitant introduction of additional (unnecessary) distortion.

A heavy, well-balanced turntable, running in adequate bearings, is mandatory and the current tendency for reducing the power of the prime mover is to be deprecated. When a record cleaning device such as the Dust Bag is used at the same time as the record is being played, the turntable should not vary in speed from beginning to end of a 12-inch record. Some magnetic pickups have a considerable external magnetic field, and if the turntable is ferrous, either the counter-balance of the pickup must be adjusted to give the correct playing weight, or a packing disc must be placed between the record and the turntable.

It is unfortunately true that the majority of transcription turntables still use a shaded pole motor which has a considerable (and distorted) magnetic field and induced hum can be troublesome if the position of the pickup is such that it comes within the hum field of the motor. The question of speed control is a matter of personal opinion. The musical purist may claim to hear a difference in pitch of 2 cents, but I am reminded of an experiment carried out by Gilbert Briggs some time ago: he recorded a particular composition (a) at the normal speed; (b) plus 10 per cent; and (c) minus 10 per cent. These three versions were then played at random before a panel, who were not told about the difference in speed, but invited to comment on the differences. Three out of twenty detected some difference, but only one identified the difference, whilst one observer said *'I am almost sure that they are all by the same composer'!*

Gramophone pickups come in all shapes, sizes, and colours (and prices, which are not necessarily related to performance); they come as cartridges or complete with tone arms of varying degrees of complexity. They can be summarised as: crystal (using Rochelle Salt as a transducer); ceramic, which are actually crystal cartridges but using a ceramic material, usually Lead Zirconate, as the transducer; moving magnet, in which the generating element *is* a moving magnet inside the pickup coils; variable reluctance; and moving coil. Crystal cartridges are the cheapest and, *ipso facto*, the most popular. They are easy to manufacture, rugged, temperature sensitive and unsuitable for tropical use. Ease of manufacture should not be confused with mechanical simplicity. The crystal mechanical resonance(s) lie within the audio band, and elaborate precautions have to be taken at the design stage to damp out these resonances; because two completely separate generating systems are used, they must be mechanically de-coupled from each other, whilst still ensuring adequate drive in the wanted plane of motion. Present-day crystal cartridges are a marvel of ingenuity, but cannot by any stretch of the imagination be termed 'hi-fi' in the strictest sense. The response is virtually a series of controlled resonances, which can be seen by the erratic crosstalk/frequency values. Because of the complexities of the 'front end', the stylus mass is considerably greater than other types, usually of the order of 10 milligrammes, although compliances of the order of 5×10^{-6} to 10^{-5} cm/dyne are common. Because of their high output, they are used almost exclusively on the cheaper forms of reproducer.

Ceramic cartridges follow almost exactly the same philosophy as the Rochelle Salt crystal cartridge, except that being impervious to moisture they are suitable for tropical use. But, like the crystal cartridge, because the crystal supports, driving members, etc., are copolymers of Vinyl Chloride, which have considerable temperature coefficient of elasticity and hysteresis loss, both the sensitivity and frequency response, not to mention crosstalk, vary with temperature.

Moving magnet cartridges are the most efficient transducer in terms of magnet efficiency, and because of this, signal to noise ratio is extremely good. Compliance in all directions can be made extremely high, sometimes approaching 3×10^{-5} cm/dyne, despite advertising claims, the writer has not yet measured any moving magnet pickup with a tip mass of less than 2·7 milligrammes, and the majority lie in the 4 to 7 milligramme region. Crosstalk is commendably low, and because a PVC type material is used for the suspension, the high frequency resonance is low amplitude. Apart from the rather high tip mass, they suffer from several minor disadvantages: in a number of cases there can be appreciable longitudinal motion of the stylus resulting in an insidious form of transient distortion. Also, torsional resonance can produce untoward effects in both the transient response and crosstalk.

Moving coil pickups have inherently a lower generated distortion than any other type of pickup; the sensitivity and hence signal to noise ratio is not as high as in the moving magnet type. The effective compliance can be made any reasonable value; tip mass is of the order of 2 milligrammes. On the models tested there has been no appreciable longitudinal motion, and some torsional resonances are apparent, but because of the geometry of the moving coils, do not intrude on performance.

Variable reluctance type of cartridges basically offer the widest frequency response. They are mechanically the simplest type of cartridge, and can be produced so that the resonances are completely outside the audio frequency range. Tip mass can be below 1 milligramme, and compliance any reasonable value. $1{\cdot}5 \times 10^{-5}$ cm/dyne lateral, and 7×10^{-6} cm/dyne vertical are average.

Unlike all the other types of generators, these cartridges work on a sum and difference principle in that the generators proper are responsive to lateral and vertical motion and not 45°. By suitable connection to the generating coils electrical outputs proportional to the velocity of the styli in the two 45° directions are obtained. There is, however, one minor snag with this type of cartridge: in all other cartridges, the generating systems are completely independent electrically, therefore loading of one channel does not affect the performance of the other one. With summation type pickups, where the sensing coils are common, any current flowing in one circuit will result in a voltage being generated in phase in the other one, and this will impair the crosstalk figures.

For this reason, minimum load impedances of 50,000 to 100,000 ohms are mandatory, and the common practice of using a low input resistance for record equalisation in transistor amplifiers cannot be applied to these cartridges.

We will mention, *en passant,* a revolutionary type of pickup, of which the first generation are just making their appearance in the United States, euphemistically known as the 'Transistor' pickup. This description is incorrect, the generator is *not* a transistor, but a 'piezo-resistor', that is, an element in which the resistance changes with applied pressure. For some years now, micro-miniature strain gauges have been used in the aircraft industry, using the same semi-conductor materials used in the manufacture of transistors.

One company, using two of these tiny strain gauges, have now produced a pickup with startling claims for sensitivity, frequency responce, etc.; not all these claims have been met, however. The individual strain gauges are connected in a modified bridge circuit fed from about 5 volts; movement of the stylus results in a variation of resistance of the strain gauge and because of the circuit configuration, this variation in resistance is converted into a voltage. When used in low impedance transistor circuits, power gains of 30 dB relative to piezo crystal devices are obtained, and because the pickup is virtually an 'amplitude'-operated device, mechanical correction within the pickup for recording characteristics is substantially the same as for crystal devices, resulting in very simple pre-amplifiers. The manufacturers claim a saving of two transistors, together with all the equalisation networks per channel.

To summarise, crystal cartridges have a high output (about 0·3 volt), do not require any equalisation in the amplifier, but frequency response, crosstalk, and stylus mass are inferior to other types. Ceramic cartridges are tropical proof, have approximately the same mechanical and electrical characteristics, have a sensitivity of some 6 to 10 dB less than crystal units, and suffer the same defects in performance. Moving magnet, moving coil, and variable reluctance are velocity operated devices, and therefore require equalisation for recording characteristics. They are essentially wide range high fidelity units, with outputs of a few millivolts only, and require considerably more amplification than crystal devices.

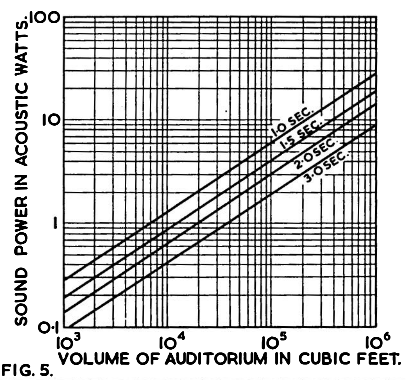


FIG. 5.

The question of which pickup to choose is largely a question of the depth of one's pocket, remembering that the amplifier must match the pickup for input impedance, voltage sensitivity, and equalisation. 'Transistor' pickups have yet to prove themselves, and although they offer some advantages on simplified circuitry in transistor amplifiers, they are at present extremely costly and by no means meet their claimed performance; but with the rapid development of semi-conductor devices, there is no reason why, in the future, these should not only have the same performance as the highest quality magnetic devices, but have sufficiently high output to feed an equalised signal directly into the power amplifier.

So far, we have discussed the pickup unit only, and in the absence of sky hooks or other esoteric devices, some form of carrier must be used. With one or two exceptions, all crystal, ceramic and moving magnet pickups have two-hole fixing on internationally agreed ½-inch centres, the majority of turntable manufacturers offer a tone arm with similar fixing centres, thus the user can fit the cartridge of his choice to any turntable. Additionally, tone arms are being produced by specialist manufacturers, each with its own special features. The requirements for the tone arm can be summarised as follows: the main pedestal must be truly vertical and frictionless, stiction should be a minimum, and any viscous damping introduced into the pedestal for the purpose of reducing the amplitude of the low frequency resonance of the pickup system should not be used as an excuse for shoddy workmanship on this point; likewise, the horizontal pivot should also be blameless.

Whether a 'unipivot' or more complex bearing system for the tone arm is used, the system should be dynamically balanced when the pickup is in the operating position. That is, in addition to the longitudinal balance (plus the additional mass to effect the correct playing weight) the pickup should be balanced laterally; there must be no tendency for the head to turn on its axis, and the addition of mechanical bias to counteract side thrust is worthwhile.

The low frequency resonance is inversely proportional to the square root of the product of the total effective mass related to the stylus tip of the cartridge and tone arm, and the cartridge restoring force (compliance), and varies between 3 c/s and 45 c/s.

Although modern turntables are relatively rumble free, it is wise to ensure that the resonant frequency mentioned above is below 22½ c/s (the 'slip' frequency of induction motors); at the same time it must be higher than the resonance frequency of the turntable or motorboard system (usually 3 to 5 c/s). Should a relatively low compliance cartridge be used with a low mass arm, the combination may resonate at a frequency greater than 30 c/s, then trouble will probably result due to the pickup 'groove jumping'! This is caused by the high mechanical impedance of the pickup at resonance which in turn requires greatly increased playing weight, and this resonant frequency can have considerable influence on ultimate low frequency response, motor rumble, and mechanical and acoustical feedback from the loudspeaker system. With modern high compliance cartridges the lower frequency (3 cps) can be approached if the tone arm mass is excessive, and to this end modern tone arms are being designed to have minimal effective mass in order to bring the resonant frequency in the 10 to 15 c/s region, which is the most desirable value.

(3) *Amplifiers and Speakers:* As with pickups, amplifiers can come in all shapes and sizes, and although 3+3 watt amplifiers are on offer, about 7 watts rms per channel is the minimum value for serious 'hi-fi' listening. The power output of the amplifier is determined basically by two parameters: the volume and damping of the listening room, and the efficiency of the speakers (in modern flats and houses, sound insulation between the listening room and the neighbours may also condition maximum volume).

The sound level of normal conversational speech at 30 cms is about 1 dyne/cm^2. The maximum level of a large orchestral crescendo in the front row of the Festival Hall is about +40 dB ref. 1 dyne/cm^2. This is a very loud sound! For normal reproduction of symphonic works a maximum level of +30 dB (104 phons) is more than adequate in small 'live' rooms; the power requirements are reduced by a further 3 dB due to resonances in the room! At the same time, resonances in the speaker system, especially in the middle frequency range, can give an apparent increase in level, usually with increased fatigue after prolonged listening.

The graph, **fig. 4** shows the relation between auditorium volume and sound power to maintain a maximum level of +30 dB ref. 1 dyne/cm^2, assuming average reverberation times of 1 to 3 seconds. The acoustic power required for a given sound level is inversely proportional to the reverberation time; it can therefore be easily calculated for any individual listening room. The power output of the amplifier is therefore determined by the size and reverberation of the listening room and the loudspeaker efficiency! Generally, the smaller the speaker the lower the efficiency. As a rough guide, a 1 cu ft enclosure has an efficiency of 2 per cent and a 4 cu ft enclosure 5 per cent. This is assuming good-quality units, the small enclosure being in the £25 to £30 class, and the large one in the £55 to £75 class. It is really impossible to be specific, because of the idiosyncracies of the individual speaker designer, but the above figures are average.

For analysis, we can conveniently divide amplifiers into two sections, namely the power amplifier and the pre-amplifier. As suggested by its title, the power amplifier supplies electrical power to the loudspeaker and this energy should be an exact facsimile to that fed into it. Such has been the development of the art that for the past ten years most power amplifiers have claimed distortions of less than 0·1 per cent at the rated output, with signal to noise ratios of the order of 70 or 80 dB. The frequency response is generally very much better than 20 c/s to 20 Kc/s for limits of ±A dB, but it should be noted that this claimed frequency response is a 'low level', usually of the order of 1 watt.

What is very rarely specified is the power output at the rated distortion; and very few amplifiers will meet the rated output over the claimed frequency response at the specified distortion. As an example, a well-known 15-watt amplifier actually delivers 18 watts at 0·1 per cent at 1,000 c/s. The frequency response is within ±1 dB from 20 c/s to 20 Kc/s at 1 watt. But it is impossible, under any circumstances, to obtain more than 6 watts at 30 c/s (at this point, the total harmonic distortion is in excess of 30 per cent) or more than 9 watts at 20 Kc/s, again for a total harmonic distortion of 30 per cent.

The above figures relate to valve amplifiers, but the position is even more serious regarding transistor amplifiers. Transistor power amplifiers, as indeed valve amplifiers, generally are theoretically capable of producing substantial amounts of distortionless power over a very wide frequency range, but like everything else, the tighter the specification, the more costly the product.

With one or two notable exceptions, all domestic transistor power amplifiers use 'audio type' transistors, which have a relatively low frequency cut off. For instance, the AD.140 currently used in many transistor amplifiers has a half power point at below 5 Kc/s, whilst the AD.149 has a half power point at approximately 25 Kc/s, and although the low level response of these power amplifiers can extent to 50 Kc/s, it is not possible to extract the rated (1 Kc/s) output at high frequencies.

In order to produce a specification which, according to the advertising community, is realistic the output power of amplifiers are now rated under what are known as *'speech and music'* conditions. These conditions have been brought about by the fact that particularly with transistor amplifiers, the output stage is run under class AB or class B conditions, and sustained output under sine wave conditions will result in either/and burn out of the driver or output transistor, or overloading the power supply, resulting in reduction of supply voltage and increased distortion. The conditions of *'speech and music'* rating are arbitrary, and are usually about double the sine wave rms output. It is the writer's contention that power amplifiers should be specified in terms of power output against rated distortion over the claimed frequency range.

The purpose of the pre-amplifier is to raise the level of the input source from pickup, radio, tape head, etc., to a level sufficient to drive the power amplifier and at the same time apply such equalisation as is necessary to produce a correctly balanced signal. In addition to the basic corrective networks, control of the level of both the treble and bass frequencies relative to the mid-band should be provided, usually ± 10 dB at 100 c/s and 10 Kc/s. At the same time, it is sometimes desirable to apply a steep cutting high pass filter with cut off frequencies variable between 5 and 20 Kc/s. Rumble filters cutting off at frequencies below 40 c/s are also advocated.

These two extreme frequency filters are in reality a policy of despair, because the signal should be sufficiently pure to require no attenuation at the extremes. In this Year of Grace 1965 there is no excuse for turntables which produce rumble, although a case can be made for high frequency attenuation (due to edginess of string tone, etc.) on otherwise excellent records which have some historical interest.

As with pickups and amplifiers, types and varieties of loudspeaker are legion. By far the greater majority are of the moving coil variety, and it will be well to start with these. In order to maintain a given sound pressure at a particular frequency a certain volume of air must be moved, and the lower the frequency the greater the volume. In an optimum position in a concert hall, the sound pressure at the listener's ear from crescendoes of symphonic works is between 100 and 110 dB, and with an average listening room of 2,000 cu ft, this type of pressure requires approximately 500 milliwatts of acoustic energy—i.e. 250 milliwatts per speaker. With speakers of 4 per cent efficiency, this corresponds to maximum (rms) output powers from the amplifiers of 10 watts, but to produce this level at, say 40 c/s, requires a peak to peak displacement of a 10-inch piston (12-inch nominal loudspeaker diameter) of 0·7 inch, and the loudspeaker enclosure must have a volume in excess of 6 cu ft if it is not to unduly restrain the motion of this size of piston using commercial cone and magnet systems.

The tendency today is towards smaller and smaller loudspeakers and some excellent units are being produced in which the middle and upper frequencies are beyond reproach, but in all cases the response below 100 to 200 c/s is reduced. This, in theory, can be compensated for at low listening levels by increasing the bass boost, but unfortunately the bass control of most pre-amplifiers 'hinges' about 1,000 c/s instead of, say, 200 c/s, with the result that if the 50 c/s level is brought flat, there is considerable hump in the 200 to 500 c/s region.

Sine wave distortion on all modern speakers is of a very low order, but the transient distortion can become considerable. Indeed, during transient tests recorded in *Revue de Son,* 10 microsecond rectangular pulses at repetition rates of 5 and 10 Kc/s were fed to four loudspeakers, namely (a) a direct radiator HF unit; (b) a horn type HF unit; (c) a ribbon unit; and (d) the Ionofon.

Units (a) and (b) both generated pure sine waves at the repetition frequency. Unit (c) generated 12 microsecond pulses with a rise time of 2 microseconds, followed by a 5 per cent ring at 50 Kc/s, and unit (d) generated an 11 microsecond pulse with a rise time of 1 microsecond and 10 per cent ring at 50 Kc/s. In the mid and lower frequency region, there are no loudspeakers which will reproduce

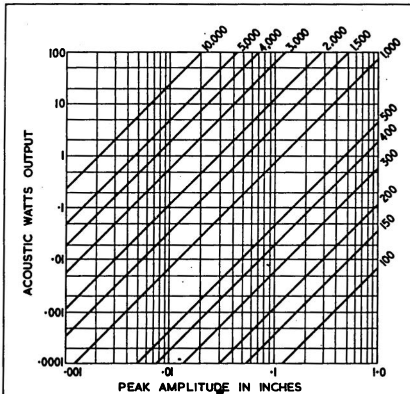


FIG.6.

accurately a square wave of, say, 400 c/s. This all sounds very distressing, and the surprising thing is that reproduced music sounds quite as realistic as it does—we can only attribute this to the accommodation of the human ear.

Obtaining adequate bass response from small enclosures has raised many design problems. All moving coil loudspeakers exhibit a 'bass resonance' determined by the mass of the cone and voice coil and compliance of the suspension system: below this frequency the response falls off at 6 to 12 or 18 dB per octave, dependent on the mode of operation. When the loudspeaker unit is fitted into an enclosure, the 'acoustic stiffness' of the enclosure, in series with the loudspeaker unit compliance, raises the basic resonant frequency and this reduces the bass response. Acoustic compliance (1/stiffness) is proportional to enclosure volume, so the smaller the cabinet, the higher the bass resonant frequency and reduced bass response for a given loudspeaker.

One way out of the difficulty is to increase the mass of the cone, but increasing cone mass reduces sensitivity! Keeping the cone mass constant, but reducing its diameter will also reduce the resonant frequency of the enclosure, but again with reduced efficiency. The efficiency can be restored by increasing the magnet size, but the magnet accounts for the major part of a loudspeaker cost and rapidly becomes uneconomic with even moderate increase in size.

Reducing the cone size brings another problem, namely power handling capacity at low frequencies. For a given sound, output power the cone area times displacement ('volume current') is constant. Thus, as stated above, to radiate 250 milliwatts of acoustic energy at 40 c/s requires a peak displacement of 0·35 inches, for a 10-inch-diameter cone. To produce the same volume displacement using a 5-inch-diameter cone would require a total movement of $2\frac{3}{4}$ inches, which is clearly impossible at the present state of the art. Obviously small speakers just cannot handle large input (and hence output) powers at low frequencies.

'Hi-Fi' Today. Summing Up!: We will attempt to summarise this essay with a few extra pointers for the would-be purchaser of 'hi-fi' equipment: It is assumed that he will wish to reproduce records and listen to radio, and that the majority of records purchased will be stereo. Records cannot be reconditioned, therefore any damage at any time to a record is permanent. Because the majority of us are not blessed with unlimited wealth, it is generally necessary to build up the 'hi-fi' system over a period of time. The first requirement is therefore to protect the major investment (usually gramophone records) as much as possible, and to this end it is advisable to sacrifice initially either amplifiers or preferably speakers (which have a good secondhand value and can be easily replaced) in order to obtain the very best pickup available.

It should have a diamond stylus, and this stylus should be checked for wear at least every 500 hours of playing. Those with elliptical or small radius points should be checked every 200 hours.

The type of pickup purchased will determine the motor, which should have a heavy, well-balanced turntable, adequate power, and be supported on a substantial base plate.

The pre-amplifier should have adequate sensitivity and correct input impedance to match the pickup. Extra facilities, i.e. tape recording, etc., are at the discretion of the purchaser, but pre-set gain controls are advisable so that large differences in volume are not experienced when switching from pickup to radio, etc.

Because of the large variation in signal level over the country, it is difficult to specify exactly the requirements for an FM tuner, but any tuner which exhibits 'drift'—i.e. needs retuning after, say, 10 minutes or even half an hour, should be rejected out of hand. Some tuners have automatic frequency control, and it is a debatable point whether AFC is a clever means of overcoming deficiencies in oscillator design or is economically justifiable. What is most important is that correct limiting takes place in order that the demodulator functions over the most linear portion of its operating curve.

The power amplifier will usually be purchased with the pre-amplifier as a matching pair, salient points are power output, the frequency response at rated distortion, signal to noise ratio, and price. Transistor power amplifiers are much more sensitive to low load impedances than valve amplifiers, and it should be checked that with the intended speakers there is no possibility of 'thermal run way'.

With some transistor amplifiers, if the DC resistance of the load is below a specified value, or if the output terminals are accidentally short-circuited whilst the amplifier is being driven, 'otherwise run way' will result. The effect of 'thermal run way' is that the temperature of the transistor itself is increased beyond its safe limit and the transistor is irreparably damaged. *In the majority of cases, this takes place in only a few milliseconds,* and because of the time lag of ordinary fuses, cut outs, etc., it is impossible to protect against it. Recent developments using current limiting devices are negating this effect, but not all amplifiers have these safety devices built into them.

The ultimate choice of the loudspeaker system is usually made by the distaff side of the household. The enclosures have usually to fit in with predetermined furnishing schemes, and the available space allocated to the speakers is much less than optimum. Like other musical instruments, all loudspeakers have built-in 'tone' quality, and it is possible for the experienced listener to hear a completely new loudspeaker and identify the manufacturer by its characteristic sound quality.

Because loudspeakers have these particular qualities (or failings?) the only safe method is to listen, and having listened, go away and come back and listen again.

Finally, do listen to live music as much as possible. Good as modern 'hi-fi' is, it is not perfect, and, who knows, you may be able to get a donation from the housekeeping money to improve your equipment after a few visits to the Festival Hall!

PICKUP PRACTICE

by Gordon J. King

IT is the job of the pickup to translate the groove waveforms impressed upon a disc record accurately to corresponding electrical signals. Just how well a pickup performs this exacting task depends on its design and construction. During the early days of electrical recording, the audio and amplification equipment employed to drive the record cutter was many points in quality below the equipment that we ourselves use today to amplify and reproduce the pickup signals. Nevertheless, it was even then the aim of a small band of enthusiasts to achieve as faithful as possible translation from disc to speaker. Incidentally, the term 'hi-fi' was coined around 1927!

Although the more sophisticated electromechanics of disc recording and reproduction had by no means been exhaustively investigated, and in spite of the relatively poor quality

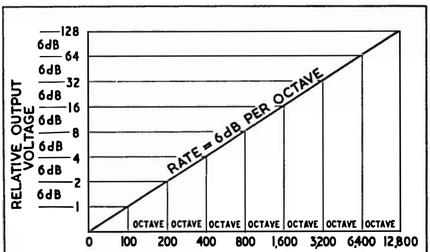


FIG.1.

Fig. 1. *This graph shows how the output voltage from an electromagnetic generator increases at the rate of* 6 *dB per octave.*

of the records (by today's standards), it eventually became apparent that a well-produced disc carried information that even the best of the early equipment was unable fully to exploit. At first, the quality of the recording electronics had the edge on that of the reproducing electronics—unlike today, of course, where there is little to choose between the electronics quality at either end of the chain.

The pioneering enthusiast was thus presented with something tangible to pursue—programme material of quality potential above that of his

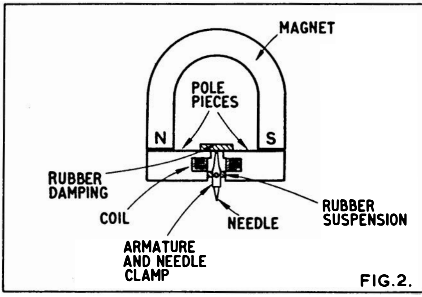


FIG.2.

Fig. 2. *Diagram of early armature type pickup. Tracking was in the order of seven ounces, the compliance was very low and the resonances high.*

equipment. Radio quality in those days failed to offer much encouragement. Resulting from the speedily developing hi-fi momentum, a number of firms whose names are well known today invested in the future of high-quality sound. Research laboratories were established and quite a few of us have followed the incredible development of the pickup over the last three or four decades. It seems amazing that a so-called 'hifi' pickup of the 'thirties required a tracking force (downward pressure) of about *seven ounces* to keep its stylus tracking and tracing a groove of restricted frequency range, when it is considered that some of our finest present-day cartridges can track the extended frequency groove of a modern record with a tracking force of less than one gram!

Improved Electronics

While the quality of the reproducing electronics has steadily improved—extended frequency response, better power response, lower distortion and so forth—so also has the quality of the recording electronics. Relatively, then, a condition similar to that of the early hi-fi days exists still today. Even though our reproducing amplifiers match the quality of the recording amplifiers, there are very few present-day pickups that can match the response of all that is recorded on the modern disc.

At the present state of the art, one can put on to a disc, in terms of groove modulation, somewhat more than can easily be taken off. This is basically because a record cutter can be accelerated and decelerated electrically with greater efficiency than a pickup stylus can be likewise accelerated and decelerated mechanically. That is, by the groove taking control of the stylus. Consequently, there is still quite a bit of activity going on in the back rooms of pickup makers. The chief problem, then, is in getting the stylus to trace the fantastic modulation velocities that modern electronics impart on the disc. Optical micrographs of unplayed discs reveal that in some cases the groove turns a complete right-angle!

Although ultimate modulation velocities of this order are physically impossible to trace mechanically anyway, some pickups have difficulty in tracing more practical velocities of reasonable recording level while holding to the groove under a contemporary tracking force. High audio frequencies and recording levels create modulation velocities of such magnitude that the pickup stylus is subjected to accelerations and decelerations of values sometimes thousands of times the force of gravity. The stylus, through its mechanical coupling to the pickup generator, has reflected to its tip a specific value of mass (tip mass). It is this mass that the modulated groove of a record has to accelerate and decelerate. In other words, the stylus tip should always be in close contact with the groove modulation pattern for optimum translation of the groove pattern to electrical signal.

When mass is accelerated a force is produced which is a function of the mass and the velocity; the greater either one, the greater the force. At great accelerations the force is such that it either breaks down or flexes the groove walls or, alternatively, the stylus tip no longer follows the modulation pattern and loss of definition and distortion result.

Impossible Solution

The absolute solution to the problem would be for the tip mass to be zero. This, of course, is impossible from the mechanical point of view, so pickup design will always be something of a compromise. Early pickups relied on tracking force to retain definition. This appeared to be tolerable then because modulation velocities were nowhere near as high as they are today. Indeed, a high tracking force was necessary to combat the incredibly high stylus mass of the early specimens.

Something had to go, of course, and the thing that the user knew most about was the 'needle'. After one playing on a new 12-inch disc this changed from a point to a chisel shape. Thus, to retain 'quality', the needle was

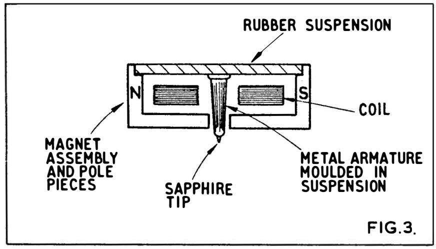


Fig. 3. *An assembly in which the metal stylus shank formed the armature.*

changed after each playing. Soon it was noticed that after several playings the disc lost its 'sparkle'. The treble (what there was of it) disappeared. The days of the optical micrograph had yet to come, so it was difficult for the early enthusiast to assess just what was happening to his treasured discs. Anyway, he knew without a doubt that the treble was being wiped off, and in the hope of overcoming this he may have changed from steel to fibre needles. The reasoning being that greater wear on a soft point should result in less wear on the record.

High Distortion

Fibre needles came complete with a little sharpener, and after each playing it was necessary to re-sharpen. Theoretically, it was necessary to re-sharpen several times during the playing of a 12-inch disc. This was rarely done, of course, so that towards the end of the disc the reproduction gave the impression that the amplifier was suffering from about 50 per cent harmonic distortion. Even when the point was new the transference of treble frequencies from the groove to the pickup 'motor' was very inefficient, and playing with fibre needles gave a characteristic treble cut.

The great and rapid wear to the fibre tip tended to impair the groove almost at the same rate as by the use of steel needles. Thus, the fibre—or 'thorn' needle, as it was sometimes called—soon lost popularity with the hi-fi fraternity of those days, though it was retained for a while afterwards by gramophone societies and the like.

Early steel needles were made of soft steel, to be discarded after one playing. These were followed by needles of hard steel, sometimes with the addition of chromium plating to increase their hardness. A finer needle of this nature was used in certain 'needle armature' pickups.

Needles with sapphire tips produced fair treble on a couple of playings of a new disc before wiping the disc clean of treble. It was not long after this that the backroom boys started demonstrating their laboratory findings.

Weights and masses were ruthlessly cut and the needle changed its name to stylus, it then being sapphire or diamond. From then on, weights and masses were further reduced and eventually the tip of the stylus became elliptical. We shall see the reason for this later.

A pickup is in two main sections. The mechanical section and the 'generator' section. The mechanical section couples the modulated record groove to the generator section. This is where many of the problems lie.

Dynamo Principle

Electromagnetic pickups employ the 'dynamo' principle. This means that a small electric force (electro-motive force—emf) is produced in a coil of wire when a magnetic field cutting the coil is varied. The voltage so generated has a strength which is directly proportional to the rate at which the magnetic field cutting the coil of wire is varied. The greater the rate, the greater the voltage produced. There are three ways by which the magnetic field cutting the coil of wire can be varied. A small magnet can be made to move and thus vary its field across a coil of wire; an armature can be made to move in such a way that it varies a magnetic field cutting a coil of wire; or the coil of wire itself can be made to move within a magnetic field. All three ways are used in pickups. The moving element in each case is coupled to the stylus.

Clearly, as the stylus vibrates in sympathy with the groove modulation, so the moving element of the generator is caused to vibrate in a similar manner. The moving element causes the magnetic field cutting the coil of wire to vary and a small voltage is produced across the winding. This is a 'signal voltage' and it possesses the characteristics of the original signal which was used to operate the cutting head during the record-making operation.

One important thing about this signal—or ac—voltage is that its strength increases as the frequency of the vibrations coupled from the groove increases. This is a constant law relative to electromagnetic devices of this nature, and if we assume a constant record level (that is, a constant *amplitude* of movement of the stylus), the pickup voltage will double in strength each time the stylus frequency is doubled. The simple graph in **fig. 1** shows this effect. Thus, the relative output voltage doubles from 100 to 200 c/s, doubles again from 200 to 400 c/s, again from 400 to 800 c/s, and so on . . .

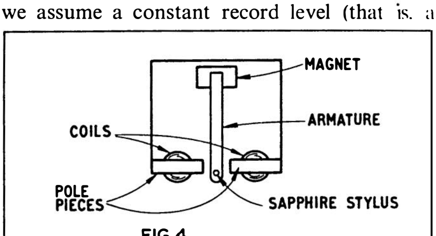


Fig. 4. *Diagram of variable reluctance pickup. This is the basis of modern designs.*

6 dB per Octave

When a voltage (or current) is doubled it is said to have increased in strength by 6 decibels (dB) and when a frequency is doubled it is said to have gone up by an octave. This gives the line on the graph a rate of rise equal to 6 dB per octave, as shown. This is how the voltage from any electromagnetic device increases as a *constant amplitude* magnetic field *cutting rate* is increased. Mechanical and electromagnetic losses tend to modify this slightly at high audio frequencies, as would be expected, but the basic law remains unchanged.

A diagram of a very early electromagnetic pickup is given in **fig. 2.** The magnetic field produced by the large magnet cuts the coil of wire, and the cutting effect is varied by a soft iron armature, coupled to the groove through the needle, vibrating between the pole pieces. **Fig. 3** shows the diagram of a later version of somewhat less tip mass. Here the armature is integral with the sapphire stylus tip, thereby avoiding many resonances and 'tuning-fork effects' produced by the large armatures of the very early specimens.

Several early pickups employed this 'needle armature' construction, and in some models the steel (replaceable) needle formed the actual armature which vibrated directly in the magnetic field between the pole pieces. The author recalls using a *Burndept* pickup of that kind (ex-BBC!). The output voltage was that much less than the more solid versions of those days, but the frequency response very very exciting after adequate amplification, and the relatively smaller tip mass retained the treble on the disc for a little longer than was then usual.

The diagram in **fig. 4** shows the basic construction of a recent variable reluctance pickup. The stylus is permanently fitted to the armature which is thus caused to vibrate between a pair of pole pieces. In this kind of pickup the armature itself assumes the polarity of one side of the magnet, and this reacts against the opposite polarity reflected to each pole piece, thereby causing changes in magnetic field across the coils.

The fundamental idea of the moving magnet pickup is revealed in **fig. 5.** It is here seen that the magnet is caused to 'vibrate' axially, via the stylus and cantilever coupling. A changing magnetic flux thus occurs in the metal yoke and a signal voltage is developed in the windings.

The moving coil principle is depicted in **fig. 6.** This is basically the reciprocal action of the moving coil speaker. The coil is pivoted in such a way that vibrations from the groove cause its vibration. The magnetic field is thus cut correspondingly and an audio voltage is produced across the winding. All the way up the development scale the aim has been to maintain the best coupling efficiency to the generator section, while reducing the effective mass at the stylus tip for the reasons already expounded.

Light-ray Stylus?

At one time an unsuccessful attempt was made to use a fine ray of light instead of a stylus to pick up the information from the groove. How this was attempted is shown in **fig. 7.** A fine light ray was carefully focused on to the side of the groove and the reflection back from the groove was focused on to a photo-electric cell. With rotation of the record the reflective characteristics of the groove varied in accordance with the modulation. This, in effect, modulated the reflected ray, the modulation then being abstracted by the photoelectric cell, giving rise to an audio voltage across its output. The output of a photoelectric cell, of course, depends upon the amount of light falling upon it, and as the modulation was really a changing intensity of light, the output voltage changed to the same pattern as the light intensity.

As may be imagined, many problems were presented by this idea, not the least of which was holding the light ray in track with the groove and at the correct angle! So far as the author is aware, this has been the only attempt towards a 'zero mass stylus', the stylus being the ray of light in the example cited. However, with the rapid advance of electronics there may yet be other attempts using somewhat different techniques, but it seems right now that the tip mass of the stylus will remain the basic problem of disc record reproduction for many years to come.

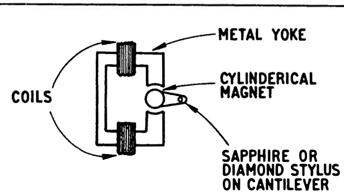


FIG.5.

Fig. 5. *Moving magnet pickup diagram. The cylindrical magnet, which is a lightweight variety, vibrates axially due to the cantilever coupling.*

Pickups have been made to produce an audio output voltage by the groove modulation changing capacitance, the frequency of an oscillator and the density of an electron stream in a valve-like pickup. None of these caught on.

Piezo-electricity

One technique, which is almost as popular as the electromagnetic principle of signal production, is where the signal voltage constitutes piezo-electricity. Piezo-electricity appears between two electrodes either side of a special

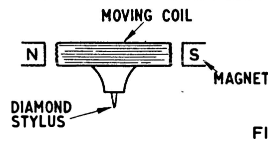


FIG.6.

Fig. 6. *Cross-section of moving coil pickup.*

cut of crystal when the crystal is subjected to a mechanical stress. Until comparatively recently, the only materials exhibiting the 'piezo-electric effect' and satisfying certain practical requirements have been quartz and water soluble crystals.

Early piezo-electric or crystal pickups used a Rochelle Salt as the active element, and the diagram in **fig. 8** shows the basic construction of an early Rothermel-Brush crystal pickup. The needle chuck was forked at the top end and this embraced the crystal, via damping pads, thereby causing the crystal to vibrate in accordance with the groove modulation. The crystal element was tapered to facilitate flexing, and the wide end of the crystal was clamped between two metal foil electrodes and resilient pads. Now, vibration through the needle resulted in the crystal being stressed in sympathy with the modulation. The electric charge (or piezo-electricity) across the electrodes thus constituted a signal voltage, which was fed to the input of the amplifier.

This basic method of operation is unchanged in today's piezo-electric pickups, but now a ceramic crystal is used instead of the early water soluble crystals, which suffered large variations of permittivity with temperature, and which were deliquescent and thus needed protection from extremes of humidity and temperature.

Capacitive Source

The output from a piezo-electric pickup can be considered as a varying charge across a capacitor. Indeed, as a piezo-electric crystal is stressed in one direction a charge of specific polarity develops across its electrodes, and when the stress is changed to the opposite direction the charge also changes in polarity.

Earlier we saw that the output from an electromagnetic pickup rises at the rate of 6 dB/octave. It is thus said to have a 'constant velocity' characteristic. The output from a piezo-electric pickup differs from this in that the output voltage increases as the *force* applied to the driving point of the crystal increases. This means that the output voltage remains relatively constant (depending on the frequency characteristics of the pickup) at all frequencies provided the amplitude of stylus movement is

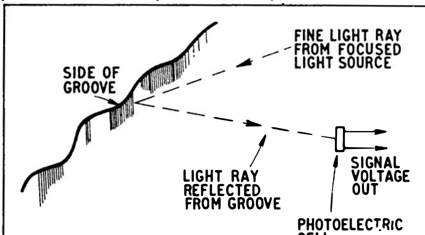


FIG.7.

Fig. 7. *Basis of an early idea using a thin beam of light and photo-electric cell instead of a pickup to play disc records. The beam was modulated by the groove variations and the modulation was translated to electric signals by the photoelectric cell.*

the same at all frequencies. It will be understood, of course, that the amount (or amplitude) of movement of the stylus is governed by the level of the recording. The greater the recording level, the greater is the movement of the stylus. The velocity, on the other hand, is governed by the frequency of the recorded material.

With natural crystal, the crystal sections making up the whole crystal structure are in a definite pattern relating to a specific cut, and the direction of maximum piezo-electric activity is associated with a certain axis. The crystalline structure is created during the growth of the crystal. With ceramic crystal, which is essentially man-made, the material is initially composed of randomly orientated crystals and the direction of maximum piezo-electric effect is produced during manufacture by a polarising process.

Piezo-electric Ceramics

The exercise resolves into getting the whole crystalline mass to act as a single crystal; and this is achieved by the application of an electrostatic polarising field. This causes the individual crystals of the ceramic to orientate along a common axis in the required direction. This polarisation remains after the removal of the polarising field. Piezo-electric ceramics contain lead-zirconate-titanate and, owing to the multicrystal composition, are often referred to as 'polycrystalline ceramics'.

What has already been said applies equally to stereo as well as to mono pickups. With the former, however, a pair of generator sections are featured to provide the left- and right-hand signals. The mechanical coupling is somewhat more complex, of course, but modern designs ensure that stereo pickups exhibit high lateral and vertical compliances.

Compliance refers to the ease with which the stylus can be moved. From side to side, lateral compliance, and up and down, vertical compliance. Actually, it is the reciprocal of stiffness. A pickup with a high compliance has little stylus stiffness.

It has been the aim of pickup designers to dispense their pickups so that the forces applies to the groove walls remain within the *elastic* limit of the record material. These forces are then so small that there is virtually no wear at all on the record. The very best of our pickups subject the groove walls to this very small force. Less advanced pickups, however, subject the walls to a greater force so that *plastic deformation* of the record material results. This happens after the first playing, and thereafter the record is unchanged. Pickup forces in excess of the plastic deformation limit literally destroy the walls of the groove and, as we have seen when discussing early pickups, wipe the disc clean of treble!

Tip-mass and Compliance

Low wall forces demand a low tracking force, and to keep within the elastic limit of the record material the tracking force may not have to exceed about 1 gram. However, a pickup will only trace the groove at this low downward pressure when the mechanical impedance at the stylus tip is correspondingly low over the audio spectrum. This then brings back the factors of stylus tip mass and compliance.

Tip mass is expressed in milligrams while compliance is expressed in millionths of a centimetre per dyne (i.e. 10^{-6} cm/dyne). To keep the

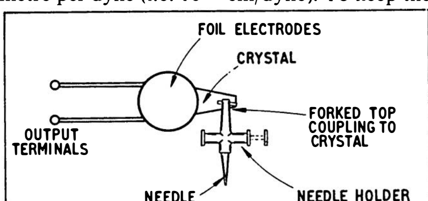


FIG.8.

Fig. 8. *The basic mechanics of an early crystal pickup. Ceramic is now used instead of the early water soluble crystals.*

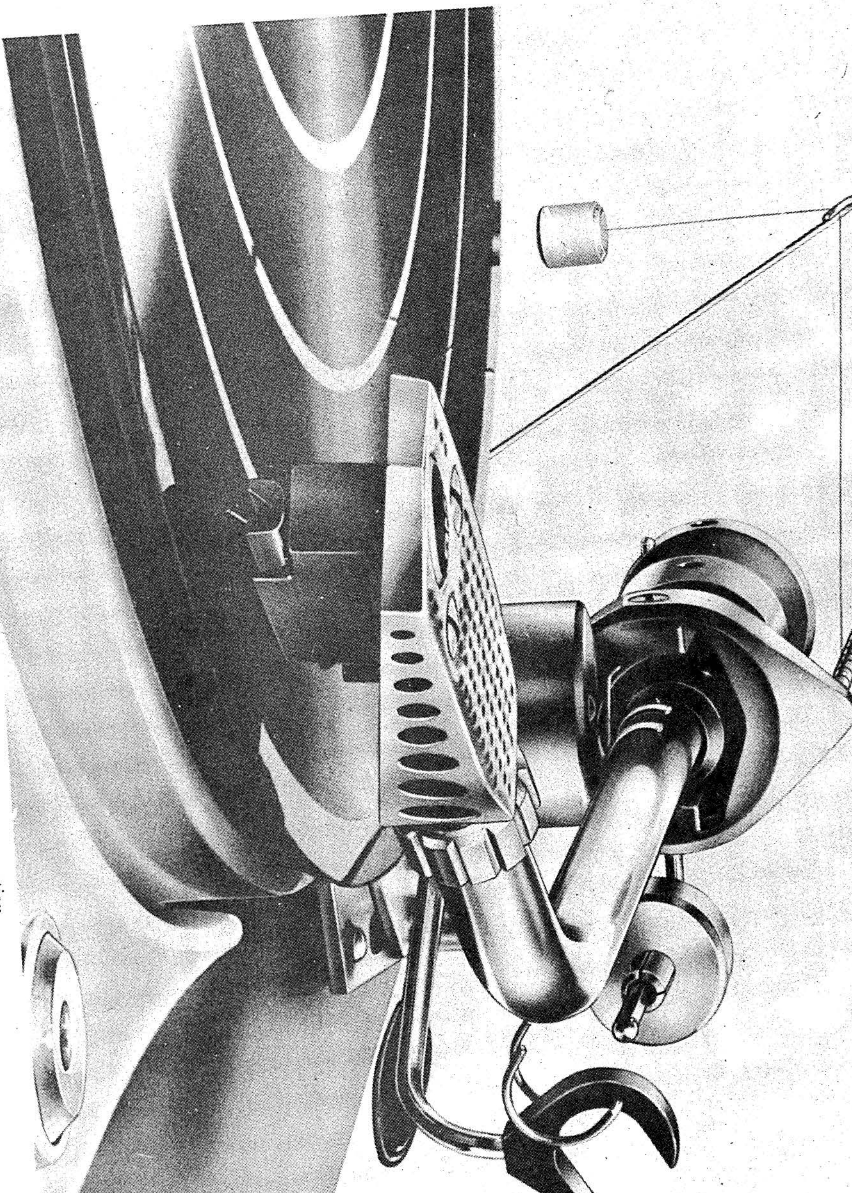


Fig. 11. *The SME Arm with thrust compensation.*

stylus tracking at low frequency recording peaks, the compliance must be made higher as the tracking force is reduced. Thus, for a tracking force of, say, 1 gram the lateral compliance would probably have to be as high as 20×10^{-6} cm/dyne, while by increasing the tracking force to 2 grams the lateral compliance could probably be reduced to about 10×10^{-6} cm/dyne for good tracking. The corresponding vertical compliance of stereo models is less than the lateral compliance because the vertical components of the groove modulation are smaller than the

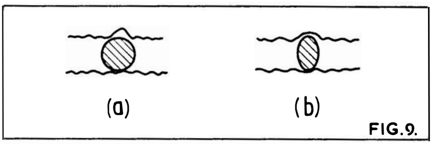


Fig. 9. *This diagram shows how an elliptical stylus tip of 0·3-thou (b) across the ends can trace modulation of higher velocity (frequency) than a conventional stylus (a).*

lateral ones. Moreover, as pointed out by *Decca,* the vertical compliance should not be too great, otherwise the stylus will fail to trace the rapid downward movement, having in mind that the stylus is not 'driven' downwards but falls, due to gravity plus the stiffness of the suspension.

Typical vertical and lateral compliances are 2×10^{-6} cm/dyne and 10×10^{-6} cm/dyne respectively. Some pickups have a compliance greater than this. The ADC Point Four cartridge, for instance, has a compliance specification of 30×10^{-6} cm/dyne.

For optimum tracing of high level treble signals, the effective mass at the stylus tip must also be very small. Tip mass is related to tracking force. With a tracking force of, say, 2 grams, the tip mass should not exceed 1 milligram, and it should not exceed 0·5 milligram when the tracking force is down to 1 gram.

Watchmaker's Art!

The mass of the moving parts of the modern pickup is kept well down by the use of very lightweight stylus mounting materials and couplings. Hollowed micro-armatures are also employed for this reason. The art of modern pickup making is approaching that of the watchmaker! There is now a world of difference between the mechanics of the early pickups of a few decades ago and the modern specimens, and in an article of this nature full justice could not be given to the mechanical design of the diversity of models, especially the stereo models.

For stereo, a stylus tip radius of half-thou is essential for good tracing, provided the tracking force does not exceed about 3 grams. Less exacting pickups tracking at a greater force may feature a 0·7-thou tip, and a tip of this dimension is often considered desirable when playing mono discs with a stereo pickup to avoid 'bottoming' in some of the grooves. Most stereo models can now be used mono-wise quite successfully.

Elliptical Stylus

Some makers are now fitting the new elliptical stylus. This has an active radius in the order of 0·3-thou. It does not bottom, of course, because it is that much wider across its major axis, and thus rides correctly on the groove walls. However, it does trace the high-frequency modulations better than the conventional stylus, particularly those recorded towards the inner of the disc where the speed of the groove past the stylus decreases progressively. At $33\frac{1}{3}$ rpm the wavelength of a treble signal recorded on an inner groove could be smaller than a 0·5-thou tip, thereby being untraced by a conventional stylus. The elliptical tip can solve this problem, as shown in **fig. 9.**

It is very important for the major axis of an elliptical stylus to fall exactly across the groove, and for this reason a microscope should be employed to check on this, particularly after stylus replacement.

Some pickups are being geared to a 15-degree tracking angle. This angle, in fact, has now been recommended by the American RIAA and there have also been similar moves by the

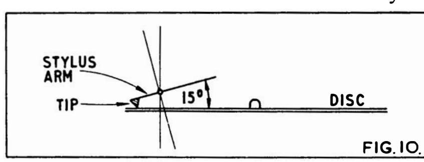


Fig. 10. *This diagram illustrates the 15-degree tracking angle.*

European CCIR. The philosophy is based upon the fact that the pickup stylus does not move truly vertically because it is usually secured to the end of a coupling, the other end of which represents a pivot. Thus, the stylus moves in an arc, as shown in **fig. 10.** The 15-degree angle will be seen to be forward from vertical.

The very lightweight precision stereo pickups now available give the best stereo performance when the natural force pulling the pickup to the centre of the record is completely balanced. Arms with bias compensators are available to satisfy this requirement. The *SME* and *Pritchard* arms, for instance, employ a small weight coupled to the end of the arm by a thread. The mechanics are arranged so that the side thrust between the stylus and the inner wall of the groove is exactly cancelled by the weight applying an opposite thrust. A picture of the *SME* arm is given in **fig. 11.**

An unbalanced lateral force that tends to push the stylus away from its centre position can have a serious effect on stereo crosstalk and general distortion. This, of course, applies in particular to delicate pickups of very high compliances. Indeed, the performance of pickups in the superclass is governed very much by the arm used to house the cartridge.

Arm designs have improved greatly in detail during recent years, and the state that now exists is that, in order to get the optimum from the new, high compliance stereo cartridges, a precision arm is no longer a luxury but a necessity. There is very little object in employing an expensive cartridge in a mediocre arm.

Integrated pickups are becoming popular, particularly so far as newcomers are concerned, for these ensure that the cartridge and arm are matched to the optimum degree within the range of quality of the system. A question often asked by those fairly new to the art goes something like this: *'Is my existing arm suitable for taking a stereo cartridge?'* and questions of a like kind. The answer to this sort of question depends to a large extent on the type of equipment in use and, of course, on how good the existing arm is!

There is not much future in spending pounds on a super-quality cartridge (even to work in conjunction with an arm of matching quality) if the amplifier and speaker system are of mediocre specifications (unless, of course, one has it in mind to improve the rig, starting from the pickup).

After being mono-bound for some time, one gets used to an arm and its characteristics, and an idea as to how it will behave stereo-wise is gleaned. A dramatic improvement in reproduction is sometimes achieved simply by putting a cartridge, formerly used in an average arm, into one of the latest precision arms.

Arms are still being very much investigated by the backroom boys of hi-fi, and arrangements to secure true parallel tracking will probably be exposed. The old-style arms of complex mechanical linkages designed to eliminate tracking error and provide parallel tracking have doubtful justification today, since the latest arms give a very small tracking error, anyway, and with these the bearing friction is incredibly small. However, there may be favour for the latest idea where the pickup carriage virtually floats, as a boat, on oil. Here can be obtained true parallel tracking without the friction increase due to multiple bearings.

The crosstalk factor of stereo pickups is also improving, aided, as mentioned above, by bias compensation at the arm. The ultimate, of course, is for the signals produced by the two walls of the stereo track to be completely independent, so that two separate programmes can be carried in one track (which is the required specification for stereo broadcasting!) without one interfering with the other.

In practice, there is always a bit of breakthrough of one channel into the other. The amount of breakthrough is called 'crosstalk' and it is expressed in decibels at 1,000 c/s. A separation of about 20 dB (10-to-1 voltage ratio) over the whole audio spectrum is desirable, but rarely achieved. A big factor of crosstalk is that any breakthrough signal should not itself be distorted. If it is, then it will add distortion to the system, which is very bad. Crosstalk in one channel is not always equal to the crosstalk in the other channel, even under constant signal conditions. But, again, the arm has a bearing on this aspect of crosstalk.

Output Voltage

Crystal pickups usually give more output than magnetic types, but the output of the latest ceramic types is less than that of a crystal. Output is given in rms volts for a certain stylus velocity. A typical specification in this respect is 1mV/cm/sec. This simply means that for each cm/sec of stylus velocity the output is 1 mV. The velocity is, of course, always changing with the programme material, so the output voltage changes accordingly. A pickup with an output given as 0·5 mV/cm/sec would give an output of 2·5 mV at a recorded level of 5 cm/sec.

The sensitivity of the amplifier should be in the order of three times the output of the pickup as specified above for maximum drive conditions. Thus, a pickup with an output of, say, 1·4 mV/cm/sec would fully drive an amplifier with a sensitivity of about 5 mV.

Magnetic pickups need to be loaded into a medium impedance, often in the order of 47,000 ohms, while crystal pickups need a much higher termination in the order of 2 megohms (2 million ohms). By loading a crystal (or ceramic pickup to a lower value resistance, its output roughly approximates that of the velocity characteristics of a magnetic pickup. This results from the effect of the capacitive source (the piezo-electric element) in conjunction with the relatively low value load.

Magnetic pickups, of course, demand equalisation at the amplifier, while crystal and ceramic pickups (when loaded to a high value resistance) can be connected direct to a 'flat' amplifier input, and thus require no equalisation. Equalisation is necessary, though, when a crystal or ceramic is loaded to a low value resistance.

DIRECTORY OF PICKUPS AND ARMS.

★ In the abridged specifications of this directory, the following abbreviations are used for economy of space: **P.w.** = recommended playing weight; **mg.** = milligram; **gm.** = gram; **Rec. load** = recommended resistive load; **mV** = millivolt. In all cases where decibel limits for frequency response and frequency for stated separation are given by manufacturer, these are included. Output is usually referred to a recorded velocity of 1 cm/sec.; this figure should be multiplied by five for the practical music output. ● denotes stereo equipment.

AUDIO DYNAMICS CORPORATION, New York, U.S.A. Sole U.K. agents: KEF Electronics Ltd., Tovil, Maidstone, Kent. Tel.: Maidstone 55761. Cables: KEF, Maidstone.

●**ADC point four.** Stereo cartridge. Induced magnet. ½ in. fixing centres. Stylus 0·4 thou. diamond. P.w. ¾-1½ gm. Compliance 30 × 10^{-6} cm/dyne. Range 10 c/s-20 Kc/s ±2 dB. Separation 30 dB from 50 c/s-8 Kc/s. Output 1 mV. Rec. load 47K. 15° vertical tracking angle. For use only with the ADC 40 arm. Price: £20 10s. (U.K. purchase tax £3 5s. 9d.).

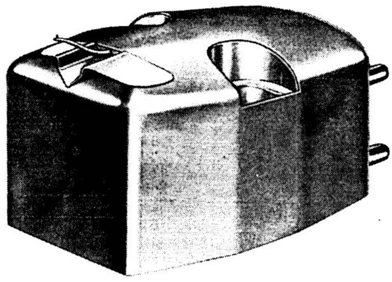
●**ADC point four/E.** Similar specification to ADC point four but with elliptical stylus 0·2 × 0·8 thou. Price: £25 (U.K. purchase tax £4 0s. 2d.).

●**ADC 660.** Stereo cartridge. Induced magnet. For use with all high grade arms. Stylus 0·5 thou. diamond. Sensitivity 7 mV at 5·5 cm/sec. F.R. 10 c/s-20 Kc/s ±3 dB. 15° tracking angle. P.w. 1½-4 gm. Compliance 20 × 10^{-6} cm/dyne. Weight 7 gm. Separation 30 dB 50 c/s to 8 Kc/s. Price £12 (U.K. purchase tax £1 18s. 6d.).

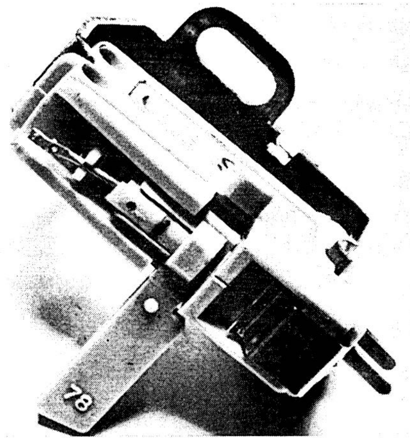
●**ADC 660/E.** Similar specification to ADC 660 but with elliptical stylus 0·2 × 0·8 thou. and playing weight 1½-3 gm. Price: £17 4s. (U.K. purchase tax £2 15s.).

●**ADC 770.** Stereo cartridge. Induced magnet. For use with good quality automatic turntables and record changers. Sensitivity 8 mV at 5·5 cm/sec. Separation 30 dB 50 c/s to 8 Kc/s. F.R. 10 c/s-20 Kc/s ±3 dB. Stylus 0·7 thou. diamond. Vertical tracking angle 15°. P.w. 2-6 gm. Compliance 15 × 10^{-6} cm/dyne. Weight 7 gm. Price £9 (U.K. purchase tax £1 8s. 10d.).

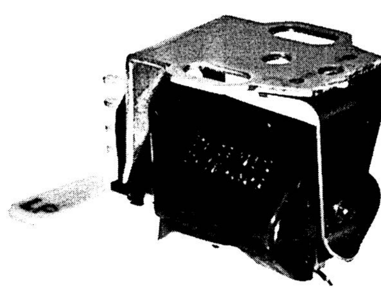
ADC 40. Complete low inertia arm with side thrust compensator and anti-drag lead out arrangement. Single-thrust ball bearings used at four points. Accurately machined walnut non-resonant arm. Adjustable counterweight. Plug-in head shell accommodates nearly all cartridges. Easy installation. Built-in arm rest.



ADC Professional cartridge



Acos GP91-1 crystal mono cartridge



Acostereo 73.2 cartridge

Arm length $10\frac{5}{8}$ in. overall. Pivot to stylus tip 9 in. Rear overhang $1\frac{3}{4}$ in. Price: £14 8s. (U.K. purchase tax £2 6s. 3d.).

★

BANG & OLUFSEN. U.K. Sales Division, Eastbrook Road, Eastern Avenue, Gloucester. Tel.: Gloucester 26841. Cables: DEBELEC, Gloucester.

●**Stereodyne SP.1 and SP.2.** Stereo cartridge. Moving iron. Plug-in. Stylus 0·7 thou. diamond. P.w. 2-4 gm. Range 30 c/s-15 Kc/s ± 2 dB. Separation 22 dB min. Output 7 mV. Rec. load 47K. Price: £5 5s. (U.K. purchase tax 15s. 2d.). Replacement styli 0·5, 0·7, 1·0, 3·0 thou. diamonds. Price: £2 5s. (U.K. purchase tax 7s. 6d.).

●**ST/L.** 9 in. pickup arm, less cartridge. Price: £6 6s. (U.K. purchase tax 18s. 3d.).

●**ST/A arm.** Arm with plug-in shell for use with SP.1 cartridge, or will take all standard cartridges. Price: £6 6s. (U.K. purchase tax 18s. 3d.).

●**ST/P arm.** Professional 12 in. arm. Price: £8 2s. (U.K. purchase tax £1 7s.).

★

BSR LTD., Monarch Works, Powke Lane, Old Hill, Staffs. Tel. Cradley Heath 69272. Telex 33282.

●**C.1.** Ceramic stereo turnover cartridge. Stylus: sapphire or diamond, ·0007 LP/stereo, ·0025 78. P.w. 2–6gm. Lateral and vertical compliances 5×10^{-6} cm/dyne and 3×10^{-6} cm/dyne. F.R. 20 c/s-10 Kc/s ± 2 dB, up to 15 Kc/s -6 dB. Output 0·11V ± 2 dB. Load impedance 2 megohms 100 pF. Prices: with sapphires £2 (U.K. purchase tax 6s. 5d.), with diamond LP £2 12s. 6d. (U.K. purchase tax 8s. 5d.).

BURNE-JONES & COMPANY LTD., 18 Brunswick Road, Sutton, Surrey.

B.J. Tan/11 arm. Designed to overcome tracking error. Total tracking error less than $\frac{1}{2}$ degree. Height adjustable. Price on application.

B.J. Super 90 Mk. II pickup arm. Two models. 12 in. and 16 in. Price (including two plug-in shells to carry standard cartridges) on application.

★

CLARKE & SMITH MANUFACTURING CO. LTD., Melbourne Works, Wallington, Surrey. Tel.: Wallington 9252. Cables: Electronic, Wallington.

●**E.M.I. EPU100.** Complete stereo pickup. Variable reluctance type. Stylus diamond, 0·5-0·6 thou. stereo, 0·8-1·0 thou. mono LP, 2·5-3·0-78. P.w. pre-set at 2·5 gm. Tip mass 1 mg. Compliance 7×10^{-6} cm/dyne lateral, $3{\cdot}5 \times 10^{-6}$ vertical. Range 30 c/s-20 Kc/s. Separation 20 dB at 1 Kc. Output 1·5 mV. Rec. load 50-100K. Arm features built-in lowering device with all movement on a viscous damped uni-pivot. Price (stereo): £16 8s. 9d. (U.K. purchase tax £2 16s. 1d.); (mono): £15 13s. 1d. (U.K. purchase tax £2 13s. 5d.).

Spare heads: Price (type EPH/S (stereo)): £7 16s. 7d. (U.K. purchase tax £1 6s. 9d.); (type EPH/M (mono)): £7 0s. 11d. (U.K. purchase tax £1 4s. 1d.); (type EPH/78 (78)): £10 (U.K. purchase tax £1 14s. 2d.).

★

CONNOISSEUR. See A. R. Sugden & Co. Ltd.

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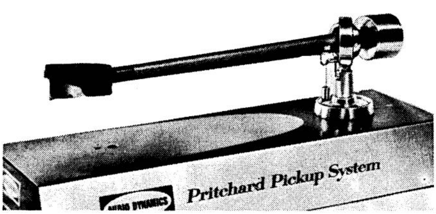
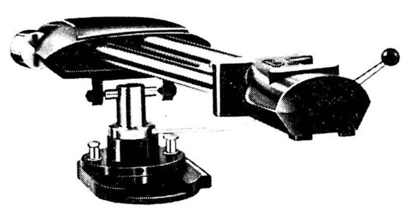
COSMOCORD LTD., Eleanor Cross Road, Waltham Cross, Herts. Tel.: Waltham Cross 27331. Cables: Acos, Waltham Cross.



ADC Pritchard Pickup arm



B.J. Super 90 arm

●**Acos GP73-2.** Stereo/mono crystal cartridge. Turnover type. Stylus, sapphire or diamond. P.w. 3-4 gm. Range 40 c/s-12 Kc/s. Output 150 mV. Rec. load 2 megohms. Price: (sapphire/sapphire) £1 15s. (U.K. purchase tax 5s. 8d.); (sapphire/diamond): £2 4s. 7d. (U.K. purchase tax 7s. 2d.).

●**Acos GP94.** Stereo ceramic cartridge. Turnover dual stylus. Stylus 0·6-0·7 thou. diamond or sapphire, 2·5 thou. sapphire. P.w. 3-6 gm. Tip mass 2·5 mg. dynamic. Compliance: Lat. 6 × 10^{-6} cm/dyne, vert. 6 × 10^{-6} cm/dyne. F.R. Flat 100 c/s-12 Kc/s, 7-8 dB down at 30 c/s relative to 1 Kc/s. Separation: 20 dB at 1 Kc/s, 8 dB at 10 Kc/s, minimum. Output 80 mV minimum. Load impedance: 1 megohm each channel. High capacity ceramic elements (1,000 pF). Low temperature co-efficient. Price to be announced.

Acos GP91-1. Mono crystal cartridge. Turnover dual stylus. LP 0·8 thou. diamond or sapphire, 78 2·5 thou. sapphire. P.w. 3-6 gm. Tip mass 2·5 mg. dynamic. Compliance 5 × 10^{-6} cm/dyne. F.R. 30 c/s-20 Kc/s. Output 160 mV. Load impedance 1 megohm. Low temperature co-efficient. Price: (sapphire/sapphire) £1 7s. 6d. (U.K. purchase tax 4s. 5d.); (diamond/sapphire) £1 16s. 1d. (U.K. purchase tax 5s. 10d.).

Acos GP92. Mono ceramic cartridge. Turnover stylus assembly. LP 0·8 thou. diamond or sapphire, 78 2·5 thou. sapphire. P.w. 5–10 gm. Tip mass 2·5 mg. dynamic. Compliance 2·5 × 10^{-6}. F.R. 150 c/s-16 Kc/s ±3 dB, 12 dB down at 30 c/s relative to 1 Kc/s. Output 100 mV. Load impedance 1 megohm. Low temperature co-efficient. Price: to be announced.

●**Acos GP93.** Stereo crystal cartridge. Turnover dual stylus. Stylus 0·6-0·7 thou. diamond or sapphire, 2·5 thou. sapphire. P.w. 5-10 gm. Tip mass 2·5 mg. dynamic. Compliance: vertical 2·2 × 10^{-6} cm/dyne, lateral 2·2 × 10^{-6} cm/dyne. F.R. flat 250 c/s-18 Kc/s, 3 dB down at 100 c/s relative to 1 Kc/s. Output 250 mV. Rec. load 1 megohm. Low temperature co-efficient. Price: to be announced.

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DECCA SPECIAL PRODUCTS. Decca Radio and Television Division of The Decca Record Co. Ltd., Ingate Place, Queenstown Road, London, S.W.8. Tel.: Macaulay 6677.

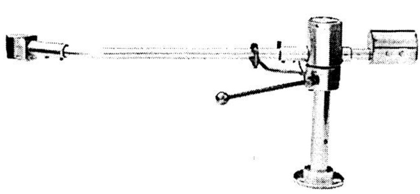
●**Deram Ceramic.** Stereo/mono cartridge. Transcription: white shell. Autochanger: black shell. P.w. white 2·5 gm., black 3·5 gm. Tip mass: white 0·6 mg., black less than 1 mg. Compliance: white 9 × 10^{-6} lateral, 5 × 10^{-6} vertical; black 6·5 × 10^{-6} lateral, 4 × 10^{-6} vertical. F.R. 18 c/s-18 Kc/s ±3 dB (black ±3·5 dB). Separation better than −20 dB at 1 Kc/s. Output 50 mV per channel. Rec. load impedance 2 megohms. Stylus 0·5-0·6 thou. diamond. Price: (white) £4 1s. 4d. (U.K. purchase tax 13s. 2d.), (black) £3 3s. 4d. (U.K. purchase tax 10s. 2d.).

Deram Ceramic. Mono cartridge. Stylus 1 thou. diamond. All other details as for stereo/mono cartridge. Price: (white) £4 1s. 4d. (U.K. purchase tax 13s. 2d.); (black) £3 3s. 4d. (U.K. purchase tax 10s. 2d.).

Deram Ceramic. Mono 78 cartridge. Stylus 3 thou. sapphire. All other details as for stereo/mono changer Deram. Price: £2 9s. 7d.

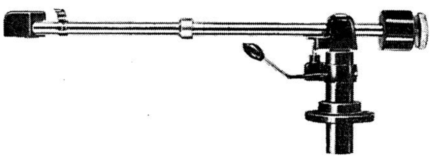
●**ffss Mk. I head.** Variable reluctance stereo/mono head. Stylus 0·5 thou. diamond. P.w. 3·5 gm. Tip mass less than 1 mg. Compliance: 10 × 10^{-6} lateral, 2 × 10^{-6} vertical. F.R. 40 c/s-15 Kc/s ±1 dB. Separation −20 dB at 1 Kc/s. Output 1·4 mV per cm/sec. RMS per channel. Rec. load 50K. Price: £11 15s. 3d. (U.K. purchase tax £1 17s. 9d.).

●**ffss Mk. II head.** Variable reluctance stereo/mono head. F.R. 40 c/s-16 Kc/s ±1 dB. Separation −20 dB at 1 Kc/s; −15 dB at 50 c/s and 12 Kc/s. Output 1·2 mV per channel. Other details as for Mk. I head.

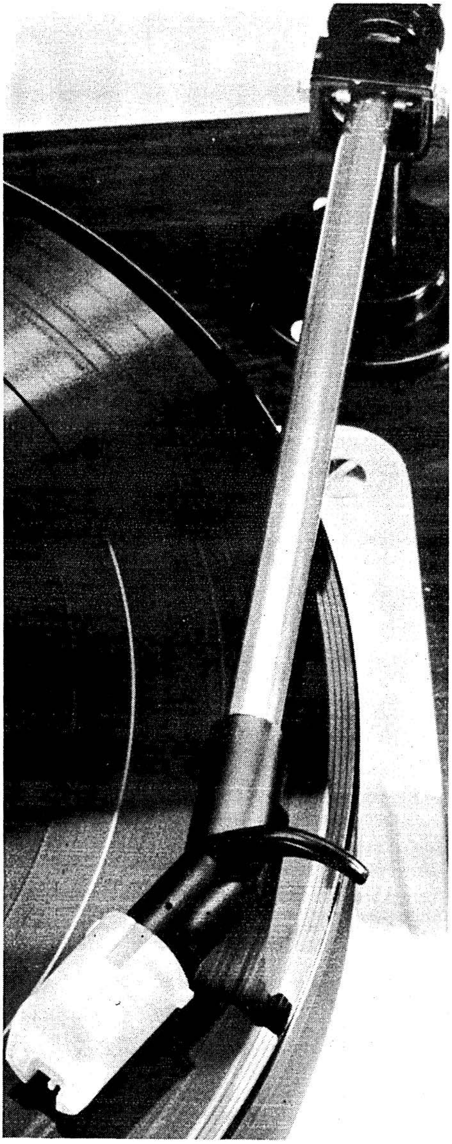


EMI EPU 100 arm and head

Decca Mk I 'Super' arm and head



Decca ffss professional arm and head



Decca Anti-Rumble Pickup

●**ffss Mk. III head.** Variable reluctance stereo/mono head. Stylus 0·3 × 0·7 elliptical diamond. P.w. 2 gm. Compliance: 15 × 10^{-6} lateral, 4 × 10^{-6} vertical. F.R. 20 c/s-16 Kc/s ±1 dB. Other details as for Mk. II. Price: £15 16s. 8d. (U.K. purchase tax £2 10s. 10d.).

ffss Mono Elliptical. Variable reluctance mono equivalent of the Mk. III stereo/mono head. Stylus 0·3 × 1 thou. elliptical diamond. Price: £11 6s. 3d. (U.K. purchase tax £1 16s. 3d.).

ffss Mono LP. Variable reluctance mono equivalent of Mk. I and Mk. II stereo/mono heads. Stylus 1 thou. diamond. Price: £8 11s. 11d. (U.K. purchase tax £1 7s. 7d.).

ffss Mono 78. Variable reluctance 78 equivalent of Mk. I and Mk. II stereo/mono heads. Stylus 2·8 thou. diamond. Price: £8 11s. 11d. (U.K. purchase tax £1 7s. 7d.).

Deram Universal Arm. General purpose arm with head shell for Deram and many other cartridges. Price: £4 10s. 6d. (U.K. purchase tax 14s. 6d.).

Deram ARI arm. Anti-rumble integrated design. Used with Deram cartridge achieves mechanical rumble filter without attenuation of wanted frequencies. Price: £5 17s. 7d. (U.K. purchase tax 18s. 11d.).

ffss Mk. I and Mk. I Super. Transcription arms suitable for *ffss* heads only. Super arm suitable for elliptical stylus as well as other *ffss* heads. Prices: Mk. I £4 10s. 6d. (U.K. purchase tax 14s. 6d.); Mk. I Super £6 15s. 9d. (U.K. purchase tax £1 1s. 10d.).

ffss Professional Arm. Suitable for all *ffss* heads. Includes lowering device and pressure adjustment. Price: £15 16s. 8d. (U.K. purchase tax £2 10s. 10d.).

NOTES: Decca maintains that head and arm should be designed as an entity for optimum results. For this reason Decca *ffss* arms and heads have an exclusive head fitting, which also ensures accurate alignment. All *ffss* heads will fit all *ffss* arms, but heads with elliptical stylus should be used only with Professional arms, or arms reaching the Super specification. Mk. I arms not reaching Super specification can be converted for £3 3s.

Deram arms are designed specifically for Deram ceramic cartridges. The anti-rumble properties of the ARI arm depend on it being used with a Deram cartridge. Deram heads are suitable for use with amplifiers having sensitivity of 150 mV.

Specifications for Deram heads assume the use of the latest (light blue) stylus assembly. The specification is less advanced with the white stylus although the output is greater. Stylus for all Deram pickup heads, including diamond 78, are £1 5s. each including tax.

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ELAC. Electroacustic GmbH., Kiel, West Germany. Distributors: Mitchell Enterprises Ltd., 61 West Street, Dorking, Surrey. Tel.: Dorking 4229.

●**STS222D.** Stereo cartridge. Moving magnet. ½ in. fixing centres. Stylus 0·7 thou. diamond. P.w. 2·5-4·5 gm. Compliance 7 × 10^{-6} cm/dyne. Range 20 c/s-20 Kc/s (up to 10 Kc/s ±2 dB). Separation 24 dB at 1 Kc/s. Output 2·2 mV. Rec. load 33-51K. Price: £13 5s. 6d. (U.K. purchase tax £2 4s. 3d.).

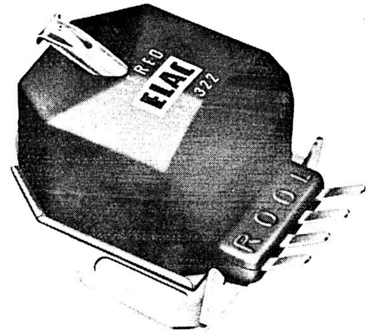
●**STS322.** Stereo cartridge. Moving magnet. ½ in. fixing centres. Stylus 0·5 thou. diamond. P.w. 2·5-3 gm. Compliance 12 × 10^{-6} cm/dyne. Range 20 c/s-20 Kc/s ±2 dB. Separation 26 dB at 1 Kc/s, 20 dB at 10 Kc/s. Output 1 mV. Rec. load 33-51K. Price: £16 18s. 6d. (U.K. purchase tax £2 16s. 10d.).

MST1. Mono magnetic cartridge. ½ in. fixing centres. Stylus (33⅓, 45) 1 thou. diamond, (78) 2·6 thou. sapphire. P.w. 5-8 gm. Tip mass 2·5 mg. Compliance 5·1 × 10^{-6} cm/dyne. Range 20 c/s-20 Kc/s ±2 dB. Output 4·5 mV. Rec. load 37K. Price: Diamond £6 14s. 3d. (U.K. purchase tax £1 2s. 5d.).

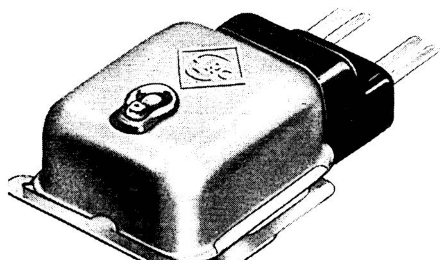
●**MST2.** Two MST1 cartridges back to back. Price: Diamond/sapphire £7 15s. (U.K. purchase tax £1 5s. 10d.).

●**BST406.** Stereo ceramic cartridge. Stylus (33⅓, 45) 0·7 thou. (78) 2·6 thou. P.w. 5-8 gm. Compliance 4 × 10^{-6} cm/dyne. Range 20 c/s-18 Kc/s ±2 dB. Output 90 mV. Rec. load 0·5-1 megohm. Cross-talk damping at 1 Kc/s 20 dB. Price: (sapphires) £3 15s. (U.K. purchase tax 12s. 6d.).

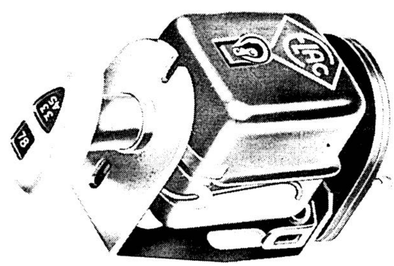
●**KST106.** Stereo crystal cartridge. Similar specification to BST406 but output 150 mV. Price: (sapphires) £2 7s. 6d. (U.K. purchase tax 7s. 11d.).



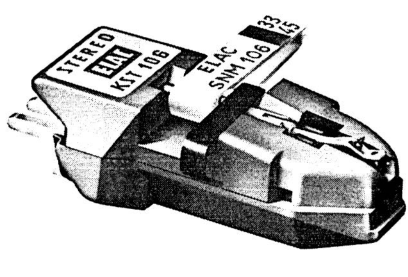
Elac STS 322 cartridge



Elac MST 1 mono



Elac MST 2 mono



Elac KST 106 cartridge

E.M.I. See Clarke & Smith Manufacturing Co. Ltd.

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EMPIRE SCIENTIFIC. Distributors: Howland-West Ltd., 11 Howland Mews, Howland Street, London, W.1. Tel.: Langham 1381.

●**880P.** Stereo/mono magnetic cartridge. Standard $\frac{1}{2}$ in. mounting. Hand-polished diamond stylus 0·6 thou. P.w. $\frac{1}{2}$-4 gm. Tip mass 0·5 mg. Compliance 15 $\times$ 10^{-6} cm/dyne. F.R. 10 c/s-28 Kc/s. Channel separation better than 30 dB. Output 10 mV. Rec. load impedance 47K. Price: £11 5s. 10d. (U.K. purchase tax £1 16s. 8d.).

●**880PE.** Stereo/mono magnetic cartridge. Standard $\frac{1}{2}$ in. mounting. Elliptical diamond stylus 0·2 $\times$ 0·9 thou. P.w. $\frac{1}{2}$-4 gm. Compliance 20 $\times$ 10^{-6} cm/dyne. F.R. 8 c/s-30 Kc/s. Separation better than 30 dB. Output 10 mV. Rec. load impedance 47K. Price: £17 (U.K. purchase tax £2 15s. 3d.).

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EXPERT PICKUPS LTD., 84D Belsize Lane, Hampstead, London, N.W.3. Tel.: Swiss Cottage 6324.

Moving coil pickup heads. LP and 78. Output 0·25 mV/cm/sec. Impedance 10 ohms. (step up required for use with most pre-amplifiers). Stylus: 0·7 thou. or 1 thou. (LP), 2·5 or 3·5 thou. (78). Fit most shells with $\frac{1}{2}$ in. fixing centres. Price: £7 12s. 9d. (U.K. purchase tax £1 6s. 9d.).

Four-pin plug-in heads. Special for Ortofon, S.M.E. arms, styli as above. Price: £8 10s. (U.K. purchase tax £1 9s. 9d.).

Miniature Thorn Heads. Price: £6 10s. (U.K. purchase tax £1 6s. 8d.). Four-pin angled type £7 12s. 6d. (U.K. purchase tax £1 6s. 8d.).

Pathé-Edison. Hill and dale disc reproducer for Expert, Ortofon, S.M.E. arms. Price: £7 1s. 1d. (U.K. purchase tax £1 3s. 8d.).

Cantilever system replacement styli. Highly polished diamond in circular or elliptical tip. Radii from 0·5 thou. to 4 thou. Prices and details on request.

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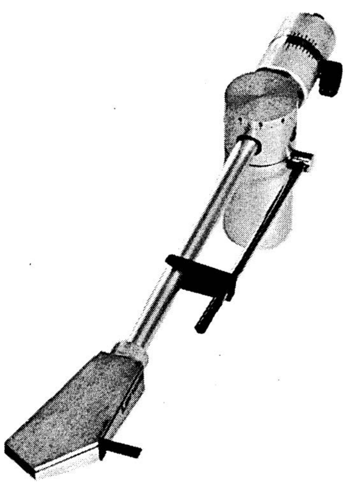
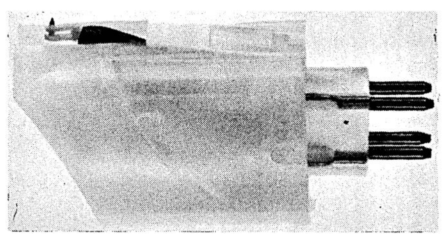
GOLDRING MANUFACTURING CO. (GREAT BRITAIN) LTD., 486/488 High Road, Leytonstone, E.11. Tel.: Leytonstone 8343. Cables: Echovox, London.

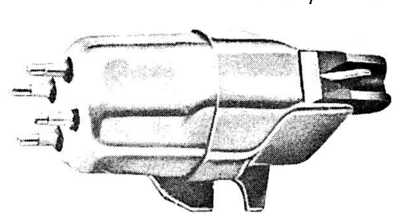
CM60. Ceramic turnover cartridge fitted with sapphire LP and coarse groove styli. Load impedance 1 megohm. Output voltage 200 mV. Range 30 c/s-14 Kc/s ± 2 dB. P.w. 5-7 gm. Price: £1 5s. (U.K. purchase tax 4s. 11d.).



Goldring-Lenco P77 arm



Deram transcription head



Howland & West Empire 880*PE cartridge*

CM60/D. As CM60 but fitted with LP diamond. Price: £2 1s. 6d. (U.K. purchase tax 6s. 9d.).

●**SX10/L.** Stereo turnover cartridge. Fitted with sapphire LP and 78 styli. Output voltage 170 mV. Range 30 c/s-14 Kc/s. Load impedance I megohm. P.w. 4 gm. Price: £1 8s. 6d. (U.K. purchase tax 4s. 8d.).

●**SX10L/D.** As SX10/L but fitted with 0·7 thou. diamond. Price: £2 5s. (U.K. purchase tax 7s 4d.).

●**CS80.** Stereo/mono ceramic turnover cartridge. Stylus 0·7 thou. sapphire or diamond for stereo/LP and 2·5 thou. for 78. P.w. 2-4 gm. Compliance 4×10^{-6} cm/dyne. Range 30 c/s-14 Kc/s. Separation 20 dB (1 Kc/s), 10 dB (10 Kc/s). Output 200 mV. Rec. load 1-2 megohms. Price: (sapphire) £1 15s. (U.K. purchase tax 5s. 8d.); (diamond) £2 11s. 6d. (U.K. purchase tax 8s. 5d.).

●**CS90.** Stereo ceramic cartridge. Stylus 0·5 thou. diamond. P.w. 2 gm. Compliance 8×10^{-6} cm/dyne. Range 30 c/s-18 Kc/s. Separation 25 dB (1 Kc/s); 10 dB (10 Kc/s). Output 50 mV. Rec. load 1-2 megohms. Price: £4 4s. (U.K. purchase tax 13s. 8d.).

●**CS91E.** Stereo/LP ceramic cartridge. Stylus diamond elliptical. P.w. 1½-3 gm. Tip mass 1 mg. F.R. 20 c/s-20 Kc/s. Separation 25 dB. Output 20 mV. Rec. load 2 megohms. Price: £6 6s. (U.K. purchase tax £1 0s. 6d.).

"580". Variable reluctance turnover cartridge. Sapphire stylus for LP, sapphire for 78. Output voltage 3·2 mV. Range 20 c/s-18 Kc/s. P.w. 6-7 gm. Load impedance 68K. Price: £4 4s. (U.K. purchase tax 13s. 8d.).

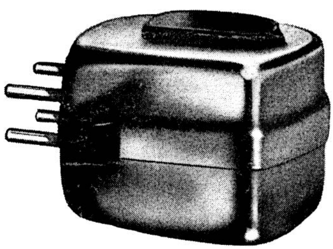
"600". Variable reluctance turnover cartridge. ½ in. centre, mounting holes. Diamond stylus for LP, sapphire for 78. Output voltage 3·2 mV. Range 20 c/s-21 Kc/s ±2 dB. P.w. 5 gm. Load impedance 68K. Price: £8 8s. (U.K. purchase tax £1 7s. 4d.).

●**700 Mk. 2.** Magnetic variable reluctance stereo cartridge. Diamond 0·7 thou. stylus. Load impedance 50K. per channel. Output voltage 3 mV per channel (RMS). Range 40 c/s-16 Kc/s. P.w. 3-4 gm. Price: £7 7s. (U.K. purchase tax £1 3s. 11d.).

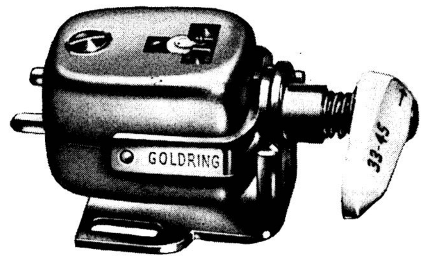
●**Pickering 380A.** Moving-magnet stereo cartridge with ½ in. fixing centres. Stylus 0·7 thou. diamond. P.w. 2 gm. Output 3 mV. Price: £12 12s. (U.K. purchase tax £2 0s. 11d.).

●**Pickering V15.AMI.** Stereo/LP moving magnet cartridge. Stylus 0·7 thou. diamond. P.w. ¾-3 gm. Tip mass 1 mg. F.R. 20 c/s-20 Kc/s. Separation 35 dB. Output 1·1 mV. Price: £9 9s. (U.K. purchase tax £1 10s. 9d.).

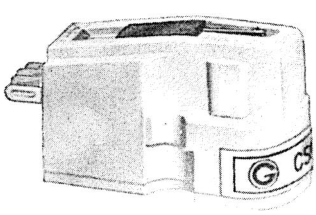
●**Pickering V15.AMEI.** Similar specification to V15.AMI but with elliptical diamond stylus. Price: £13 15s. (U.K. purchase tax £2 4s. 8d.).



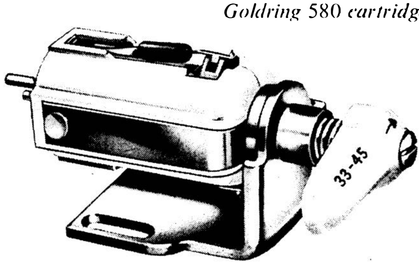
Goldring 700 stereo



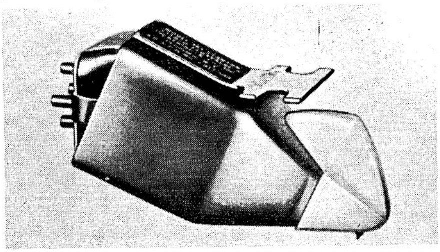
Goldring 580 cartridge



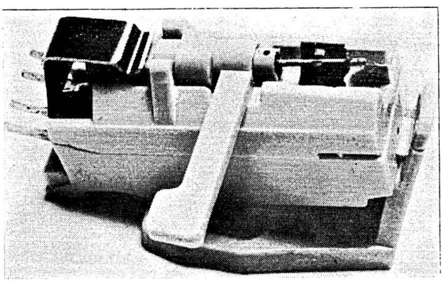
Goldring CS90 Stereo Ceramic Cartridge



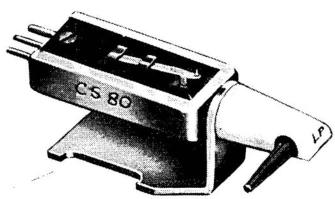
Goldring SX 10/D stereo



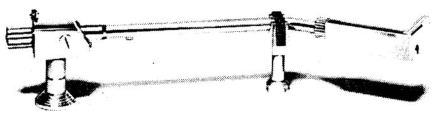
Pickering 380A stereo



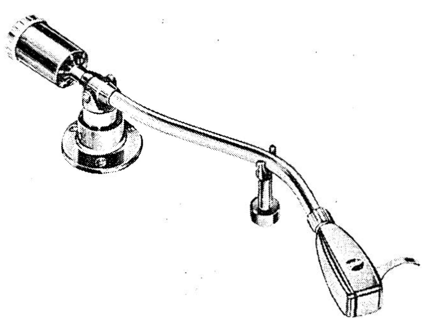
Acos GP93 crystal stereo



Goldring CS 80 ceramic stereo



Lenco L70 arm



Ortofon SMG 212 arm and shell

G65. Low-mass tubular arm. Removable head slide, moving counterweight, stylus pressure adjustment, height adjustment. Price: £6 6s. (U.K. purchase tax £1 0s. 6d.).

●**Lenco L70.** Stereo and mono transcription pickup arm. P.w. adjustable. Price: £7 7s. (U.K. purchase tax £1 3s. 11d.).

Lenco P77. Transcription pickup arm. P.w. adjustable and calibrated in grammes. Lowering device incorporated. Can be balanced in all planes. Price: £25 6s. (U.K. purchase tax £4 12s. 6d.).

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ORTOFON. Fonofilm Industri A/S Copenhagen. Distributed in the U.K. by Metro-Sound (Sales) Ltd., Bridge Works, Wallace Road, London, N.1. Tel.: Canonbury 8641. Cables: Metrosound, London.

Type AG. Moving coil, interchangeable head with vertical coils. Diamond stylus. Output voltage LP 0·5 mV. Range 20-14,000 c/s $\pm$2 dB. P.w. 5-7 gm. Load impedance 2 ohms (iransformer required). Price: £7 5s. (U.K. purchase tax £1 3s. 3d.).

Type CG. Moving coil as above. Diamond stylus. Output voltage LP 0·3 mV. Range linear 20-20,000 c/s. P.w. 3 gm. Load impedance 2 ohms (transformer required. Price: £14 (U.K. purchase tax £2 4s. 10d.).

Transformer for use with above pickups. Price: £3 5s.

●**SPU/G.** Moving coil stereo cartridge. Diamond stylus 0·00065-0·0007. Output voltage 0·05 mV. Range 20-20,000 c/s. Separation 20-25 dB. P.w. 2 gm. Rec. load 2 ohms. Price: £18 (U.K. purchase tax £2 17s. 9d.).

●**SPU/GT.** Moving coil cartridge with built-in transformers. Diamond stylus. Channel separation 20-25 dB. Range 20-20,000 c/s. Load imp. 50K ohms. P.w. 2 gm. Output voltage 2 mV. Available with pure stereo 0·0005 or 0·00065 diamond for use with mono/stereo. Price: £20 (U.K. purchase tax £3 4s. 2d.).

●**SKG/212.** 12 in. pickup arm with adjustable playing weight. Price: £7 (U.K. purchase tax £1. 2s. 6d.).

●**SMG/212.** 12 in. pickup arm for stereo and mono cartridges. Playing weight adjustable from 0-12 gm. Price: £11 (U.K. purchase tax £1 15s. 4d.).

RKG/309. 16 in. pickup arm. Details as for SKG/212. Price: £17 (U.K. purchase tax £2 14s. 8d.).

●**RMG/309.** 16 in. pickup arm. Details as for SMG/212. Price: £21 (U.K. purchase tax £3 7s. 6d.).

RMG/212. Pickup arm with shell. Details as for RMG/309, but with plug insert for leads. For details of lowering device see Ortofon Hi-Jack. Price: £18 15s. (U.K. purchase tax £3 0s. 2d.).

SPU-G/E (SPU-E without shell). Stereo cartridge. Moving coil. Stylus elliptical diamond 23 × 8 microns. P.w. 2 gm. Tip mass 1 mg. Compliance 10 × 10^{-6} cm/dyne. Range 20 c/s-20 Kc/s. Separation 25 dB. Rec. load 2 ohms. Output voltage 0·05 mV. Price (SPU-G/E): £23 (U.K. purchase tax £3 13s. 10d.); (SPU-E): £22 5s. (U.K. purchase tax £3 11s. 5d.

SPU-G/T-E (SPU-T/E without shell). Stereo cartridge with built-in transformers. Output voltage 2 mV. Rec. load 50K. Other details as for SPU-G/E. Price (SPU-G/T-E): £25 (U.K. purchase tax £4 0s. 3d.); (SPU-T/E): £24 5s. (U.K. purchase tax £3 17s. 10d.).

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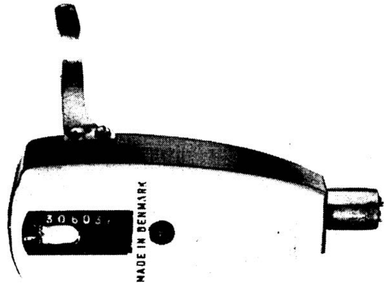
PHILIPS ELECTRICAL LTD., Century House, Shaftesbury Avenue, W.C.2. Tel.: Gerrard 7777. Cables: Phillamps.

AG.3016. Crystal head fitted with sapphire styli. Output voltage 100 mV. Range 30-15,000 c/s. P.w. 5-7 gm. Load imp. 470K ohms. Price: £1 1s. 6d. (U.K. purchase tax 3s. 6d.).

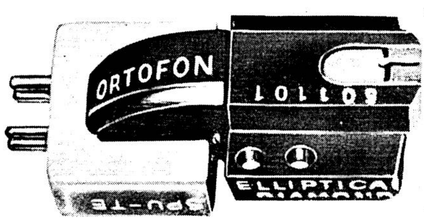
●**AG.3401.** Stereo magnetodynamic head with diamond stylus. Output voltage 2 mV per channel. Range 20-20,000 c/s. P.w. 3-5 gm. Load imp. 68K per channel. Price: £8 2s. 9d. (U.K. purchase tax £1 6s. 3d.).

●**AG.3301.** Crystal stereo pickup cartridge with turnover head. Sapphire styli. Output voltage 120 mV per channel. P.w. 4-6 gm. Load imp. 470K per channel. Price: £1 8s. (U.K. purchase tax 4s. 6d.).

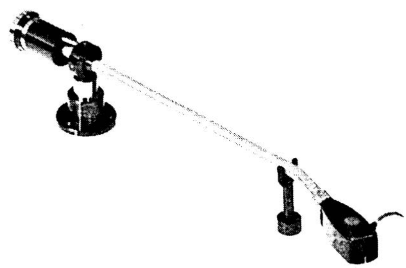
●**AG.3060.** Crystal stereo pickup. Diamond stylus. Range 30 c/s-12 Kc/s. Output voltage 120 mV per channel. P.w. 4-6 gm. Load imp. 470K ohms per channel. Price: £2 6s. 6d.). (U.K. purchase tax 7s. 6d.).



Ortofon SPU-G/T stereo head

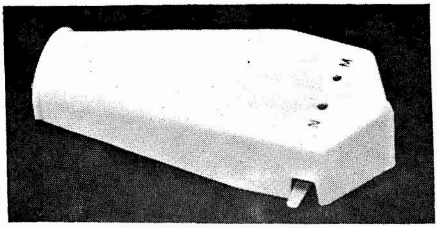


Ortofon SPU-T/E cartridge

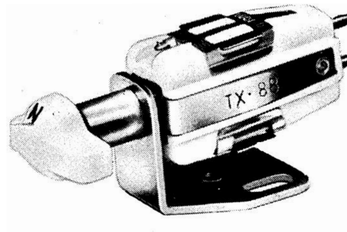


Ortofon RMG 309 *arm*

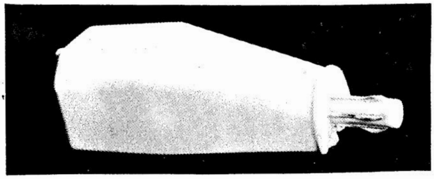
Ortofon SKG 212 *arm*



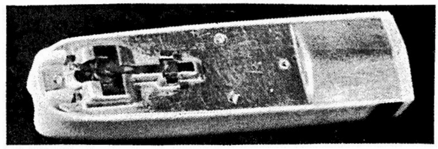
Philips AG 3301 *crystal stereo*



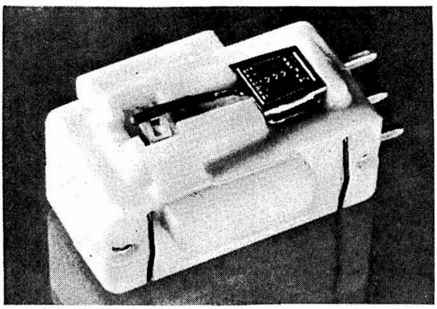
*Ronette TX*88 *mono cartridge*



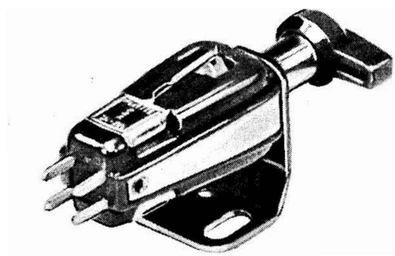
Philips AG 3402 *stereo head*



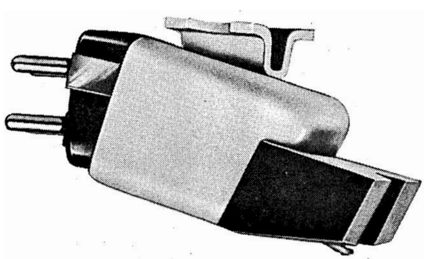
Philips AG 3060 *stereo head*



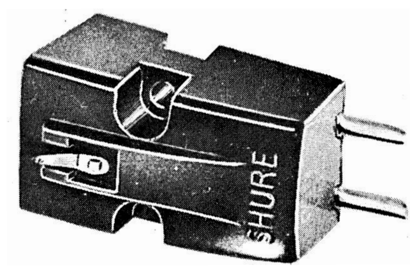
Ronette BF-40 *stereo*



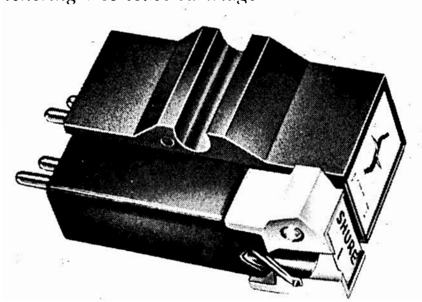
Ronette Stereo **105** ***Cartridge***



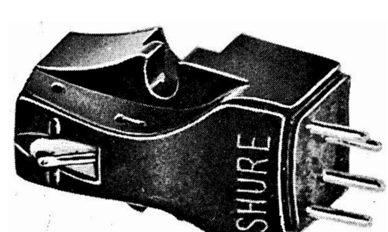
*Pickering V*15 *AMI cartridge*



Shure M5D cartridge



Shure M55-E cartridge



Shure M3D-M cartridge

●**AG.3063.** Stereo crystal head. Sapphire 0·7 thou. stylus. Load imp. 470K ohms per channel. Output voltage 120 mV per channel. Range 30-12,000 c/s. P.w. 4-6 gm. Price: £1 8s. (U.K. purchase tax £4s. 6d.).

●**AG.3304.** Stereo crystal turnover head. Styli: 3 thou. sapphire for 78, diamond 0·7 thou. for microgroove. Load imp. 470K ohms per channel. Output voltage 120 mV per channel. P.w. 4-6 gm. Price: £2 14s. 3d. (U.K. purchase tax 8s. 9d.).

●**AG.3402 5-contact stereo magneto-dynamic pickup.** Microgroove only, 0·7 thou. diamond stylus. Output voltage 2 mV per channel. Range 20-20,000 c/s. P.w. 3-5 gm. Load imp. 68K per channel. Price: £8 2s. 9d. (U.K. purchase tax £1 6s. 3d.).

●**AG.3306.** Stereo crystal turnover head. Styli: sapphire (78) 3 thou., (LP) 0·7 thou. P.w. 3-6 gm. Compliance (lat.) 3 x 10^{-6} cm/dyne; (vert.) 1·8 × 10^{-6} cm/dyne. Range 30 c/s-16 Kc/s. Separation 18 dB. Output 70 mV. Load imp. 470K per channel. Price: £1 6s. 4d. (U.K. purchase tax 4s. 3d.).

●**AG.3310.** Stereo crystal turnover head. Styli: sapphire (78) 3 thou.; diamond (LP) 0·7 thou. P.w. 3-6 gm. Range 30 c/s-16 Kc/s. Separation 18 dB. Output 70 mV. Load imp. 470K per channel. Price: £2 14s. 3d. (U.K. purchase tax 8s. 9d.).

★

PICKERING. See Goldring Manufacturing Co. Ltd.

★

RONETTE. U.K. distributors: H. K. Harrisson & Co. Ltd., 1-3 Jacob's Well Mews, George Street, London, W.1. Tel.: Welbeck 9453 and 9606. Cables: Empirian, Audley.

DC-395. Crystal turnover cartridge. Sapphire stylus. Load imp. 1 megohm 100 pF. Output voltage 1,000 mV. Range 30-6,000 c/s. P.w. 6-10 gm. Price: £1 10s. (U.K. purchase tax 4s. 10d.).

DC-284-OV. Crystal turnover cartridge. Sapphire stylus. Load imp. 1 megohm 100 pF. Output voltage 230 mV. Range 30-10,000 c/s. P.w. 6-10 gm. Price: £1 13s. 9d. (U.K. purchase tax 5s. 7d.).

DC-284-T. Crystal turnover cartridge. Sapphire stylus. Load imp. 1 megohm 100 pF. Output voltage 600 mV. Range 30-8,000 c/s. P.w. 6-10 gm. Price: £1 13s. 9d. (U.K. purchase tax 5s. 7d.).

DC-284-P. Crystal turnover cartridge. Sapphire stylus. Load imp. 1 megohm 100 pF. Output voltage 105 mV. Range 30-12,000 c/s. P.w. 4-8 gm. Price: £1 13s. 9d. (U.K. purchase tax 5s. 7d.).

DC-395-S. Crystal turnover cartridge. Sapphire stylus. Load imp. 1 megohm 100 pF. Output voltage 1,450 mV. Range 30-6,000 c/s. P.w. 10 gm. Price: £1 13s. 9d. (U.K. purchase tax 5s. 7d.).

TX-88. Crystal turnover cartridge. Sapphire stylus. Load imp. 1 megohm 100 pF. Output voltage 150 mV. Range 30-20,000 c/s. P.w. 2-8 gm. Price: £1 19s. 5d. (U.K. purchase tax 6s. 7d.).

●**BF-40.** Stereo single sided crystal cartridge. Sapphire 0·75 thou. stylus. Load imp. 1 megohm 100 pF. Output voltage 180 mV. Range 30-12,000 c/s. P.w. 5-7 gm. Price: £2 16s. 3d. (U.K. purchase tax 9s. 4d.).

●**Stereo 105.** Stereo crystal turnover cartridge. Sapphire stylus. Load imp. 1 megohm 100 pF. Output voltage 250 mV. Range 30-12,000 c/s. P.w. 3-6 gm. Price: £2 17s. 4d. (U.K. purchase tax 9s. 7d.).

●**Stereo 106.** Stereo crystal turnover cartridge. Details as for 105 but output voltage 580 mV. Price: £2 17s. 4d. (U.K. purchase tax 9s. 7d.).

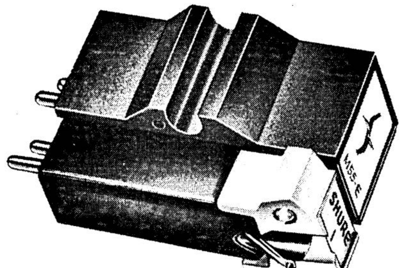
●**Stereo 208.** Stereo crystal turnover cartridge. Details as for 105 but output voltage 750 mV. Range 30-6,000 c/s. P.w. 6-10 gm. Price: £2 17s. 4d. (U.K. purchase tax 9s. 7d.).

★

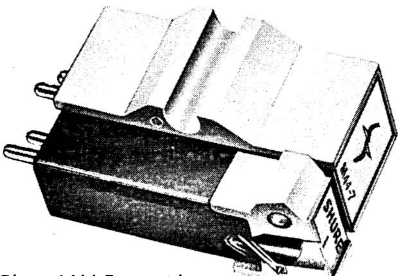
SHURE ELECTRONICS LTD., 84 Blackfriars Road, London, S.E.1. Tel.: Waterloo 6361.

●**M3D-M.** Stereo Dynetic cartridge. Moving magnet. ½ in. fixing centres. Stylus 0·7 thou. diamond. P.w. 3-6 gm. Compliance 4 × 10^{-6} cm/dyne. F.R. 20 c/s-15 Kc/s. Separation 20 dB. at 1 Kc/s. Output 1 mV. Load impedance 47K. Price: £7 10s. (U.K. purchase tax £1 4s. 1d.).

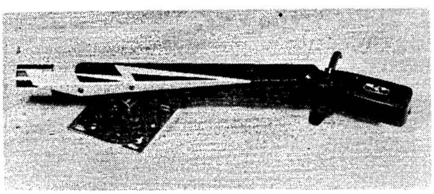
●**M44-C.** Stereo Dynetic cartridge. Moving magnet. ½ in. fixing centres. Stylus 0·7 thou. diamond. (1 thou. and 3 thou. styli available). P.w. 3-5 gm. Compliance 7·5 × 10^{-6} cm/dyne. F.R. 20 c/s-20 Kc/s. Separation 25 dB at



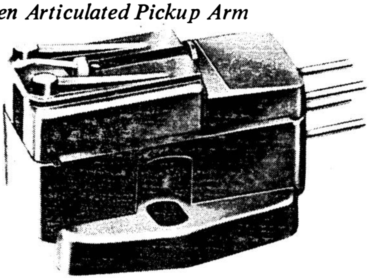
Shure M44-5 cartridge



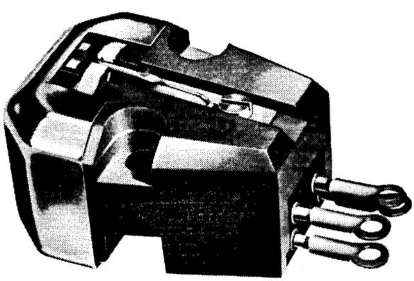
Shure M44-7 cartridge



Worden Articulated Pickup Arm



Connoisseur stereo ceramic cartridge



Tannoy Vari-twin Mk II cartridge

1 Kc/s. Output 1·4 mV. Load impedance 47K. Price: £11 (U.K. purchase tax £1 15s. 3d.).

●**M44-5.** Stereo Dynetic cartridge. Moving magnet. $\frac{1}{2}$ in. fixing centres. Stylus 0·5 thou. diamond. (1 thou. and 3 thou. styli available). P.w. $\frac{3}{4}$-$1\frac{1}{2}$ gm. Compliance 25 × 10^{-6} cm/dyne. F.R. 20 c/s-20 Kc/s. Separation 25 dB at 1 Kc/s. Output 1·2 mV. Load imp. 47K. Price: £12 10s. (U.K. purchase tax £2 0s. 1d.).

●**M44-7.** Stereo Dynetic cartridge. Moving magnet. $\frac{1}{2}$ in. fixing centres. Stylus 0·7 thou. diamond. (1 thou. and 3 thou. styli available). P.w. $1\frac{1}{2}$-3 gm. Compliance 20 × 10^{-6} cm/dyne. F.R. 20 c/s-20 Kc/s. Separation 25 dB at 1 Kc/s. Output 1·8 mV. Load imp. 47K. Price: £11 17s. 6d. (U.K. purchase tax £1 18s. 1d.).

●**M55-E.** Stereo Dynetic cartridge. Moving magnet. $\frac{1}{2}$ in. fixing centres. Stylus 0·9 × 0·2 thou. elliptical diamond. (3 thou. stylus available). P.w. $\frac{3}{4}$-$1\frac{1}{2}$ gm. Compliance 25 × 10^{-6} cm/dyne. Load imp. 47K. Price: £17 2s. 6d. (U.K. purchase tax £2 10s.).

★

S.M.E. LTD., Steyning, Sussex. Tel.: Steyning 2228.

Model 3009 (9 in.). Series II precision pickup arm. Extremely low vertical and lateral friction. Side-thrust compensation. Hydraulically damped lowering control. Tracking force applied precisely, without the need for a gauge. Rapidly adjustable for a wide range of cartridges and heads. Price (with standard shell S.3): £21 7s. 6d. (U.K. purchase tax £3 11s. 3d.).

Model 3012 (12 in.). Series II precision pick-up arm. Details as above. Price (with standard shell S.3): £22 17s. 6d. (U.K. purchase tax £3 16s. 3d.).

S.3 shell with mounting hardware. Price: 18s. (U.K. purchase tax 3s.).

S.2 ultra light-weight shell. Weighs only 6 gm. with mounting hardware. Price: £1 4s. (U.K. purchase tax 4s.).

Companion balance weight for S.2 shell. Price: £1 1s. (U.K. purchase tax 3s. 6d.).

★

SONOTONE. Distributors: Metro-Sound Manufacturing Co. Ltd., Bridge Works, Wallace Road, London, N.1. Tel.: Canonbury 8641. Cables: Metrosound, London.

●**9TA.** Stereo turnover cartridge. Ceramic. Diamond stylus. P.w. 2-4 gm. Tip mass 3·5 mg. Compliance 5·3 × 10^{-6} cm/dyne. F.R. 30 c/s-15 Kc/s ±3 dB. Separation 27 dB. Output voltage 80-120 mV. Load imp. 2 megohm. Price (including diamond stereo/LP stylus): £3 5s. (U.K. purchase tax 10s. 6d.).

●**9TAHC.** Stereo turnover ceramic cartridge. Choice of both sapphire styli or sapphire 78/diamond stereo LP. F.R. 20 c/s-20 Kc/s (±3 dB from 1 Kc/s). Rec. load 2 meg. Sensitivity 55-85 mV/cm/sec at 1 Kc/s. Lateral compliance 8·5 × 10^{-6} cm/dyne. Separation 25 dB at 1 Kc/s. P.w. 1-3 gm. Tip mass 2·5 mg. Capacitance 800 pF. Prices: sapphire/sapphire £2 (U.K. purchase tax 6s. 5d.), sapphire/diamond £3 (U.K. purchase tax 9s. 8d.).

●**20T.** Stereo crystal cartridge. Sapphire styli. F.R. 20 c/s-15 Kc/s (±4 dB from 1 Kc/s). Rec. load 2 megohm. Sensitivity 270-535 mV/cm/sec at 1 Kc/s. Compliance 1 × 10^{-6} cm/dyne. Separation 20 dB at 1 Kc/s. P.w. 8 gm. Capacitance 1,200 pF. Price: £1 10s. (U.K. purchase tax 5s.).

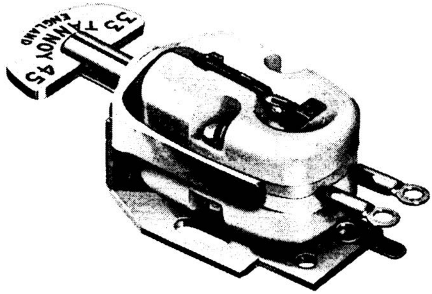
★

A. R. SUGDEN & CO. (ENGINEERING) LTD., Market Street, Brighouse, Yorkshire. Tel.: Brighouse 2142. Cables: Connoisseur, Brighouse.

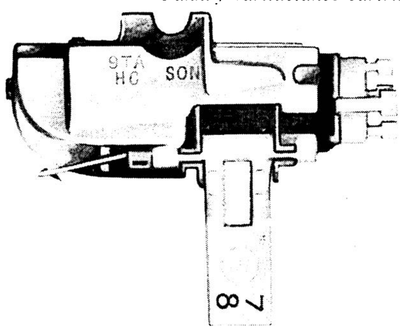
●**Connoisseur stereo head CS1.** Ceramic cantilever system. Diamond stylus 0·5-0·6 thou. Output 20 mV. Load imp. 50-100K ohms. Range 20-16,000 c/s ±2 dB. Channel separation 20/25 dB. P.w. 3½-4 gm. Price: £6 (U.K. purchase tax 19s 11d.). Prices of Mark II heads available. Mark II LP diamond: £6 10s. (U.K. purchase tax £1 1s. 7d.); Mark II Std. or LP sapphire: £3 10s. (U.K. purchase tax 11s. 8d.).

●**Connoisseur stereo ceramic cartridge SCU1.** ½ in. fixing centres. Stylus diamond 0·5-0·6 thou., or 1 thou. for mono. P.w. 2-4 gm. Tip mass 1 mg. Compliance: lateral 12 × 10^{-6} cm/dyne; vertical 8 × 10^{-6} cm/dyne. Range 20 c/s-20 Kc/s ±3 dB. Separation (1 Kc/s) 25-30 dB; (10 Kc/s) 18 dB. Output 6 mV into 100K (constant velocity); 26 mV into 2 megohms load. Features: 4-terminal output; easily replaceable diamond armature. Price: £4 10s. (U.K. purchase tax 14s. 3d.).

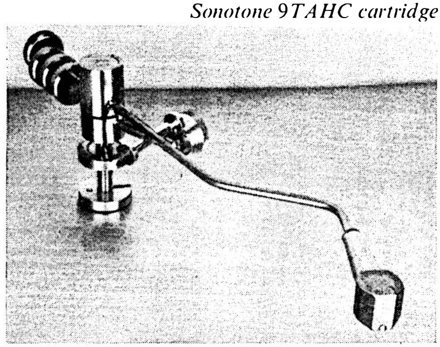
Connoisseur pickup arm SAU1, with detachable head shell wired for stereo/mono. Optional lift/lower device. Single hole fixing. Single unipivot bearing. Accommodates all standard

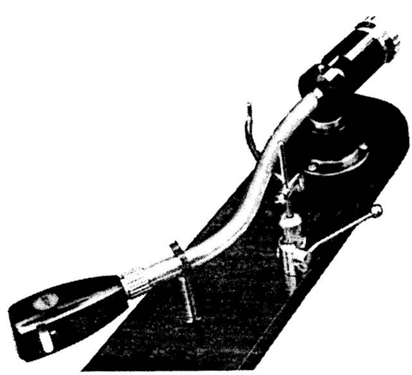


Tannoy variluctance cartridge



Sonotone 9TAHC cartridge


Transcriptor arm


Ortofon RMG/212 Pickup Arm and Shell

cartridges. Adjustable stylus force-calibrated weights supplied. Single lever height adjustment. Price (arm): £5 5s. (U.K. purchase tax 16s. 7d.); (arm with lifting device): £6 5s. (U.K. purchase tax 19s. 9d.); (head shell): £1 2s. 6d. (U.K. purchase tax 3s. 7d.).

★

TANNOY PRODUCTS LTD., West Norwood, London, S.E.27. Tel.: Gipsy Hill 1131. Cables: Tannoy, London.

Variluctance. Turnover cartridge. Output voltages: LP: 10-12 mV; 78 18-20 mV. Range 20-16,000 c/s ±2 dB. P.w. 5-6 gm. (less with professional arms). Load imp. 50K ohms. Price (with 2 diamonds); £12 (U.K. purchase tax £2 3s. 4d.); (with 1 diamond and 1 sapphire): £9 10s. (U.K. purchase tax £1 14s. 3d.); (with 2 sapphires): £7 (U.K. purchase tax £1 5s. 3d.).

Single stylus version of Variluctance for LP also available. Price (with diamond): £6 15s. (U.K. purchase tax £1 4s. 4d.).

●**Vari-twin Mk. II.** Magnetic stereo cartridge. Balance 4-pole system. Diamond stylus 0·5 or 0·7 thou. Output voltage 7 mV per channel. Range 30-15,000 c/s ±1·5 dB. P.w. 4 gm. (less with professional arms). Load imp. 100K ohms. Inductance 350 mH. Price: £9 19s. (U.K. purchase tax £1 15s. 11d.).

★

THORENS. Distributors: Metro-Sound (Sales) Ltd., Bridge Works, Wallace Road, Canonbury, London N.1. Tel.: Canonbury 8641. Cables: Metrosound, London, N.1.

TP. 12 pickup arm. Precision 9 in. pickup arm. Horizontally and vertically balanced. Patented plug-in shell with adjustable vertical tracking angle. Viscous-damped lowering and lifting control. Anti-skating horizontal bias device. Stylus pressure adjustable ½ to 4 gm. Price: £15 (U.K. purchase tax £2 14s. 2d.).

★

TRANSCRIPTORS LTD., 26 Bloomsbury Way, London, W.C.1. Tel.: Chancery 4771, Hampstead 8842.

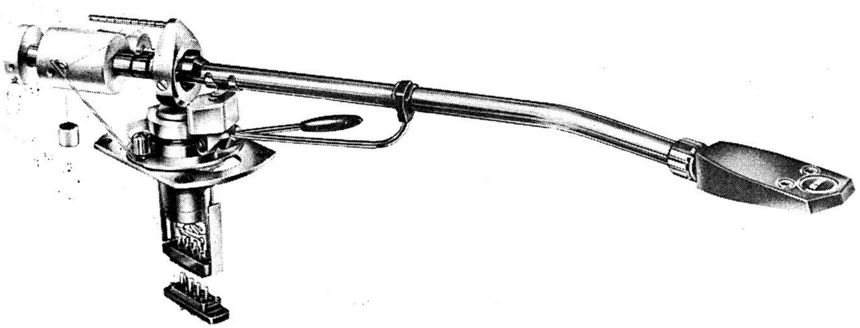
Transcriptor Arm. Stereo or mono pickup arm only. Suitable for cartridges tracking at 0-5 gm. Precision engineered in polished aluminium and chrome. Single-wheel raising and lowering device also provides lateral movement of arm. Fine adjustment of weight. Horizontal and vertical base adjustment. Low mass arm. Wired for stereo. Single hole fixing. Available in 10 in. or 12 in. with universal head fitting, and in 10 in. or 12 in. for E.M.I. EPU100, Decca *ffss*, Decca Deram, Shure Dynetic, and ADC range. Price: (all types) £8 (U.K. purchase tax £1 7s.).

Transcriptor fluid arm. More sophisticated version of the Transcriptor arm. Incorporates fluid-damped unipivot mounting with various grades of oil to cater for different cartridges. Bias compensator. Models for *ffss*, EMI, and universal (not Deram). Price: £11 (U.K. purchase tax £1 18s. 4d.).

★

WORDEN AUDIO DEVELOPMENTS LTD., 54 Chepstow Road, London, W.2. Tel.: Bayswater 4996.

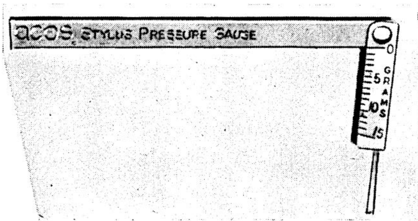
Worden articulated arm. Radially operative single arm with articulated head piece. Tracking correct to $\pm\frac{1}{4}^\circ$. Vertical and lateral friction less than 50 mg. Adjustable counterbalance weight. Height adjustment. Detachable head-shell accepts all standard ½ in. centre fixing cartridges. No resonances above 10 c/s. Price: Complete with one head-shell, £14 7s. (U.K. purchase tax £2 7s. 9d.). Extra shells 15s. (U.K. purchase tax 2s. 6d.). Decca *ffss* adaptor 7s. 6d. (U.K. purchase tax 1s. 3d.).



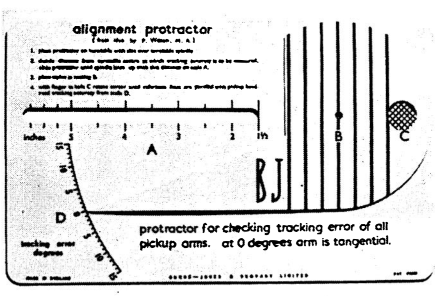
S.M.E. Series 2 Precision Pickup Arm and Shell

PICKUP ACCESSORIES

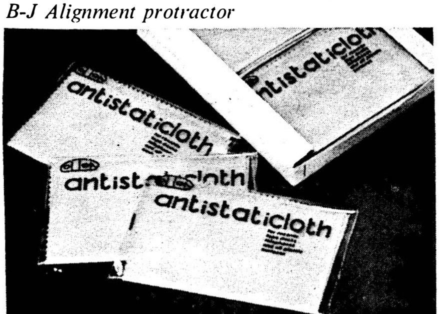
Auriol Mk II pickup control



Acos stylus pressure gauge



B-J Alignment protractor



Colton Antistaticloth

AURIOL (GUILDFORD) LTD., Farnham Trading Estate, Farnham, Surrey. Tel.: Farnham 3366.

Auriol pickup control. This unit eliminates accidental damage to the record by the stylus, the control provides air cushioned lowering and positive vertical lifting and lowering of the stylus. The supporting arm is serrated and calibrated for accurate positioning of the stylus at any pre-selected position within 1-2 microgrooves. Three cursors are provided to mark starting positions and an indexing clip is supplied to suit any specified pickup arm. Price: £3 1s. 3d. (U.K. purchase tax 10s. 3d.).

Auriol pickup control Mk. II. This is dimensionally similar to the above but the arm will swing clear of the turntable to allow its use with the Autochanger/Manual player units. Price: £3 12s. (U.K. purchase tax 12s.).

★

BANG & OLUFSEN. U.K. Sales Division, Eastbrook Road, Eastern Avenue, Gloucester. Tel.: Gloucester 26841. Cables: DEBELEC, Gloucester.

M/lift. For Bang & Olufsen arms only. Hydraulic operation. Price: £3 13s. 6d. (U.K. purchase tax 10s. 8d.).

●**Type GF2.** Transistorised stereo pickup pre-amplifier. Sensitivity: 7 mV input for 0·5V output per channel. N.L. −62 dB. Price: £5 5s.

★

BURNE-JONES & CO. LTD., 18 Brunswick Road, Sutton, Surrey.

Counterweight unit. The addition of this unit to a B.J. pickup arm permits speed and accuracy in weight compensation. Price on application.

Alignment protractor. For measuring the tracking accuracy of all pickup assemblies. Made in plastic ivorine. Price: 8s.

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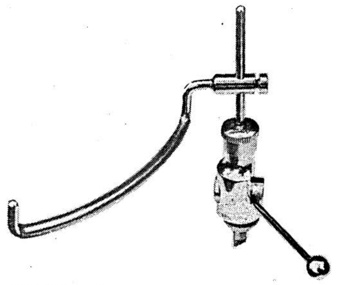
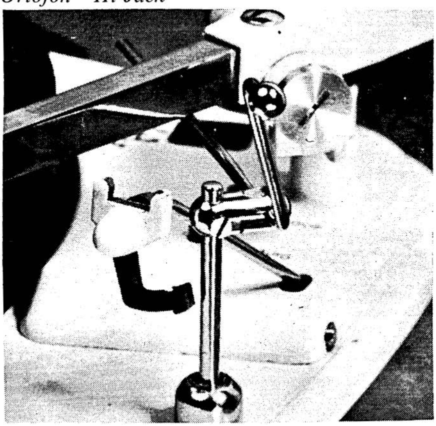
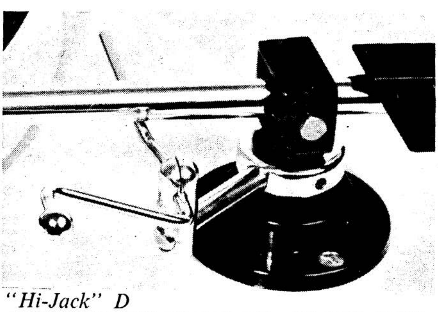
CLENDISC (MAIL ORDER) LTD., c/o Mrs. E. Smith, 7 Trinity Court, Grays Inn Road, London, W.C.1. Tel.: Terminus 9088.



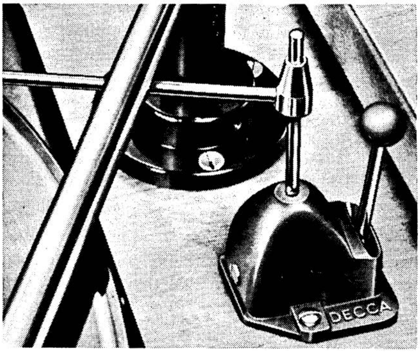
Ortofon "Hi-Jack"



"Hi-Jack" U



"Hi-Jack" D



Decca Microlift

Clendisc. An anti-static cleaner and preserver for records. Price 3s. 9d. Clendisc record cleaning pad. Price: 2s. 11d. including tax.

★

COLTON & CO. (LAPIDARIES) LTD., The Crescent, Wimbledon, London, S.W.19. Tel.: Wimbledon 9401.

Antistaticloth. A soft cloth impregnated with an anti-static material, for cleaning records. Price: 2s. 6d.

Colton E.P. record centre adaptors (45 r.p.m.). Small plastic centre pieces which enable E.P. records to be used again on slim spindle changers after the large centre piece has been removed. Price: 3s. per packet of one dozen. (U.K. purchase tax 6d.).

Varilift. A precision instrument for lowering pickup on to record. Instantly adjustable for height using a single knurled nut. Screw valve provides variable rate of fall which, being hydraulically controlled, is smooth and independent of pickup weight. Provision is made for locking in the raised position when required. Price: £2 11s. 4d. (U.K. purchase tax 8s. 2d.).

Precision level. Circular bubble-type spirit level in white plastic case $1\frac{3}{16}$ in. diameter $\frac{1}{2}$ in. high. Three fixing holes provided or it may be fixed with adhesive. Ensures accurate levelling in all directions. Price: 8s. 3d.

★

COSMOCORD LTD., Eleanor Cross Road, Waltham Cross, Herts. Tel.: Waltham Cross 27331.

Acos changer dust bug. Developed in conjunction with Cecil Watts. Clips on to changer arms. Price: 17s. 6d. (U.K. purchase tax: 2s. 11d.

Acos stylus pressure gauge. A spring balanced gauge calibrated 0-15 gm. Accurate to within 0·5 gm. Price: 9s. 6d. (U.K. purchase tax 1s. 7d.).

★

DECCA SPECIAL PRODUCTS, Decca Radio and Television Division of the Decca Record Co. Ltd., Ingate Place, Queenstown Road, London, S.W.8. Tel.: Macaulay 6677.

Magnetic bias compensator. Neat, simple, unobtrusive device using magnetism precisely to neutralise the forces which draw a pickup towards the centre of the turntable. Type A for Mk. I and Mk. I Super *ffss* arms, and for Deram Universal and Deram ARI arms. Type B for current Decca Professional arm. Type C for early Professional arms. Prices: Types A and B 18s. 1d. (U.K. purchase tax 2s. 11d.), Type C £1 16s. 2d. (U.K. purchase tax 5s. 10d.).

Counterweight adjuster. Placed on counterweight of Mk. I *ffss* arm produces tracking weight of 2 gm. for Mk. III and mono elliptical heads. Already supplied with Mk. I Super arms. Price: 6s. 6d. (U.K. purchase tax 1s.).

Centre locator. Fits on *ffss* arm like *ffss* head. Pickup arm is correctly positioned when the locator moulding fits the turntable centre spindle. Price: 4s. 9d. (U.K. purchase tax 9d.).

Decca Microlift. A device for raising and lowering a manual pickup arm at any point on the record for minimising risk of damage either to record or stylus through handshake. Easy to fit to any back-pivoted pickup. It does not hinder record handling by overlapping the turntable. Price: £1 5s. 10d. (U.K. purchase tax 4s. 2d.).

Stylus cleaner. Incorporates wheel covered in soft hair, which engages with the stylus when in its rest position. A height adjustment screw enables the cleaner to be accommodated to suit all non-automatic record players on the market. Price: 18s. 1d. (U.K. purchase tax 2s. 11d.).

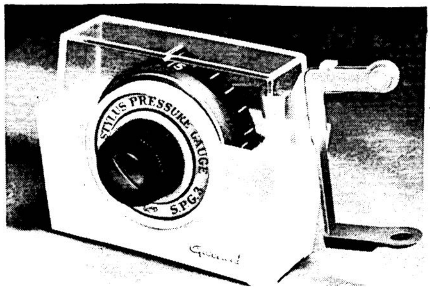
★

EAGLE PRODUCTS. Distributors: B. Adler & Sons (Radio) Ltd., 32a Coptic Street, London, W.C.1. Tel.: Museum 9606/7. Cables: Reldab, London.

RC12 automatic record cleaner. Easily fitted to any pickup arm. No change on stylus force. The brush contains hairs of different thickness and length, set towards different directions, thus removing dirt and dust which is absorbed on a rotating roller. Complete with adjustable mounting bracket and operating instructions. Price: 14s. (U.K. purchase tax 2s. 3d.).
(Price quoted is approximate).

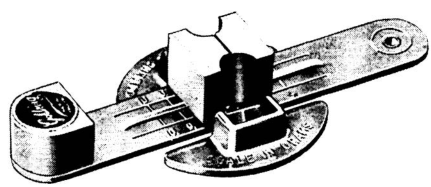
★

M. B. FITCH. U.K. Distributors: Metro-Sound Manufacturing Co. Ltd., Bridge Works,



S.P.G.3


Stylovue


STB 1

Metro-Sound stylus cleaning kit

Wallace Road, London, N.1. Tel.: Canonbury 8641. Cables: Metrosound, London, N.1. Overseas Distributors: T. D. Bailey & Son Ltd., 9 St. Helen's Place, London, E.C.3.

Cuematic Mk. II. Precision record groove locator and pickup lowering device with sufficient accuracy to locate within one microgroove. Price: £19 7s. 6d. (U.K. purchase tax £3 15s. 7d.).

"Hi-Jack" Model "D". A raising and lowering device specially designed for direct attachment to the Decca *ffss* pickup pedestal. All metal chrome plated construction, positive stops in fully raised and lowered positions. Price: £1 1s. (U.K. purchase tax 3s. 6d.).

"Hi-Jack" Model "U". A raising and lowering device specially suited for use with the Garrard 4HF motor unit for which no extra fixing hole is required. 1½ in. height adjustment by means of sliding head. All metal chrome plated construction. One $\frac{3}{16}$ in. hole needed for fixing. Price: £1 1s. (U.K. purchase tax 3s. 6d.).

GARRARD ENGINEERING LTD., Newcastle Street, Swindon, Wilts. Tel.: Swindon 5381. Cables: Garrard, Swindon.

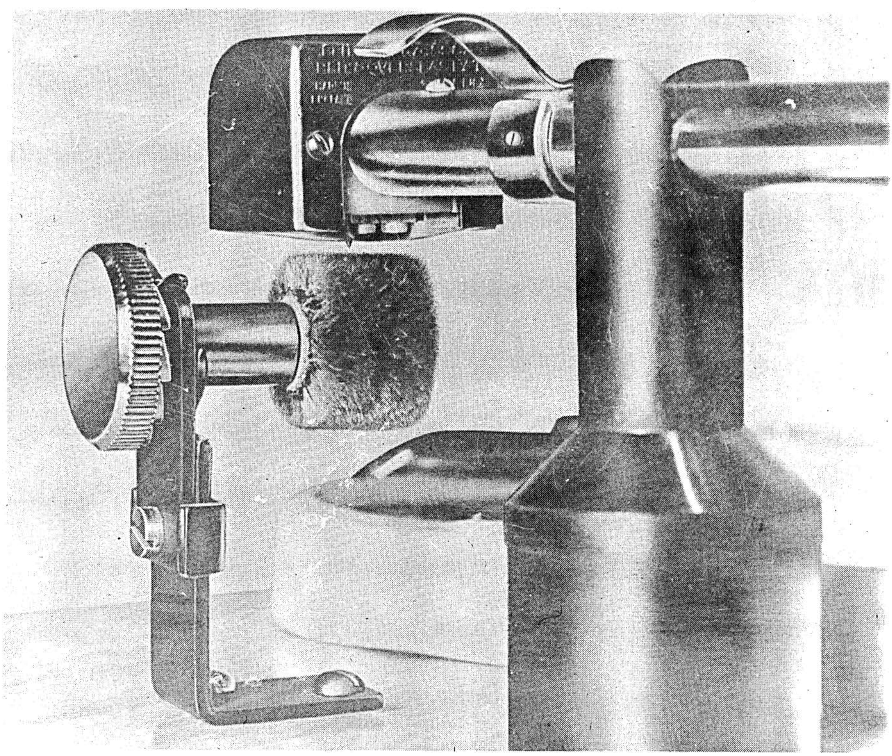
SPG3. Stylus pressure gauge. Suitable for all current pickup arms and heads. Elegantly styled. Range 0-12 gm. with ½ gm. indications. Supplied with 5 gm. calibration checking weight. Price: 16s. 9d. (U.K. purchase tax 2s. 9d.).

★

GOLDRING MANUFACTURING CO. (GREAT BRITAIN) LTD., 486/488 High Road, Leytonstone, E.11. Tel.: Leytonstone 8343. Cables: Echovox, London.

STB.1. Stylus balance, a simple yet accurate gauge which operates a record level. Stylus pressure is read directly in grams off the calibrated scale. Price: 3s. 6d. (U.K. purchase tax 7d.).

Lenco STB.2. Stylus pressure balance. A simple and accurate device, not relying on springs. Price: 12s. 6d. (U.K. purchase tax 2s. 1d.).



Decca Stylus Cleaner

METRO-SOUND MANUFACTURING CO. LTD., Bridge Works, Wallace Road, Canonbury, London, N.1. Tel.: Canonbury 8641. Cables: Metrosound, London, N.1.

Metro-Mat. Carbon activated turntable mat. Discharges static from all LP records. Suitable for all turntables. Price: 10s. 6d. (U.K. purchase tax 1s. 9d.).

High Fidelity Stylus Cleaning Kit. Comprises bottle of special cleaning fluid, fine brush applicator and dirt remover. Safe for use with all pickups. Price: 6s. (U.K. purchase tax 1s.).

★

ORTOFON A/S. Distributors: Metro-Sound Sales Ltd., Bridge Works, Wallace Road, London, N.1. Tel.: Canonbury 8641. Cables: Metrosound, London, N.1.

Ortofon "Hi-Jack". Pickup arm lift/lowering device. All metal chromium plated. Special spring-loaded friction system for "air cushioned" lowering. Adjusting lowering speed. Positive positioning on record. Works independently of weight of cartridge or stylus force. Price: £2 14s. (U.K. purchase tax 8s. 8d.).

★

Q-MAX (ELECTRONICS) LTD., Napier House, High Holborn, London, W.C.1. Tel.: Holborn 8534.

Stylovue. A device for projecting a magnified shadow of a stylus on to a screen facilitating inspection of a stylus *in situ.* Powered by torch batteries. Price: £1 4s.

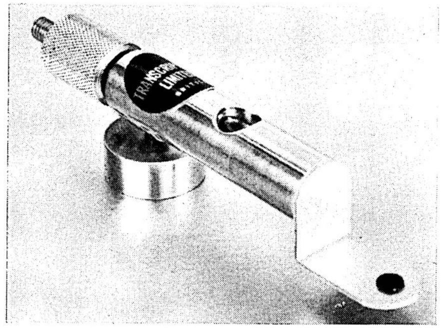
★

TRANSCRIPTORS LTD., 26 Bloomsbury Way, London, W.C.1. Tel.: Chancery 4771, Hampstead 8842.

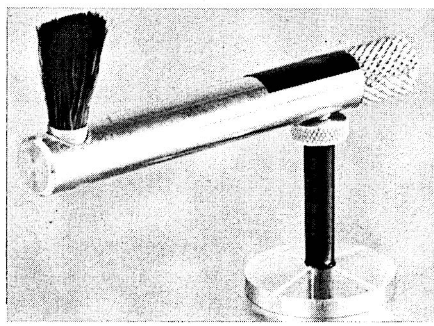
Stylus scales. Sensitive to less than 0·01 gm. Accuracy better than 0·02 gm. Weighs 0-5 gm. in increments of 0·05 gm. Bubble read-out. Supplied with reference weights. Polished aluminium construction. British made. Price: £2 2s. (U.K. purchase tax 6s. 10d.).

Sweep arm. Record cleaning attachment. Permanently fitted to motor-board cleans records whilst playing. Incorporates squirrel hair brush tracking at 0·75 gm. Unipivot with balance adjuster. Adjustable for height. Does

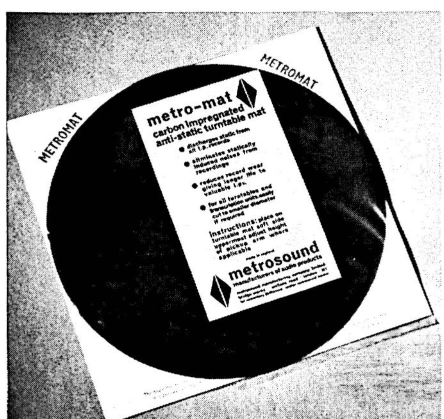
The "Dust Bug"



Transcriptor stylus scales



Transcriptor stylus brush



Metro-Sound metro-mat

not affect turntable speed. Precision engineered. British made. Price: £2 2s. (U.K. purchase tax 7s. 1d.).

Stylus brush. For permanent installation. Incorporates squirrel hair brush for cleaning stylus. Adjustable for height. Single hole fixing. Polished aluminium construction. Price: £1 5s. (U.K. purchase tax 4s. 3d.).

CECIL E. WATTS LTD., Darby House, Sunbury-on-Thames, Middx. Tel.: Sunbury 3252.

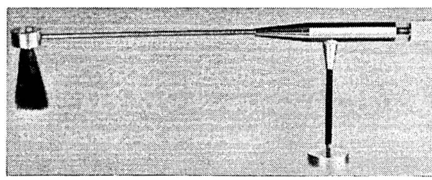
The "Dust Bug". Claimed to be the most efficient method of removing all static and dust from records as they are played. Instantly fitted, suitable for all types of records. Record quality is improved, surface noise and wear reduced. Price: 17s. 6d. (U.K. purchase tax 2s. 11d.).

Manual parastat

The "Parastat". For cleaning both sides of an LP disc simultaneously and making it inert to all static charges. Principally for trade use. Price: Mk. III.B. £18 10s. (U.K. purchase tax £3 1s. 8d.).

"Parostatik" regd. Disc Preener. For record maintenance where anti-static agents are not desirable (where stylus force is less than 2 gm.). Price: 6s. 9d. (U.K. purchase tax 1s. 2d.).

Manual parastat. Manual Model Parastat record cleaning machine. For the cleaning and application of anti-static agents to LP records. Price: £2 5s. (U.K. purchase tax 7s. 6d.).



Transcriptor sweep arm record cleaner

DIRECTORY OF MOTOR UNITS

BANG & OLUFSEN. U.K. Sales Division, Eastbrook Road, Eastern Avenue, Gloucester. Tel.: Gloucester 26841. Cables: DEBELEC, Gloucester.

●**Beogram 1000.** Four-speed motor unit complete with pickup arm, cartridge and dust cover. Speeds $16\frac{2}{3}$, $33\frac{1}{3}$, 45, 78 rpm with fine speed control. Wow 0·2%. Rumble −35 dB at 1·4 cm/sec. 100 c/s NARTB. 12 in. turntable. Belt drive. Own motor. Type STL pickup arm. Built-in hydraulic arm lift. Stroboscopic mat. Anti-microphonic suspension. Price: to be announced.

Model 610V. Transcription turntable. Four variable speeds. Belt driven. 12 in. turntable, fitted with stroboscopic mat. Complete with "Stereodyne" cartridge and ST/L pickup arm, in teak plinth. Price: £30 9s. (U.K. purchase tax £4 7s. 10d.).

GF2. Pre-amplifier for above. See Pickup Accessories section.

★

BRAUN AG. Distributors: Argelane Ltd., 251 Brompton Road, London, S.W.3. Tel.: Kensington 9611.

PS400. Turntable, pickup arm, cartridge, mounted on plinth with plexiglass lid. Speeds $16\frac{2}{3}$, $33\frac{1}{3}$, 45, 78 rpm with ±3% fine adjustment. W. and F. less than 0·02%. Rumble better than −56 dB. Turntable $10\frac{1}{4}$ in. 5 lb. Stepped spindle, friction wheel, intermediate roller and drive belt. Four-pole synchronous motor. Tubular cranked metal pickup arm. Lowering and raising device. Cueing for 7 in., 10 in. and 12 in. records. Price: £46 10s. (U.K. purchase tax £7 10s.).

PC5. Turntable, pickup arm, cartridge, mounted on plinth with plexiglass lid. Speeds $16\frac{2}{3}$, $33\frac{1}{3}$, 45, 78 rpm. Accuracy within −0·3% and +0·7%. Wow less than 0·1%. Flutter less than 0·05%. Rumble −52 dB. Turntable $11\frac{7}{8}$ in. diameter, 6·6 lb. Drive by stepped pulley, friction wheel, capstan, belt and idler. Hysteresis synchronous motor. 9 in. tubular metal pickup arm. Lowering device. Cueing for 7 in., 10 in. and 12 in. records. Price: £73 2s. (U.K. purchase tax £11 18s.).

★

COLTON & CO. (LAPIDARIES) LTD., The Crescent, Wimbledon, London, S.W.19. Tel.: Wimbledon 9401.

Jobo 2800S. Turntable unit. Speeds $33\frac{1}{3}$ and 45 rpm. Fine speed control ±4%. Non-magnetic mineral loaded 4 lb. plastic turntable. Six-pole outside rotor Papst motor, capacitor start. Built-in spirit level and illuminated stroboscope. Belt drive. Motor board has space for pickup arm at side. Price: (with accommodation for 9 in. arm) £37 15s. 6d., (with accommodation for 12 in. arm) £39 7s.

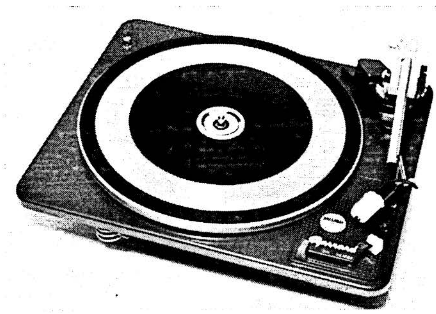
★

CONNOISSEUR. See A. R. Sugden & Co. Ltd.

★

DECCA SPECIAL PRODUCTS, Decca Radio and Television Division of the Decca

Decca ffss Deccadec



Decca Deccadec

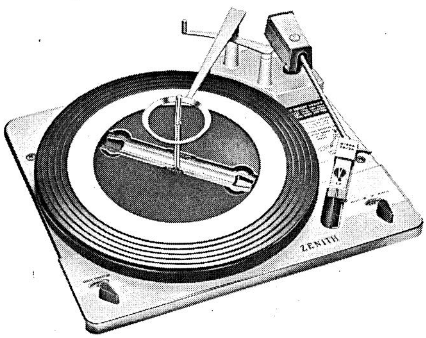
Connoisseur Classic

Record Co. Ltd., Ingate Place, Queenstown Road, London, S.W.8. Tel.: Macauley 6677.

ffss Deccadec. Motor unit with pickup arm plus extension/adaptor for *ffss* head but excluding head. Speeds $16\frac{2}{3}$, $33\frac{1}{3}$, 45, 78 rpm with no fine adjustment. $10\frac{1}{2}$ in. non-magnetic turntable. Non-magnetic drive components. Pulley drive. Garrard motor. Lifting and lowering device. Bias compensation. Accepts *ffss* heads but not recommended for models with elliptical stylus. Price: £12 13s. 3d. (U.K. purchase tax £2 0s. 9d.).

●**DD1.** Deccadec motor unit with Deram pickup in teak table or shelf-mounting cabinet. Anti-rumble pickup. Autochanger version with Garrard AT6/1 available at the same price. Price: £23 10s. 7d. (U.K. purchase tax £3 15s. 5d.).

●**Deccadec.** Motor unit with Deram transcription head and arm including all fittings for cabinet mounting. Speeds $16\frac{2}{3}$, $33\frac{1}{3}$, 45, 78 rpm with no fine adjustment. $10\frac{1}{2}$ in. non-magnetic turntable. Pulley drive. Garrard motor. Automatic motor switch off and return of pickup at end of record. Built-in anti-rumble filter. De luxe version includes lifting and lowering device and bias compensation. Prices: Standard £13 11s. 6d. (U.K. purchase tax £2 3s. 6d.); De luxe £15 7s. 7d. (U.K. purchase tax £2 9s. 5d.).



Zenith 4-speed professional

Decola separates playing desk. Speeds $33\frac{1}{3}$, 45, 78 rpm, variable $\pm 2\frac{1}{2}\%$. Incorporates the Garrard 301 and Microlift together with the Decca *ffss* Mk. I pickup mounted on a $\frac{3}{4}$ in. motor-board in cabinet. Price: £52 9s. 8d. (U.K. purchase tax £8 8s. 4d.). Other *ffss* heads and arms available with appropriate price adjustment.

★

DUAL. Distributors: Celsa Electric Co. Ltd., Celsa House, Kelway Place, London, W.14. Tel.: Fulham 9761.

1009. Transcription turntable with automatic record changer. Speeds $16\frac{2}{3}$, $33\frac{1}{3}$, 45, 78 rpm with $\pm 6\%$ fine adjustment. Dynamically balanced low-mass tone arm. Four-pole magnetically shielded motor. Adjustable weight, 0-7 gm. Automatic stop and switch off. Dynamically balanced $7\frac{1}{2}$ lb. non-magnetic turntable. Friction damped rubber cushioned spring suspension. Suspension resonance 4 c/s vertically and horizontally. Available with Dual magnetic cartridge DMS900 or B and O SP1. Will take any cartridge with $\frac{1}{2}$ in. fixing centres. Mains 110-220V 50 c/s, adaptable 40 or 60 c/s. Size 13 in. wide, $10\frac{7}{8}$ in. deep. Weight $15\frac{1}{2}$ lb. Price (less cartridge): £30 14s. 2d. (U.K. purchase tax £4 19s. 10d.).

★

ELAC. Electroacustic GmbH., Kiel, West Germany. Distributors: Mitchell Enterprises Ltd., 61 West Street, Dorking, Surrey. Tel.: Dorking 4229.

Miracord 10H. Four speeds, with automatic shut-off. Magnetic pickup cartridge STS222. (Can also be supplied without cartridge or with other Elac cartridges). Studio tone arm with adjustable stylus force (2-6 gm.). Heavy balanced turntable, 12 in. dia. (driven by special hysteresis motor), 220V AC, 50 c/s or 110V AC, 60 c/s. Push-button control for various functions. Size $14\frac{1}{2} \times 12\frac{1}{2}$ in. Weight $14\frac{3}{4}$ lb. Price: £57 8s. (U.K. purchase tax £9 11s.).

Miraphon 17H. Details as for Miracord 10H, but without push-button control. Pneumatic lowering device. Weight $13\frac{1}{2}$ lbs. Price: £51. (U.K. purchase tax £8 17s. 10d.).

Miraphon 18H. Design and basic technical characteristics same as for Miracord 10H. Incorporates built-in arm raising and lowering device. Weight $14\frac{3}{4}$ lb. Price: £60 10s. (U.K. purchase tax £10 1s. 8d.).

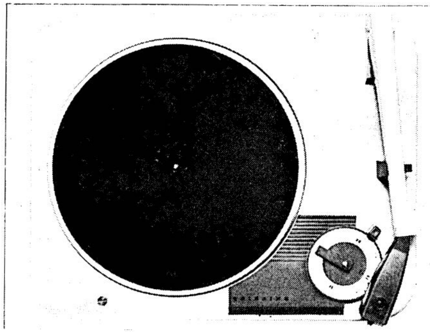
★

GARRARD ENGINEERING LTD., Swindon, Wiltshire, England. Tel.: Swindon 5381. Cables: Garrard, Swindon.

Model 401. Transcription motor. Three speeds: $33\frac{1}{3}$, 45, 78 rpm. Adjustable by eddy current brake. 6 lb. machined aluminium turntable with gear-cut illuminated strobe markings on rim. Statically balanced. Die-cast aluminium unit plate. Completely screened spring-mounted shaded-pole motor. Anti-static turntable mat. Styled by Eric Marshall and finished in metallic charcoal with chrome relief. W. and F. less than 0·05% RMS. Rumble almost non-existent. Mains: 100-130V, 200-250V, 50 c/s or 60 c/s according to pulley fitted. Size $13\frac{7}{8}$ in. wide, $14\frac{5}{8}$ in. front to rear, $2\frac{1}{8}$ in. above motor board, 4 in. below motor board. Price: £27 19s. (U.K. purchase tax £4 11s.).

Lab 80. Transcription turntable with auto-change facility. Two speeds: $33\frac{1}{3}$, 45 rpm. 12 in. diameter, heavy non-magnetic turntable. Statically balanced. Plug-in head with locking ring. Wood Afrormosia counter-balanced arm with aluminium stabilising channel. Bias compensator. Magnetic auto-trip. Anti-static mat. Stylus pressure fine click adjustment. Wired for mono and stereo. Dynamically balanced motor with spring suspension. Mains: 100-130V, 200-250V, 50 c/s or 60 c/s according to pulley. Size $16\frac{3}{4}$ in. wide, $14\frac{1}{8}$ in. front to rear, $5\frac{1}{2}$ in. above motor board, $3\frac{1}{2}$ in. below motor board. Price: £23 13s. (U.K. purchase tax £3 17s.).

A70. Developed from the Laboratory series Type A the A70 provides manual operation with autochange facility. Counter-balanced pickup arm. Plug-in head with locking ring. Bias compensator. Sandwich construction turntable. Four speeds: $16\frac{2}{3}$, $33\frac{1}{3}$, 45, 78 rpm. Wired for mono and stereo. Balanced and screened motor. Pickup muting switch. Mains: 100-130V, 200-250V, 50 c/s or 60 c/s according to pulley. Size $16\frac{3}{4}$ in. wide, $14\frac{1}{8}$ in. front to rear, 6 in. above motor board, $2\frac{7}{8}$ in. below motor board. Price: £19 8s. (U.K. purchase tax £3 3s. 1d.). Less pickup cartridge.



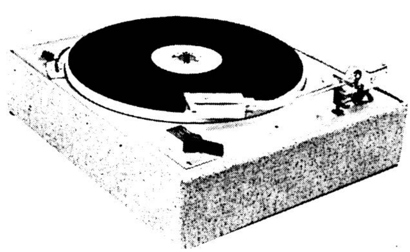
Goldring G66

SP25. High quality single record player. Die-cast non-magnetic turntable. Four speed. Magnetically screened motor. Cueing device to raise or lower pickup arm where required. Counter-balanced tubular aluminium arm. Plug-in head. Integral calibrated stylus pressure adjustment. Bias compensator. Automatic trip and return. Wired for stereo and mono. Mains: 100-130V, 200-250V, 50 c/s or 60 c/s according to pulley. Size $15\frac{5}{8}$ in. wide, $13\frac{1}{8}$ in. front to rear, $3\frac{1}{2}$ in. above motor board, $2\frac{7}{8}$ in. below motor board. Price: £10 16s. (U.K. purchase tax £1 15s. 2d.). Less pickup cartridge.

★

GOLDRING MANUFACTURING CO. (GREAT BRITAIN) LTD., 486/488 High Road, Leytonstone, London, E.11. Tel.: Leytonstone 8343.

Goldring-Lenco GL68. Integrated turntable and pickup arm. Infinitely variable speeds 30-80 rpm with preset click stops for $16\frac{2}{3}$, $33\frac{1}{3}$, 45, 78 rpm. Wow 0·2%. Speed constancy: 1% change for 13% change in voltage. Turntable 12 in. diameter pressed steel. Drive via vertical idler. Four-pole motor. Pickup arm Goldring G65. Pickup lowering device. Idler wheel disengagement. Price: £16 16s. (U.K. purchase tax £2 14s. 7d.).



Goldring GL70/P

GL70 transcription unit. Non-ferrous turntable, weight 8 lb. Speed may be continuously adjusted from above 80 rpm to below 30 rpm and from 15 to 18 rpm. Pre-set standard speeds. Four-pole constant velocity motor (15 watts). W & F max. 0·2%. Incorporates L.70 pickup arm. Pickup lowering device. Price: £25 15s. (U.K. purchase tax £4 3s. 8d.). Now available on plinth (GL70/P). Price: £28 15s. (U.K. purchase tax £4 13s. 5d.).

Goldring G66. Integrated turntable unit and arm. Four speeds with 10% fine adjustment. Wow 0·2%. Turntable $8\frac{1}{2}$ in. diameter pressed steel. Pulley drive. Two-pole motor. Die-cast aluminium arm with plug-in shell. Pickup arm lowering device. Prices: G66/MX2 £9 18s. 8d. (U.K. purchase tax £1 12s. 4d.); G66/CS80 £10 10s. (U.K. purchase tax £1 14s. 2d.); G66/CS90 £12 12s. (U.K. purchase tax £2 1s. 2d.).

Goldring G99. Transcription motor only. Infinitely variable speeds 30-80 rpm. Wow 0·1%. Speed remains constant with 13% voltage change. Turntable 12 in. die-cast zinc. Vertical idler wheel with provision for disengagement. Four-pole motor. Built-in illuminated strobe. Push-button on-off. Price: £18 18s. (U.K. purchase tax £3 1s. 5d.).

★

PERPETUUM-EBNER. Distributors: Howland-West Ltd., 11 Howland Mews, Howland Street, London, W.1. Tel.: Langham 1381.

PE Studio 33. Turntable with pickup arm. Speeds: $16\frac{2}{3}$, $33\frac{1}{3}$, 45, 78 rpm with fine control +1% to −2%. Wow better than ±0·15%. Flutter better than ±0·1%. Rumble −46 dB. Turntable 11 in. diameter 4·4 lb. non-magnetic alloy casting. Belt drive via intermediate pulley. Shaded pole induction motor. Pickup arm adjustable 0-6 gm. stylus pressure. Slow motion lowering device. Automatic lift optional. Push-button on-off. Illuminated strobe. Size 14 in. wide, 13 in. deep, $3\frac{5}{8}$ in. above, $3\frac{7}{8}$ in. below. Weight 16 lb. Complete with Shure M77 Dynetic cartridge. Price: £39 18s. 11d. (U.K. purchase tax £7 6s. 1d.).

Perpetuum Ebner PE Studio 33

PE.34. Turntable with pickup arm. Speeds: $16\frac{2}{3}$, $33\frac{1}{3}$, 45, 78 rpm with fine control +1% to −2%. Wow better than ±0·15%. Flutter ±0·1%. Rumble −42 dB. Turntable 11 in. diameter 3·9 lb. cast alloy. Belt drive via intermediate pulley. Four-pole induction motor. Pickup arm mounted on precision bearings with adjustable stylus pressure. Slow-motion arm lowering device. Price: to be announced.

★

PYE LTD., High Fidelity Division, P.O. Box 49, Cambridge. Tel.: Cambridge 58985. Cables: Pyrad, Cambridge.

Brahms HF3T. Goldring GL70 motor and arm fitted with Pye floating-action retractable cartridge. Speed continuously variable with positive click positions for $16\frac{2}{3}$, $33\frac{1}{3}$, 45, 78 rpm. W and F better than 0·2%. Speed change less than 1% for 13% mains variation. Turntable 12 in. diameter 8 lb. non-magnetic. Four-pole constant velocity motor. Shelf mounting cabinet available. Size $15\frac{3}{8} \times 13\frac{1}{4} \times 5\frac{1}{2}$ in. Price: to be announced.

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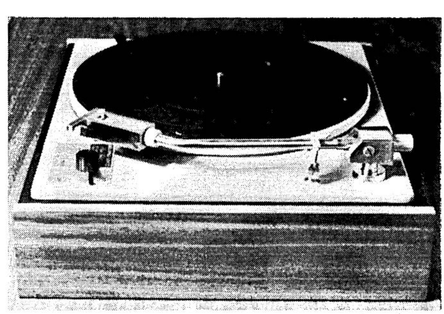
S.R.T. Distributors: Denham and Morley Ltd., 173/175 Cleveland Street, London, W.1. Tel.: Euston 3656.



Pye Brahms HF3T

●**SRT.643.** Transcription unit with pickup on modern teak plinth with perspex cover. Four speeds. Adjustable $\pm 10\%$ by centrifugal governor. Two-pole motor. W. and F. less than 0·2%. Belt drive. Rubber mat with stroboscope markings. Micro-lift pickup arm. Plug-in stereo Merula ceramic cartridge. Size $13\frac{1}{4} \times 10\frac{1}{8}$ in. Height above motor board 2 in., depth below motor board $3\frac{3}{8}$ in. Price: £17 3s. 9d. (U.K. purchase tax £2 15s. 9d.).

●**SRT.643FF.** Similar to the 643 but with B and O dynamic stereo cartridge and built-in twin transistor pre-amplifiers. Price: £26 4s. 10d. (U.K. purchase tax £4 4s. 10d.).

★

A. R. SUGDEN & CO. (ENGINEERS) LTD., Market Street, Brighouse, Yorkshire. Tel.: Brighouse 2142. Cables: Connoisseur, Brighouse.

Connoisseur "Craftsman" two speed transcription motor. Operates at $33\frac{1}{3}$ and 45 rpm fixed speeds. Full 12 in. turntable of non-ferrous material. All bearings are adjustable throughout the life of the unit. Synchronous motor. Price: £14 14s. (U.K. purchase tax £2 8s. 11d.).

Connoisseur "Craftsman" three speed transcription turntable. Requires minimum mounting space. Heavy non-ferrous 12 in. turntable. 33, 45 and 78 rpm. 4% variation on all speeds. Neon lit stroboscope fitted. Dynamically and electrically balanced synchronous motor. All bearings are adjustable. Price: £19 10s. (U.K. purchase tax £3 4s. 10d.).

Connoisseur Classic. Combined assembly of 2-speed motor, transcription arm and cartridge mounted on Afromosia plinth complete with Perspex dust cover. Two slow speed synchronous motors, $33\frac{1}{3}$ rpm 45 rpm direct drive. All spindles high quality carbon steel, phosphor-bronze bearings. $10\frac{1}{4}$ in. lathe turned aluminium turntable. Price: £25 10s. (U.K. purchase tax £4 0s. 9d.).

Craftsman plinth assembly. Available with Craftsman 2-speed or 3-speed motor with SAU1 arm with lifting device and head shell fitted with SCU1 cartridge. Size: $16 \times 14 \times 7\frac{1}{2}$ in. Finish: wood grain effect base with grey motor board and Perspex cover. Price: 2-speed unit £33 11s. 6d. (U.K. purchase tax £5 11s. 7d.); 3-speed unit £39 2s. 6d. (U.K. purchase tax £6 10s. 1d.).

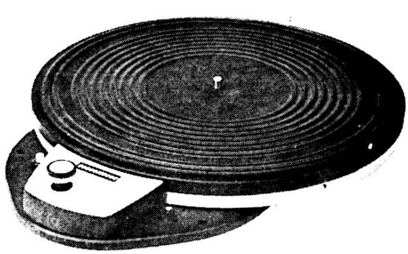
★

THORENS. Distributors: Metro-Sound (Sales) Ltd., Bridge Works, Wallace Road, Canonbury, London, N.1. Tel.: Canonbury 8641. Cables: Metrosound, London, N.1.

TD.124 Series II. Transcription turntable. Four speeds, variable $\pm 3\%$. Neon lit stroboscope with mirror. Double turntable, (non-ferrous flywheel as standard but cast-iron available to order), with clutch action, four-pole motor. Belt plus idler drive system. Inbuilt levelling device with spirit indicator. Total W. and F. 0·15% p-p. Rumble −35 dB. New NAB stereo standards. Price: £34 2s. 6d. (U.K. purchase tax £6 3s. 2d.).

TD.135. Transcription turntable and arm. Four speeds, variable $\pm 3\%$. Belt plus idler drive system. 12 in. non-ferrous 7 lb. turntable. Four-pole motor. BTD-12S pickup arm incorporated, horizontally and vertically balanced. Precision raise/lower control. Total W. and F. 0·2% p-p, Rumble −30 dB. New NAB standards. Built-in levelling device. Price: £31 10s. (U.K. purchase tax £5 18s. 3d.).

TD.224. Transcription turntable and arm with autochange facility. Four speeds, variable $\pm 3\%$. Built-in neon lit stroboscope. Incorporates BTD-12S arm. Total W. and F. 0·15% p-p. Rumble −35 dB. New NAB



Connoisseur Craftsman 2 speed

Connoisseur Craftsman 3 speed

standards. Auto-change facility with record stacking before and after play separate from turntable. Each record placed on turntable individually and removed after playing. Price: £70 17s. 6d. (U.K. purchase tax £12 15s. 8d.).

TD.150. Transcription turntable. Two speeds, 33⅓ and 45 rpm. Low-speed synchronous motor (375 rpm). Belt drive. 12 in. non-ferrous 7½ lb. turntable. Spring-mounted damped support for turntable bearing and pickup wooden panel. Total W. and F. 0·2% p-p. Rumble −35 dB. New NAB stereo standards. Price: £17 10s. (U.K. purchase tax £3 3s. 2d.).

TD.150.B. As TD.150 plus wooden base mounting. Price: £21 (U.K. purchase tax £3 15s. 10d.).

TD.150.A. As TD.150 plus TP.13 precision pickup arm horizontally and vertically balanced. Viscous damped lowering control. Patented plug-in shell with adjustable vertical tracking angle. Stylus pressure adjustable ½ to 4 gm. Price: £22 10s. (U.K. purchase tax £4 1s. 3d.).

TD.150.AB. As TD.150.B plus wooden base mounting. Price £25 10s. (U.K. purchase tax £4 12s. 1d.).

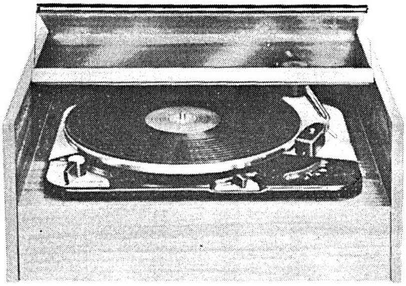
★

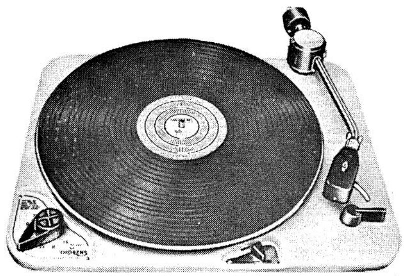
TRANSCRIPTORS LTD., 26 Bloomsbury Way, London, W.C.1. Tel.: Chancery 4771, Hampstead 8842.

Transcriptor Turntable. Speed 20-80 rpm infinitely variable. Built-in strobe. PTFE bearings. Soft rubber drive belt. Shaded pole motor. Built-in spirit levels. Mains: 110 or 200-240V 50 or 60 c/s. Available free-standing or for cabinet mounting. Price: to be announced but expected to be about £30 including purchase tax. Available October or November.

ZENITH RADIO CORPORATION. Distributors: United Mercantile Co. Ltd., 13/14 Queen Street, London, W.1. Tel.: Grosvenor 4901. Cables: Ramsaco, Telex, London.

●**Stereo Professional.** Four-speed automatic record changer unit. Speeds, 16⅔, 33⅓, 45, 78 rpm. 11¾ in. 4 lb. turntable. Belt drive. 8 9/16 in. pickup arm. Floating-action cartridge. Ceramic cartridge with 0·7 thou. diamond and 3 thou. sapphire. Separation 25 dB. Output 350 mV. Rec. load 1-3 megohms. Price: £52 10s. (U.K. purchase tax £8 8s. 5d.).


Telefunken Hi-fi 220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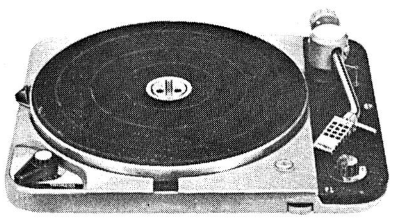
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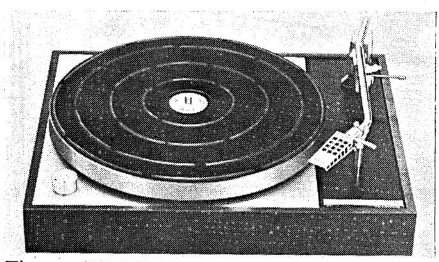
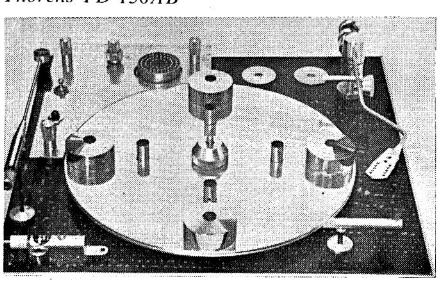

Thorens TD 150*AB*


Transcriptor motor unit

TUNERS

by W. Ian Heath

SOONER or later every audio enthusiast decides that he requires a tuner with which he can receive his favourite broadcast programmes, and listen to them through the rest of the equipment he has chosen for his particular requirements. The question then is, '*Which tuner*'? and the answer to this depends very much on what sort of service he is going to expect from the tuner. How many broadcast stations does he wish to receive? What sort of overall sound-quality does he desire? What are reception conditions like, and what sort of aerial system is he prepared to install?

The question of a tuner sometimes arises at the very beginning, because the intending purchaser possesses nothing that justifies that much misused description 'high fidelity'. In such a case it is tempting to consider a combined tuner-amplifier, having on one chassis the tuning arrangements covering one or several wave-bands, together with an audio amplifier giving at least eight watts output for driving a separate loudspeaker. We will assume that our inquirer is already convinced that a loudspeaker system in its own separate and specially designed cabinet is the first and most important step towards balanced 'high fidelity'. Will a combined tuner-amplifier operate satisfactorily with a high-quality loudspeaker system? It will, provided that the maximum power output, and distortion, from the audio amplifier section is comparable with that from suitable alternative separate amplifiers capable of driving such a loudspeaker.

For the reproduction of broadcast programmes, such an apparently simple solution can be as good as one using a separate tuner and amplifier of rather greater combined cost. One very well known firm, famous in years gone by for its 'radiogram' chassis, offers combined tuner-amplifiers with increasingly exacting specifications. These usually have both Medium and Long Wavebands, as well as the VHF band on which FM broadcasts can be received. The relative utility of these wavebands will be discussed later, but it can be said quite simply that if you live within 50 miles of an FM transmitter you will be able to receive 'local' programmes with greater clarity and lack of interfering signals on the FM band than on the Medium or Long Wavebands. At least one manufacturer offers a high-quality receiver for FM only, with an eight-watt output stage that can either be used to drive a separate loudspeaker system, or

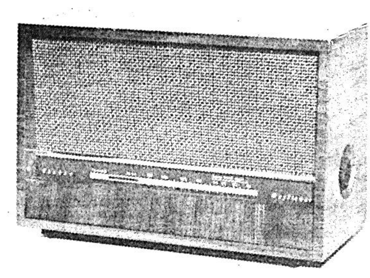


Fig. 1 *Photograph of Hacker Mayflower II FM only receiver with 8 watts output*

can be switched to the internal loudspeaker in the wooden cabinet of the receiver. Such a receiver is shown in **Fig. 1.**

It is when reproducing music from disc records that a tuner-amplifier is most likely to show limitations in performance. The built-in amplifier is designed primarily to amplify the output from the tuner-section, which like any separate tuner provides about a quarter of a volt (250 millivolts) with a 'flat' frequency response. It follows that the same amplifier, when switched to '*gram*' or '*pickup*', requires a similar input, i.e. a 'flat' frequency response with a maximum of not less than 200 mV. This can be provided by many crystal pickups provided the input impedance of the amplifier is not less than 1 MΩ, but the various types of high-quality magnetic pick-up are ruled out because they do not provide a 'flat' frequency response without the equalisation provided in the first stage of any but the cheapest 'separate' amplifier. If the purchaser of a tuner-amplifier desires to reproduce disc records with a clarity and range comparable with an FM broadcast of local origin, and without the record wear that inevitably leads to increasing muzziness in sound-quality, then his choice of pickup will be limited to the one or two well-known light-weight ceramic cartridges that give a performance strictly comparable with the best magnetic designs. It will be necessary for the pickup input socket to present an impedance of 1 MΩ or 2 MΩ, or there will be insufficient bass.

Most combined tuner-amplifiers include bass and treble controls, but are unlikely to include two facilities that are sometimes very necessary for the satisfactory playing of disc records. The first is a Low Pass filter which can be brought into use to remove the highest treble components when these are of 'fizzy' or 'broken' quality on a record of doubtful condition or vintage. The second is a High Pass filter which removes turntable rumble without removing all the double-basses that the better 'separate' loudspeaker systems enable us to hear. It may be concluded that the choice of a combined tuner-amplifier can be satisfactory if the source of programme material is to be mainly from broadcasts, with disc records playing a minor role. This choice can also be satisfactory where the tuner-amplifier is to be used with a tape-recorder, bearing in mind the laws of copyright, and provided the amplifier section has an input socket that will enable the tape-recorder to play back through the larger amplifier and loudspeaker system normally used for listening to broadcast programmes.

In the majority of cases a separate amplifier, having the desired facilities input sensitivity, and output power, is chosen first as the 'heart' of the equipment. A separate tuner is then necessary if broadcast programmes are required. If only the three BBC programmes are required, with an overall sound quality strictly comparable to that obtainable from long-playing records, then a tuner that receives only the local FM broadcasts on the VHF band is all that is required. If, on the other hand, broadcasts from European stations are sometimes required to provide a broader range of programme material, then the tuner should be able to receive AM broadcasts on the Medium and Long Wavebands in addition. It must be remembered, however, that the overall audio frequency range of a programme received on the MW or LW bands is restricted at the high frequency or treble end of the audio spectrum. Such a programme often sounds dull and lifeless, compared with the best FM broadcasts or the best LP disc recordings, when played through a wide-range amplifier and loudspeaker with a smooth wide-range response. It may indeed sound brighter on a less perfect loudspeaker with a more 'peaky' or 'forward' treble response, but this invariably leads to a confused sound in the more complicated orchestral or choral passages which can be very tiring to the listener. For language broadcasts, however, reception on the MW band can be very satisfactory with a 'forward' loudspeaker, even if it is not entirely realistic.

The decision on how many broadcast programmes are likely to be required is thus unavoidably tied to the overall sound quality that can reasonably be expected from the various wavebands. This can be broken down into three important characteristics: bandwidth, interference, and non-linear distortion. These are in some respects interdependant.

All receivers of average or higher performance are of the superhetrodyne type. Most of the sensitivity and selectivity is provided by the Intermediate Frequency Amplifier, which is

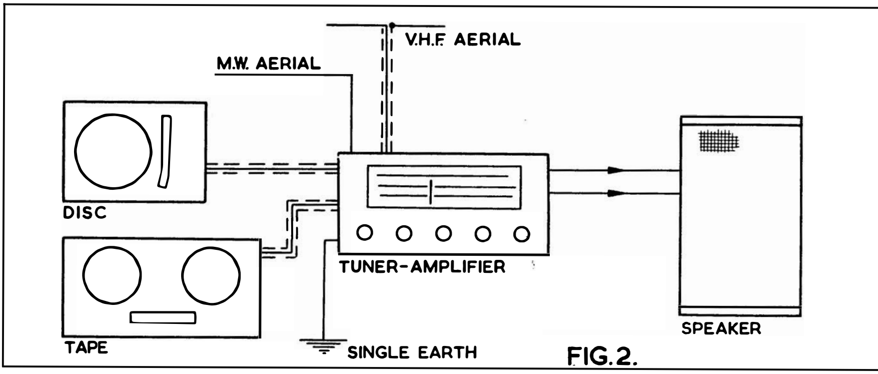


FIG. 2.

tuned to a fixed frequency and therefore has a constant performance over the one or more wavebands on which the receiver operates. In a Medium and Long Wave receiver the Intermediate frequency is around 470 Kc/s, and has typically a bandwidth of 4 Kc/s on either side of this frequency. The total bandwidth of 8 Kc/s is therefore about 1·7% of the Intermediate frequency. This is normally achieved quite easily by using double-tuned IF transformers that are very slightly 'over-coupled', and provide the necessary selectivity to separate most stations on the MW band which are rarely more than 9 Kc/s apart, and sometimes rather closer! The outer sideband components, corresponding to programme components above 4 Kc/s, are not amplified, and therefore after detection the audio frequency spectrum of the programme is considerably attenuated above 4 Kc/s. It is worth remembering that the major characteristics of the sound of 's' in speech depends on frequencies in the region of 6 Kc/s, as do the sounds in 't' and 'th' as in 'theatre'. A MW receiver of slightly wider bandwidth will therefore sound more natural on speech and music, but will suffer more from interference from the side-bands of neighbouring stations, especially after sunset when Medium Waves propagate over greater distances.

T.V. Sound

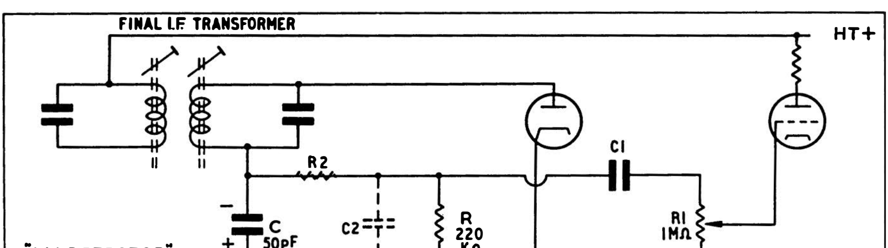
For the VHF bands, which include FM broadcasting and Television, a typical Intermediate Frequency is around 10 Mc/s, and assuming for the moment the same easily achievable percentage bandwidth of 1·7%, the corresponding total bandwidth is 170 Kc/s. Where Amplitude Modulation is in use, as in the sound channel of BBC 1, or of ITA. This receiver bandwidth exceeds by about five times that required for the full audio-frequency spectrum, i.e. a bandwidth 2 × 15 Kc/s. TV sound *can* therefore be full frequency range! It is therefore worth considering the inclusion of TV sound in a tuner for those few programmes where sound quality has not been compromised by the need for microphones to be unobtrusive, or of a special type for 'difficult' conditions.

Unfortunately the VHF band is susceptible to man-made interference such as from car ignition. To overcome this most TV receivers incorporate suppression circuits which limit both the amplitude and frequency range of the audio signals, and the resulting quality is sometimes worse than that obtained from MW broadcasts, both as regards non-linear distortion and effective audio bandwidth. The few tuners available with TV sound will not, of course, have this severe limitation of performance, but to avoid interference a good aerial placed where it will not pick up appreciable ignition interference will be needed in most cases.

Bandwidth

About ten years ago, when it was decided to use the VHF band for sound broadcasting because of the increasing congestion and interference on the MW band, the disadvantage of ignition interference was largely overcome by using Frequency Modulation. With this system, the bandwidth required to accommodate the sidebands associated with the carrier depends on the amplitude of the programme (i.e. on its loudness in the studio) and not on the frequency-range as in Amplitude Modulation. It is therefore possible to design a receiver for FM which is insensitive to amplitude changes, such as ignition interference, while responding to frequency deviations which are proportional to the programme amplitude. The ratio of programme to interference can be increased by making the maximum frequency deviation greater, and the BBC uses a maximum deviation, corresponding to the loudest peaks of a programme, of 75 Kc/s either side of the carrier frequency.

The bandwidth required to accommodate the resulting sidebands exceeds 2 × 75 Kc/s because each component frequency in the audio pro-



"A.M. DETECTOR"
FIG. 3.

gramme produces in fact an infinite series of sidebands. However a total bandwidth of about 240 Kc/s includes sufficient sidebands to represent very accurately the loudest peaks in the programme. The 10 Mc/s IF amplifier which was cited earlier, with a bandwidth of 1·7% (i.e. 170 Kc/s), has hardly sufficient bandwidth to avoid non-linearity in the loudest passages, but this will have no effect whatever on the audio-frequency range of the reproduced programme. A good FM receiver therefore has a bandwidth in excess of 200 Kc/s both in the IF amplifier and in the discriminator.

Non-Linear Distortion

The problem of non-linear distortion in FM receivers is, however, no worse, even in the cheapest design, than the non-linear distortion which occurs only too easily in an AM receiver. In an FM receiver designed with reasonable care, non-linear distortion is less because one of the two main causes of distortion in an AM receiver, which occurs due to distortion of the modulation envelope waveform in the variable-mu IF stages, especially when Automatic Gain Control is in operation with a strong signal, is of no consequence in the reception of FM. In fact the more IF stages 'clip' the amplitude of the signal, the better will be the suppression of interference. AGC without distortion is particularly difficult to achieve in transistor AM receivers, and explains why some transistor portables often sound worst on the strongest local station. The transistor offers no disadvantage in this respect for FM reception.

The second cause of non-linear distortion in an AM receiver, and the only comparatively serious cause in an FM receiver, is to be found in each case in the detector or discriminator.

Fig. 3 shows the essential features of a typical diode detector in a MW receiver using valves. The *dc* load of the diode is *R*, and *C* charges very nearly to the peak value of the incoming carrier voltage (which is at Intermediate Frequency), while the time-constant *C R* is short enough for the voltage across *C* to follow all audio-frequency variations of the carrier. The audio-frequency voltage developed across *C* is coupled by C_1 and grid-resistor R_1 to the first Audio Frequency amplifier stage. The *ac* load of the diode is thus *R* with R_1 in parallel. The highest modulation depth that the detector will handle without peak clipping can be shown to be:

$$\frac{\text{ac diode load}}{\text{dc diode load}} \times 100\%$$

With the values of **fig, 2,** this will be

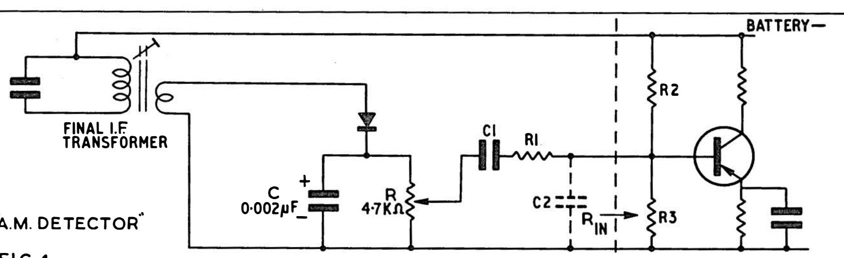
$$\frac{180}{220} \times 100\%$$

which is 82%. This is not a bad figure, but it shows that the circuit design can cause more non-linearity than the curvature of the diode characteristics. It is usually not practicable for several reasons to increase the value of R_1, and the above figure can only be improved by reducing the value of R. Unfortunately this reduces the selectivity of the final IF transformer, which experiences a damping effect due to the detector circuit equivalent to a resistance across the secondary of value R/2. As it is nearly always necessary to include the decoupling components R_2 and C_2, to prevent the residual IF carrier from being passed to the AF amplifier, one solution is to make $R_2 = R = 100$ KΩ. The total *dc* load of the diode is then still 200 KΩ, but only half of this is shunted by R_1. The highest modulation depth that can be handled by this modified circuit is

$$\frac{100+91}{100+100} \times 100\%$$

which is 95%. This is very good, but there is sure to be a snag! This is that only half the audio voltage developed across C is passed on to the AF amplifier. This is why in communication receivers, where sensitivity is all important, R_2 is usually much smaller than R, which is sometimes higher than the value shown here to improve selectivity also.

Fig. 4 shows a typical detector in a transistor



"A.M. DETECTOR"

FIG.4.

receiver. The problem is similar. The dc load of the germanium diode is R, which in this case is the volume-control. The first AF stage has an input resistance, RΩ, which is compounded of the biassing resistors R_2 and R_3 in parallel with the input resistance of the transistor. The latter is low, of the order of 1 KΩ, and also non-linear, so that a resistor R_1 is necessary in series with the AF signal to provide a linear input current. The value of R_1 has to be high compared with R but not so high as to 'throw away' all the gain of the stage. A typical value for R_1, is 6·8K, so that towards the maximum setting of the volume control the diode load R is shunted via C1 by about 7KΩ, R therefore has to have a low value. If R is 4·7K, the maximum modulation depth that the detector will accept in this case without peak clipping will be

$$\frac{2{\cdot}8}{4{\cdot}7} \times 100\%$$

which is 60%. This may be acceptable in a small portable receiver, but it would be shown up rather badly if the resulting programme was fed into a wide-range amplifier and loudspeaker system. The figure would be improved by tapping C_1 down R as before, in this case by turning the volume control down, or by making the first AF stage an emitter follower with a comparatively high input impedance. Incidentally the low value of R, compared with that in the value circuit, necessitates the detector being coupled to the last IF transformer by an untuned low impedance winding.

Waveform Distortion

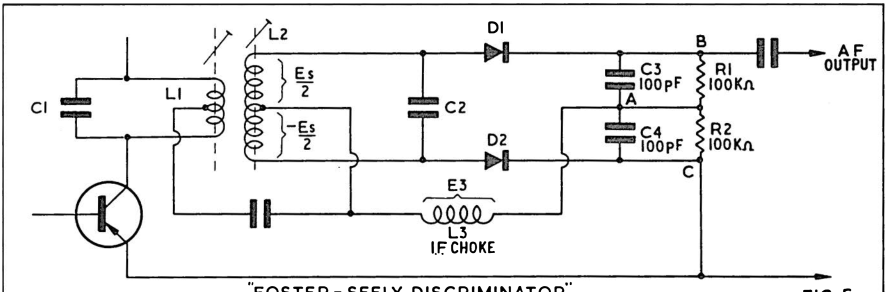
The moral here is not to expect startling improvements in sound-quality by playing a small transistor portable into a wide-range loudspeaker. Another point worth mentioning in this connection is that coupling capacitances, such as C_1, are kept to a minimum value for cost reasons, in the secure knowledge that the bass so lost could not be reproduced by the tiny built-in loudspeaker anyway. However, some noticeably expensive transistor portables are intended to be connected to a high-quality system when their owners are at home.

Before leaving AM detectors it must be mentioned that waveform distortion can occur at the higher audio frequencies if the time constant CR is too long to follow the envelope waveform. This trouble only occurs when the modulation depth is large at the higher frequencies, and will for example cause 'thickening' of close-up speech, or orchestral cymbals. This trouble will be avoided if the product CR is not more than 10 microseconds, so that C in **fig. 3** should be not more than 50 pF, and in **fig. 4** not more than 0·002 μF with the values of R shown.

To avoid unnecessary loss of the highest audio frequencies the decoupling capacitor C_2 must in each case have a value which gives a time constant of not more than 10 microseconds with the associated decoupling resistors. A larger value of C_2 is often used to mask some of the effects of distortion caused in the detector and earlier stages, and also to minimise unwanted noise and interference.

Two Types

FM detectors, or discriminators as they are often called, are commonly of two types which look confusingly similar. They are shown for comparison in **figs. 5** and **6.** In both, the primary circuit L_1C_1 acts as the anode or collector load of the last IF amplifier stage, and is tuned to the IF carrier frequency. In both, the whole secondary L_2 is also tuned, with C_2, to the IF carrier frequency. An essential feature in both circuits is that a fraction E_3 of the primary voltage is developed across L_3 and applied to the centre point of the secondary circuit. The signal applied to each diode via one reservoir capacitor, C_3 or C_4, is therefore the addition with respect to point A, of E_3 and half the secondary voltage E_s. The appropriate phasor diagrams are discussed in detail in other books, but the action may be summarised as follows.



"FOSTER - SEELY DISCRIMINATOR." FIG. 5.

If the applied signal is at the resonance frequency f_0 of L_1C_1 and L_2C_2, then E_s is in exact quadrature, 90°, with E_3. The resultant signal voltage applied to diode D_1 is then equal in magnitude (but not in phase) with that applied to D_2, and reservoir capacitor C_3 is charged to the same voltage as C_4. If the applied signal is at a frequency above or below f_0, then E_s leads E_3 by less than, or more than 90°, the resultant signals applied to the two diodes are unequal, and the voltages developed across C_3 and C_4 are unequal.

The two circuits differ in the polarity of diode connections. In the Foster-Seely, the diodes are connected so that the voltages developed across C_3 and C_4 are in series opposing, so that for an unmodulated applied signal at frequency f_0 the total voltage is zero across the two diode loads, R_1+R_2, i.e. across BC. Note that each diode has a separate *dc* load circuit; for D_1 this is through R_1 and L_3 while for D_2 the *dc* path is through R_2 and L_3. If the applied signal is modulated, its frequency will vary above and below f_0 and the output voltage across BC will vary above and below zero with substantially the same waveform as the original modulation.

Ratio Detector

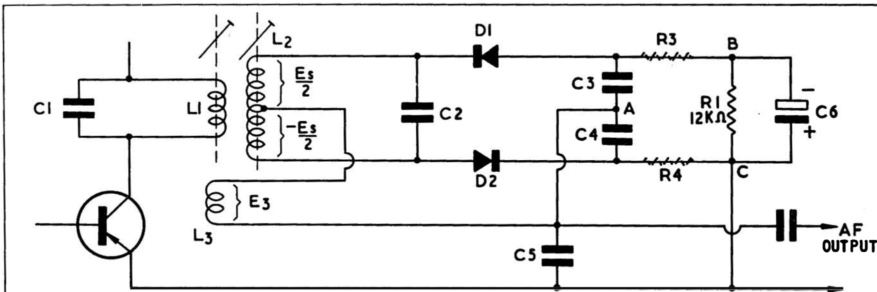
In the Ratio detector, the diodes are connected in series aiding, so that the voltages developed across C_3 and C_4 are in series aiding. For an applied signal at frequency f_0 the total voltage across the common diode load R_1, i.e. across BC, is approximately equal to the peak carrier voltage across the whole secondary L_2. If the applied signal is modulated, the frequency varying above and below f_0, then the voltages across C_3 and C_4 will vary, but the total voltage across BC will remain constant provided the amplitude of the signal remains constant. The voltage across either C_3 or C_4 is then a replica of the original modulation, and in figure 5 the output is taken from A with point C earthed. If the earth connection were taken to a centre tapping point on R_1, then as for the Foster-Seely, the output voltage would contain no direct voltage component provided the mean carrier frequency of the applied signal corresponded to the resonance frequency of L_1C_1 and L_2C_2.

For both circuits, therefore, the output voltage bears a substantially proportional relationship to the frequency deviation on each side of the resonance frequency. However for applied signals having a frequency far removed from the resonance frequency, the voltages developed across primary and secondary will be small, and the voltages developed across C_3, C_4 and their differences will be small. The curve of instantaneous output voltage against frequency is therefore of the well known S-shape, with only the centre portion usefully linear. **Fig. 7** shows a typical curve, which can be plotted point by point by connecting a valve-voltmeter or a C R O across points AC, and varying the frequency of an applied unmodulated signal.

Three Conditions

For the output of an FM detector to be an undistorted replica of the applied frequency modulation, three necessary conditions are clear from **fig. 6.** Firstly the centre portion of the curve must be linear and symmetrical about a definable mid-point. Secondly the usable linear portion must span a frequency bandwidth of not less than 200 Kc/s. Thirdly it must be possible to ensure that the mean frequency of the signal applied to the detector can be constantly located at the resonance frequency of the detector.

The first and second conditions require patient cunning on the part of the designer, and a nice degree of symmetry in the circuit. The third condition requires accurate tuning-in by the listener, and, just as important, a local oscillator in the receiver that is stable enough for the required station to remain accurately tuned in for hours, during which time the whole receiver may change considerably in temperature. The accurate shaping and alignment of



"RATIO DETECTOR"

FIG. 6.

the FM detector response curve is therefore all important, and a few manufacturers are beginning to quote a distortion figure for their tuners. Incidentally, a tuning indicator can be very misleading if alignment is not carefully carried out.

Drifting

Tuning-drift is an ever-present challenge to the designer of VHF receivers. As a receiver warms up, after a cold switch-on, the components in the tunable oscillator-section change in inductance and capacitance, due to small changes of dimension and permittivity. Valve or transistor parameters change not only with temperature, but also with supply voltage. If the oscillator tuning in an FM receiver drifts by more than about 20 Kc/s. then the operating point on the detector response curve will no longer lie at the centre of the linear portion, and full modulation will operate the detector over the curved portion of the characteristic, giving audible distortion. By avoiding insulators with a high temperature-coefficient of capacitance, such as bakelite, and by using a negative temperature-coefficient ceramic capacitor to balance the normal positive temperature coefficient of ceramic insulators, etc., it is possible to build a tunable oscillator with a total drift within the above limit. A commercial answer to this design problem is to ensure stability of frequency by connecting across the oscillator tuned circuit a variable reactance stage which is controlled by a direct voltage derived from the detector, for example from point A in **fig. 5,** or from a centre-tapping on R_1 in **fig. 6.** Of the two circuits, the Foster-Seely, **fig. 5,** provides the greater control voltage. However, Automatic Frequency Control, as it is called, cannot completely disguise a poor oscillator design. Nor is it fair on the designer to mount a tuner in a cabinet so that it 'cooks' immediately above the power amplifier.

Programme Requirements

This discussion on the major factors governing audio-bandwidth and non-linear distortion in tuners should be viewed in the light of the type of programme that is usually required. If you really want to hear what other people are saying all over the world, then you want a good communications receiver. If, on the other hand, you like listening to fairly complex choral or instrumental music, then you must remember that although 1% or 2% harmonic distortion, or even more, may be inaudible (*sic*) when a single instrument is playing, it will add an objectionable amount of 'mush' (in fact plain *noise*) when many instruments are playing together. This is called intermodulation. You may now be persuaded that it is wise to buy the best FM tuner you can afford. If price is a limiting factor, it is surely best to buy something that does one job really well: while you are contentedly listening it does not really matter how many other wave-bands you might be roaming if you had 'the lot'.

Interference suppression was mentioned earlier as being the most important reason for the use of FM on the VHF band. All unwanted noise and interference actually present in the output of a tuner or receiver has already passed through the IF amplifier, and been applied to the detector. It takes the form of amplitude variation of the IF carrier, regardless of the original cause. The output voltage of the Foster-Seely discriminator (**fig. 5**) is insensitive to amplitude changes of the applied signal, provided there is no modulation, because the output across BC is then zero anyway. In the

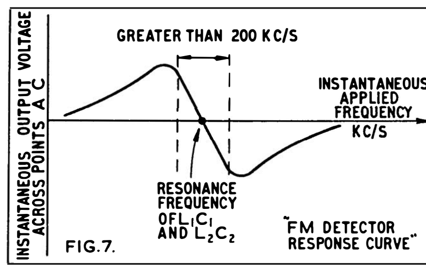


FIG.7.

presence of frequency modulation, the instantaneous output voltage is the difference between the voltages developed across C_3 and C_4, and is thus directly dependant on the amplitude of the applied signal as well as the frequency deviation.

Foster-Seely Detector

A Foster-Seely discriminator therefore has to be used with an IF amplifier incorporating one or more stages which limit the amplitude of the signal. An acceptable overall AM suppression ratio is 40 dB, and this is only achieved when the signal from the aerial is large enough, with the receiver gain available, to operate the limiting stage. The suppression ratio is often better than this for larger signals, especially if a second limiter is thereby brought into operation. The effect of the limiter is that the output from the Foster-Seely detector is substantially independent provided it is of the signal strength, above the minimum required for suppression.

The Ratio Detector, **fig. 5,** is much used in commercial receivers because it provides a greater degree of AM suppression without additional limiters. This is achieved by the inclusion of a large capacitance C_6 across the common diode load R_1. The value of R_1, typically 12 KΩ, is low enough to damp the secondary circuit L_2C_2 heavily. The time constant C_6R_1 is longer than the period of any audio frequency, and is about 0·1 second. On the application of a sudden increase of signal amplitude, as in ignition interference, the diodes conduct heavily to increase the charge in C_6 and the damping on L_2C_2 is increased. The addition of the series resistors R_3 and R_4 improves the effect by lengthening the charging time constant. If the applied signal suddenly decreases, the diodes cease to conduct, and all damping effect is removed from L_2C_2, thus temporarily increasing its magnification. The voltage across R, is thus held reasonably constant for all audio-frequency charges in amplitude, and the audio signal developed across points AC is free of interference. Long-term changes of signal strength will directly affect the audio output voltage, and the addition of Automatic Gain Control, or an additional limiter stage which has the same effect, is to be found in the more refined tuners.

All FM tuners and receivers perform better if the aerial signal available substantially exceeds that minimum required for acceptable suppression of interference. It is therefore a good idea to install a suitable aerial as high off the ground as possible, where it will, incidentally, be further from sources of man-made interference. An attic aerial is far, far better than one in a ground-floor room, where the signal strength may vary as people move about, and where it may more easily pick up interfering signals from thermostats, fluorescent lights, etc. Sometimes freak reception conditions provide a background from an FM transmitter that is supposed to be outside the service area, which normally only extends about 50 miles. In such cases a directional aerial can be used to discriminate against the unwanted signal. One type of horizontal X aerial has a useful 'null' on one quarter which can be useful in such cases.

The time constant governing the choice of C_3 and C_4 depends on exactly the same criterion as in AM detectors, that is the voltage developed across them must follow the waveform of the highest audio frequency in the programme. The value chosen should not exceed 100 pF with R_1 and R_2 100 KΩ each in **fig. 5.** Where the tuner is to handle a stereo-multiplex signal, the demodulated signal contains components up to 53 Kc/s, and as well as omitting the de-emphasis circuit (not shown in **figs. 4** and **5**), the values of C_3 and C_4 will be considerably lower to avoid distortion of the difference signal which lies between 23 and 53 Kc/s. It is possible that the Ratio Detector (**fig. 6**), with its lower impedance, will prove better for multiplex reception.

Finally a word on connecting up the various bits and pieces may forestall some tiresome problems with hum. **Fig. 1** showed a simple layout using a tuner-amplifier as the basis of the equipment. **Fig. 8** shows a more complicated layout, with stereo facilities. Both diagrams show two essential rules in connecting together several items of equipment with leads carrying audio-frequency signals: firstly, use coaxial screened cable throughout, with no unscreened joints, and remember that TV aerial lead with a polythene inner has a quarter the capacitance of PVC screened cable; secondly, the 'earths' of the various chassis are connected together only by the cables, and only one chassis is connected to the house earth. This method avoids earth loops, via the skirting plugs which, with the 'live' signal leads, provide loops of several square feet in area capable of picking up the mains-frequency hum field from any nearby transformer or even from stray mains wiring. To put it more strongly, the *worst* thing to do is to earth each unit separately.

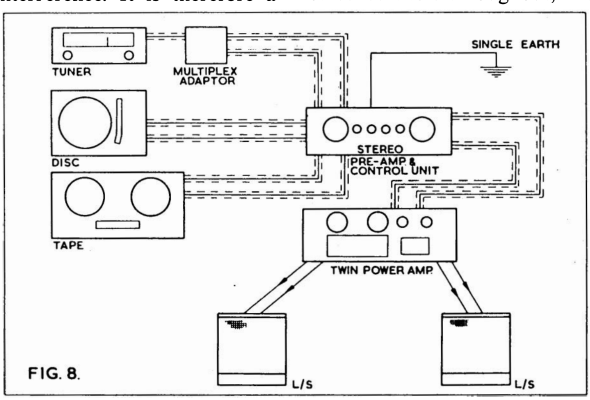


FIG. 8.

DIRECTORY OF RADIO TUNERS

★ In the abridged specifications of these directory entries the following abbreviations have been used: **P.s.n.** = Power supply needed; **A.F.C.** = Automatic frequency control; **A.G.C.** = Automatic gain control; **Mc/s** = Megacycles; **ind.** = Indicator; **disc** = Discriminator; **imp.** = Impedance; **det.** = Detector.

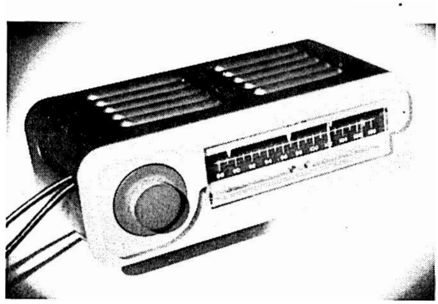
ACOUSTICAL MANUFACTURING CO. LTD., St. Peter's Road, Huntingdon, Hunts. Tel.: Huntingdon 361 and 574. Cables: Acoustical.

F.M. tuner. Variable tuning. Range 87·5-108 Mc/s. Special double neon display ind. P.s.n. 330V at 27 mA; 6·3V at 1·85 amps. Size: 10½ × 3½ × 6 in. Price: £21 (U.K. purchase tax £3 18s. 9d.).

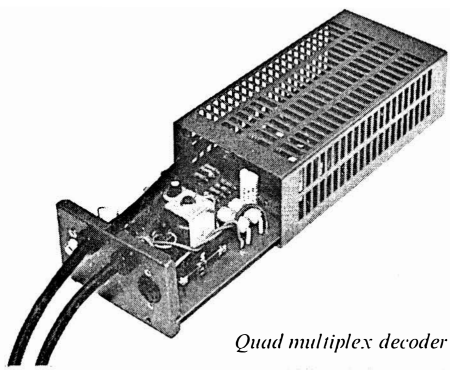
Multiplex decoder. Stereo multiplex adaptor available. Transistorised. P.s.n. 330V DC, 8 mA mono plus extra 9 mA on stereo. Price: £16.

A.M. II tuner (European). Variable tuning. Ranges: 800-2070 m., 185-588 m., 5·8-18·5 Mc/s. Magic eye indicator. Output 100 mV nominal for 30% modulation. Output resistance 15K. Filter rejection 9 Kc/s. P.s.n. 330V at 35 mA; 6·3V at 1·2 amps. Size: 10½ × 3½ × 6 in. Price £24 (U.K. purchase tax £4 10s.).

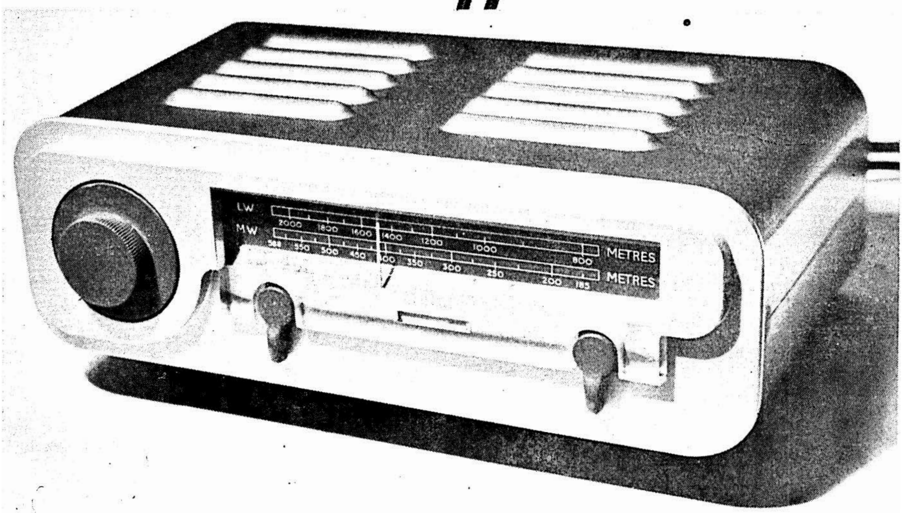
A.M. II tuner (Overseas). Variable tuning. Ranges: 185-588 m., 2·2-6·6 Mc/s, 5·8-18·5 Mc/s. Filter rejection 10 Kc/s. Magic eye



Acoustical FM tuner



Quad multiplex decoder



Acoustical AM tuner covering short, medium and long wave bands

Armstrong 223 *AM/FM tuner*

Armstrong 224 *FM Tuner*

Dynaco FM-3

indicator. Output 100 mV nominal for 30% modulation. Output resistance 15K. P.s.n. 330V at 35 mA; 6·3V at 1·2 amps. Size: $10\frac{1}{2}$ × $3\frac{1}{2}$ × 6 in. Price: £24 (U.K. purchase tax £4 10s.).

★

ARMSTRONG AUDIO LTD., Warlters Road, Holloway, London, N.7. Tel.: North 3213/4.

A.M./F.M. tuner 223. Variable tuning. Range M.W. 180-600 m.; F.M. 87-108 Mc/s. Foster Seeley disc. Tuning meter. Full facilities for multiplex. Aerial imp. 70-80 ohms and 300 ohms. Output 0-2V variable from dual stereo outputs. P.s.n. 200-250V AC. Size: $12\frac{3}{8}$ × $4\frac{3}{4}$ × 9 in. Price: £24 11s. 3d. (U.K. purchase tax £4 3s. 9d.).

F.M. tuner 224. Variable tuning. Range 87-108 Mc/s. Foster Seeley disc. Tuning meter. Full facilities for multiplex. Aerial imp. 70-80 ohms and 300 ohms. Output 0-2V variable from dual stereo outputs. P.s.n. 200-250V AC. Size: $10\frac{3}{8}$ × $4\frac{3}{4}$ × 9 in. Price: £19 4s. 6d. (U.K. purchase tax £3 5s. 6d.).

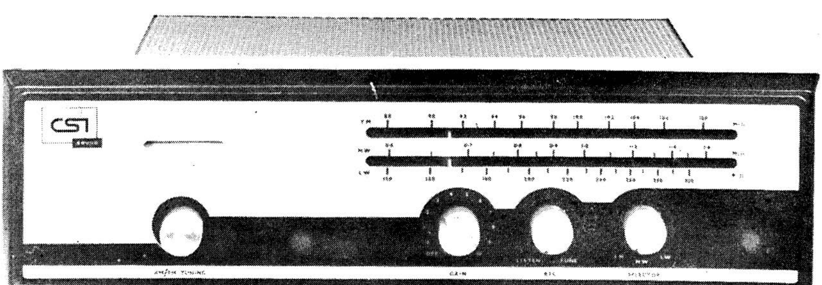
★

BRAUN AG. Distributors: Argelane Ltd., 251 Brompton Road, London, S.W.3. Tel.: Kensington 9611.

CE16. A.M./F.M. tuner. V.H.F. 88-108 Mc/s, M.W. 188-545 m. Variable tuning. Foster Seeley discriminator. Meter indicator. Sensitivity 1·5 μV. for 26 dB quieting. Aerial 300 ohms balanced. Output 200 mV. Optional multiplex. A.F.C. switchable. Mains 240V AC. Size: $12\frac{7}{8}$ × 8 × 4 in. Price: £65 4s. (U.K. purchase tax £9 16s.).

★

CHAPMAN (ULTRASONICS) LTD. See Derritron (Ultrasonics) Ltd.



Clarke and Smith CSI 658 *Mk* 2 *AM/FM Tuner*

CLARKE & SMITH MANUFACTURING CO. LTD., High Fidelity Components Division, Melbourne Works, Wallington, Surrey. Tel.: Wallington 9252. Cables: Electronic, Wallington.

CSI 658 Mk. II. A.M./F.M. Continuously variable tuning. Range M.W. 600 Kc/s-1·6 Mc/s; LW. 150-320 Kc/s; F.M. 88-108 Mc/s. Ratio det. E.M.87 M.E. ind. Multiplex conversion facilities. Aerial imp. 75 ohms. Output 0·5V. Self-powered. Size: 4 × 14 × 8 in. Price: £34 1s. 8d. (U.K. purchase tax £5 16s. 4d.).

★

DECCA SPECIAL PRODUCTS, Decca Radio and Television Division of The Decca Record Co. Ltd., Ingate Place, Queenstown Road, London, S.W.8. Tel.:Macaulay 6677.

Decola "Separates" F.M. tuner. Variable tuning. Range 86-108 Mc/s. Tuning ind., M.E. P.s.n. 200V DC 20 mA; 6·3V AC 1·6 amps. Size: 11 × 5¾ × 5¼ in. Price: £17 3s. 10d. (U.K. purchase tax £2 15s. 2d.).

★

DERRITRON RADIO LTD., Chapman Division, 24 Upper Brook Street, London, W.1. Tel.: Hyde Park 2291.

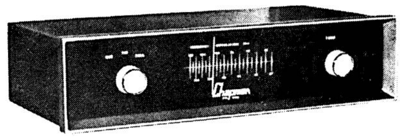
Chapman A.M./F.M. S6BS/FM. Free-tuned. Range F.M. 87·7-108 Mc/s; A.M. 6 bandspreads: 11, 13, 16, 19, 25 and 31 m.; also 15-43, 43-140, 175-570 m, Wide-band ratio det. Magic eye ind. Self-powered. Size: 13¾ × 8¼ × 13½ in. Price: £58 10s. (U.K. purchase tax £10 4s. 6d.).

Chapman A.M. tuner S6BS. Free-tuned. Range 6 bandspread ranges: 11, 13, 16, 19, 25 and 31 m., also 13-43, 43-140, 175-570 m. Magic eye ind. P.s.n. 6·3V at 1·5 amps. Self-powered. Size: 13¾ × 11 × 8¼ in. Price: £45. (U.K. purchase tax £7 17s. 4d.).

Chapman FM1000. Transistorised F.M. tuner. Variable tuning. Range 87·5-108 Mc/s. A.F.C. Multiplex conversion facilities. Aerial imp. 75 ohm co-ax. Output 250 mV. Self-powered. Size: 14½ × 3½ × 7¼ in. Complete with tuning meter. Price: £24 13s. (U.K. purchase tax £4 12s. 5d.).

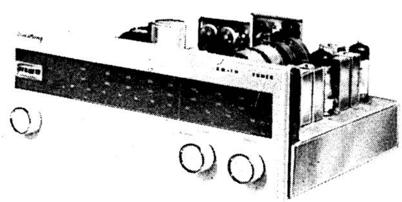
Chapman FM1005. Transistorised A.M./F.M. tuner. Variable tuning. Range F.M.

Chapman FM1005 AM/FM tuner

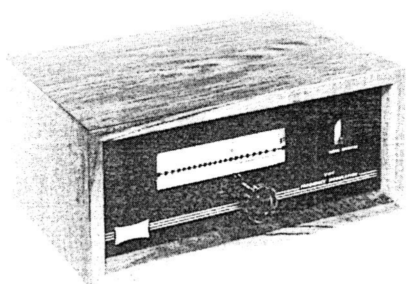


Chapman FM1000 FM tuner

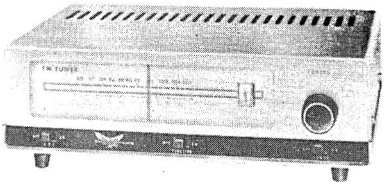
Chapman S6BS/FM Mk II tuner



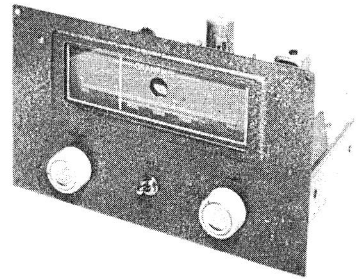
Armstrong AM/FM Tuner 223



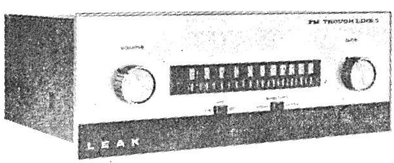
Decola "Separates" FM tuner



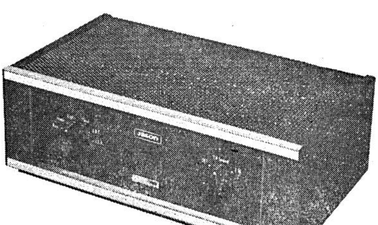
Eagle FMT 640 *FM Tuner*



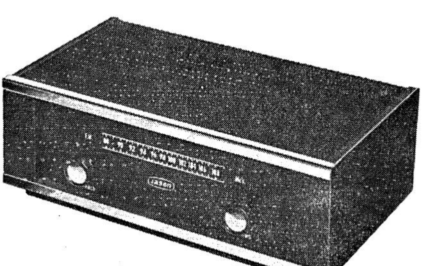
Grampian 571 *FM tuner*



Leak Troughline 3 *FM tuner*



*Jason JVT/*2 *tuner*



*Jason FMT/*4 *tuner*

87·5-108 Mc/s; A.M. 16-50 m., 50-195 m., 195-550 m., 800-2000 m. A.F.C. Multiplex conversion facilities. Aerial imp. F.M. 75 ohms; A.M. high imp. Output 250 mV, 100 K. Self-powered 100-125V, 10W consumption. Size: 14½ × 5½ × 7¼ in. Price: £36 4s. 6d. (U.K. purchase tax £6 15s. 10d.).

★

DYNACO. Distributors: Howland-West Ltd., 11 Howland Mews, Howland Street, London, W.1. Tel.: Langham 1381.

FM-3. Variable tuned V.H.F./F.M. tuner for shelf mounting or building in synchronous balanced-bridge detector. Twin indicators for tuning and stereo transmissions. Sensitivity 4 μV for 30 dB quieting. Output 2V. Multiplex decoder fitted. Four IF stages with progressive limiting. Completely stable without A.F.C. Can be fully aligned without use of test instruments. Size: 13½ × 4½ × 8 in. Mains power unit. Price: (assembled) £63 18s. 4d. (U.K. purchase tax £11 13s. 8d.); (kit) £53 5s. 3d. (U.K. purchase tax £9 14s. 9d.).

★

EAGLE PRODUCTS. Distributors: B. Adler & Sons (Radio) Ltd., 32a Coptic Street, London, W.C.1. Tel.: Museum 9606/7. Cables: Reldab, London.

FMT 640 F.M. tuner. Variable tuning. Range 88-108 Mc/s. A.F.C. Armstrong circuit with dual limiters and wide-band discs. F.M. calibrated signal meter. Input for multiplex adaptor. Aerial imp. 300 ohms. Self-powered. Size: 11 × 6½ × 3¾ in. Price: £22 (U.K. purchase tax £3 14s. 1d.).
(Price quoted is approximate).

★

GRAMPIAN REPRODUCERS LTD., 19 Hanworth Trading Estate, Feltham, Middx. Tel.: Feltham 2657. Cables: Reamp, Feltham.

F.M. tuner 571. Free-tuned. Range 85-98 Mc/s. Ratio det. Magic eye ind. P.s.n. 300V at 35/40 mA; 6·3V at 2·5 amps. Size: 10¼ × 5½ × 6¼ in. Price: £19 10s. (U.K. purchase tax £3 4s.).

★

GRUNDIG (GREAT BRITAIN) LTD., Newlands Park, Sydenham, London, S.E.26. Tel.: Sydenham 2211.

●**RT50.** Stereo radio tuner incorporating 10 valves, 2 transistors and 15 diodes. Wavebands: AM WM 510-1,620 Kc/s, FM 87-104 Mc/s.

Sensitivity: FM 1·4 μV for 26 dB quieting, AM 8μV for 10 mV output. Output: 3·5V across 2K. Distortion less than 1% at maximum deviation. F.R. 30 c/s-15 Kc/s. ±1 dB. Separation better than 35 dB. Built-in multiplex decoder. Switchable AFC. Switchable inter-station noise suppression. Mains 110, 130, 220, 240V 50-60 c/s. Consumption 55W. Shelf mounting walnut cabinet. Size: $15\frac{3}{8} \times 10\frac{1}{2} \times 6$ in. Price: £72 9s. including purchase tax.

★

HEATHKIT. See Kit section.

★

HENRY'S RADIO LTD. See Constructional Kits Section.

★

JASON ELECTRONIC DESIGNS LTD., 18 Tudor Place, Tottenham Court Road, London, W.1. Tel.: Museum 4666.

F.M. tuner FMT/4. Variable tuning. Range 88-108 Mc/s. Transistor amplified. A.F.C. Ratio det. Multiplex adaptor output. Self-powered. Size: $11\frac{1}{4} \times 6\frac{5}{8} \times 4\frac{3}{8}$ in. Better than 5 μV for 40 dB quieting. Price: £17 5s. (U.K. purchase tax £2 15s. 4d.).

JTV/2 F.M. and A.M./TV sound tuner. Switched turret tuning. Automatic frequency control. Range 88-96 Mc/s, plus all television channels. Disc. Self-powered. Size: $11\frac{1}{4} \times 6\frac{5}{8} \times 4\frac{3}{8}$ in. 10 μV for 40 dB quieting. Price: £19 4s. (U.K. purchase tax £3 1s. 7d.).

Monitor F.M. and A.M./TV sound tuner. Switched tuning. A.F.C. Range 40-212 Mc/s. Foster-Seeley disc. P.s.n. 230V at 35 mA; 6·3V at 1·5 amps. Size: $5 \times 5\frac{1}{2} \times 7$ in. Price: £14 5s. (U.K. purchase tax £2 5s. 8d.).

★

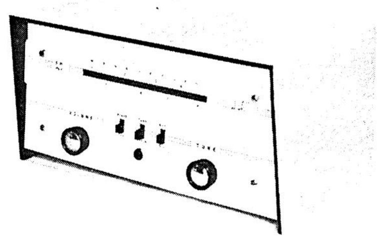
H. J. LEAK & CO. LTD., 57/59 Brunel Road, East Acton, London, W.3. Tel.: Shepherds Bush 1173. Cables: Sinusoidal, Ealux, London.

Trough line 3 F.M. tuner. Variable tuning. Range 88/108 Mc/s. A.F.C. giving tuning stability from the instant of switching on. Foster-Seeley disc. Magic eye ind. Self-powered. Size: $11\frac{1}{2} \times 4\frac{1}{4} \times 8\frac{1}{4}$ in. Price: £27 (U.K. purchase tax £4 14s. 6d.).

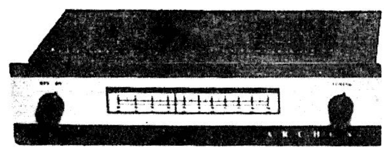
★

LEE PRODUCTS (G.B.) LTD., 10-18 Clifton Street, London, E.C.2. Tel.: Bishopsgate 6711. Cables: Leprod, London.

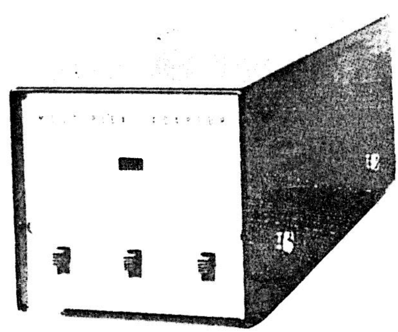
Dulci. A new F.M./V.H.F. tuner and a new F.M./A.M. (long, medium and short) tuner



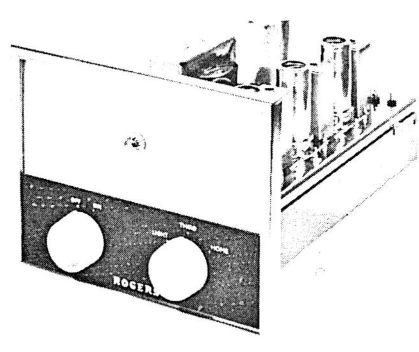
Lowther FM tuner Mk. V



Archon PF41 FM tuner



Pioneer MXA-1A Multiplex adaptor



Rogers FM tuner (switched)

are being added to the Dulci range of matching equipment. Details were not available as we went to press.

★

L & H. Distributors: Britimpex Ltd., 16-22 Great Russell Street, London, W.1. Tel.: Museum 7600. Cables: Britron, London.

Signalmaster 6077A. Self-contained battery-operated F.M./V.H.F. tuner. Plug-in V aerial. Single knob tuning control. Transistorised. Built-in audio pre-amplifier. Teak case. Size: 9 × $2\frac{5}{8}$ × $2\frac{1}{2}$ in. Range 87-105 Mc/s. Batteries: Six U7 giving approximately one months use at 4 hours a day. On-off switch. Output by screened lead. Price: £17 12s. 10d. (U.K. purchase tax £2 16s. 8d.).

★

LOWTHER MANUFACTURING CO., Lowther House, St. Mark's Road, Bromley, Kent. Tel.: Ravensbourne 5225. Cables: Lowther, Bromley.

F.M. tuner Mk. V self-powered. Twin gang tuning, horizontal scale. Range 87·5-108 Mc/s. A.F.C. Foster-Seeley disc. Switched ind. 50 c/s injection. Self-powered. Size: $13\frac{1}{4}$ × $5\frac{1}{2}$ × 5 in. Price: £24 10s. (U.K. purchase tax £4 7s. 5d.).

F.M. tuner Mk. V. Variable tuning. Range 87·5-108 Mc/s. A.F.C. Foster-Seeley disc. Switched A.F.C. and hum check ind. P.s.n. 250V 30 mA; 6·3V 2 amps. Size: $10\frac{1}{4}$ × $4\frac{3}{4}$ × 7 in. Price: £22 (U.K. purchase tax £3 18s. 5d.).

★

MARTIN ELECTRONICS LTD. See Constructional Kits Section.

PIONEER ELECTRONICS CORPORATION. Distributors: C. E. Hammond & Co. Ltd., 90 High Street, Eton, Windsor, Berks. Tel.: Windsor 63388. Telex.: 84306.

MXA-1A multiplex adaptor. Self-powered for use with most F.M. tuners. Price: £16 16s.

●**TX-5.** Stereophonic tuner. Wavebands: V.H.F./F.M. 88-108 Mc/s., medium wave 187-560 m. Variable tuning. Foster-Seeley discriminator. M.E. Sensitivity: F.M. 1·5 μV, A.M. 5 μV. for 20 dB quieting. Aerial input 300 ohms balanced plus built-in ferrite rod. Multiplex decoder included. A.F.C. Self-powered. Channel separation using multiplex better than 35 dB. Size: $15\frac{1}{2}$ × $13\frac{1}{2}$ × 6 in. Price: £68 5s.

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PYE LTD., High Fidelity Division, P.O. Box 49, Cambridge. Tel.: Cambridge 58985. Cables: Pyrad, Cambridge.

Brahms HFT300. Transistorised tuner covering F.M./V.H.F. 87·5-108 Mc/s, M.W. 196-550 m., L.W. 1000-1800 m. Variable tuning. Foster-Seeley F.M. discriminator. Centre-zero meter indicator. Sensitivity: F.M. 3 μV for 20 dB signal-to-noise ratio, A.M. 10 μV for 100 mV output. F.M. aerial 75 ohms coaxial. Nominal output 500 mV. Switched A.F.C. Provision for multiplex decoder. Mains 110-250V AC. Sizes: chassis $11\frac{1}{2}$ × $9\frac{1}{4}$ × $3\frac{1}{2}$ in., panel 12 × 4 in., cabinet $12\frac{3}{4}$ × $5\frac{1}{2}$ × 9 in. Price: £37 8s. (U.K. purchase tax £6 14s.).

★

RADFORD ELECTRONICS LTD., Ashton Vale Estate. Bristol 3. Tel.: Bristol 662301/2.

Radford FMT1 FM tuner

FMT1 F.M. tuner. Range 87·5-108·5 Mc/s. Variable tuning. Aerial imp. 75 and 300 ohms. Sensitivity 4 µV. for 30 dB s/n. Output up to 2V at 100% modulation, adjustable. Mains powered 110-250V 50/60 c/s. Transistor inter-station quieting circuit. Size: $10\frac{1}{2} \times 3\frac{3}{4} \times 12\frac{5}{8}$ in., panel $10\frac{3}{16} \times 3\frac{5}{16}$ in. Weight 12 lb. Price: £34 (U.K. purchase tax £5 17s. 11d.).

FMT1.M tuner. Similar to FMT1 but with multiplex decoder incorporated. Price: £46 (U.K. purchase tax £7 19s. 7d.).

FMM adaptor. F.M. multiplex accessory. Price: £15.

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ROGERS DEVELOPMENT (ELECTRICAL) LTD., 4-14 Barmeston Road, Catford, London, S.E.6. Tel.: Hither Green 7424/4340. Cables: Rodevco, London, S.E.6.

Mk. III switched F.M. tuner. Range 87-96 Mc/s. A.F.C. Foster-Seeley discriminator. Multiplex conversion facilities. Aerial imp. 70-90 ohms. Output 0·25V RMS. Self-powered. Cathode follower output. Size: (chassis model) $11 \times 6\frac{1}{2} \times 4\frac{1}{2}$ in.; (case model) $11 \times 7\frac{1}{4} \times 5\frac{3}{8}$ in. Prices: (chassis model) £16 16s. (U.K. purchase tax £2 17s. 4d.); (case model) £19 10s. (U.K. purchase tax £3 6s. 6d.).

Mk. III Variable F.M. Receiver. New design styled to match the Cadet III range. Suitable for use with Cadet III or HG88 III stereo amplifiers. Range 88-108 Mc/s. Sensitivity 1·5 µV for 20 dB quieting. Twin limiters. Foster-Seeley discriminator. Accurate tuning indicator. A.F.C. Provision for adding multiplex decoder. A.G.C. Station marker device. Self-powered. Price: to be announced.

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SHIRLEY LABORATORIES LTD., 3 Prospect Place, Worthing, Sussex. Tel.: Worthing 30536.

F.M. tuner SB/V16. Variable tuning. Standard range. Ratio det. Magic eye ind. P.s.n. 200-300V 15 mA; 6·3V 2·5 amps. Price: £20 (U.K. purchase tax £3 15s.).

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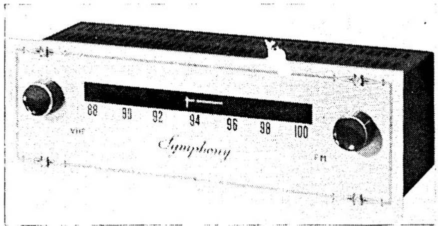
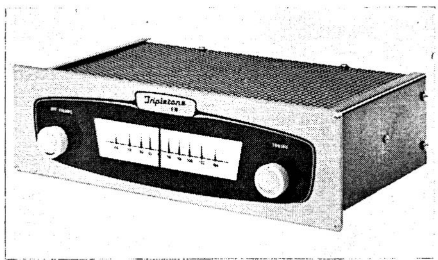
SYMPHONY AMPLIFIERS LTD., 16 Kings College Road, London, N.W.3. Tel.: Primrose 3314/5.

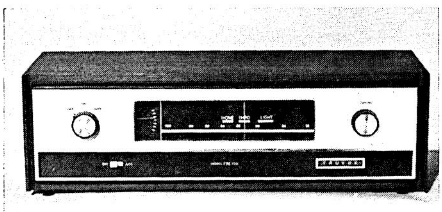
Pye Brahms HFT300 AM/FM tuner



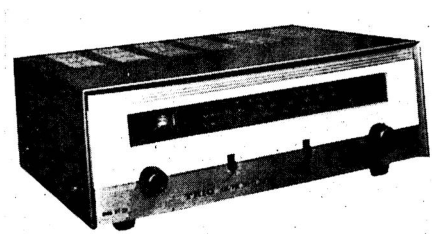
Symphony FM tuner



Tripletone FM tuner



Truvox FM100 tuner



Trio AF220 AM/FM tuner

FM2 F.M. tuner. Variable tuning. Range 88-100 Mc/s. A.F.C. Foster-Seeley disc. Tuning ind. EM84 strip. Aerial imp. 75 ohms. Output 1V. P.s.n. self-powered version 200-250 AC, unpowered version 250V at 35 mA; 6·3V at 1·5 amps. Dimensions 13 × 4 × $4\frac{3}{4}$ in. Enclosed in steel cabinet. Price (unpowered): £16 16s. (including purchase tax); (self-powered): £18 18s. (including purchase tax).

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TANSLEY-HOWARD LTD., 144 Holland Park Avenue, London, W.11. Tel.: Bayswater 2848.

Archon PF41F.M. tuner. Variable tuning. Range 88-108 Mc/s. A.F.C. Self-powered. Size: 12 × 6 × $2\frac{3}{8}$ in. Panel: $12\frac{1}{2}$ × 3 in. Price: £18 15s. (U.K. purchase tax £3 7s. 9d.).

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TRIO. Distributors: Winter Trading Co. Ltd., 95-99 Ladbrook Grove, London, W.11. Tel.: Park 1341. Cables: Winlec, London, W.11.

FM106. Variable tuned F.M./V.H.F. tuner covering 80-108 Mc/s. Foster-Seeley discriminator. M.E. Sensitivity 2 µV for 20 dB signal/noise at 98 Mc/s. Aerial 75 ohms coaxial. Multiplex decoder available. A.F.C. Mains 115/230V 50-60 c/s. Size: $11\frac{1}{4}$ × 5 × 8 in. Price: £22 12s. (U.K. purchase tax £3 12s. 7d.).

AFE220. Mains-operated valve tuner covering V.H.F., M.W., and L.W. Variable tuning. F.M./V.H.F. 88-108 Mc/s, M.W. 187-560 m., L.W. 855-2000 metres Meter tuning indicator. Sensitivity: F.M. 2·1 µV at 98 Mc/s, A.M. 20 µV. Aerial 75 ohms coaxial. Output: F.M. 2V at 400 c/s ± 75 Kc/s deviation, A.M. 1·5V at 400 c/s 30% modulation. Multiplex decoder available. A.F.C. Mains 115/230V 50-60 c/s. Size: $12\frac{1}{4}$ × 5 × 5 in. Price: £35 8s. 7d. (U.K. purchase tax £6 0s. 11d.).

TRIPLETONE MANUFACTURING CO. LTD., 241a The Broadway, Wimbledon, S.W.19. Tel.: Liberty 1189.

Tripletone F.M. tuner. Variable tuning. Range 86-104 Mc/s. A.G.C. Ratio det. Aerial imp. 70-80 ohms. Output 500 mV. Cathode follower output. P.s.n. 200-250V AC for powered version; 250V DC at 25 mA and 6·3V at 2 amps for unpowered version. Size: 11 × $6\frac{1}{2}$ × 3 in. Price (unpowered): £11 17s. 11d. (U.K. purchase tax £2 1s. 7d.); (powered): £13 7s. 8d. (U.K. purchase tax £2 6s. 10d.).

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TRUVOX LTD., Neasden Lane, London, N.W.10. Tel.: Dollis Hill 8011. Cables: Truvoxeng, London, N.W.10.

FM100. Variable tuning F.M./V.H.F. tuner covering 87·5-108·5 Mc/s. Ratio detector. Meter tuning indicator plus light for stereo transmissions. Sensitivity 1·5 µV for 20 dB quieting. Aerial imp. 75 ohms coaxial, 300 ohms balanced. Nominal output 1V. Internally-fitting decoder available. Switched A.F.C. Overload limiting diode. Preset output control. Mains 100-120V, 200-250V, 40-60 c/s. Price: to be announced.

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ZENITH RADIO CORPORATION. U.K. Distributors: United Mercantile Co. Ltd., Sovereign House, 13/14 Queen Street, London, W.1. Tel.: Grosvenor 4901. Cables: Ramsaco, Telex, London.

MHT15 stereo F.M./A.M. tuner. Range A.M. 550-1,600 Kc/s, F.M. 88 to 108 Mc/s. A.F.C. Ratio det. Limiter. Multiplex incorporated. Aerial imp. 300 ohms. Sensitivity 2-3 µV at 30 dB quieting. P.s.n. 110V. Dimensions: $13\frac{1}{2}$ × 6 × 10 in. Price: £52 10s. (U.K. purchase tax: £8 8s. 5d.).

TRANSISTOR AMPLIFIER PROGRESS

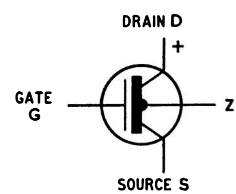
by George Tillett

THIS past year has seen considerable progress in transistor amplifier design and there is no doubt that this advance is due in some measure to the larger variety of transistors now available. And—just as important—prices have fallen to a more acceptable level! For example, high voltage NPN types suitable for medium power driver stages—such as those used in the Texas amplifier described in the 1962 Yearbook, cost at that time, well over £10 each! So it was no wonder that this particular design stopped in the lab! But now, these same transistors can be bought for less than £1 each —and even higher power types can be had for little more. The price of silicon power transistors has also dropped recently, and so—to a lesser extent—has the cost of ordinary small signal types—germanium and silicon. When it is realised that a moderate power, high-performance amplifier will use between 25 and 45 semi-conductors of one kind or another it is easy to see that cost just cannot be ignored.

New types of transistors seem to be invented every week and although most of them are intended for high frequency or computer switching applications, there are some types which might be suitable for audio work. Among these are Field Effect Transistors (FETS or MOS FETS), which are metal oxide silicon types closely resembling a valve in operation. They are inherently high impedance devices and gain is a function of voltage rather than current as in ordinary transistors. **Fig. 1** shows the graphical symbol and it will be seen that Gate G corresponds to the Grid, Drain D the anode, and Source S the cathode. The fourth connection Z, is joined to the semi-conductor substrate and the metal case, and is not normally used for low frequency applications. The input impedance at G is fantastically high—over 1 million megohms, and in practise this is really determined by the parallel bias resistor (assuming no feedback loops are used).

Fig. 2 shows an amplifier input stage using a Mullard FET type 95BFY—or similar. Rl and Cl form part of the equalising feedback loop, which is taken from the collector of the next transistor. This circuit not only has a very high input impedance, but the noise level is very low—certainly lower than could be achieved with ordinary transistors at such an impedance. Transistor noise has two components, one that is independent of the source impedance, called its *'voltage noise'*, and one that is not—called its *'current noise'*.

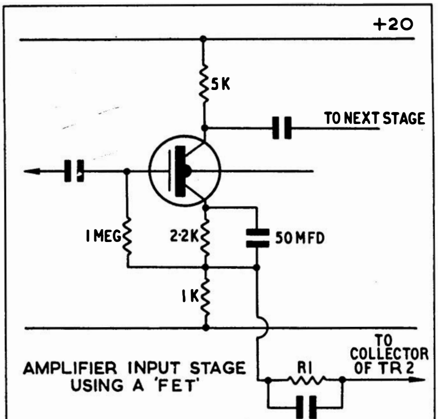
When the source resistance is very high, the current noise becomes more significant than the voltage noise, and one of the important



SYMBOL OF FET (FIELD EFFECT TRANSISTOR)
FIG. I.

characteristics of a FET is that it has a very low current noise with a high impedance. In fact, the noise is so low that it is difficult to measure! Apart from such obvious uses as pre-amplifiers for condenser microphones, PE cells and ceramic devices, FETS might be considered as an alternative to silicon planar types for low noise input stages where a high impedance is necessary. They may also find application in phase-splitting circuits where their symmetry would be an advantage. The particular Mullard type mentioned—95BFY, is only available in small quantities and at the moment it is rather expensive, but there is no doubt that prices will fall within a year or so.

At the present time there are a number of small signal transistors available—both germanium and silicon planar types—which have a lower noise level than conventional valves of the EF86 class provided that an input impedance above about 100K is not required. Moreover, they are free from hum and microphony—a tremendous step forward in itself (ask any tape recorder designer!).



AMPLIFIER INPUT STAGE USING A 'FET'

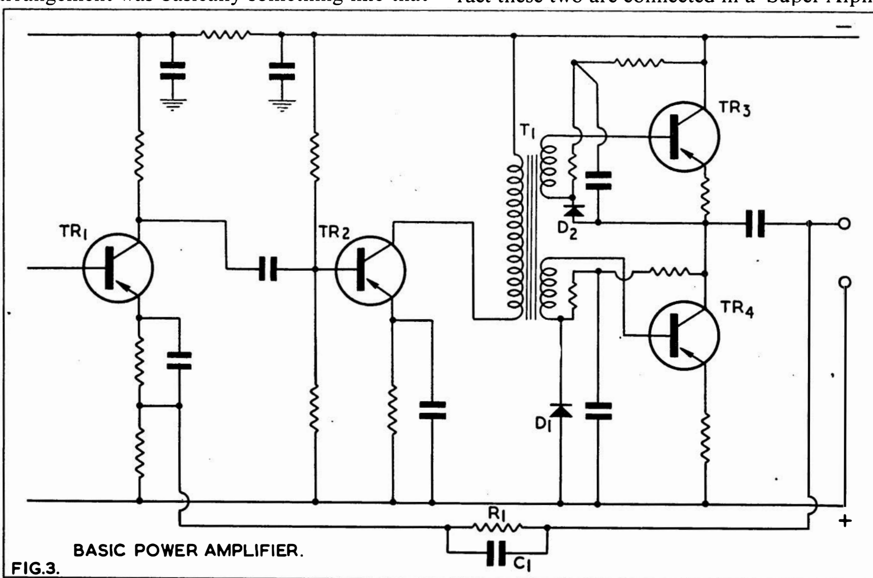
FIG. 2.

It is true that gain spreads are still very wide (power gains of 80 to 200 are not unknown), but this can be taken care of by preselection, by large feedback loops, or by using pre-set controls. Most of the newer small transistors will have a plastic case instead of the familiar metal one. Earlier plastic types were not successful because of interaction between the plastic and the semi-conductor material, but this problem has now been solved. Plastic cases are easier to make by modern mass production methods and have the advantage of giving a moisture-proof seal.

How about progress in actual design? Well, taking power amplifiers first, until a few months ago (in America at least) the most popular arrangement was basically something like that shown in **fig. 3.** TR2, the driver transistor, is usually a small power type operating at a fairly high current—say 50 to 200 milliamps. TR3 and TR4 are the output transistors—probably 2N21 7's connected in the now conventional single-end push-pull circuit. The diodes Dl and D2 stabilise the bias and negative feedback is applied via RI and CI to the emitter of the first transistor TRI.

The circuit is simple, straightforward, and works reasonably well. Its main limiting factor is the driver transformer itself (TI). It is not by any means easy to make such a transformer (commercially) having a wide bandwidth, low leakage reactance, tight coupling with a low phase shift. This last requirement is most important because the driver transformer is inside the main feedback loop which is quite large to reduce distortion and control other parameters.

Figs. 4A and **4B** show different methods of coupling the primary, **A** is parafed from the collector and **B** from the emitter. Both have the advantage of removing the high DC current from the primary and keeping the inductance high (or the cost down) but the emitter connection can give the best results due to the low impedance, although the stage gain will be less. **Fig. 5** shows the output stage of the *Fisher* TX300 and TX200 amplifiers. Here the driver transformer is tri-filar wound and so has a tight coupling with a wide bandwidth—actually within 1 dB from 5 cycles to 800 Kc/s. The driver transistor TR3 is connected as an emitter follower to give a low source impedance and it is preceded by another emitter follower—in fact these two are connected in a 'Super Alpha'



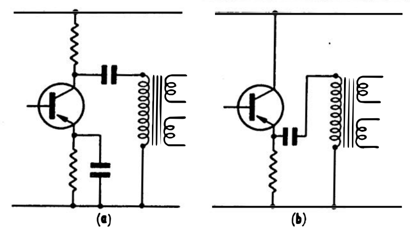
BASIC POWER AMPLIFIER.

FIG.3.

or 'Darlington' pair configuration which gives a low output and high input impedance. Negative feedback is applied to the emitter of TR1, and R2 with C2 constitute an 'LF step' to maintain stability at low frequencies. Note that the speaker is returned to an artificial centre-tap at *X* to prevent that annoying switching 'thump'. Each pair of output transistors (TR4 and TR5, TR6 and TR7) are series connected to give a high output and also to allow a high voltage to be used.

Fig. 6 shows a rather different arrangement, this is the German Grundig SV50, and here we see another example of the use of Darlington pairs; but this time they are in the output stage itself (TR2 and TR3 with TR4 and TR5). Used this way, they can reduce drive requirements and maintain a good frequency response. Like the Fisher amplifiers, the SV50 uses an HT centre-tap, but the supply voltage is lower and current higher so the nominal output impedance is only 5 ohms. Power is around 20 watts per channel with less than 0·2% distortion.

Fig. 7 shows a most unusual circuit—the American *Sherwood* S-9000, which has a push-pull driver stage with a PNP-NPN combination plus a driver transformer. TR2 is the PNP and TR3 its NPN 'mirror image' and they are both silicon types. In fact *all* the transistors in this amplifier are silicons. Power output is rated at 50 watts per channel. I do not know what the stability factor is but I do know it is marginal



SHOWING 2 METHODS OF COUPLING THE DRIVER TRANSFORMER
FIG.4.

with some other amplifiers using driver transformers, and without modifications many are not suitable for use with electrostatic speakers.

In general, stability can only be achieved by accepting a higher distortion—in other words, high feedback equals low distortion with low stability, and conversely lower feedback equals higher distortion with better stability. These factors can be reconciled by having a very elaborate tri-filar driver transformer (as in the Fisher) or possibly by using push-pull drive, but it would seem more logical to do without a transformer altogether and use some form of direct coupling. The arguments against this are as follows:

(a) Power transistors of the germanium diffused alloy and power drift types need a low base-emitter resistance to offset thermal drift.
(b) In direct coupled circuits the output transistors can be affected by changes in the operat-

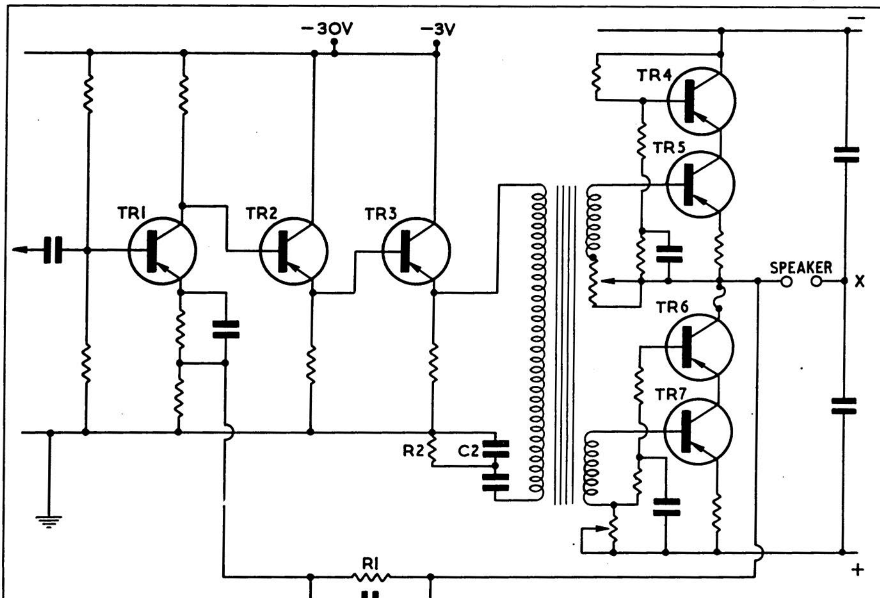


FIG.5. OUTPUT STAGE OF FISHER TX 300 AMPLIFIER.

ing conditions of the early stages. (c) High voltage driver transistors with a good HF response are not easy to come by. Actually, the last objection no longer applies, as mentioned earlier. As for the other points—they are certainly valid with respect to germanium transistors—although some very successful amplifiers have been made using direct coupling. Emitter followers can provide low impedance drive with a fairly low DC resistance (if required) and diodes, thermistors, plus compensating circuits can be used to maintain very close control of all the parameters.

As far as high powers are concerned (i.e. over 25 watts) there is no doubt that silicon transistors are far superior. They have lower leakages, are relatively free from drift, less sensitive to thermal runway and are more robust. They can be obtained with a very wide frequency range, high operating voltage and current rating (300-volt types are now quite common) and many of the silicon planar types have a noise level comparable with the very best germanium types. **Fig. 8** shows the circuit of a direct coupled amplifier which was published as long ago as 1956.* This is the LIN circuit which used a PNP-NPN complementary pair directly coupled to a transformerless output stage. TR2 is the NPN and TR3 is its PNP partner and all the transistors are germaniums.

A variation of this circuit has been described by Tobey and Dinsdale† and a high power version using silicon transistors (the Acoustech 11) was mentioned in the 1964 Year Book. Other amplifiers using this type of circuit include the *Leak* Stereo 30, *Truvox* TSA100, and the *Pye* HFS 30. The advent of high-voltage silicon transistors will certainly see many higher power amplifiers using a similar arrangement and already many American designers are adopting it. The problem is not only concerned with voltage ratings but of matching the NPN-

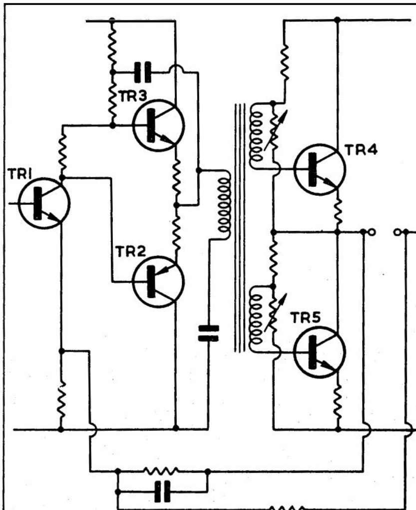


FIG.7. OUTPUT STAGE OF SHERWOOD S-9000

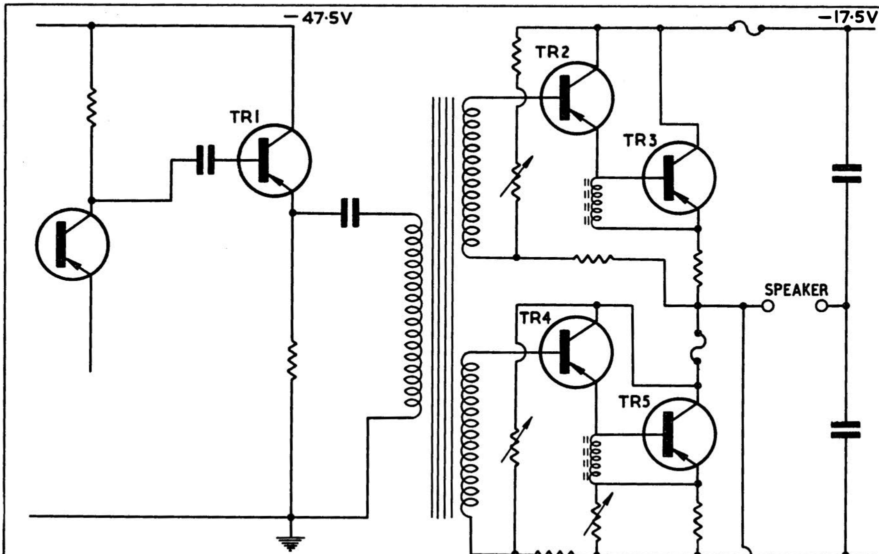


FIG.6. OUTPUT STAGE OF GRUNDIG SV50

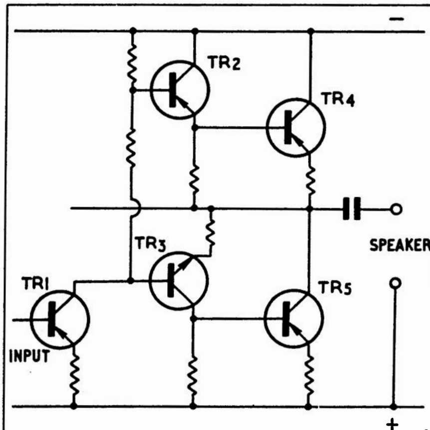
* H. C. Lin, *Electronics*, September 1956.
† Tobey and Dinsdale, *Wireless World*, December 1961, January 1965.

PNP pair, and in some cases the NPN is a silicon type and the PNP a germanium!

Matching problems do not arise in the circuit shown in **fig. 9** which is the power amplifier section of the *Harmon-Kardon* A1000. Here the driver transistors TR2 and TR3 are identical types, and like the others they are NPN silicons. TR1 is the phase-splitter with outputs taken from the collector and emitter. The HT rail is 80 volts, and the rated output is over 50 watts per channel. Distortion is less than 0·5%, and the frequency range extends to over 200 Kc/s! In spite of the fact that AC coupling is employed, the response is only 1 dB down at 20 cycles.

Back nearer home, we come to a new circuit developed by Mullard (**fig. 10**). In this arrangement, TRI and TR2 are the phase-splitters driving a PNP-NPN complementary pair (TR3 and TR4), which in turn drive the output stage consisting of another complementary pair. TR5 is a NPN type ADi62, and TR6 is a ADi61. These are, of course, specially made to have similar characteristics. The arrangement used for the connection of TR2 gives excellent stabilising as the circuit is self-compensating. Power output of this particular amplifier is only 5 watts or so, but a larger version using four output transistors is shown in **fig. 11.** TR6 and TR7 are AD162's and TR8 and TR9 are AD161's. The HT rail is 50 volts, and the series connection gives a very good safety factor. This type of output circuit is called a 'beanstalk' and this particular beanstalk is rated at 15 watts output. Incidentally, in America this configuration is known as a 'totem pole'—no doubt there is a Freudian significance somewhere but I can't find it . . .

Few amplifiers use a completely stabilised power supply so there is a difference between continuous power and Music Power ratings.



BASIC CIRCUIT USING COMPLEMENTARY PAIR

FIG. 8.

This is because the DC voltage will fall with a sine wave signal but (in theory, at any rate) it will remain constant under speech and music conditions. Thus, the difference between the two figures is really an indication of the power supply regulation, and an amplifier (having a *fully* stabilised supply) will have the same figures for both sine wave and music power. (*See appendix.*)

Progress in pre-amplifier design has not been so spectacular, nevertheless one or two ingenious circuits are worthy of note. **Fig. 12** shows a typical input stage using silicon planar transistors (*Fisher* TX300). Note that the base of TR1 is stabilised from the emitter of TR2 and that there is a small resistor RI (3·3 ohms) between the input earth and earth proper. The collector load resistor of TR1, R2, is 180K, which is a typical value for this type of transistor. Equalisation is effected by a feedback loop connected from the collector of TR2 to

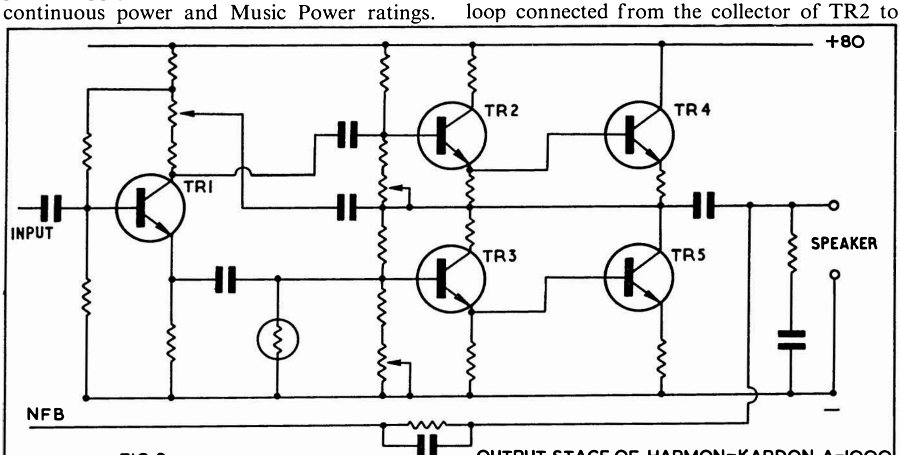
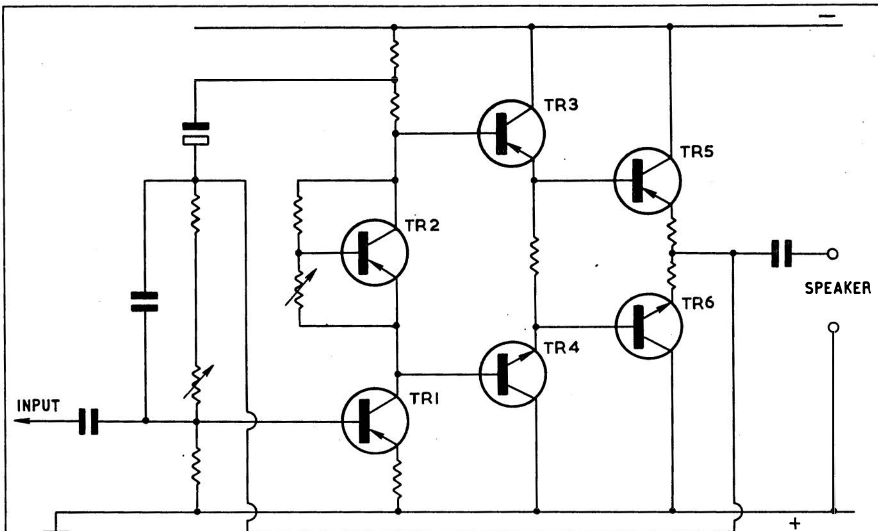


FIG. 9.

OUTPUT STAGE OF HARMON-KARDON A-1000



MULLARD CIRCUIT USING 'COMPLEMENTARY PAIRS' FIG. 10.

the emitter of TR1. (Only one network is shown in the diagram.) This feedback loop, plus the low current of TR1, makes for a high input impedance.

Another way of obtaining a high input impedance is by using a 'bootstrap' arrangement as shown in **fig. 13.** The effective input impedance of this circuit is higher than the bias resistors and this method is used in the *Grundig* SV50—not only for the input stage but for some of the others too. The *Grundig* amplifier has another interesting circuit which is shown in **fig. 14.** This is a novel way of obtaining base stabilising by using the collector load resistor of the preceding transistor as part of the potentiometer (R1 and R2 form the top half and R3 the bottom section).

Fig. 15 shows part of the tone control circuit of the *Lansing* 'Graphic Controller' which is a semi-professional pre-amplifier. Although the circuit looks very complicated it is in reality quite simple. The bass and treble controls VR1 and VR2 form a Baxandall system, but three transistors are inside the loop instead of one. The first is an emitter follower (with 'bootstrap' input), the second TR2 is a normal amplifier—it is shown 'upside down' because it is a NPN. This is followed by a PNP emitter follower TR3—so the three transistors have a high impedance input and low impedance out. C1 and R1 form a high frequency 'step' to roll off the response at a high frequency to secure stability.

After TR3 comes a switched (S1) low-pass filter using a choke L1 with C2 and R2. The tone control range would be greater with this arrangement than with a single transistor but it is probably justified as the Graphic Controller is intended for studio use as well as for enthusiasts. Incidentally, this unit uses ten transistors for each channel and three more in the fully stabilised power supply.

Transistor Protection

Transistors have a fantastically long life without deterioration, and they cannot be easily broken without using something like a hammer, but they *can* be destroyed by excessive voltage or current. In a well-designed amplifier, precautions are taken to avoid excessive current under the most adverse conditions of temperature, input voltage variations, etc., and the most likely source of trouble is the possibility of shorting the loudspeaker terminals which can cause a very high current to flow in the output transistors.

This is a serious problem with high power amplifiers, and although silicon transistors are tougher than their germanium equivalents they are not indestructible. Naturally, fuses are wired in the HT supplies and sometimes in the speaker leads but these can only offer secondary protection as they do not normally act fast enough. No doubt, fast-acting fuses which will blow in less than 50 milliseconds with, say, five times overload, will eventually become available, but in the meantime various kinds of protection circuits have been devised to take care of the problem. Two basic methods are used, one which operates by removing the drive and the other which cuts off the HT voltage.

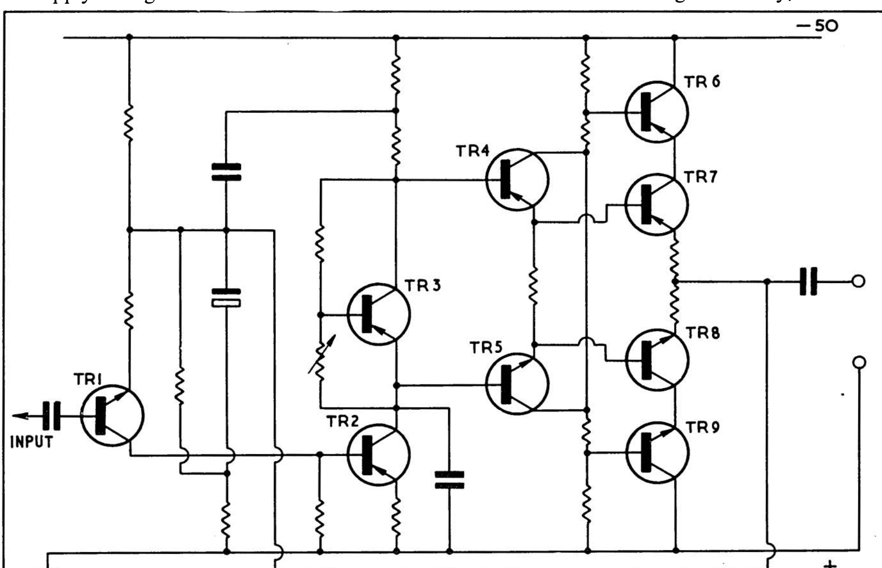
Fig. 16 shows an example of the former. The protection circuit is shown inside the dotted lines. R12 and R13 constitute a voltage divider across the supply and so establish a reference voltage of 82·5 millivolts at the anode of D1 and also at the base of TR2. This reference voltage is enough to keep TR2 cut off and so it acts as a high resistance of about 30K in series with the driver transformer TR1, and so very little gain is obtained. Now, under normal conditions the diode Dl rectifies the output signal making point B positive. This positive voltage acting through R/3 brings TR2 into saturation, and thus the driver transistor TR1 is restored to its normal operation.

If a short occurs across the speaker terminals, TR1 is cut off and so reduces the gain of the driver stage to unity, thus a signal at the input to the driver will not be amplified but will appear at the load Z. A low-level signal at the output will be detected by the sensing device and will actuate the variable impedance switch to restore gain in the driver stage. The sensing device is sensitive enough to differentiate between a small signal level and no signal at all. By changing the values of the potential divider the point at which gain is restored can be predetermined. This particular circuit is due to Amperex company and it can obviously be adapted or modified for different applications. One such variation puts TR2 across the HT supply voltage to the pre-driver stage and TR1 functions in reverse, so a short circuit *switches it on* and its heavy current then drains away the supply voltage.

A two-terminal 'electronic switch' which can be inserted in the DC power supply is shown in **fig. 17.** This circuit-breaker was devised by RCA and is very fast acting. Under normal operating conditions TR1 and TR2 are held in saturation by the bias voltage developed across R3. Transistor TR3 is cut-off because the voltage across R4 is not sufficient to overcome the offset voltage of TR3 and the diode D1. So the device acts as a low value resistance and the amplifier gets its correct voltage. However when (or if) the current reaches a predetermined level, the voltage drop across the circuit produces sufficient voltage across R4 to turn on TR3. The drop across R3 increases, reducing the bias on TR1 and TR2 so that they start to cut-off. Ultimately, TR3 is biased into saturation and TR1 and TR2 are cut off completely so the circuits then acts as a high resistance, cutting off the power from the amplifier.

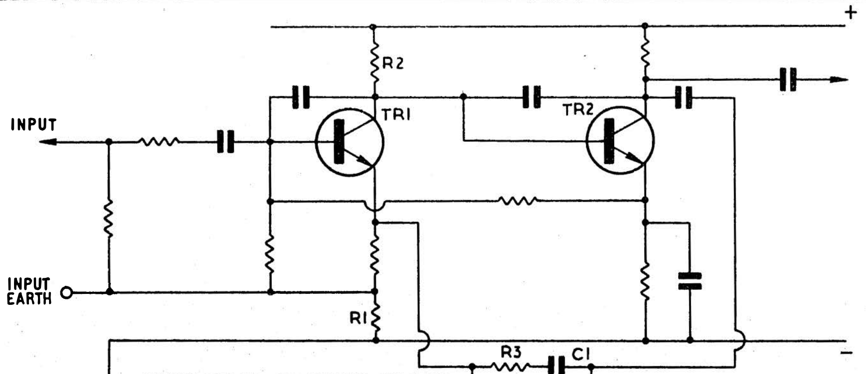
Motional Feedback

It is not too difficult to design amplifiers with distortion below 0·5% down to 20 c/s or so, but most speaker systems will give ten times this amount at 40 c/s! Fortunately, the human ear is more tolerant of distortion at this frequency than, say, 4,000 c/s. Nevertheless, a clean bass response *does* help to give realistic reproduction and minimises listening fatigue. During the past few years much progress has been made in loudspeaker design—not in fundamentals, but in refinements including various types of cone



MULLARD AMPLIFIER WITH 4 OUTPUT TRANSISTORS.

FIG.11.



INPUT STAGE OF FISHER TX 300

FIG. 12.

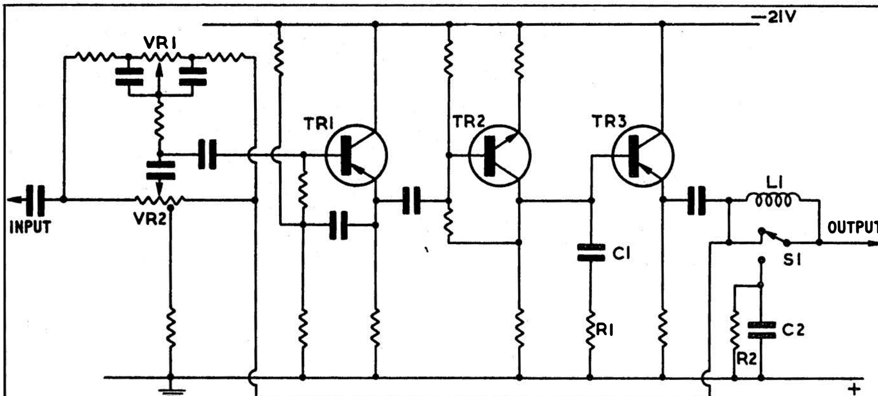


FIG. 15.

LANSING 'GRAPHIC CONTROLLER'

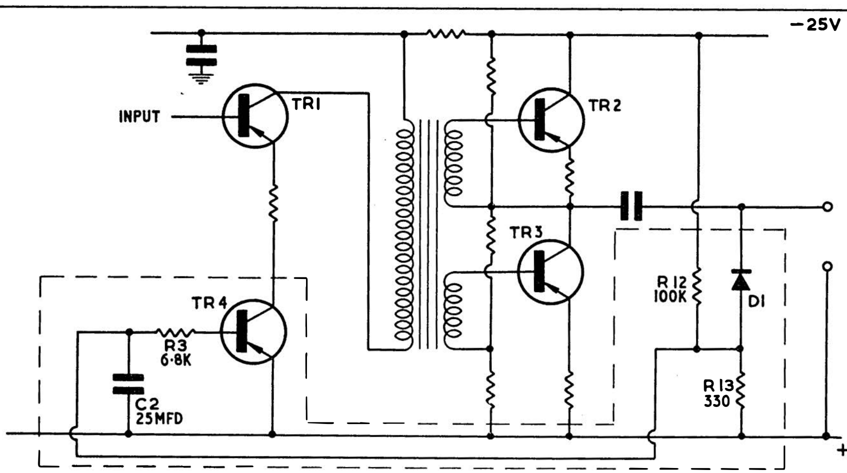
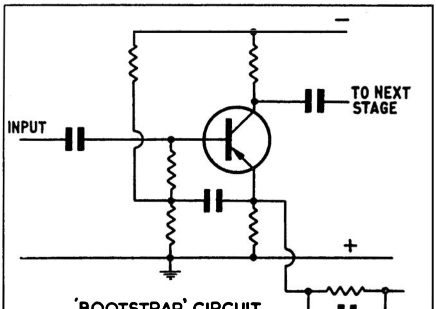


FIG. 16.

TRANSISTOR PROTECTION CIRCUIT

surround, linear suspensions, high efficiency magnets with 'long throw' speech coils and acoustically damped enclosures; but even so many engineers have been attracted by the idea of 'motional feedback'. In other words, the negative feedback which does so much to reduce amplifier distortion is extended to include the speaker itself within the loop. This can be done by using a separate speaker or transducer to pick up the induced voltage, or it can be achieved to some extent by using a separate speech coil.‡

One of the most successful systems using the latter method is the French system of *Gogny* shown in **fig. 18.** *A* is the normal speech coil and *B* is the pickup coil. The magnetic pole pieces are in fact duplicated so there is a speech coil each side of the cone. *C* is made of non-



'BOOTSTRAP' CIRCUIT
FIG.13.

magnetic material and serves as a mounting piece only. The amplifier (see **fig. 19**) is divided into two sections, one handling the bass and the other the treble. The treble speaker is an Orthophase multi-cell unit—also made by *Gogny*—and the moving coil speaker with servo coil handles frequencies below 800 c/s. It will be seen that both amplifiers are modified versions of the Lin circuit and that a transformer Tl is used for the Ortophase but the bass speaker is fed direct at *Z*.

Signals are applied to TR1 which amplifies them and feeds them to TR2 which is followed by the cross-over unit L1, Cl and L2 and C2. Low frequency signals are applied to TR3 thence to the LF amplifier, and HF signals are applied to the treble amplifier via the control TCl at the crossover junction. L3 and C4 in the emitter of TR1 form a 3 Kc/s rejection filter to counteract a speaker cavity resonance inherent in the Orthophase system. Feedback voltage from the pickup coil *B* is amplified by the two-stage amplifier TR10 and TR11 before being taken to the base of TR3 via R5 and C6. The normal feedback for the bass amplifier is

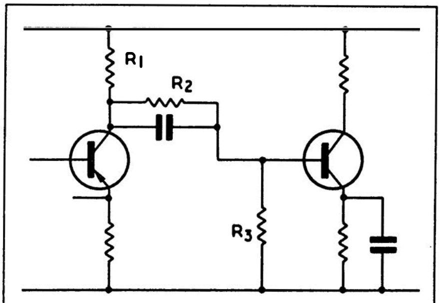


FIG.14. NOVEL COUPLING CIRCUIT (GRUNDIG SV50)

effected by R1 and R2 which are connected from the output stage back to the emitter of TR4.

The published response curve is very smooth but there is no doubt that a separate transducer would be more effective in reducing coloration and the effects of cabinet resonance, etc. Probably the transducer should be mounted outside the speaker enclosure but there are many snags to this idea. However considerable development work is going on—particularly in America and Japan—so we may hear more about motional feedback in the near future.

APPENDIX

I.H.F.M. (Institute of High Fidelity Manufacturers), standard methods of measurements for amplifiers and definition of terms.

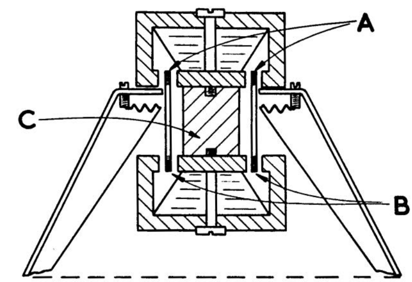
2.1.2.1. *Continuous power output* shall mean the greatest single-frequency power that can be obtained for a period of not less than 30 seconds without exceeding rated total harmonic distortion when the amplifier is operated under *standard test condition. Power output* shall be expressed in terms of watts as defined by the formula:

$$P = \frac{E^2}{R}$$

P = power output.
E = rms voltage across load.
R = resistance of the load in ohms.

2.1.2.2. *Music power output* shall mean the greatest single-frequency power that can be obtained without exceeding rated total harmonic distortion when the amplifier is operated under *standard test conditions* except that the measurement shall be taken immediately after the sudden application of a signal and during a time interval so short that supply voltages within the amplifier have not changed from their no-signal values.

‡R. Lafaurie, *Revue du Son*, October 1964. 'Un haut-parleur electriquement asservi dans le registre grave'.



GOGNY SPEAKER WITH 2 SPEECH COILS.

FIG.18.

2.1.3.1. *Measurement of continuous power output*

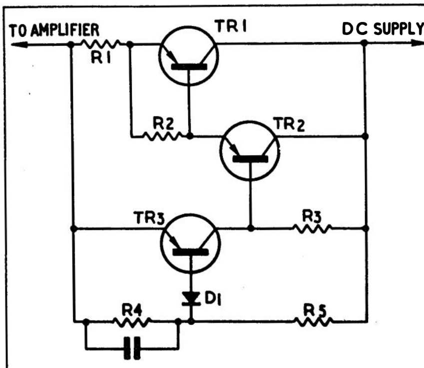
2.1.3.1.2. Adjust *input frequency* to value specified for the test.

2.1.3.1.2. Adjust *signal input level* to the maximum value for which the total harmonic distortion percentage is the same as the rated distortion for the amplifier.

2.1.3.1.4. Measure the RMS voltage across the load.

2.1.3.1.5. Compute the *power output* by the formula of 2.1.2.1.

2.1.3.1.6. *Accuracy* of measurement shall be sufficient to assure statement of the *power output* within $\pm\frac{1}{2}$ dB.



'ELECTRONIC CIRCUIT-BREAKER'

FIG.17.

2.1.3.2. *Measurement* of *music power output.*

2.1.3.2.1. Operate amplifier under *standard test conditions* with no signal applied and note significant supply voltages.

2.1.3.2.2. Perform procedure of 2.1.3.1.1 through 2.1.3.1.6 except that the significant supply voltages shall be maintained at the same value as they were under no-signal conditions. (This means using an external stabilised power supply.)

2.1.4.1. It shall be standard to rate power amplifiers in terms of *music power output* and/or *continuous power output* at the standard frequency of 1,000 cycles per second.

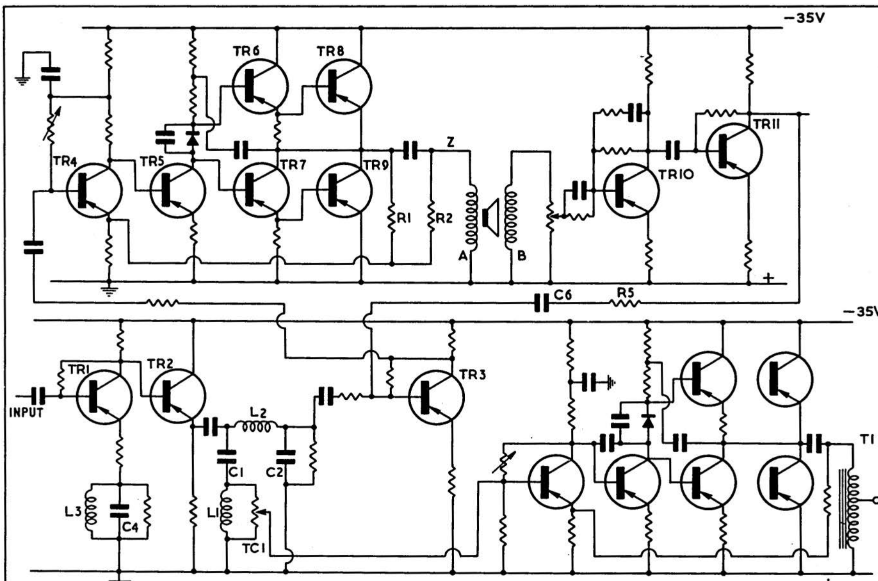


FIG.19. 'GOGNY' AMPLIFIER WITH SERVO FEEDBACK.

Other References:

R. E. Werner. 'Loudspeakers and negative impedance'. July 1958. 'Transactions on Audio of the IRE'.

E. de Boer. 'Theory of Motional Feedback'. January 1961. 'Transactions on Audio of the IRE'.

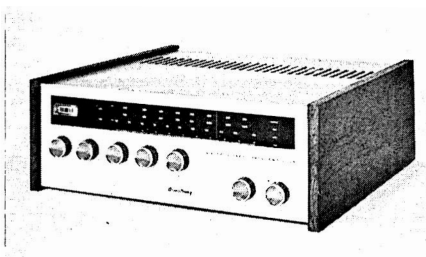
H. W. Holdaway. 'Design of velocity feedback transducen for stable low frequency behaviour'. September 1963. 'Transactions on Audio of the IRE'.

N. Crowhurst. 'A Speaker with Twin Speech coils'. October 1956. *Radio & Television News.*

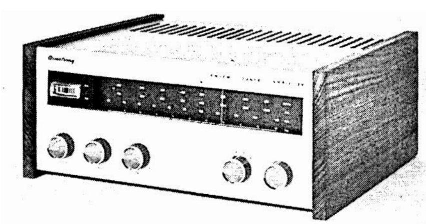
DIRECTORY OF TUNER/AMPLIFIERS

★ The abbreviations used in this section are defined at the beginning of the Tuner and Amplifier Sections.

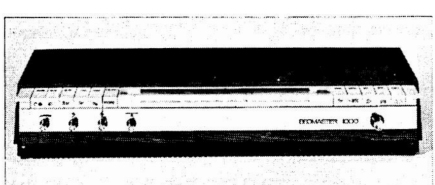
Armstrong 226 *stereo tuner/amplifier*



Armstrong 227*M mono tuner/amplifier*



Armstrong 227 *stereo tuner/amplifier*



Beomaster 1000 *stereo amplifier and FM tuner*

ARMSTRONG AUDIO LTD., Warlters Road, Holloway, London, N.7. Tel.: North 3213/4.

●**Model 226.** Stereo tuner/amplifier. A.M./F.M. Variable tuning. Range M.W. 180-600 m.; F.M. 87-108 Mc/s. Foster-Seeley disc. Tuning meter. Full multiplex facilities. Aerial imp. 70-80 ohms and 300 ohms. Output 10W per channel. P.s.n. 200-250V AC. Inputs: gram. (1) 80 mV, 1 megohm; gram. (2) 3·5 mV, 47K (RIAA); tape playback 80 mV, 1 megohm; tape monitor 600 mV, 100K. Controls: sel., vol., balance, bass, treble, waveband, tuning, treble filter, rumble filter, tape monitor, loudness. Treble filter 7 Kc/s, 12 dB per octave. F.R. 30 c/s-20 Kc/s ±1 dB. H and N better than −55 dB. H.D. less than 0·5% at 8W (overall). Feedback 15 dB. L.S. matching 4, 8, 16 ohms. Output stages 4 × ECL86. Free-standing. Size: $15\frac{1}{4}$ × $5\frac{3}{8}$ × 15 in. Optional case. Price: £52 2s. 3d. (U.K. purchase tax £8 17s. 9d.).

●**Model 227.** Stereo tuner/amplifier. A.M./F.M. Variable tuning. Range M.W. 180-600 m., F.M. 87-108 Mc/s. Foster-Seeley disc. Tuning meter. Full multiplex facilities. Aerial imp. 70-80 ohms and 300 ohms. Output 10W per channel. P.s.n. 200-250V AC. Inputs: gram. 80 mV, 1 megohm; tape playback 80 mV, 1 megohm. Controls: sel., vol., balance, bass, treble, waveband, tuning. Rumble filter −6 dB at 35 c/s. F.R. 30 c/s-20 Kc/s ±1 dB. H and N better than −55 dB. H.D. less than 0·5% at 8W (overall). Feedback 15 dB. L.S. matching 4, 8, 16 ohms. Output stages 4 × ECL86. Free-standing. Size: $15\frac{1}{4}$ × $5\frac{3}{8}$ × 15 in. Optional case. Price: £45 1s. 3d. (U.K. purchase tax £7 13s. 9d.).

Model 227M. Mono tuner/amplifier. A.M./F.M. Variable tuning. Range M.W. 180-600 m.; F.M. 87-108 Mc/s. Foster-Seeley disc. Tuning meter. Aerial imp. 70-80 ohms. Output 10W. P.s.n. 200-250V AC. Inputs: gram/tape playback 80 mV, 1 megohm. Controls: vol., bass, treble, sel., tuning. Rumble filter −6 dB at 35 c/s. F.R. 30 c/s-20 Kc/s ±1 dB. H and N better than −55 dB. H.D. less than 0·5% at 8W (overall). Feedback 15 dB. L.S. matching 4, 8, 16 ohms. Output stages 2 × ECL86. Free-standing. Size: 13 × $5\frac{3}{8}$ × $10\frac{1}{2}$ in. Optional case. Price: £31 8s. (U.K. purchase tax £5 7s.).

BANG & OLUFSEN. U.K. Sales Division, Eastbrook Road, Eastern Avenue, Gloucester. Tel.: Gloucester 26841. Cables: DEBELEC, Gloucester.

●**Beomaster 1000.** Transistorised F.M. tuner and stereo amplifier. Inputs: mag. PU 5 mV 47K, crystal PU 180 mV 100K. Controls: Scratch filter, rumble filter, bass, treble, volume, balance. Output 15W per channel. Distortion 1% at full output. F.R. 30 c/s-20 Kc/s. Output imp. 3-5 ohms. Fitted with multiplex decoder. Size: $19\frac{7}{8} \times 3\frac{7}{16} \times 10$ in. Mains 110-240V. Price: £82 19s.

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BRAUN AG. Distributors: Argelane Ltd., 251 Brompton Road, London, S.W.3. Tel.: Kensington 9611.

●**TS45.** Stereo tuner amplifier. Transistorised. V.H.F. 88-108 Mc/s. M.W. 188-545 m. Variable tuning. Foster Seeley discriminator. Meter indicator. Sensitivity 1·5 µV for 26 dB quieting. Aerial 300 ohms balanced twin. Optional multiplex. A.F.C. switchable. Output 12W each channel. Distortion less than 1% at 1 Kc/s for 12W output. F.R. 30 c/s-20 Kc/s. Output imp. 4 ohms. Mains 240V AC. Size: $19\frac{1}{4} \times 11\frac{1}{4} \times 4\frac{3}{8}$ in. Price: £107 10s. (U.K. purchase tax £17 10s.).

★

DUALTONE LTD., 166 Oatlands Drive, Weybridge, Surrey. Tel.: Weybridge 44786.

●**Electra 2000.** Integrated tuner-amplifier with stereo output and provision for fitting multiplex decoder. Combined valve and transistor circuit. F.M./V.H.F. 87·6-108 Mc/s. A.F.C. Silent inter-station tuning. M.E. Individual station pointers. A.M. 195-550 m. Bass control +15 dB to −20 dB. Treble control +20 dB to −25 dB. Balance control ±8 dB. Inputs: mag. PU, crystal PU, tape (stereo). Output 15W (music) each channel. Designed for use with Dual 1009 turntable and Dual CL3 speakers. Price: £102 18s.

★

FISHER RADIO CORPORATION, Long Island City 1, New York, U.S.A. Distributors: Imhofs (Retail) Ltd., 112-116 New Oxford Street, London, W.C.1. Tel.: Museum 7878.

●**800C tuner amplifier.** Stereo. A.M./F.M. Variable tuning. Range F.M. 87·5-108 Mc/s; A.M. 522-1630 Kc/s. A.F.C. Ratio disc. Horizontal tuning meter. Multiplex incorporated. Aerial imp. 72 ohms. Inputs: high level 230 mV; gram 3·3 mV; tape head 2·5 mV. Controls: speaker, sel., bass, treble, vol., tape monitor, loudness contour. High and low filters 12 dB/octave. Response 25 c/s-25 Kc/s ±1·5 dB. H and N −80 dB. Output 30W per channel. H.D. 0·5%. Load imp. 4, 8, 16 ohms. Direct tape monitor. Self-powered. Size: $17\frac{1}{2} \times 5\frac{3}{4} \times 13\frac{1}{2}$ in. Price: £202 10s. (U.K. purchase tax £32 10s.).

★

LEE PRODUCTS (G.B.) LTD., 10-18 Clifton Street, London, E.C.2. Tel.: Bishopsgate 6711. Cables: Leprod, London.

Fisher 800-C 75 *watt AM/FM stereo Multiplex tuner/amplifier*

Dulci. Two new tuner/amplifiers, one stereo and one mono are being added to the Dulci range of matching equipment. Details were not available as we went to press.

★

METZ. Distributors: Mitchell Enterprises Ltd., 61 West Street, Dorking, Surrey. Tel.: Dorking 4229.

●**Metz 420.** Transistorised stereo tuner/amplifier. 42 transistors and diodes. Inputs for mic., tape, crystal PU, mag. PU. Controls: On-off, loudness, bass, treble, H F filter, rumble filter. Output 10W each channel. F.M./V.H.F. radio with auto-tuning. Size: 17¾ × 4¾ × 10 in. Price: £83 15s. (U.K. purchase tax £13 19s 2d.).

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PIONEER ELECTRONICS CORPORATION. Distributors: C. E. Hammond & Co. Ltd., 90 High Street, Eton, Windsor, Berks. Tel.: Windsor 63388. Telex.: 84316.

●**SM-G205.** Stereo tuner/amplifier. A.M./F.M. Variable tuning. Range M.W. 535-1605 Kc/s; F.M. 88-108 Mc/s. A.F.C. Foster-Seeley disc. M.E. tuning ind. Multiplex incorporated. Aerial imp. 300 ohms. Output 11W per channel. H.D. less than 1%. Response 20 c/s-50 Kc/s ±1 dB. S/N (mag. pu) better than 50 dB; (aux.) better than 70 dB. L.S. matching 8, 16 ohms (switchable). Output stages ECL86s. Inputs: mag. pu 2·5 mV; crystal pu 28 mV; tape playback 165 mV; aux. 165 mV. Controls: tone, separate bass and treble for each channel, loudness control, balance, vol., high- and low-pass filters, mode sel., function sel., tape monitor switch. Switchable A.M. selectivity. P.s.n. 115, 230V (switchable). Free-standing. Size: 18½ × 13¼ × 5½ in. Price: £89 5s. (including purchase tax).

●**SM-Q300.** Stereo tuner/amplifier. F.M./A.M. Tuning variable, S.W./M.W. and F.M./M.W. Range S.W. 3·5-108 Mc/s; M.W. 535-1605 Kc/s; F.M. 80-108 Mc/s. A.F.C. Foster-Seeley disc. 2 × M.E. tuning ind. Output for multiplex. Aerial imp. 300 ohms. Output 15W per channel. H.D. less than 1%. Response 20 c/s-50 Kc/s ±1 dB. S/N (mag. pu) better than 50 dB; (aux.) better than 65 dB. L.S. matching 4, 8, 16 ohms (switchable). Output stages EL84s. Inputs: mag. pu 3·4 mV; mic. 4 mV; crystal pu. 38 mV; tape playback/aux. 160 mV. Controls: tuning A, tuning B, scratch, rumble and whistle filters; tape monitor switch, loudness, sel. A, sel. B, bass, treble, balance, vol., mode blend. Remote control sub-balancer. P.s.n. 115, 230V (switchable). Free-standing. Size: 18½ × 13¼ × 5½ in. Price: £89 5s. (including purchase tax).

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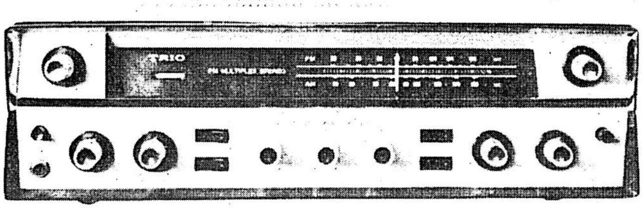
SABA ELECTRONICS LTD., 3/5 Eden Grove, Holloway, London, N.7. Tel.: North 8161. Cables: Arc Eeslon.

●**Stereo Studio 1.** Wavebands: F.M./V.H.F. 87-104 Mc/s, S.W. 16-51 m., M.W. 184-590 m., L.W. 832-2140 m. Variable tuning. Ratio detector. Strip tuning indicator. Sensitivity 3 μV. V.H.F. aerial 240 ohms balanced. A.F.C. Multiplex decoder available. Output 9W each channel. Mains: 115-240V AC. Size: 16 × 6½ × 12¾ in. Price: £85 (U.K. purchase tax £13 13s.).

TELEFUNKEN. Distributors: Welmec Corporation Ltd., Lonsdale Chambers, 27 Chancery Lane, London, W.C.2. Tel.: Chancery 9944. Cables: Welmcor, London, Telex.

●**Concerto.** A.M./F.M. tuner/amplifier. Fitted multiplex decoder. Four wavebands. Separate tuners for A.M. and F.M. Output 4W each channel. Light walnut cabinet. Matching speaker enclosures with 10 in. bass driver and 7 × 5 in. mid-range and treble units available. Price on request.

●**Opus.** A.M./F.M. stereo tuner/amplifier. Fitted multiplex decoder. Four wavebands. Separate tuners for A.M. and F.M. 14 valves.



Trio WX 400*U*

Output 8W each channel. Light matt walnut cabinet. Matching speaker enclosures with four drive units in each available. Price on request.

TRIO. Distributors: Winter Trading Co. Ltd., 95-99 Ladbroke Grove, London, W.11. Tel.: Park 1341. Cables: Winlec, London, W.11.

●**WX400U.** A.M./F.M. Stereo tuner/amplifier. Wavebands: F.M. 80-108 Mc/s, A.M. 187-560 m. Variable tuning. Neon indicator. Aerial: 75 ohms coaxial. Sensitivity: F.M. 1·9 μV at 98 Mc/s, A.M. 20 μV at 1000 Kc/s. Multiplex adaptor fitted. A.F.C. Rumble filter, noise filter, stereo headphone jack. Valves. Inputs: mag. PU 3 mV, crystal PU 30 mV, aux. 150 mV. Output 20W (peak) per channel. F.R. F.M. 20 c/s-20 Kc/s, F.M. Stereo 50 c/s-15 Kc/s. Both $\pm\frac{1}{2}$ dB. Noise level −10 dB at 10 Kc/s. Imp. 0-16 ohms. Mains 115V/240V AC. Size: $17\frac{3}{4} \times 5\frac{1}{8} \times 14$ in. Price: £88 6s. (U.K. purchase tax £15 13s.).

●**W38.** A.M./F.M. Stereo tuner/amplifier. Wavebands: F.M. 76-108 Mc/s., M.W. 187-560 m., S.W. 27-79 m. Variable tuning. M E. 75 ohms aerial input. Sensitivity: F.M. 2·6 μV at 94 Mc/s, M.W. 40 μV at 1 Mc/s, S.W. 6 μV at 8 Mc/s. Multiplex adaptor available. Loudness control. DC filament heating. Stereo headphone jack. Output 14W (peak) per channel. F.R. Up to 20 Kc/s ±0·5 dB at 500 mW output. Inputs: mag. PU 30 mV, aux. 4 mV. Output imp. 0-16 ohms. Valves. Size: $18 \times 10\frac{1}{2} \times 5\frac{1}{2}$ in. Price: £71 6s. 3d. (U.K. purchase tax £12 3s. 3d.).

●**KW33E.** A.M./F.M. stereo tuner/amplifier. Wavebands: F.M. 88-108 Mc/s, A.M. 187-560 m. Variable tuning. Meter indicator. Foster-Seeley discriminator. Sensitivity: F.M. 2 μV at 98 Mc/s, A.M. 10 μV at 1 Mc/s. Aerial input 75 ohms coaxial. Multiplex decoder fitted. Inputs: mag. PU 1·5 mV, crystal PU 20 mV, aux. 100 mV. Output 14W (peak) per channel. Size: $16\frac{1}{2} \times 5\frac{7}{8} \times 14$ in. Price: £79 19s. 4d. (U.K. purchase tax £13 9s. 8d.).

●**WE8S.** A.M./F.M. tuner/amplifier. Wavebands: FM. 88-108 Mc/s, M.W. 187-545 m., L.W. 858-2000 m. Variable tuning. Foster-Seeley discriminator. M.E. Sensitivity: F.M. 2·5 μV, M.W. 10 μV, L.W. 10 μV. Aerial input 75 ohms coaxial. Multiplex adaptor available. A.F.C. Valves. Controls: Volume, balance, bass, treble, selector, tuning, power on-off, stereo/mono. F.R. 20 c/s-20 Kc/s ±1 dB at 500 mW output. Output 14W (peak) per channel. Output imp. 0-16 ohms. Size: $16\frac{1}{2} \times 5 \times 11$ in. Mains 110V/220V AC. Price: £43 18s. 11d. (U.K. purchase tax £7 10s. 1d.).

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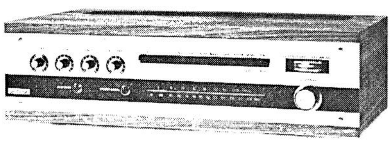
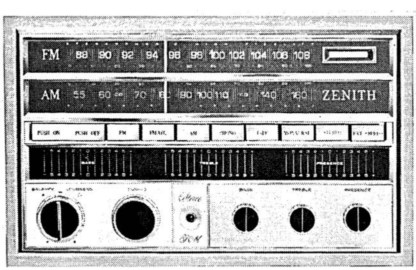
ZENITH RADIO CORPORATION. Distributors: United Mercantile Co. Ltd., 13/14 Queen Street, London, W.1. Tel.: Grosvenor 4901. Cables: Ramsaco, Telex, London.

●**A.M. and Stereo/F.M. tuner-amplifier.** F.M./V.H.F. 88-108 Mc/s, M.W. 187-545 m. Push-button controls. Strip indicator. Separate bass, treble and presence controls. Indicator for stereo broadcasts. Combined loudness and balance control. A.F.C. 16-transistor amplifier. 120W R.M.S. total output. Price: £159 (U.K. purchase tax £25 10s. 2d.).

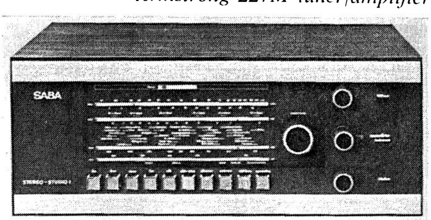


Metz 420 *tuner amplifier*



Zenith AM/FM tuner/amplifier

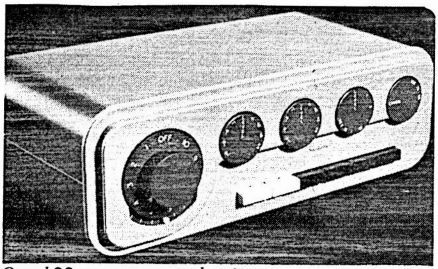
Armstrong 227*M tuner/amplifier*



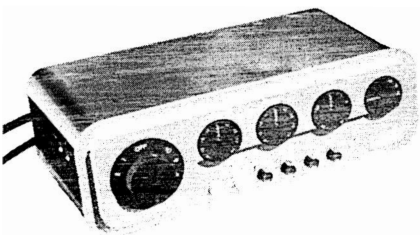
Saba stereo Studio I

DIRECTORY OF AMPLIFIERS & CONTROL UNITS

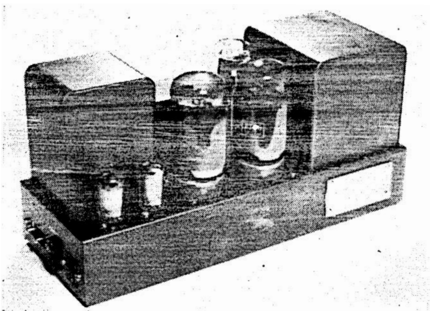
★ The following abbreviations are used in this directory section: **H.D.**=Harmonic Distortion; <=less than; **H and N**=Hum and Noise; **P.a.t.**=Power supplies available for tuner; **RMS**=root mean square; **N.L.**=Noise level; **Sel.**=Selector switch; **P.s.n.**=Power supply needed; ●=Stereo equipment.



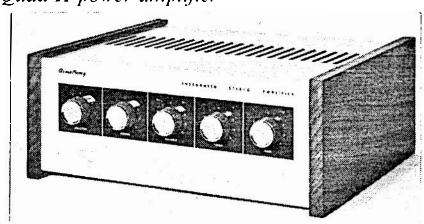
Quad 22 stereo control unit



Quad Q.C. II control unit



Quad II power amplifier



Armstrong 222 stereo amplifier

ACOUSTICAL MANUFACTURING CO. LTD., St. Peter's Road, Huntingdon, Hunts. Tel.: Huntingdon 361 and 574. Cables: Acoustical.

Quad II Q.C. II control unit. Inputs: radio/tape 100 mV; mic. 1·5 mV; gram. to suit pickup. Treble, bass, vol. and on/off, filter slope. Switch filter 5, 7, 10 Kc/s and "out". Tape record socket, switched playback socket. H.D. <0·1%. H and N −70 dB. Size: $10\frac{1}{2} \times 3\frac{1}{2} \times 6\frac{1}{2}$ in. To operate with Quad II power amp or similar. Price: £23.

●**Quad 22 control unit.** Inputs: radio/tape 70 mV at 100 K; mic. 1·5 mV at 100 K; pickup dependent on adaptor unit used. Vol. and on/off, bass, treble, filter slope, filter switch 5, 7, and 10 Kc/s. Push-button selection of channels, mono/stereo, and record equalisation. H.D. <0·02%. H and N −70 dB total. P.a.t. 330V 35 mA each tuner; 6·3V 3 amps. Size: $10\frac{1}{2} \times 3\frac{1}{2} \times 6$ in. Price: £25. To operate with Quad II amplifiers.

Quad II amplifier. 15W. Dist. total 3rd harmonic and higher. <0·1% at 12 W. Input for spec. output 1·4V RMS for 15W. Response 20-20,000 c/s ±0·2 dB; 10-50,000 c/s ±0·5 dB. Feedback incorporated in original ultra-linear arrangement. N.L. −80 dB at 15W. Output imp. 7 and 15 ohms. Output KT66's. Original combined anode/screen current circuit. Size: $12\frac{1}{2} \times 4\frac{3}{4} \times 6\frac{1}{2}$ in. To operate with Q.C.II or Q.22 control units. Price: £22 10s.

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ARMSTRONG AUDIO LTD., Warlters Road, Holloway, N.7. Tel.: North 3213/4.

●**Model 222.** Integrated stereo amplifier. Inputs: gram. 80 mV, 1 megohm; tape playback 80 mV, 1 megohm; radio 80 mV, 1 megohm. Output 10W per channel. Controls: sel., vol., balance, treble, bass. Rumble filter −6 dB at 35 c/s. F.R. 30 c/s-20 Kc/s ±1 dB. H and N better than −55 dB. P.s.n. 200-250V AC H.D. less than 0·5% at 8W (overall). Feedback 15 dB. L.S. matching 4, 8, 16 ohms. Output stages 4 × ECL86. Free-standing. Size: $12\frac{3}{8}$ × $4\frac{3}{4}$ × $10\frac{5}{8}$ in. Optional case. Price: £27 10s.

●**Model 221.** Integrated stereo amplifier. Valve and transistor. Inputs, pickup (1) 80 mV 2 megohms, pickup (2) 3·5 mV 50K, tape playback 80 mV 2 megohms, tape monitor 600 mV 100K, radio 80 mV 2 megohms. Controls: Volume, bass, treble, balance, treble filter, rumble filter, loudness, tape monitor, input selector. Noise level better than −55 dB on all inputs. Output 10W RMS per channel. Distortion 0·5% at 8W. Response 30 c/s-20 Kc/s ±1 dB. Feedback 15 dB. Output imp. 4, 8, 16 ohms. Mains input 100-130V, 200-250V AC. Size: $12\frac{3}{8}$ × $10\frac{3}{8}$ × $4\frac{3}{4}$ in. Price: £33 15s. Shelf mounting case £3 10s. extra.

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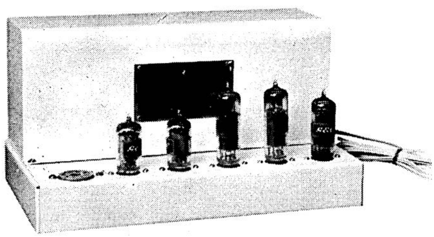
ASSOCIATED ELECTRONIC ENGINEERS LTD., 10 Dalston Gardens, Stanmore, Middx. Tel.: Wordsworth 4474/5/6. Cables: Astronic, Stanmore.

Astronic A1332 control unit. Inputs: mic. 20 mV; gram. A.E.S., *ffrr*, NARTB 10-20 mV; radio/tape 220 mV. 6-pos. sel., treble, bass, vol. and on/off, gram. input attentuator. Tape record and playback socket. H and N −70 dB. Size: 12 × $3\frac{3}{8}$ × $1\frac{7}{8}$ in. To operate with A1333 power amp. Price: £11 16s.

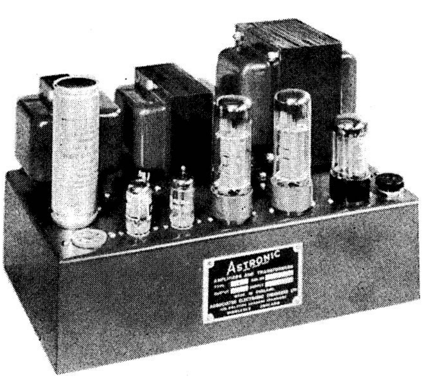
Astronic A1432 control unit. Inputs: mic. 20 mV; radio 120 mV; PU 4 mV or 20 mV; tape (C.C.I.R.) 1-2 mV. 6-pos. sel. (3 record equal.), treble, bass, vol. on/off. Filters 5, 7, 10 Kc/s. Slope 6-30 dB/octave. Loudness −18 dB max. Presence +6 dB, 2-3 Kc/s. Rumble filter. Variable pu. attenuator. Socket for direct replay from tape head. H.D. not measurable. H and N −65 dB. Size: $11\frac{1}{2}$ × $3\frac{1}{2}$ × $5\frac{1}{4}$ in. To operate with A1333 or A1440 amplifiers. Price: £23 10s. 6d.

Astronic A1333 amplifier. 10W nom., 13W max. Dist. 0·1% at 10W. Input for spec. output 0·33V RMS. Response 20-20,000 c/s ±0·5 dB. Feedback 18 dB. N.L. −72 dB. Output imp. $3\frac{3}{4}$, $7\frac{1}{2}$ and 15 ohms. Output N709s or EL84s. Ultralinear. Size: $11\frac{1}{2}$ × $6\frac{1}{4}$ × 6 in. To operate with A1332 control unit. Price: £21 5s.

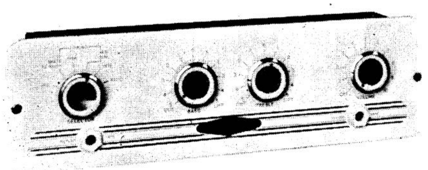
●**Astronic A1434 stereo control unit.** Inputs, single channel: tape 1-2 mV; LP (Int.) 4 mV; radio 120 mV; mic. 20 mV; aux. 12 mV. Stereo inputs for tape, PU and radio same



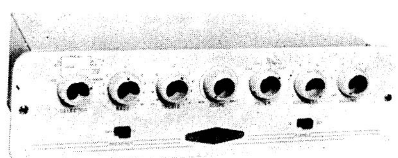
*Astronic A*1333 *power amplifier*



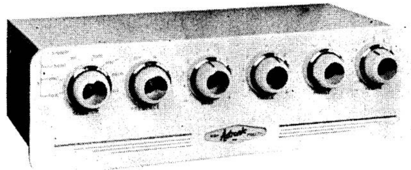
*Astronic A*1440 *power amplifier*



*Astronic A*1332 *control unit*



*Astronic A*1432 *control unit*



*Astronic A*1434 *stereo control unit*

sensitivities. 8-pos. sel., bass, treble, vol., on/off, rumble filter, presence switch, channel balance (pre-set). Dist. negligible. H and N −65 dB. Size: $11\frac{1}{2} \times 3\frac{1}{2} \times 6$ in. To operate with amplifiers A1333 Mk. I and Mk. II or A1440. Price: £24 5s.

Atlas A1440. 20W nominal, 35W max. Dist. 0·1%. Input for spec. output 0·25V. Response 20-20,000 c/s ±5 dB. Feedback 30 dB. N.L. −85 dB. Output imp. $3\frac{3}{4}$, $7\frac{1}{2}$ and 15 ohms. Output EL34s. Ultralinear. Size: $13 \times 7\frac{1}{4} \times 8\frac{1}{2}$ in. Price: £40. To operate with amplifiers A1332, A1432, and A1434.

Astronic A1646 Response Control Unit. Input 700 mV at 600 ohms, output 700 mV at 600 ohms. Response in flat position 20 c/s-20 Kc/s. Each octave independently variable from +13 dB to −12 dB. Size: 20 × 8 × 13 in. Price: £66.

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BRAUN AG. Distributors: Argelane Ltd., 251 Brompton Road, London, S.W.3. Tel.: Kensington 9611.

●**CSV 10.** Integrated transistor amplifier. Inputs: 3 mV mag. PU, 240 mV crystal PU, 40 mV mic., 150 mV tape/radio. Output 8W. 4 ohms. F.R. 30 c/s-30 Kc/s ±2 dB. Mains 110-240V AC. Distortion less than 2% at 8W. Size: $11\frac{1}{4} \times 11\frac{1}{4} \times 4$ in. Price: £58.

●**CSV 13.** Integrated stereo valve amplifier. Output 12W. Distortion less than 0·5% at 12W. Response 20 c/s-30 Kc/s ±3 dB (± 0·5 dB 40 c/s-15 Kc/s). Inputs: mag. PU 1·5 mV, crystal PU 3 mV, mic. 10 mV, radio 200 mV, tape 200 mV. Output imp. 4, 8, 15 ohms and electrostatic. Mains 110-240V AC. Size: $16 \times 12\frac{7}{8} \times 4$ in. Price: £86.

●**CSV 60.** Integrated stereo valve amplifier. Output 30W. Distortion 0·8% for 30W at 1 Kc/s. F.R. 20 c/s-30 Kc/s ±3 dB. (±1 dB 40 c/s-15 Kc/s). Inputs: mag. PU 1·5 mV, crystal PU 3 mV, mic 10 mV, radio 200 mV, tape 200 mV. Output imp. 4, 8, 16 ohms and electrostatic. Mains 110-240V AC. Size: $16 \times 12\frac{7}{8} \times 4$ in. Price: £108.

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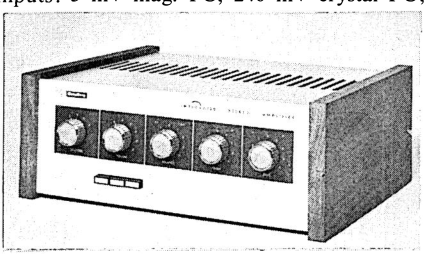
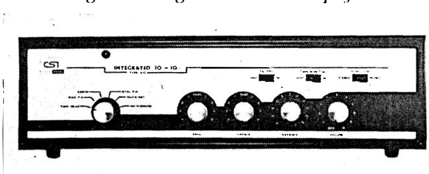
BRYAN AMPLIFIERS LTD., 120 Ashley Road, Hale, Altrincham, Cheshire.

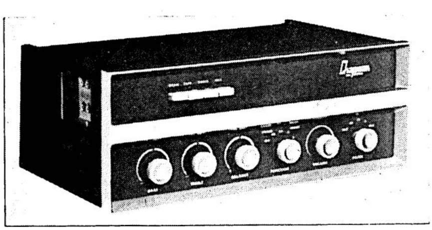
●**Model 500 Mk. IIb.** Transistorised stereo control unit. Inputs: mag. pu. 2·5 mV, 50K;



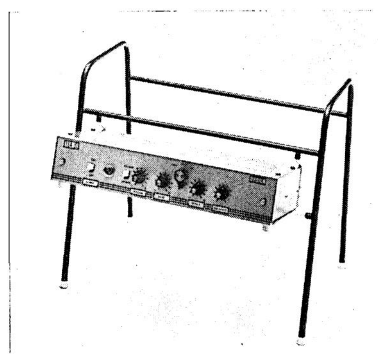
Armstrong 221 *integrated stereo amplifier*



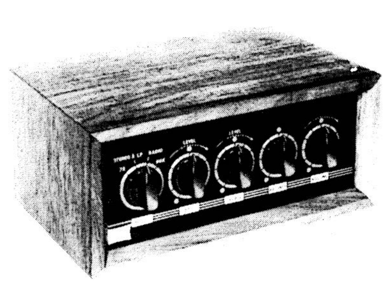
Clarke & Smith 655 *integrated stereo amplifier*



Chapman 306 *integrated amplifier*



Decca TSA 33 *integrated transistorised stereo amplifier*



Decca Decola "Separates" control unit

ceram. pu. 25 mV, 250 K (R.I.A.A. corrected); radio, tape, aux. 100 mV, 100 K. Output 100 mV. Controls: input sel., and mono/stereo function switches; bass, treble, balance. Filters: high-pass 70 c/s and 25 c/s; low-pass 4, 6 and 9 Kc/s at 8-10 dB per octave. H. and N. -70 dB (including power amplifier. Model 700). Powered from Model 700 amplifier with which it operates. Size: $11 \times 4\frac{1}{4} \times 6\frac{3}{8}$ in.

●**Model 700.** Transistorised stereo amplifier. Output 12W + 12W for 100 mV inputs. Feedback 60 dB. Response ± 1 dB 40 c/s-20 Kc/s. Dist. less than 0·25% at 10W. Size: $10 \times 6\frac{1}{4} \times 6\frac{1}{4}$ in. Price (together with Model 500): £56 14s.

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CHAPMAN (ULTRASONICS) LTD. See Derriton (Ultrasonics) Ltd.

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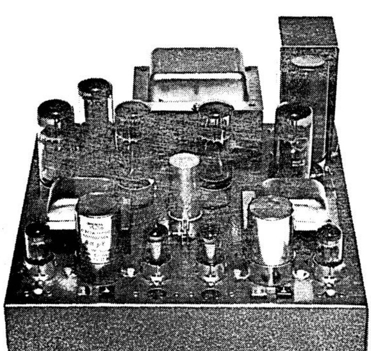
CLARKE & SMITH MANUFACTURING CO. LTD., High Fidelity Components Division, Melbourne Road, Wallington, Surrey. Tel.: Wallington 9252. Cables: Electronic, Wallington.

●**655.** Stereo integrated amplifier. Inputs, tape 3 mV 470K, mag. PU 100 mV 33K, radio 100 mV 470K, mic. 2 mV 470K, aux. 100 mV 470K, tape monitor 500 mV 1 megohm. Output 0·5V and 10W per channel 0·2% at 1 Kc/s, less than 1·0% 40 c/s-12 Kc/s. Controls: volume, bass, treble, balance, input selector. Filters: high-pass 30 c/s, low-pass 7 Kc/s. Response 40 c/s-20 Kc/s (depending upon input). Noise equivalent to 0·8 μV on R.I.A.A. input. Size: $4 \times 14 \times 13\frac{3}{4}$ in. Price: £44 2s.



Decca Decola "Separates" amplifier

DECCA SPECIAL PRODUCTS, Decca Radio and Television Division of the Decca Record Co. Ltd., Ingate Place, Queenstown Road, London, S.W.8. Tel.: Macaulay 6677.

●**TSA33 Amplifier Mk. II.** Transistorised integrated stereo amplifier. Inputs for PU, tape and radio. 90 mV on all inputs for 3W output each channel. Controls: Selector, on/off, volume, balance, bass (+12 dB and -5 dB at 40 c/s relative to 1 Kc/s), treble (+8 dB and -13 dB at 12 Kc/s relative to 1 Kc/s). Noise level -50 dB. Output imp. 15 ohms. Mains 200-250V in 10V steps. 50 c/s. Special stand available to carry DD1 or AT6/1 playing desk with Mk. II amplifier below. Price: (amplifier) £26 5s.; (stand) £4 4s.

●**Stereo Decola "Separates" control unit.** Inputs: pickup 14 mV; mic. 15 mV; radio 60 mV; tape 35 mV. Output 90 mV. Controls sel., bass, treble, balance, vol. Filters high-pass 40 c/s. Response 40 c/s-25 Kc/s. P.s.n. 280 V DC 8 mA; 37·5V DC. To operate with "Separates" power amplifier. Size: $11 \times 7\frac{1}{2} \times 5\frac{1}{4}$ in. Price: £23 2s.

●**Stereo Decola "Separates" power amplifier.** Output 12W per channel. Distortion 0·1% at 10W, measured at 1 Kc/s. Response 30 c/s-25 Kc/s ± 1 dB. Noise -75 dB referred to 12W. Input 90 mV. L.S. matching, 15 ohms. P.s.n. 100-250V AC. To operate with "Separates" control unit. Price: £42.

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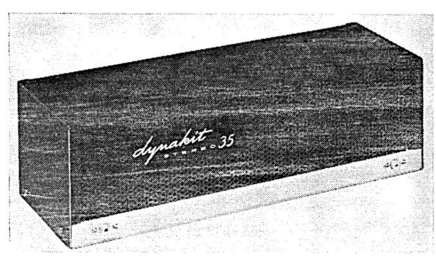
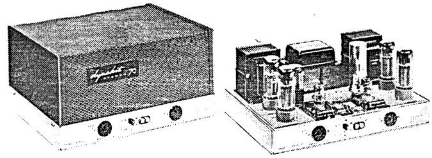
DERRITRON RADIO LTD., Chapman Division, 24 Upper Brook Street, London, W.1. Tel.: Hyde Park 2291.



Dynaco ST 35 *stereo amplifier*



Dynaco ST 70 *mono/stereo amplifier*

Chapman 205 amplifier. 30W from 30-20,000 c/s. Dist. <0·05% at 20W; 0·1% at 30W. Response 2-100,000 c/s ±1 dB. Feedback 30 dB. N.L. −89 dB at 20W. Output imp. 15 ohms. Output EL34s. Ultra-linear. Price: £34.

●**Chapman integrated 306 stereo amplifier.** Inputs: gram. 5 mV, 100K (R.I.A.A.); radio, aux. 100 mV, 250K flat; tape 50 mV, 100K flat. Controls: bass, treble, function, balance, vol., filter, press-button sel. Filters: low-pass, 5, 10, 20 Kc/s at 12 dB octave. Response (±0·5 dB) 36 c/s-20 Kc/s including filters at 1W level, 25 c/s-25 Kc/s without filters. H. and N. (main amp) −75 dB; (radio, tape, aux.) −60 dB; (gram.) −50 dB. P.s.n. 200-250V 50 c/s. Output 8W per channel. H.D. less than 0·1% at 1 Kc/s, intermodulation less than 1%. Feedback 15 dB. Output imp. 3, 15 ohms. Output 4 × ECL86. Size: 14½ × 5½ × 9½ in. Free-standing. Fully tropicalised. Price: £47.

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DUAL. Distributors: Celsa Electric Co. Ltd., Celsa House, Kelway Place, London, W.14. Tel.: Fulham 9761/2.

●**CV.2.** Shelf-mounting transistorised stereo amplifier and control unit. 15 transistors, four diodes, one mains bridge rectifier. Output 10W RMS push-pull each channel. Inputs: mag. PU, crystal PU, tape, radio. Controls: Selector, mode switch, volume, balance, bass and treble. Separate on/off switch. Size: 16½ × 11 × 4¼ in. Weight: 17½ lb. Price: £60 18s.

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DYNACO. Distributors: Howland-West Ltd., 11 Howland Mews, Howland Street, London, W.1. Tel.: Langham 1381.

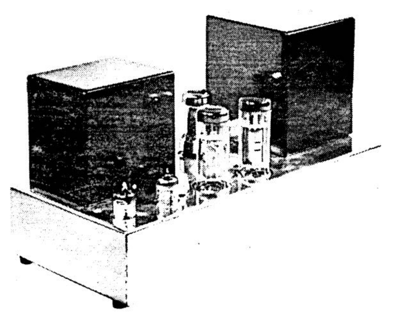
●**PAS-2.** Stereo valve pre-amplifier. Inputs: PU R.I.A.A. 1·45 mV, tape NAB 2·7 mV, special (optional for second PU, tape or mic.) 1·75 mV, F.M. multiplex, radio, auxilliary. Output 2V. Controls: selector, volume, balance, blend (mono-stereo), separate bass and treble for each channel, tape monitor, loudness, HF filter, on/off. Noise 70-74 dB below level of 10 mV cartridge. Mains power unit. Suitable for use with ST35, ST70 or any other power amplifier. Size: 13½ × 4¼ × 8 in. Price: (assembled) £40 19s.; (kit) £34 13s.

●**PAS-3.** Similar to PAS-2 but with de luxe finish brass panel and knobs. Price: (assembled) £45 3s.; (kit) £38 17s.

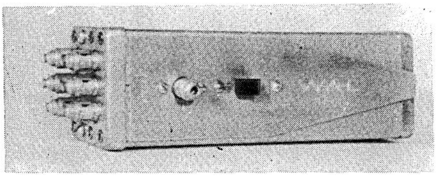
●**SCA-35.** Integrated mono/stereo valve amplifier. Seven pairs of inputs covering high- and low-level PU (50K), tape head NAB 100K, radio, tape and auxilliary. Controls: selector, volume, balance, bass, treble, stereo-mono switch, loudness switch, HF filter switch, on/off switch. Output 17½W per channel. Distortion: less than 1% over whole range ±0·25 dB of 17½W per channel. F.R. 20 c/s-20 Kc/s ±0·25 dB. Noise: 70 dB below 10 mV input on low-level inputs, 80 dB below on high-level inputs. Output imp. 8 and 16 ohms and centre channel. Mains supply. Size: 13½ × 4¼ × 10 in. Price: (assembled) £59 17s.; (kit) £52 10s.

●**ST-35.** Stereo valve main amplifier. Output 17½W per channel. F.R. 10 c/s-40 Kc/s ±1 dB. Distortion: less than 1% from 20 c/s-20 Kc/s within 1 dB of 17½W each channel. Noise: more than 80 dB below. Input voltage for 17½W output, 1V. Output imp. 8 and 16 ohms. Suitable for use with pre-amplifiers PAS-2, PAS-3 or any similar units. Size: 13 × 5½ × 4 in. Price: (assembled) £40 19s.; (kit) £34 13s.

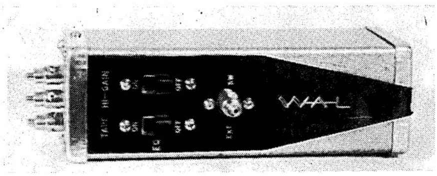
Howland-West Dynaco SCA-35 stereo amplifier



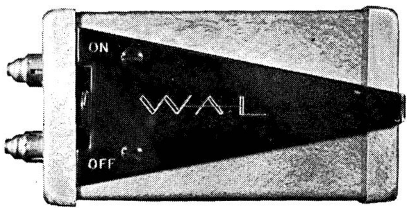
Derritron 205 amplifier



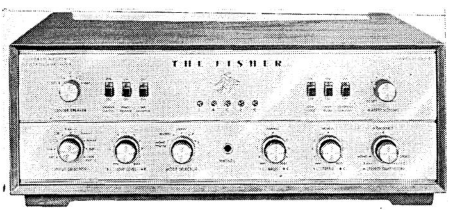
Stereo WAL Gain



WAL Hi-Gain

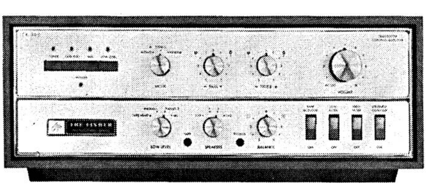


WAL gain



*Fisher X*202-*C Integrated Stereo Amplifier*

*Fisher X*101-*D Integrated Stereo Amplifier*



Fisher TX 300 *integrated transistorised amplifier*

●**ST-70.** Stereo valve main amplifier. 35W per channel. F.R. 10 c/s-40 Kc/s ±0·5 dB. Distortion less than 1% from 20 c/s-20 Kc/s within 1 dB of 35W output per channel. Noise more than 90 dB below 35W on each channel. Input voltage for 35W output, 1·3V. Output imp. 4, 8 and 16 ohms. Mains power unit. Size: 13 × $9\frac{1}{2}$ × $6\frac{1}{2}$ in. To operate with PAS-2, PAS-3 or any other similar pre-amplifier. Price: (assembled) £59 17s.; (kit) £52 10s.

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EAGLE PRODUCTS. Distributors: B. Adler & Sons (Radio) Ltd., 32a Coptic Street, London, W.C.1. Tel.: Museum 9606/7. Cables: Reldab, London.

●**SA.80 integrated stereo amplifier.** Output 4W per channel. H.D. 4W, 1%; 8W, 2%. Response 50 c/s-15 Kc/s. N.L. −40 dB. Inputs: gram. 5 mV; tuner 50 mV. L.S. matching 16 ohms. Self-powered. Controls: sel., vol. A, vol. B, tone. Free-standing. Size: $7\frac{1}{8}$ × 3 × 6 in. Price: £9 10s.

●**SA.200.** Integrated stereo amplifier. Inputs: mag. PU 5 mV, crystal PU 100 mV, radio 100 mV, tape 5 mV, mic. 5 mV. Output 7·5W per channel. Controls: selector, mode, volume, bass, treble, loudness, speaker/phones, on/off. Distortion less than 1% at 15W 1 Kc/s, less than 0·25% at 1W 1 Kc/s. F.R. 50 c/s-20 Kc/s ±2 dB. Output imp. 4, 8, 16 ohms. Valves. Size: $12\frac{1}{4}$ × $4\frac{3}{4}$ × $8\frac{1}{4}$ in. Price: £27 6s.

●**TSA.218.** Transistorised integrated stereo amplifier. Inputs: mag. PU 2 mV, crystal PU 74 mV, radio 120 mV, tape 3 mV, aux. 120 mV. Output 20W per channel at 3·5 ohms. Controls: on/off, bass, treble, balance, volume, rumble filter (−9 dB at 40 c/s), scratch filter (−10 dB at 20 Kc/s), input selector, speaker phasing. Response 18 c/s-22 Kc/s ±1 dB. Output imp. 3-16 ohms. 18 transistors, 2 thermistors, 2 silicon diodes. Size: $13\frac{1}{2}$ × $9\frac{1}{2}$ × $3\frac{1}{4}$ in. Price: £48.

Prices quoted are approximate.

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ELSTONE ELECTRONICS LTD., 81 Kirkstall Road, Leeds, 3. Tel.: Leeds 35111.

●**Stereo WAL Gain.** Transistorised stereo pre-amplifier. To match pickups, tape or mic., at 50,000 at 3,500 ohms. Battery life 1,000 hrs. Size: 7 × $2\frac{1}{8}$ × $2\frac{1}{2}$ in. Price: £7 10s.

WAL Gain. Impedance matching transistor pre-amp, battery operated (3,000-hour life).

Noise and distortion too low to measure, gain better than 100. Suitable for use with low output pu. or for direct connection to tape head, mic., etc. Size: $3\frac{5}{8} \times 2\frac{1}{8} \times 2\frac{1}{8}$ in. Price: £5 10s.

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FISHER RADIO CORPORATION, Long Island City 1, New York, U.S.A. Distributors: Imhofs (Retail) Ltd., 112-116 New Oxford Street, London, W.C.1. Tel.: Museum 7878.

●**X-100.** Integrated stereo amplifier. 20W per channel. H.D. 0·8 %. Response 20 c/s-20 Kc/s ±1 dB. N.L. better than −90 dB with vol. control at minimum. Inputs for mono and stereo pu., tape head, tuner, aux., tape monitor. High-pass filter. Independent tone controls for each channel. Output stages EL184s. P.s.n. 200-240V AC. Price (in chassis form): £65 9s. Also available in cabinet form.

●**X101-D.** Integrated stereo amplifier. 27W per channel. H.D. 0·5 %. Response 20 c/s-20 Kc/s ±1 dB. N.L. −88 dB. Load imp. 4, 8, 16 ohms. Inputs: high level 300 mV; gram. 3·5 mV; tape head 2 mV. Controls: mode, vol., sel., bass, treble, balance. High-pass filter subsonic cutoff 12 dB/octave. Direct tape monitor. Derived centre-channel output. Size: $15\frac{1}{8} \times 4\frac{3}{4} \times 12\frac{1}{2}$ in. Price: £116 0s. 4d.

●**X202-C.** Integrated stereo amplifier. 35W per channel. H.D. 0·5 %. Response 20 c/s-20 Kc/s. Feedback 22 dB. N.L. −90 dB. Load imp. 4, 8, 16 ohms. Inputs: high level 280 mV; gram. 3·5 mV; tape head 2 mV. Controls: vol., dual concentric bass, treble, mode, programme sel., loudness contour, centre-speaker switch. High-pass filter 12 dB/octave. Direct tape monitor. Derived centre-channel output. Self-powered. Size: $15\frac{1}{8} \times 4\frac{3}{4} \times 12\frac{1}{2}$ in. Price: £137 12s. 9d.

●**TX300.** Transistorised stereo amplifier. 31 transistors, 4 diodes and 1 selenium rectifier. 36W RMS per channel. Distortion 0·5 % at rated output. Hum and noise −86 dB below rated output. Response 20 c/s-25 Kc/s ±1 dB. 200-250V AC. Size: $15\frac{1}{8} \times 4\frac{3}{4} \times 11\frac{7}{8}$ in. Weight: 24 lb. Price: £169 1s.

The X-100 and TX300 are available from stock. Other are supplied to special order.

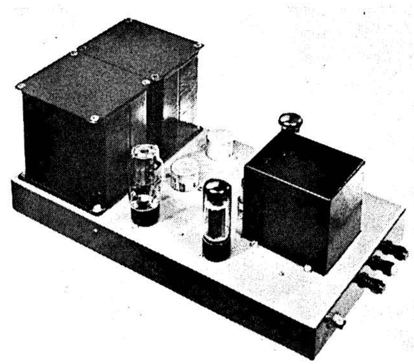
★

A. R. FRANKLIN & COMPANY LTD., 6 Kings College Mews, London, N.W.3. Tel.: Juniper 0480.

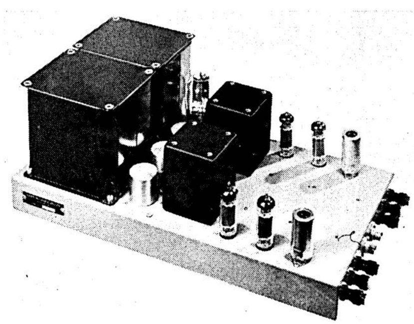
●**Pre-amplifier.** Transistorised stereo pre-amplifier with inputs for mag. PU, radio and

Eagle SA 80 *Stereo Amplifier*

Dynaco PAS 3 *(or PAS* 2*) stereo pre-amplifier*



Kerr, McCosh CWA 40 *amplifier*



Kerr, McCosh CWA 2/12 *stereo amplifier* tape. Output 1: variable to 1V. Output 2: variable up to 100 mV at 200-400 ohms for stereophones. Un-selected inputs before and after tone controls. Tape monitoring facilities. Blend control for headphone listening. Size: 10 × 4½ × 6 in. Price: £31 10s.

●**Main amplifier.** Transistorised stereo power amplifier. Designed for use with Franklin pre-amplifier. Response 30 c/s-30 Kc/s ±1 dB. Output 10W RMS per channel. Size: 8 × 5 × 3 in. Price: £23 2s.

★

GRUNDIG (GREAT BRITAIN) LTD., Newlands Park, Sydenham, London, S.E.26. Tel.: Sydenham 2211.

●**SV50.** Transistorised integrated stereo amplifier. 27 transistors plus two diodes. Output 20W RMS (25W music) into 5 ohms each channel. H.D. less than 0·1% at 20W per channel. Inputs: Microphone 6 mV, 1 megohm; mag. PU 3·5 mV, 50K; radio /1 and 2) 200 mV, 500K; tape 200 mV, 500K. Output imp. 5-16 ohms. F.R. 20 c/s-20 Kc/s ±1 dB. S to N 85 dB below 20W. Bass control ±18 dB at 30 c/s. Treble control +18 dB to −20 dB at 15 Kc/s. Balance control ±8 dB. Push-button controls: On-off, gram, mic, tape, radio 1, radio 2, mono/stereo, low pass filter, high pass filter, linear response, presence circuit. Transformerless output. Provision for reverberation unit. Mains 110, 130, 220, 240V 50-60 c/s. Shelf-mounting walnut cabinet. Size: 15⅜ × 10½ × 6 in. Price: £82 19s.

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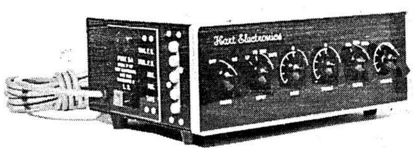
HART ELECTRONICS, 193 Hart Road, Manchester 14. Tel.: Rusholme 2212-3. Cables: Alloys Mcr.

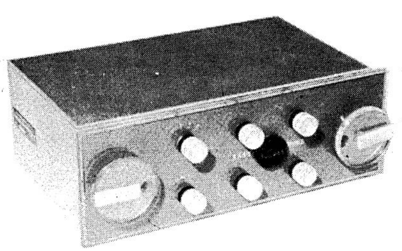
Stereo 20. Integrated transitorised amplifier. Output 20W. H.D. 0·2%. F.R. 40 c/s-20 Kc/s. Feedback 60 dB. N.L. −70 dB. L.S. matching 15 ohms. Inputs: mag. pu 5 mV, 6K; crystal pu 80 mV, 100K; mic. 1·5 mV, 1 K; tape replay 2·5 mV, 1K; aux. 150 mV, 100K. Controls: on/off, input sel., bass, treble, filter, function, vol., bal., speaker phase. Low-pass filters: 6, 10, 20 Kc/s. Internal power supply. Third head tape monitoring at 100 mV level independent of vol. control (optional extra). Cabinet mounting. Size: 12 × 7 × 3¼ in. Price: £50 8s.

Mono 10. Integrated transistorised amplifier. Output 10W. H.D. 0·25%. F.R. 40 c/s-20 Kc/s. Feedback 60 dB. N.L. −70 dB. L.S. matching 3-15 ohms. Inputs: mag. pu 5 mV, 6K; crystal pu 100 mV, 100K; aux. 150 mV, 100K; mic. 1·5 mV, 1K; tape replay 2·5 mV, 1K. Controls: input sel., on/off, bass, treble, filter, vol. Low-pass filters: 6, 10, 20 Kc/s. Internal power supply. Free standing or cabinet mounting. Size: 9 × 6¼ × 3¼ in. Price: £24 14s.



Hart Mono 10 Integrated Amplifier

Jason J2-10 integrated stereo



Kerr McCosh DSI stereo control unit

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HEATHKIT. See Kit section.

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HENRY'S RADIO LTD. See Constructional Kits Section.

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JASON ELECTRONIC DESIGN LTD., 18 Tudor Place, Tottenham Court Road, London, W.1. Tel.: Museum 4666.

●**J2-10 integrated stereo amplifier Mk. III.** Inputs: pickup 3 mV and 60 mV; tape 1·5 mV; radio 60 mV; mic. 5 mV. 5-position sel. switch, bass, treble, vol., balance, function, 9 Kc/s and 6 Kc/s filter. H.D. less than 0·1%. H. and N. −55 dB. Rumble filter. 10W per channel, 15W max. 18 dB feedback. Output imp. 4, 8, 15 ohms. Output EL84s. Size: 15 × $4\frac{3}{8}$ × 12 in. Price: £40 19s.

★

KERR McCOSH & CO. LTD., 435 Sauchiehall Street, Glasgow, C.2.

●**DSI stereo control unit.** Inputs: pickup and tape head 4 mV; crystal pickup and tape 140 mV; mic. 1·5 mV. Sel. switch, on/off, separate vol., treble, bass for each channel, flat/tone control. Tape record sockets. Size: $12\frac{1}{2}$ × $4\frac{1}{2}$ × $10\frac{1}{4}$ in. Price: £34.

●**CWA 2/12.** 12W per channel. Distortion 0·1% at 12W. Noise level −95dB. Response 25 c/s-30 Kc/s ±0·2 dB. Output imps. 7·5 and 15 ohms. Input sensitivity 1V. Designed to operate with DSI pre-amplifier. Size: 20 × 7 × 8 in. Price: £48.

CWA 40. Mono amplifier. 40W peak continuous sine wave. Distortion 0·1% at 38W. Noise level −98 dB. F.R. 25 c/s−30 Kc/s ±0·2 dB. Output imps. 7·5 and .15 ohms. Input sensitivity 1V. Designed to operate with DSI pre-amplifier. Size: 20 × 9 × 8 in. Price: £45.

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H. J. LEAK & CO. LTD., 57-59 Brunel Road, East Acton, London, W.3. Tel.: Shepherds Bush 1173. Cables: Sinusoidal, Ealux, London.

"Point One" TL/12 plus amplifier. 12W. Dist. 0·1%. Input for spec. output 125 mV. Response 20-20,000 c/s ±0·25 dB. Feedback 26 dB. N.L. −82 dB. Output imp. 4, 8 and 16 ohms. Output EL84s. Ultra-linear. Size: 10 × 8 × 6 in. To operate with any Leak control unit. Price: £20.

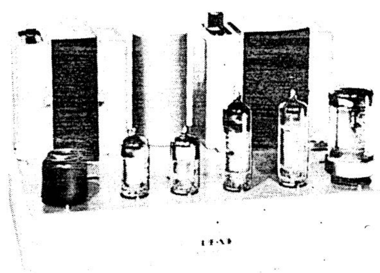
"Point One" TL/25 plus amplifier. 25W. Dist. 0·1%. Input for spec. output 125 mV. Response 20-20,000 c/s ±0·25 dB. Feedback 26 dB. N.L. −83 dB. Output imp. 4, 8 and 16 ohms (other imps. to order). Output EL34s. Ultra-linear. Size: 10 × 8 × $6\frac{3}{4}$ in. To operate with any Leak control unit. Price: £26 10s.

"Point One" TL/50 plus amplifier. 50W. Dist. 0·1%. Input for spec. output 125 mV. Response 20-20,000 c/s. Feedback 26 dB. N.L. −84 dB. Output imp. 4, 8 and 16 ohms (other imps. to order). Output KT88s. Ultra-linear. Size: $11\frac{1}{2}$ × 9 × $6\frac{3}{4}$ in. To operate with any Leak control unit. Price: £35 10s.

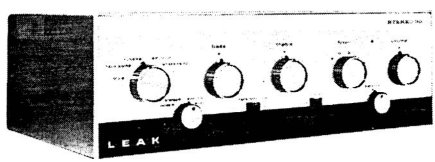
●**"Point One" stereo 20 amplifier.** 11W each channel. Dist. 0·1% on each channel. Input for spec. output 125 mV. Response 20-20,000 c/s. Feedback 24 dB. N.L. −80 dB. Output imp. 4, 8 and 16 ohms. Output EL84s. Ultra-linear. To operate with any Leak control unit. Price: £32 10s.

●**"Point One" stereo 60 amplifier.** Details as for stereo 20 but 30W each channel. Price: £45.

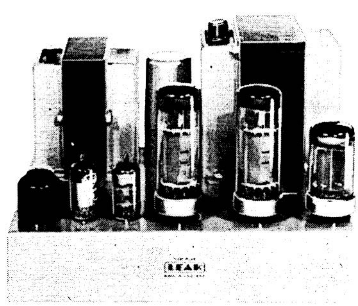
Varislope Mono control unit. Inputs: pu. (R.I.A.A. correction) 3·5 mV, 70K; tape head (CCIR correction) 3 mV 120K; mic. 3 mV, 120K; tuner 50 mV, 70K; tape amp. 125 mV, 70K. Output 125 mV. Controls: input, bass, treble, filter, slope, vol. (AC-on/off), tape monitor. Low-pass filter-off, 9 Kc/s, 6 Kc/s, 4 Kc/s. Response: flat for tuner, mic., tape amp.; R.I.A.A. for pu; CCIR for tape head. H. and N. −60 dB (tuner, tape amp.); −52 dB (mic., pu, tape head). P.s.n. H.T. and L.T. supplied by TL/12 Plus; TL/25 Plus or TL/50 Plus. H.D. 0·01%. Input level controls, tape



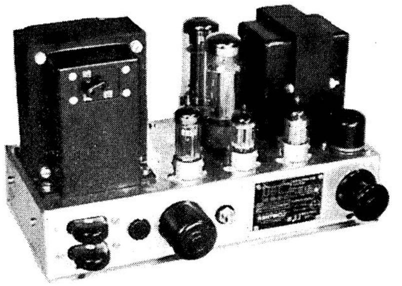
Leak "Point One" TL/12 plus



Leak stereo 30 integrated amplifier



Leak "Point One" TL/50 plus



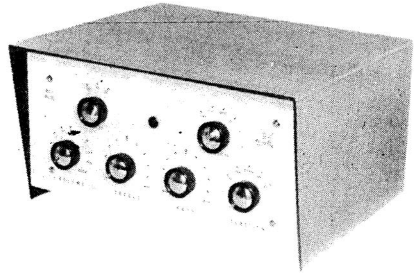
Lowther LL15 amplifier

record sockets with level control, tape monitor facility. To operate with TL/12 Plus, TL/25 Plus or TL/50 Plus. Size: $11\frac{1}{2} \times 4\frac{1}{4} \times 5$ in. Price: £15 15s.

●**Varislope 2 Stereo control unit.** Inputs: pu. (R.I.A.A. correction) 3·5 mV, 70K; tape head (CCIR correction) 3 mV, 120K; mic. 3 mV, 120K; tuner 50 mV, 70K; tape amp. 125 mV, 120K. Output 125 mV. Controls: input, bass, treble, filter, slope, vol. (AC-on/off), tape monitor, function, balance. Low-pass filter-off, 9 Kc/s, 6 Kc/s, 4 Kc/s. Response: flat for tuner, mic., tape amp.; R.I.A.A. for pu; CCIR for tape head. H. and N. −60 dB (tuner, tape amp.); −52 dB (mic., pu, tape head). P.s.n. H.T. and L.T. supplied by stereo 20 or stereo 60. Input level controls, tape sockets for recording with level control, tape monitoring facility. H.D. 0·01%. To operate with stereo 20 or stereo 60. Size: $11\frac{1}{2} \times 4\frac{1}{4} \times 6\frac{1}{2}$ in. Price: £25.

●**Stereo 30. Transistorised integrated amplifier.** Inputs: pu (R.I.A.A. correction) 3·5 mV, 47K; tape head (CCIR correction) 3 mV, 47K; mic. 3 mV, 33K; tuner 100 mV, 100K; tape amp. 125 mV, 50K. Output 10W per channel at 15 ohms, 15W at 4 ohms. Controls: input, bass, treble, filter, slope, vol. (AC-on/off), function, balance, tape monitor. Low-pass filter-off, 9 Kc/s, 6 Kc/s, 4 Kc/s. Response: flat on mic., tuner, tape amp.; R.I.A.A. on pu; CCIR on tape head. H. and N. −66 dB (tuner, tape amp.); −52 dB (mic., pu, tape head). H.D. 0·1% at 8W, 15 ohms. Feedback 60 dB. L.S. matching 4, 15 ohms. N.L. (power amp.,

Leak Varislope 2 stereo amplifier



Lowther Mk. IV control unit

vol. at minimum) −82 dB. P.s.n. 110-250V, 40-60 c/s. Input level controls, tape outlets for recording with level control, tape monitor facility. Free-standing. Size: $13 \times 4\frac{1}{4} \times 9$ in. Price: £49 10s.

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LEE PRODUCTS (GREAT BRITAIN) LTD., 10-18 Clifton Street, London, E.C.2. Tel.: Bishopsgate 6711. Cables: Leprod, London.

●**Dulci Princess DIT220.** Integrated stereo transistor amplifier. Output 10W per channel. Distortion less than 0·25% at 1 Kc/s at 10W. F.R. 15 c/s-45 Kc/s ±0·5 dB at 1W. 25 c/s-30 Kc/s ±0·5 dB at 10W. Noise: PU.1 better than −55 dB, PU.2 better than −60 dB, radio/tape/aux. better than −66 dB below full output. Inputs: PU.1 3·5 mV, PU.2 25 mV, radio 100 mV, tape 100 mV, aux. 250 mV. Output imp. 15 ohms. Mains 110-240V 50-60 c/s. Size: $15 \times 4\frac{1}{2} \times 7$ in. Price to be announced.

Dulci Consort DIT120. Mono version of the Princess DIT220. Price to be announced.

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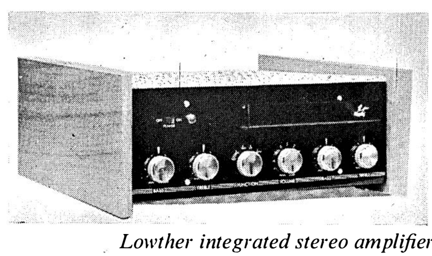
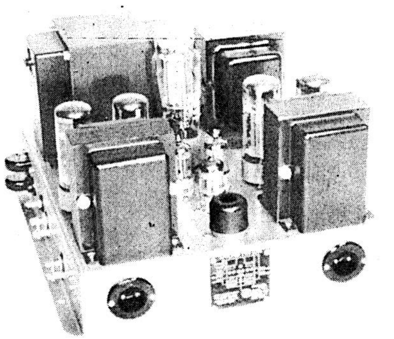
LOWTHER MANUFACTURING CO., Lowther House, St. Mark's Road, Bromley, Kent. Tel.: Ravensbourne 5225. Cables: Lowther, Bromley.

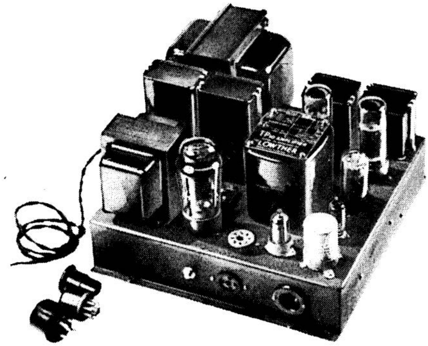
Lowther No. 2 control unit. Inputs: mic. 15 mV; pu 15 mV; radio 250 mV. 4-pos. sel., treble, bass, vol., on/off. Mic./tape input socket. H.D. 0·1% on 1V RMS. H. and N. −60 dB. Size: $10\frac{1}{4} \times 2\frac{1}{2} \times 3\frac{1}{2}$ in. To operate with LL15. Price: £10 10s.



Lowther integrated stereo amplifier



Lowther LL15S stereo amplifier



Lowther LL26 amplifier

Lowther LL15 Mk. I amplifier. 16W. Dist. <0·1%. Input for spec. output 0·75V. Response 20-40,000 c/s ±1 dB. Feedback 20 dB. N.L. −85 dB. Output imp. 16 ohms with adjustment. Output EL34s. Lowther Linear (screen and anode feedback). P.a.t. Size: 12 × 6 × 6 in. To operate with Mk. IV or No. 2 control units. Price: £25 10s.

Lowther LL26 Mk. I amplifier. 26W. Dist. <0·1%. Input for spec. output 0·75V. Response 20-70,000 c/s ±1 dB. Feedback 22 dB. N.L. −90 dB. Output imp. 16 ohms with adjustment. Output EL34s. Lowther Linear. Size: 11 × 12 × 7½ in. Weight: 33 lb. To operate with Mk. IV control unit. Price: £47.

Lowther Mk. IV control unit. Inputs: mic. 3 mV; pickup 3 mV −300 mV; radio and aux. 100 mV. 5-pos. sel., vol., bass, treble, filter, equalisation. Filters: 9, 7 and 4·5 Kc/s. H.D. <0·5%. H. and N. −65 dB. Output cathode follower 1V RMS. To operate with Lowther LL15 Mk. 1. Size: 10¼ × 4⅝ × 7 in. Price: £20.

●**Lowther Mk. I stereo control unit.** Input as for master control unit Mk. IV. Tape input sockets. H.D. 0·1%. Dual low-pass filters. Dual output balanced and balance controls between channels. Size as Mk. IV. To operate with LL15S power amp. Price: £40.

●**Lowther LL15S Mk. I stereo amplifier.** 16W output on each channel. Dist. 0·1%. Input for spec. output 0·75V. Response 20-40,000 c/s ±1 dB. N.L. −85 dB. Output imp. 8·4 or 16 ohms. Output EL34. Lowther Linear. Size: 11 × 12 × 7½ in. To operate with Mk. I control unit. Price: £47.

●**Lowther integrated stereo amplifier.** 12W per channel. Inputs: mic. 2 mV; pickup 2 mV; tape 100 mV; radio 100 mV; aux. 100 mV. H.D. 0·2% at 12W. Response 30-30,000 c/s ±1 dB. N.L. −70 dB. Built-in oscillator for calibration. Output imp. 16 ohms, with adjustment. Price: £60; £64 with cabinet.

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MARTIN ELECTRONICS LTD. See Constructional Kits section.

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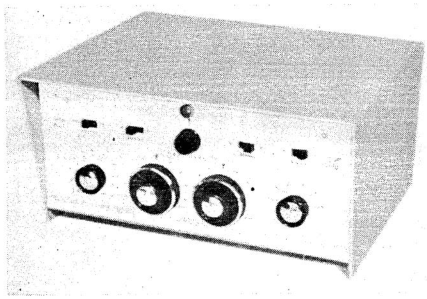
METRO-SOUND MANUFACTURING CO. LTD., Bridge Works, Wallace Road, Canonbury, London, N.1. Tel.: Canonbury 8641. Cables: Metrosound, London, N.1.

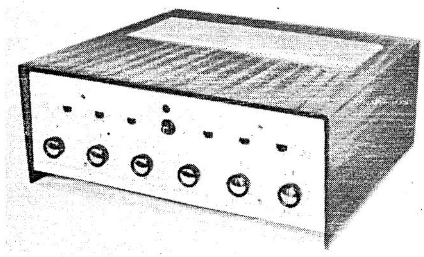
●**MST-15.** Integrated solid state stereo amplifier. 22 transistors plus two diodes. Inputs: mag. PU 2 mV 1K, crystal PU 500 mV (source capacitance 500 pF), radio 100 mV, tape 100 mV. Pickup correction R.I.A.A. Standard. Output: 15W per channel into 15 ohms inductive load, 20W per channel into 3 ohms inductive load. Output imp. <0·2 ohms 30 c/s-10 Kc/s. Output stages two AD140's in AB pi-mode push-pull. Tone controls: Bass +12 dB to −13 dB at 100 c/s,

Dulci DIT 220 Princess stereo amplifier

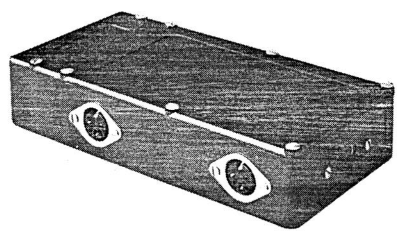
Metro-Sound MST/15 stereo amplifier



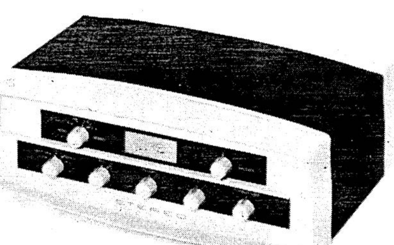
Lowther stereo control unit



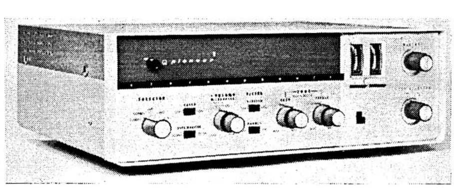
Lowther integrated stereo



Metrosound Pickup/Mic stereo pre-amp



*Ortofon KS*601 *integrated stereo*



Pioneer SM-801 *integrated stereo amplifier*

treble +8 dB to −12 dB at 10 Kc/s. Filters: HF 8 Kc/s, 12 Kc/s, 20 Kc/s. LF 20 c/s, 40 c/s, 80 c/s. Mode selector: stereo, mono, reversed stereo. H. and N. 68 dB below full output on radio and tape, 56 dB below full output on both PU inputs. Cross talk better than −55 dB at 1 Kc/s. Transient response: amplifier rise time 8 µsecs. Suitable for shelf or cabinet mounting. Cabinet in matt grey Organsole finish. Price: £84.

●**Pickup/microphone matching unit stereo pre-amplifier.** Transistorised. Input 0·05 mV, 2/50 ohms. Voltage gain 140. Response 20 c/s-30 Kc/s ±3 dB. P.s.n. 9V battery, Type VT4, or equivalent. To operate with Ortofon SPUG, SPUG/E, SPU and SPU/E, and low impedance mics. Price: £7 10s.

●**De-luxe version,** with twin concentric precision w/w potentiometer. Price: £9 10s.

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ORTOFON. Fonofilm Industri A/S Copenhagen. Distributed in the U.K. by Metro-Sound (Sales) Ltd., Bridge Works, Wallace Road, London, N.1. Tel.: Canonbury 8641. Cables: Metrosound, London.

●**KS601 integrated stereo amplifier.** Pre-amp. details: Inputs F.M., tape, aux. 100 mV; mic. 2 mV; pickup 2 mV at 1 Kc/s. Controls: sel. switch, mono/stereo, vol., balance, bass, treble. Filter high-pass 20-10 c/s (adjustable).

Power amp. details: Output 15W per channel. Dist. less than 1%. Response 20 c/s-20 Kc/s ±1 dB. Feedback 20 dB. Noise 7 mV at 3 ohm output. L.S. matching 3, 7 and 16 ohms. Output stages, two 6973s per channel. P.s.n. 220V AC on request, 110V AC. Price: £95.

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PIONEER ELECTRONICS CORPORATION. Distributors: C. E. Hammond & Co. Ltd., 90 High Street, Eton, Windsor, Berks. Tel.: Windsor 63388. Telex.: 84316.

●**SM-801.** Integrated stereo amplifier. 35W per channel. H.D. below 1%. Response 20 c/s-100 Kc/s ±1 dB. S/N (mag. pu) better than 50 dB; (aux.) better than 60 dB. L.S. matching 8, 16 ohms (switchable). Output stages 7591s. Inputs: mag. pu 3·7 mV; crystal pu 24 mV; tape head 3·5 mV; mic. 3·7 mV; tuner 240 mV; aux. 240 mV; extra (with separate control) 3.5 mV. Controls: sel., tape monitor switch, vol., loudness, high- and low-pass filters, bass, treble, balance, earphone loudspeaker switch, mode sel. Speaker phase-reversing switch. Centre-channel output. Socket for earphones. P.s.n. 115, 230V (switchable). Free-standing. Size: $16\frac{7}{8} \times 12\frac{3}{4} \times 5\frac{3}{4}$ in. Price: £78 15s.

PYE LTD., High Fidelity Division, P.O. Box 49, Cambridge. Tel.: Cambridge 58985. Cables: Pyrad, Cambridge.

●**Brahms HFS30T.** Integrated stereo transistorised amplifier. Inputs: mag. PU 2·5 mV, crystal PU 70 mV, radio 35 mV. Controls: volume, bass, treble, balance, loudness, treble filter (roll-off from 5 Kc/s), rumble filter (roll-off from 50 c/s reaching 12 dB per octave below 20 c/s). Noise: PU −60 dB, radio −65 dB, amplifier only −90 dB. Output 15W per channel (I.H.F.M.). Distortion less than 0·35% at 1 Kc/s. F.R. 30 c/s-20 Kc/s. Imp. 15 ohms. Damping factor better than 50. 110-250V AC. Size: chassis 11¼ × 8½ × 3¼ in., panel 12 × 4 in., cabinet 12¾ × 5½ × 9 in. Price: £55 13s.

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RADFORD ELECTRONICS LTD., Ashton Vale Estate, Bristol 3. Tel.: Bristol 662301/2.

●**SC.2.** Stereo control unit suitable for feeding any power amplifier with input sensitivity of 500 mV. Inputs: PU 4 mV, aux.1 100 or 250 mV, aux.2 250 or 500 mV, tape monitor 500 mV. Output 500 mV from cathode follower. P.s.n. 300V 5 mA, 6·3V 1·2A. Size: 10½ × 3¾ × 8½ in. Weight: 8 lb. Price: £27 10s.

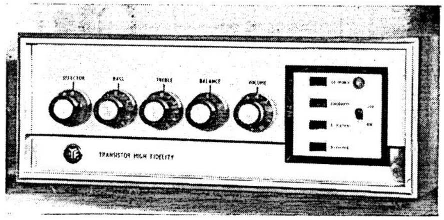
●**SC.22.** Stereo control unit with wide range of facilities. Inputs: PU 2 mV, mic. 1·5 mV, aux.1 100 mV, aux.2 200 mV, aux.3 300 mV. Outputs: Recording 100 mV nominal, 2V adjustable for power amplifier. Treble filter 5, 7 and 10 Kc/s with 12 dB/octave roll-off. Rumble filter 35 c/s 15 dB/octave. Bass and treble variable ± 12 dB at 50 c/s and 10 Kc/s. P.s.n. 300V 9 mA, 6·3V 1·5A. Size: 10½ × 3¾ × 12⅝ in. Weight: 9½ lb. Price: £32 10s.

●**SC.22P.** Similar specification to SC.22 but with self-contained mains power supply unit. Weight: 11 lb. Mains 110-250V 50/60 c/s. Price: £37 10s.

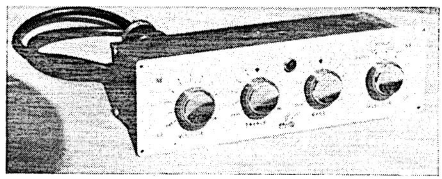
●**SC.4-10.** Transistorised stereo integrated amplifier and control unit. Inputs: mag. PU 4 mV, crystal PU 80 mV, radio 250 mV, aux.1 250 mV, aux.2 500 mV. Distortion 0·1%. Output 15W into 16 ohm load, 20W into 8 ohm load. Output imp. 8-16 ohms. Mains input 110-250V 50 c/s. Size: 10½ × 3¾ × 12⅝ in. Weight: 16½ lb. Price: £72 10s.

MA15. Power amplifier. Response 20 c/s-20 Kc/s. Distortion less than 0·1% over the major portion of the response at rated power output. Rise time less than 5 μsecs. Sensitivity 500 mV. Output imp. 4, 8 and 16 ohms. Mains 110-250V AC. Weight: 19½ lb. Output 15W. Size: 8¾ × 10¾ × 8½ in. Price: £25.

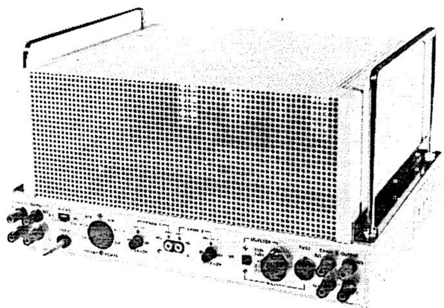
MA25. Power amplifier with similar specification to MA15 but with rated output 25W.



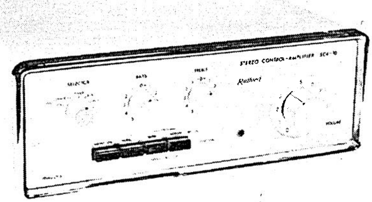
Pye Brahms HFS 30 T integrated transistorised stereo amplifier



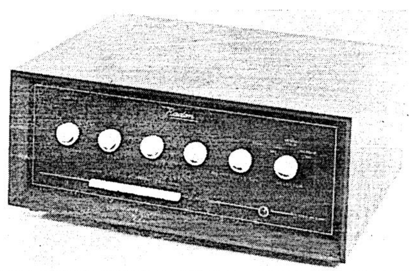
Lowther No. 2 pre-amplifier



Radford ISTA 30 and ISTA 60



Radford SC4-10 Integrated Amplifier



Radon R 6OOS Mk II integrated amplifier

Weight: 20 lb. Price: £31.

●**STA.15.** Stereo power amplifier with similar specification to MA15 but dual channel. Size: 14 × 10¾ × 8½ in. Weight: 34 lb. Price: £40.

●**STA.25.** Stereo power amplifier with similar specification to MA25 but dual channel. Size: 14 × 10¾ × 8½ in. Weight: 36 lb. Price: £50.

IMA.30. Reference standard power amplifier. Provides larger power over frequency range 10 c/s to 50 Kc/s than is normally available from domestic hi-fi amplifiers. Patented feedback circuit. Sensitivity 500 mV to 2V adjustable for rated power output. Output stage two KT88. Mains 110-250V 50 c/s. Output imp. 4, 8 and 16 ohms. Output: 30W at 0·1% distortion, 45W at 1.0% distortion. Size: 17 × 17 × 9 in. Weight: 24 lb. Price: £42 10s.

●**ISTA.30.** Stereo reference standard power amplifier. Similar specification to IMA.30 but dual channel. Size: 17 × 9 × 9 in. Weight: 42 lb. Price: £67 10s.

●**ISTA.60.** Stereo reference standard power amplifier. Similar specification to ISTA.30 but rated power 60W each channel at 0·1% distortion, 80W each channel at 1·0% distortion. Weight: 50 lb. Price: £85.

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RADON INDUSTRIAL ELECTRONICS CO. LTD., Brooklands Trading Estate, Orme Road, Worthing, Sussex. Tel.: Worthing 1063. Cables: Radon, Worthing.

●**R600.S Mk. II.** Integrated transistorised stereo amplifier available in chassis form, or in shelf mounting cabinet. Inputs: mag. PU 5 mV, crystal PU 500 mV, radio 500 mV, aux. 150 mV. F.R. 20 c/s-25 Kc/s ±3 dB. H. and N. −100 dB at 10W. Noise 20 dB below level of hum. Distortion 0·06% for 10W output. Bass control +12 dB to −12 dB at 100 c/s. Treble control +8 dB to −10 dB at 10 Kc/s. HF filter 7 Kc/s, 9 Kc/s and flat. LF filter 20 c/s, 40 c/s, 80 c/s. Output two AD140 transistors. Power output 10W RMS each channel (12W peak). Output imp. 15 ohms. Mains 220-250 AC. Chassis size: 14¼ in. wide, 10¼ in. deep, 5¼ in. high. Perspex engraved panel in black with gold lettering. Cabinet in polished mahogany. Price: (chassis) £55 13s.; (in cabinet) £58 16s.

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ROGERS DEVELOPMENT (ELECTRICAL) LTD., 4-14 Barmeston Road, Catford, London, S.E.6. Tel.: Hither Green 7424/4340. Cables: Rodevco, London, S.E.6.

●**Master II stereo control unit.** Inputs: mic. 1-10 mV, 100K; disc. 1, 2-20 mV, 68K; disc. 2, 60-600 mV, 2·2 megohms; tape 1-10 mV, 68K; radio 15-100 mV, 300K. (Impedance for mic. and disc. 1 inputs may be altered). Output 750 mV. Controls: input sel., vol., balance, on/off, equalisation, bass, treble, mono/stereo switches, high-pass filter, low-pass filter with variable slope and frequency, speaker/phones switch. Low-pass filters 7 Kc/s and 10 Kc/s + slope; high-pass 20 c/s and 60 c/s. P.s.n. 300V, 10 mA; 6·3V, 2 amps. To operate with Master stereo amplifier. Size: 14 × 6½ × 5⅛ in. Price: £35; (self-powered): £40.

●**Cadet III.** Stereo main amplifier and control unit. Inputs: radio 100 mV 470K, mag. PU 3·8 mV 68K, crystal PU 65 mV 2 megohms, tape 600 mV. F.R. 20 c/s-20 Kc/s ±2 dB. Bass control ±13·5 dB at 40 c/s. Treble control +13·5 dB −16 dB at 10 Kc/s. High-pass filter 60 c/s 10 dB/octave. Low-pass filter 6·5 Kc/s 10 dB/octave. Cross-talk 42 dB at 1 Kc/s, 26 dB at 10 Kc/s. Signal to noise: radio 60 dB, mag. PU 54 dB, ceramic PU 52 dB. Balance control 9 dB range. Valves. Size: (control unit) 10¾ × 4¾ × 4⅛ in., front panel 11¼ × 4½ in. Output 10W each channel. Distortion 5W 0·25% at 1 Kc/s, 10W 0·8% at 1 Kc/s, H. and N. −80 dB. Output imp. 3-5 ohms and 12-16 ohms. Mains 110-122-220-244V 50/60 c/s. Size (main amplifier): 10 × 6½ × 4 in. Prices: (chassis model) £31; (case model) £34 10s.

●**Master Stereo Amplifier.** Valved power amplifier. Input 1V. Output 35W. Self-powered. Suitable for Master II Stereo control unit. Price: £50.

●**HG88 Mk. III Integrated Stereo Amplifier.** Latest version of the "Eighty-eight" features increased power, more comprehensive input and control facilities. Re-styled to match new Cadet III range. Features include high performance filters, plug-in pickup matching adaptors, tape monitoring facility, tape panel socket. Silicon mains rectifier. Available in chassis or cabinet form. Output 15W. Price: (chassis) £42; (in cabinet) £46 10s.

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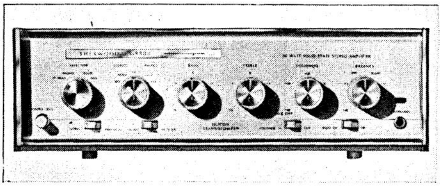
H. H. SCOTT, 111 Powdermill Road, Maynard, Mass., U.S.A. U.K. Distributors: Elstone Electronics Ltd., Edward Street, Templar Street, Leeds 2. Tel.: Leeds 35111.

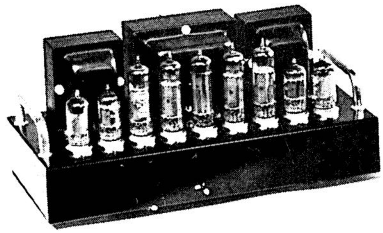
●**200 Integrated stereo amplifier.** Inputs: radio 500 mV (including muitiplex input), pickup 5 mV, tape 650 mV. Controls: mode switch and balance, treble, bass (separate



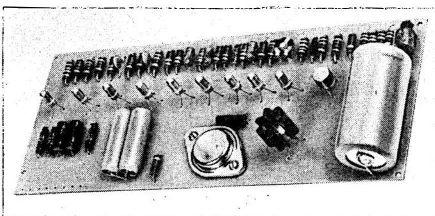
Sherwood S 9500 *silicon transistorised integrated amplifier*

*Archon SP*31 *stereo control unit*

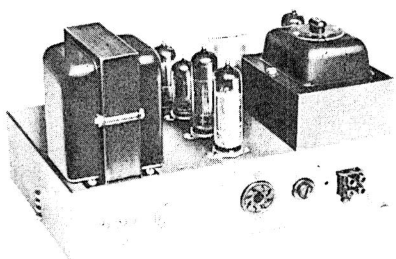
Rogers Master II Stereo Control Unit



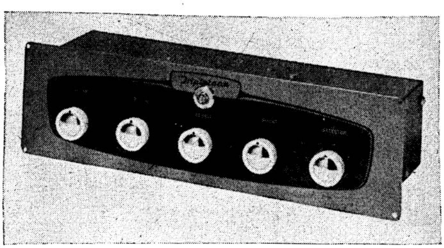
*Archon SL*101 *stereo amplifier*



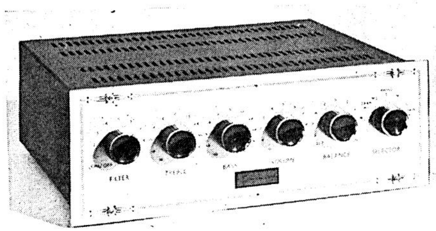
Sinclair X-20 *transistorised mono amplifier*



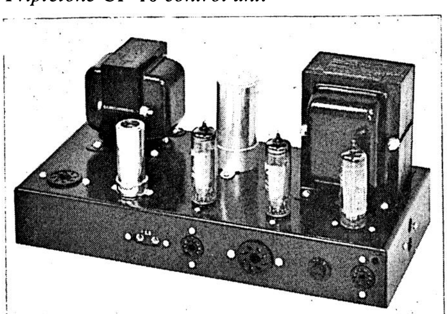
Stern 5-10 *amplifier*



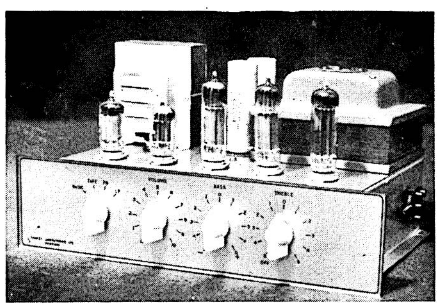
Tripletone CP 10 *control unit*



Symphony Integrated Stereo Amplifier



Tripletone DP 12 *amplifier*



Shirley Jupiter SB/1-15*E*

treble and bass for each channel), loudness, input selector switches, scratch filter, on-off. Output 15W (music) each channel. Output up to 2·5V of derived centre channel for feeding additional amplifier and speaker. Socket for stereo phones. F.R. 30 c/s-20 Kc/s ±1 dB (±3 dB at 20 c/s). Distortion 0·8% at rated output. H. and N. 70 dB down. Automatic rumble filter cuts below 20 c/s. Treble control +8 dB to −12 dB at 10 Kc/s. Bass control +11 dB to −14 dB at 50 c/s. Output imp. 4, 8, 16 ohms. Mains 220-240V 50/60 c/s. Size: 15 × 4⅜ × 13 in. Price: £86 2s.

●**260 Integrated stereo amplifier.** Fully transistorised. Incorporates usual Scott features. Two 30W (music) outputs. Price: £156 9s.

●**299D integrated stereo amplifier.** Pre-amp. details: inputs—tape (NARTB corrected) 3 mV; mag. pickup 3 mV or 9 mV; radio and aux. 0·5V. Controls: treble, bass, vol. High-pass filters 20 c/s, low-pass 5 Kc/s. Response 20 c/s to 20 Kc/s. Noise −80 dB high level input, equivalent to 10 μV on low level. Derived centre channel provided. Free-standing. Power amp. details: output 20 +20W. Dist. 0·8%. Response 20 c/s-20 Kc/s ±1 dB. Noise −80 dB. Input 3·0 mV. L.S. matching, 4, 8 or 16 ohms. Output stages, 7591s (2 for each channel). P.s.n. 210-250V AC. Size 15 × 4⅜ × 13 in. Walnut cabinet (overall) 16¼ × 13¼ × 6 in. Price: £137 11s. Walnut cabinet £7 7s. extra.

Cooper-Smith control unit and amplifier

SHERWOOD. Distributors: Audioson Ltd., York House, Empire Way, Wembley, Middlesex. Tel.: Diligence 1886.

●**S9500.** Integrated stereo amplifier using silicon transistors. 10 inputs: radio 0·25V, 2 tape 0·8 mV, PU 1·8 mV, 6 high level. Controls: selector switch, function switch, bass, treble, loudness, balance, PU volume, tape monitor, treble filter, loudness in-out, speaker on-off. Noise: PU −70 dB, radio −80 dB. 20 silicon transistors, 2 silicon rectifiers. Output 18W RMS per channel. Distortion 0·5% at 18W. F.R. 20 c/s-20 Kc/s ±1 dB. Feedback 45 dB. Output imp. 4-16 ohms. Stereo phone jack on front panel. Mains 120-240V. Size: 11 × 4 × 12½ in. Price on application.

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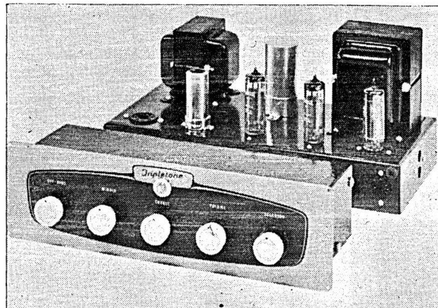
SHIRLEY LABORATORIES LTD., 3 Prospect Place, Worthing, Sussex. Tel.: Worthing 30536.

"Jupiter" SB/1-15E. Integrated mono amplifier. 12W (17W peak). Dist. 0·2% at 10W 1 Kc/s. F.R. 45 c/s-25 Kc/s ±1 dB. N.L. −80 db. Inputs: radio/tape 100 mV; gram. to suit pickup in use. L.S. matching, 15 ohms. Controls: bass, treble, vol., sel. P.a.t. 300V, 30 mA; 6·3V, 1·5 amps. Output stages EL84s. Self-powered. Front panel 12 × 3 in. Price: £23 2s.

●**SBS/15 integrated stereo amplifier.** 12W per channel (17W peak). Dist. 0·1%. F.R. 45 c/s-25 Kc/s ±1 dB. N.L. −85 dB. Inputs: radio 100 mV; gram. (R.I.A.A.) 5 mV; mic. 2 mV; tape from head 3 mV; tape recorder 100 mV. Output stages EL84s. Controls: variable vol., bass, treble, balance, switched sel., tape speed equalisation, mono/stereo. Self-powered. P.a.t.



Tripletone Hi-Fi Paragon amplifier and control unit

300V, 45 mA; 6·3V, c.t., 2 amps. Equalisation for two or three tape speeds. Facility for playing on both channels from monaural source. Price: £63.

See also Tape Amplifiers Section.

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SINCLAIR RADIONICS LTD. See kit section.

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H. L. SMITH & CO. LTD., 287/289 Edgware Road, London, W.2. Tel.: Paddington 5891/7595.

Cooper-Smith Mk. II control unit. Inputs: radio 100 mV; pu 3 mV variable; mic. 1·5 mV; tape 100 mV. 6-pos. sel. (3 record equal.), treble, bass, vol., on/off. Switch filter 6, 8 and 10 Kc/s. Co-axial tape replay switch. H.D. 0·1% or less at 1,000 c/s. H. and N. −80 dB. Rumble filter 12 dB cut at 30 c/s. Size: 10 × 3½ × 6½ in. To operate with B.P.I. power amp. Price: £10 17s. 6d.

Cooper-Smith B.P.I. amplifier. 10W nom., 12W max. Dist. 0·15% or better at 10W. Input for spec. output approximately 1·9V. Response 20-30,000 c/s ±1 dB. Feedback 18 dB. N.L. 90 dB below max. output. Output imp. 3·75 and 15 ohms. Output 6BQ5s or EL84s. Ultra-linear. Size: 12 × 7 × 7½ in. To operate with Cooper-Smith Mk. II control unit. Price: £14 5s.

●**Cooper-Smith stereo control unit.** Inputs: pickup 3 mV variable; tape 100 mV; radio 100 mV. 4-pos. sel., bass, treble, vol., balance. H.D. 0·15%. H. and N. −60 dB. Size: 10½ × 4½ × 3½ in. To operate with Cooper-Smith stereo amplifier. Price: £15.

●**Cooper-Smith stereo amplifier.** 6W per channel, 9W peak. Dist. 0·2% at 6W. Input for spec. output 800 mV. Response 40-25,000 c/s at 6W. 15 dB feedback. N.L. −80 dB. Output imp. 3·75, 7·5, 15 ohms. Output ECL82s. Size: 12 × 7 × 6¾ in. To operate with Cooper-Smith stereo control unit. Price: £16.

Cooper-Smith "Bantam" integrated mono amplifier. Output 3-4W. Response 40 c/s-25 Kc/s ±1 dB at 1W. L.S. matching 3·75, 15 ohms. Output stages ECF80, EL84/6BQ5, EZ81. Input 60 mV, 3W. Controls: bass and treble cut and boost, continuously variable. Self-powered. Size: 8 × 6½ × 4½ in. Weight: 8¾ lb. Price (kit): £7 10s.; (assembled and tested): £8 5s.

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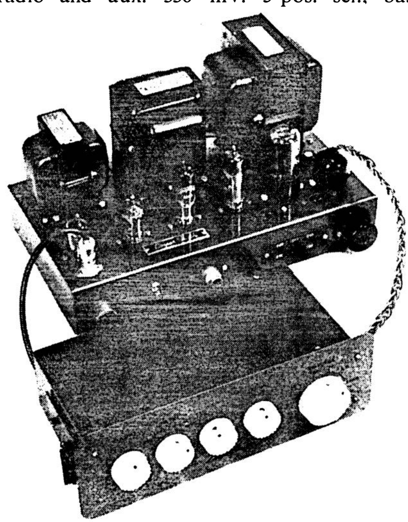
STERN-CLYNE LTD., Head Office and mail order, 3-5 Eden Grove, Holloway, London, N.7. Tel.: North 8161. Branches throughout London, Liverpool, Manchester, Sheffield and Bristol.

Mullard 2-valve pre-amplifier tone control unit. Inputs: pickup 5 mV and 13 mV (magnetic); 70 mV and 200 mV (crystal); radio 300 mV, tape 1,300 mV; tape 2, 3 mV; mic. 3 mV, 6-pos. sel., bass, treble, vol. P.s.n. 300V at 3 mA, 6·3V at 0·6 amps. Employs two EF86s. To operate with the 5-10 and similar power amplifiers. Size: 9½ × 4½ × 2⅜ in. Price: £9 10s.; (also available in kit form): £6 6s.

●**Mullard dual-channel pre-amplifier.** Inputs: pickup 5-15 mV and 70-220 mV; tape 4 mV; radio and aux. 330 mV. 5-pos. sel., bass,

Symphony No. 2 integrated stereo amplifier



Cooper-Smith Mk. II C.U. and BP1 amp.

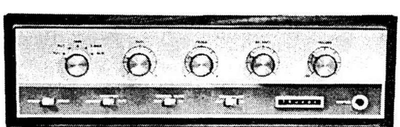
treble, vol. and balance. Output 250 mV per channel. Dist. less than 0·15%. Employs four EF86s. P.s.n. 6·3V at 1 amp., 250/350V at 6 mA. Size: 11 × 5 × 4 in. Price: £15; (also available in kit form): £12 10s.

●**Mullard "10-10" stereo amplifier.** 10W per channel. H.D. <0·2%. Input for spec. output. 23 mV. Response at 10W 20-60,000 c/s ±3 dB. Feedback 20 dB. N.L. −65 dB. Output imp. 15 ohms, alternative 3·75 or 7·5 ohms. Output two ECL86s in each channel. Ultra-linear. Size: 14 × 6½ × 6¼ in. To operate with Mullard dual channel pre-amplifier. Price: £20; (kit): £16.

●**Mullard "10-10" stereo amplifier with passive control unit.** Output 10W per channel H.D. <0·2%. Input for spec. output, passive unit 250 mV. Response 20-60,000 c/s ±3 dB. Feedback 20 dB. N.L. −65 dB. Output imp. 15 ohms (alternative 3·75 or 7·5 ohms). Output two ECL86s in each channel. Ultra-linear. Size (with passive unit attached): 14 × 8½ × 6¼ in. Price: £24; (kit): £20.

Mullard 3-valve pre-amplifier. Mono. Inputs: mag. pu 7 mV, 12 mV; crystal 150 mV, 270 mV; tape head 2·5 mV; mic. 7·5 mV; radio 250 mV; aux. 250 mV. Output 250 mV. Controls: sel., treble, bass, vol. High-pass filters 160 c/s, 80 c/s, 40 c/s, 20 c/s; low-pass 5 Kc/s, 7 Kc/s, 9 Kc/s, flat. H. and N.: mag. and crystal −58 dB; tape head −47 dB; mic. −44 dB; radio and aux. −60 dB. P.s.n. 6 mA at 250V. 1 amp at 6·3V. Jacks on front panel. Auxiliary input. Record output. Ferroxcube inductor in filter circuit. To operate with Stern/Mullard range power amplifiers (mono). Size: 11 × 4 × 4 in.; (front panel): 12¼ × 4½ in. Price: £13 13s.; (kit): £10.

Mullard 5-10 mono amplifier. Output 10W. H.D. 0·1%. Response 30 c/s-15 Kc/s ±1 dB. Feedback 26 dB. N.L. −65 dB. Input 40 mV. L.S. matching, 3·75 or 15 ohms. Output stages 2 × EL84. Self-powered (AC mains 200-250V). Size: 10 × 7 × 7 in. To operate with Stern/Mullard 2- or 3-valve pre-amplifiers. Price: £13 10s.; (kit): £10. Alternative model with cartridge output transformer available £1 6s. extra.



Truvox TSA 100 *integrated transistorised stereo amplifier*

Mullard 3-valve, 3W power amplifier, Series II. Mono. 3W output. H.D. 1%. Response 35 c/s-30 Kc/s. Feedback 20 dB. N.L. −70 dB. Input 100 mV. L.S. matching, 3 or 15 ohms. Output stages EL84. Self-powered. Incorporates sel. switch, separate bass and treble controls, vol. control. Size: 10 × 6 × 6 in. Price (kit): £8 8s.

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SYMPHONY AMPLIFIERS LTD., 16 Kings College Road, London, N.W.3. Tel.: Primrose 3314/5.

Symphony integrated mono amplifier. 10W push-pull output (15 ohms). Dist. less than 0·2% at 6W. Input for spec. output 60 mV. Response 30 c/s-20 Kc/s ±1 dB. N.L. −85 dB. Fully enclosed in steel case, 12½ × 9½ × 4½ in. high. Suitable for shelf-mounting or drop-through. Price: £21.

●**No. 2 stereophonic amplifier.** Output 10W per channel. H.D. 0·15%. Response 20 c/s-20 Kc/s ±1 dB. Feedback 27 dB. N.L. 75 dB below. Input 3 mV. L.S. matching, 15 ohms. Output stages EL84s in push-pull. P.s.n. 200-250V AC. Self-powered. Size: 13 × 4½ × 9½ in. Price: £25 4s. (integrated).

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TANSLEY-HOWARD LTD., 144 Holland Park Avenue, London, W.11. Tel.: Bayswater 2848.

●**Archon SP31. Stereo control unit.** Inputs: pickup 1, 7 or 70 mV variable; 2, 7 mV; tape 60 mV; radio 60 mV variable. Sel., balance, treble, bass, filter controls. H.D. 0·05%. H. and N. −61 dB. Rumble filter. Size: 12 × 6 × 2⅜ in. To operate with SL101 stereo amplifier. Price: £20 9s. 6d.

●**Archon SL101. Stereo amplifier.** 10W per channel. Dist. 0·2% at 10W. Input for spec. output 200 mV. Response 3-50,000 c/s ±1 dB. 22 dB feedback. N.L. −80 dB. Output imp. 3, 7 and 15 ohms. Output EL84s. Size: 12 × 6 × 5½ in. To operate with SP31 stereo control unit. Price: £29 8s.

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TRIO. Distributors: Winter Trading Co. Ltd., 95-99 Ladbroke Grove, London, W.11. Tel.: Park 1341. Cables: Winlec, London, W.11.

●**W41U.** Integrated mains-operated stereo amplifier. Valves. Inputs: mag. PU 1·7 mV, tape head 1·7 mV, aux., radio, and tape play 110 mV. Controls: Power on/off, LS on/off, selector, mode, volume, balance, tape monitor, mono-stereo input, bass (LH), treble (LH), bass (RH), treble (RH). Loudness control. DC filament supply. Stereo headphone jack. Output 10W (RMS) per channel. F.R. 20 c/s-20 Kc/s ±1 dB. Output imp. 0-16 ohms. Mains 110-117V, 220-230V AC. Size: 12½ × 5 × 10⅛ in. Price: £57 15s.

●**WE24.** Integrated mains-operated stereo amplifier. Valves. Inputs: PU 3 mV, radio 520 mV, crystal PU 115 mV. Controls: selector, bass (LH), treble (LH), loudness, balance, volume, mode, bass (RH), treble (RH), mains on/off. Output 6W (RMS) per channel. F.R. 20 c/s-20 Kc/s ±½ dB. Mains 110V, 220V, 50-60 c/s. Size: 11¾ × 5 × 7⅛ in. Price: £40 19s.

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TRIPLETONE MANUFACTURING CO. LTD., 241a The Broadway, Wimbledon, S.W.19. Tel.: Liberty 1189.

Hi-Fi Major integrated amplifier. Inputs: high imp., pickup and mic. Mixing facilities. 12W, 15W max. Dist. 0·15%. Response 15-20,000 c/s ±1 dB. Negative feedback 32 dB. N.L. −80 dB. Output imp. 2-3 or 15 ohms switchable. Output EL84s. Size: 12 × 5¾ × 6 in. Price: £15 18s. 9d.

D.P.12 power amplifier. 12W nom., 15W max. H.D. 0·15%. Input 500 mV for 10W. Response 15-50,000 c/s ±0·25 dB. Feedback 16 dB. N.L. −80 dB. Output imp. 2-3 or 15 ohms switchable. Output EL84s. To operate with stereo S.C.P.2 or mono C.P.10. Size: 12 × 6 × 5¾ in. Price: £12 6s.

C.P.10 mono control unit. Inputs: pu (crystal or ceramic) 80 mV, 2 megohms; tape 200 mV, 200K; radio 200 mV, 200K; mag. pu (equalised to R.I.A.A. curve) 5 mV; tape head (equalised to C.C.I.R. curve) 8 mV; aux. 80 mV, 2 megohms. Output 500 mV. Controls: bass, on/off, middle, treble, vol., sel., rumble filter, low-pass filter. Filters: rumble two positions, −20 dB at 20 c/s, −15 dB at 20 c/s; low-pass variable from 3-30 Kc/s, slope 6 dB/octave. H. and N. −65 dB. P.s.n. 6·3V, 0·3 amps; 250V DC, 3 mA. To operate with DP12. Size: 11 × 3½ × 2½ in. Price: £9 17s. 6d.

●**S.C.P.2 stereo control unit.** Inputs: pu 80 mV, 2 megohms; radio 200 mV, 100K; tape 80 mV, 100K. Output 500 mV. Controls: bass, on/off, middle, treble, vol., sel. Response 30 c/s-20 Kc/s ±1 dB. H. and N. −62 dB. P.s.n. 6·3V, 0·6 amps; 250V DC, 6 mA. Dual-concentric controls allow very accurate balance. To operate with one or two D.P.12s and stereo 8-8 power chassis (not sold separately). Size: 11 × 3½ × 2½ in. Price: £10 18s. 9d.

●**Stereo 8-8.** Stereo amplifier including S.C.P.2 control unit. 8W per channel. H.D. 0·2%. Response 30 c/s-20 Kc/s ±1 dB. Feedback 42 dB. N.L. −65 dB. Inputs: pu 80 mV, 2 megohms; radio 220 mV, 100K; tape 80 mV, 100K. L.S. matching 2-3 or 15 ohms (switchable). Output stages ultra-linear ECL86s. Internal power supply. Size (main chassis): 12 × 5¾ × 6 in.; (pre-amp S.C.P.2): 11 × 3½ × 2½ in. Price: £25 18s. 9d.—complete.

Tripletone stereo 12-12 comprises two D.P. 12s and the S.C.P.2 control unit. Details as above. Price: £35 10s. 9d. for three units.

Transistorised pre-amplifier. Mono or stereo version. Inputs for magnetic cartridges or tape heads. Various tape/disc combinations. S/N 70 dB. Equalisation ±2 dB (R.I.A.A. or C.C.I.R. curve). P.s.n. 200-300V DC. Octal plug connector. Size: 5 × 2 × 2 in. Price (mono): £3 17s. 6d.; (stereo): £5 10s.

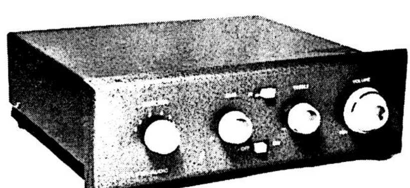
●**Stereo balance indicator.** Indicates volumetric and tonal balance. Can be switched in or out as required, and gives channel reversal facilities. No power required. Price: £2 16s. 3d.

Hi-Fi Paragon. Complete mono. system comprising one C.P.10 control unit and one D.P.12 power amplifier. Price: £22 3s. 6d.

★

TRUVOX LTD., Neasden Lane, London, N.W.10. Tel.: Dollis Hill 8011. Cables: Truvoxeng, London.

●**TSA100.** Transistorised integrated stereo amplifier. Inputs: PU.1 50 mV 100K R.I.A.A., PU.2 3·5 mV 50K R.I.A.A., tape 150 mV



Worden transistorised stereo control unit

100K, tuner 50 mV 100K, aux. 50 mV 100K. Controls; Treble, balance, volume, function switch, monitor switch, scratch filter, rumble filter. Noise <-55 dB on PU, <-60 dB other functions. 10W output per channel into 15 ohms. Distortion less than 0·25% at 10W. F.R. 15 c/s-30 Kc/s ± 1 dB. Transformerless output will feed any speaker 8-600 ohms. Four AD140. Mains supply 100-240V 40-60 c/s. Chassis form or shelf-mounting cabinet. Size: 16 × $6\frac{7}{8}$ × 5 in. Price: £51 9s.

★

VORTEXION LTD., 257/263 The Broadway, Wimbledon, London, S.W.19. Tel.: Liberty 2814, 6242/3. Cables: Vortexion, "Wimble", London.

30/50 watt amplifier. Can deliver 50W of speech and music or over 30W of continuous sine wave. Main amplifier has response of 30 c/s-20 Kc/s ± 1 dB; 0·1% distortion. Outputs 4, 7, 5, 15 ohms, 100V line. Models are available with two, three or four mixed inputs for low impedance balanced line microphones, pickup or guitar. Price: £65.

120/200 watt amplifier. Can deliver its full audio power at any frequency in the range of 30 c/s-20 Kc/s ± 1 dB. Less than 0·2% distortion at 1 Kc/s. Can be used to drive mechanical devices for which power is over 120W on continuous sine wave. Input 1 mV, 600 ohms. Output 100-120V or 200-240V. Additional matching transformers for other impedances are available. Price: £112.

WELLINGTON ACOUSTIC LABORATORIES LTD. See Elstone Electronics Ltd.

★

WORDEN AUDIO DEVELOPMENTS LTD., 54 Chepstow Road, London, W.2. Tel.: Bayswater 4996.

●**Stereo transistorised control unit.** Inputs: PU 4, 8, 10 and 20 mV; radio and tape 150 mV per channel. Output 150 mV per channel. Controls: selector, bass, treble, stereo/mono, combined volume, balance, on/off. Response 15 c/s-25 Kc/s. All pickup inputs equalised, radio and tape flat. Channel separation better than 55 dB. Available self-powered (9V battery) or powered from main 10 × 10W amplifier. Free-standing or for cabinet mounting. To operate with companion 10W per channel stereo main amplifier, or any amplifiers with input sensitivity of 150 mV or less. Size: $8\frac{3}{4}$ × $8\frac{1}{4}$ × $2\frac{3}{8}$ in. Front panel 9 × 3 in. Price: £18 18s. Companion 10 × 10W main amplifier complete with above control unit. Price: £41 10s. Specification on request.

●**Integrated 4 × 4W stereo amplifier.** Sensitivity 80-100 mV per channel. Separation better than 55 dB. H. and N. better than -50 dB. Distortion 0·25% at 3W. F.R. 20 c/s-20 Kc/s. (4 dB down at 40 Kc/s). Facilities for personal head-set listening. Controls: head-set blend, balance, bass, treble, selector, mono/stereo/ monitor switch. Price: £26 5s.

SPEAKER SITUATION

by Rex Baldock

SPEAKERS may come and speakers may go, but they all bring with them at least two problems—where they and the listeners should be positioned in the listening room for best effect. Many proud buyers rush home with their newly acquired models, set them up in the most convenient spots and there they stay indefinitely. Quite likely the performance is adequate, but seldom are the most suitable sites found without some trial, and a few experiments with alternative positions may lead to more satisfactory sound in several respects.

There are so many factors that can affect the overall performance that it is always worthwhile trying several arrangements, even when initial results seem to be quite good. Domestic rooms vary considerably in size, proportions and liveliness and a solution that is effective in one may not be appropriate in another. Experience does help to suggest the optimum disposition of speakers and listeners in differing circumstances, but it must be accepted that in some awkward situations favourable results are 'where you find them'. The acoustical properties of rooms, particularly those of irregular shape, are difficult to calculate with any precision, but a few fundamental rules are generally applicable and an appreciation of these can be of help in minimising the number of trials that may be necessary.

Before the advent of domestic stereo, the placing of speakers was fairly straightforward since only one enclosure had to be set up to best advantage. Often the normal siting was predetermined by the manufacturer; for example, many speakers were built so as to fit a right-angled corner, to give efficient bass loading and sometimes the room walls were also utilised to allow reflection and diffusion of the higher frequency output. However, not all rooms had suitable corners and some listeners preferred results with the enclosure spaced away from the walls. But, in general, it was usually possible to select several speaker/listener arrangements, the principal variable being their distance apart.

When stereo made its commercial debut, the initial move was to set up speakers and listeners in the usual triangular formation, without too much attention to its relationship to the room itself. Quite possibly one of the speakers might be unfavourably sited as regards bass loading, although fortunately accurate channel balance is of less importance at low frequencies. Even so, if the bass signals were largely towards that side during some parts of the programme distortion might set in. In addition, some listening positions are generally unfavourable for bass response and this could aggravate the situation. Achieving compatibility between stereo geometry and frequency response requirements may sometimes require an unconventional approach; but first it would be advantageous to consider a few of the easier cases.

Three significant advantages characterise the larger domestic room of around 25 ft by 18 ft. First, a given number of seated people may listen to stereo reproduction with less variation of effect than in a smaller room. Because of the greater possible speaker spacing a line of listeners may be proportionately longer before those at the ends find results deteriorating. Second, the bass response tends to be smooth and deep and somehow more 'airy' than under cramped conditions. Reflections between the walls, floor and ceiling of rooms gives rise to a large number of peaks in the overall response, called resonances or normal modes, the lowest of importance being related to the longest room dimension between parallel walls. In a large room the lowest is therefore of lower frequency than in a small room and because there are more modes in a given frequency range the impression aurally is one of greater smoothness. Third, the very fact that the listeners are further from the speakers themselves seems to enhance the illusion; perhaps something to do with the old adage 'distance lends enchantment'.

Of course, even large rooms can have their acoustic problems. One well-known speaker manufacturer introducing new models at a preview suffered from near disastrous boominess due to flexibility of the floor, the room otherwise being quite promising and of good proportions. In the middle and high frequency range lack of absorbent furnishings can lead to ringing echoes or 'bathroom' reverberation. Apart from these possible snares, results on stereo in normally appointed large rooms are usually excellent with speakers at one end and listeners not too far from the other.

The majority of audio equipment owners do not have rooms 25 ft long (it is curious that owners of large houses seldom seem to own hi-fi systems), but a quite sizeable number do have lounges around 16 ft long and 13 ft wide, with a ceiling height between $8\frac{1}{2}$ ft and 10 ft. Such a room has a volume in the neighbourhood of 2,000 cubic feet—roughly the borderline between large and small. These proportions are conducive to minimising the overlap of resonances, so improving smoothness, whilst the length gives rise to a lowest mode of about 35 c/s. This can be of considerable assistance in maintaining a reasonable bass response down to low C (CCC or 32·7 c/s)—adequate for most programme material—provided both speakers and *listeners* are suitably disposed.

Even in a large concert hall the pressure frequency response may vary by ± 6 dB at different locations, and in a typical domestic

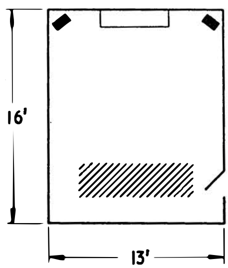


FIG. I.

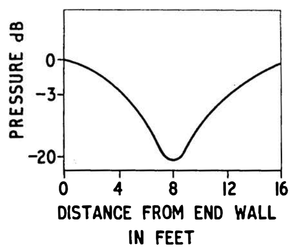


FIG. 2(a)

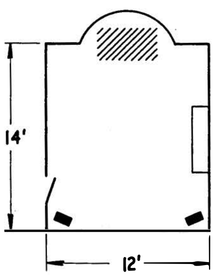


FIG. 3.

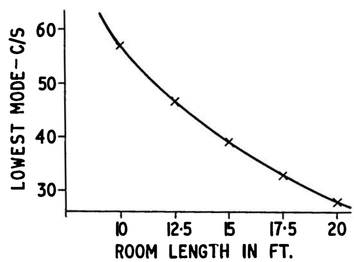


FIG. 2(b)

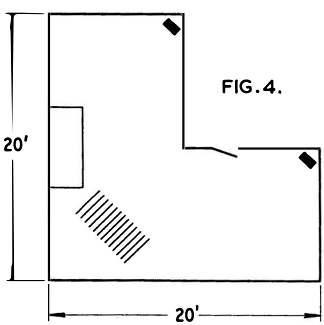


FIG. 4.

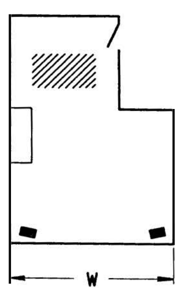


FIG. 5.

room variations of ± 10 dB or more are quite commonly encountered. This is because the low frequency absorbtion due to furniture, carpets, listeners and the air itself is only moderate and a complex sound field arises due to 'standing waves'. Thus, using conventional speakers, pressure variations of around 20 dB (10:1) will be found at different locations at one frequency, or at one location over a range of frequencies.

In a room of simple rectangular shape, the lowest mode occurs at a frequency for which its length is equal to half a wavelength, maximum pressure being found at the end walls, with a minimum near the middle of the room. Except in rooms over about 20 ft long, this region should be avoided by both speakers and listeners, since a whole octave of bass response will be lost. Examining a typical plot of the pressure variation along the axis of a room such as **fig. 1** at the frequency of the lowest mode (**fig. 2a**) it will be seen that it varies less than 3 dB within 4 ft of the end walls; most types of speaker will develop maximum output in these regions. **Fig. 2b** shows the frequency of the lowest mode for rectangular rooms of a range of lengths most commonly found; this may be regarded as the lowest frequency of efficient reproduction, although by the application of special techniques useful response down to about an octave lower is obtainable (see writer's article 'Acoustic Compensation', *Hi-Fi News*, November 1964).

*   *   *

In a nicely proportioned room such as shown in **fig. 1,** listeners will not object to sitting in the region indicated. Placing the speakers in the corners at either side of the fireplace will give a pleasant 'field of view'. If the fireplace is used for heating there may be a tendency for listeners to shift towards the centre of the room, undesirable from the bass response point of view, but understandable if they feel chilly! For winter use, therefore, it might be judicious to install extra heating in the optimum listening area. In some cases it would be preferable to reverse the whole arrangement, although the door might cause some inconvenience. Given reasonably solid construction, good stereo results are usually possible in this size of room with freedom from unpleasant resonances.

Many hi-fi equipment owners are burdened with rooms far from ideal because of their size, shape or construction. Low frequency acoustics are not easily altered without fairly extensive rebuilding; normally it is necessary to try listening in various positions with each speaker arrangement until a satisfactory compromise is reached. In average-sized rooms the smoothest bass response will often be found 2 to 4 ft from a wall or corner, and it can sometimes be so arranged that this is also satisfactory from the point of view of stereo angle.

A large number of houses have rooms of the type shown in **fig. 3,** the bay window sometimes being of rectangular form. Probably the best scheme acoustically is as shown with the listeners just within the bay area. The actual position of the door and size of speakers used would determine whether this was feasible. Other alternatives would be with speakers and listeners reversed, or speakers either side of the fireplace as in **fig. 1.** Although fairly satisfactory, the latter disposition would restrict bass response somewhat for the room size shown. Using a speaker at each end of the bay would not give a really adequate stereo field unless listeners were nearer; but this again would lead to inferior bass performance.

*   *   *

Not all large rooms are straightforward from a stereo viewpoint. Although of adequate volume, that shown in **fig. 4** presents problems if more than two or three listeners are to be accommodated. If they sit near one end of one of the 'L' branches then the speakers placed near the wall opposite cannot be a sufficient distance apart before one is obscured by the corner near the doorway. Putting the speakers at either side of one end of a branch raises the same problem with the separation limited to 10 ft. A compromise with listeners about 15 ft from one of the 20-ft walls and speakers around 14 ft apart might be acceptable, but possibly a more acoustically satisfactory layout is that shown. If domestically tolerable, this could give excellent results, since symmetry is preserved, stereo angle is sufficient, whilst listeners are well away from the speakers in a region of admirable bass response. The speakers would be well loaded down to 30 c/s or lower, but some listeners might object to sitting opposite a protruding corner. Although possibly awkward from a stereo point of view, anybody owing such a room at least has the consolation that speakers and listeners can be well separated and objectionable resonances are not likely to occur.

Some rooms have proportions midway between **figs. 1** and **4,** such as the one illustrated in **fig. 5.** The speaker/listener arrangement shown would most probably be found amenable in many ways, but an alternative would again be with speakers set in the corners either side of the fireplace and listeners opposite, provided W were not less than 12 ft or so.

A few people have rooms which are very long but relatively narrow, as in **fig. 6.** In these cases it would be permissible to seat listeners about midway along the length, as satisfactory bass response would be available down to a frequency calculated for a room of half the length (see **fig. 2b**). Generally it is not satisfactory to use the speakers in the central regions of the long walls, from considerations of both spacing and loading.

Where two rooms are normally separated by partition doors, a situation similar to the above may arise, but if the width of each room, W (**fig. 7**) approached two-thirds of the combined length L, then with partition opened wide a large room of good proportions would result. With speakers in one half as shown, several people might sit beyond the partition region and enjoy the advantages of large room acoustics. This would only be possible if the partition allowed about 75 per cent opening; with less the listeners would need to sit nearer as appropriate.

Fig. 8 represents yet another possible variation of room plan, and the best stereo seating layout would depend on the size of the alcove. If several feet wide, one or two listeners might find the arrangement shown most suitable. This

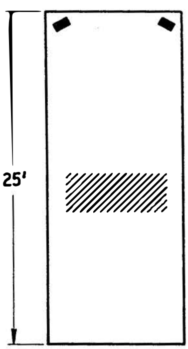


FIG. 6.

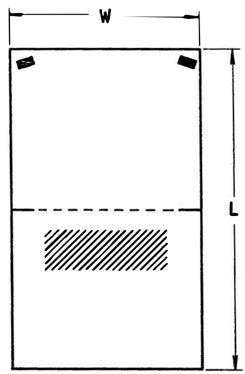


FIG. 7.

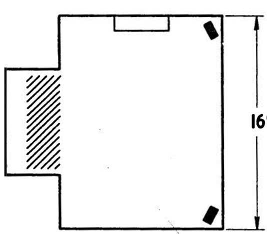


FIG. 8.

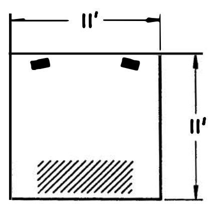


FIG. 9.

LISTENING AREA   SPEAKER

maintains symmetry with the speakers, but if the alcove were smaller an arrangement more like **fig. 1** would probably be preferable.

All the rooms covered so far have had at least one dimension not under 14 ft, which should allow satisfactory loading down to 40 c/s. But what of those whose rooms are not only small, but square (**fig. 9**) or, worse still, small and cubic? Fortunately, the merits of stereo are very apparent in the smaller room, since with suitable recordings the studio or auditorium ambience can dominate over that of the listening room, so giving a desirable feeling of space beyond the speakers. The main difficulty will be a tendency to boominess on bass notes and in bad cases this may even lead to 'one note bass'. Short of covering some of the walls with 2 to 3 ft of damping material or large area resonant absorbers, not much can be done to alleviate this situation except by persevering with different speaker-listener positions until the worst effects are minimised. Although giving reduced bass loading, it would be worth trying the speakers displaced away from the corners as shown in **fig. 9.** As indicated earlier, the centre of the room should be avoided.

* * *

So far, all the rooms considered have had at least one set of parallel surfaczs in addition to the floor and ceiling, and it might be supposed that a room constructed with non-parallel surfaces would be freer of resonances. Unfortunately this is not so; the resonances are still strongly developed, although it becomes difficult to anticipate their frequencies. Ringing echoes are less prone to arise, but irregularly shaped rooms can suffer from 'blind spots' where the stereo is not satisfactory. Bass response may vary considerably from place to place and quite striking changes in level can occur when the speakers are moved a foot or two. In a large room of irregular shape where the speaker/listener distance is adequate, a good deal of leeway is allowable in absolute speaker position, but in the smaller room the most attractive speaker positions from the point of view of response may not coincide with those suitable for stereo. Some compromise is then necessary. Examples where the overall results have been quite acceptable are shown in **figs. 10, 11** and **12.** Of the three, the room shown in **fig. 12** was the best, principally because of its greater size.

Some lighthouse keepers might like to install stereo; presumably **figs. 13** and **14** would represent the sort of room shapes available! The disposition of **fig. 13** seems the only one possible in the circumstances; results might well be quite satisfactory stereowise, but with some restriction of bass response. Given a full section of lighthouse (even the top floor is usually bigger than most people think), first-rate results might be possible if absorbers were set up as shown to avoid 'whispering gallery' effects.

In some rooms the natural absorption due to the furnishings may be sufficient, but sometimes it may be advantageous to cover one wall, usually behind the listeners, with acoustic tiles or heavy curtaining. Sometimes reflections in the side walls are troublesome and similar treatment here may be beneficial. Whether absorption is necessary may be influenced to some extent by the type of speakers used. Those giving a restricted distribution of high frequencies can help to minimise unwanted and confusing wall reflections, but if too directional, 'hole in the middle' stereo may arise for listeners away from the symmetrically placed 'stereo seat'. With omnidirectional speakers no further experiments are necessary once their positions have been chosen, but with the partially directional type, configurations, such as the 'crossed axes' system should be tried until the listener feels he has achieved the most suitable compromise. Perseverance, especially in the smaller rooms, may well be rewarded by more lifelike results.

* * *

All this may sound a rather lengthy process, but if the obviously unsuitable positions and orientations are avoided it need not be too onerous. In any case, it is always advisable to try one promising arrangement for a few days before making any drastic changes, since opinions can be easily influenced by the type of programme material. It is well to remember that any speaker worthy of the label 'hi-fi' will have a frequency response better than the room in which it will have to operate. If suspected it should be tried out of doors with an audio oscillator, when any severe resonances will be easily heard.

Once the speaker system is set up to best advantage, just how much may be expected of 'high fidelity stereophonic sound'? Can it have the clarity, spacial properties, frequency and dynamic range heard in studio, concert hall or cathedral? If not, how close is it possible to approach reproduction of the original?

Taking dynamic range first, this is one aspect of the programme which speakers do not modify, since conventional units do not generate noise or hum and therefore, within limits, the minimum output may be set as low as desired. However, even in an extremely quiet lounge, this will be of little value if below about a level of 30 dB (referred to 0·0002 dynes/sq cm, close to the minimum threshold of normal hearing around 1 kc/s). If the full dynamic range produced by a concert orchestra were reproduced as if the listener were about 50 ft distant, then occasional peak levels of 100 to 105 dB would be required. Most commercial speakers will achieve this in the middle frequency range under domestic conditions, but cannot maintain this output with low distortion at low or high frequencies. In the majority of cases, domestic considerations will limit peak levels to 90 dB or so and spurious household and traffic noise may set the lower level at 40 to 45 dB. Since the majority of programme signals are limited in dynamic range to 45 dB or less, it can be seen that speakers seldom set a limit to the *usable* dynamic range.

Given a properly designed speaker unit and enclosure it should, despite room acoustics, be possible to cover most of the required frequency range reasonably smoothly. An easily audible response between 40 and 10,000 c/s should be possible with high-quality speakers in almost any room except the smallest mentioned earlier, but the octaves above and below these limits tend to be rather expensive. A large room will ease problems at the very low fre-

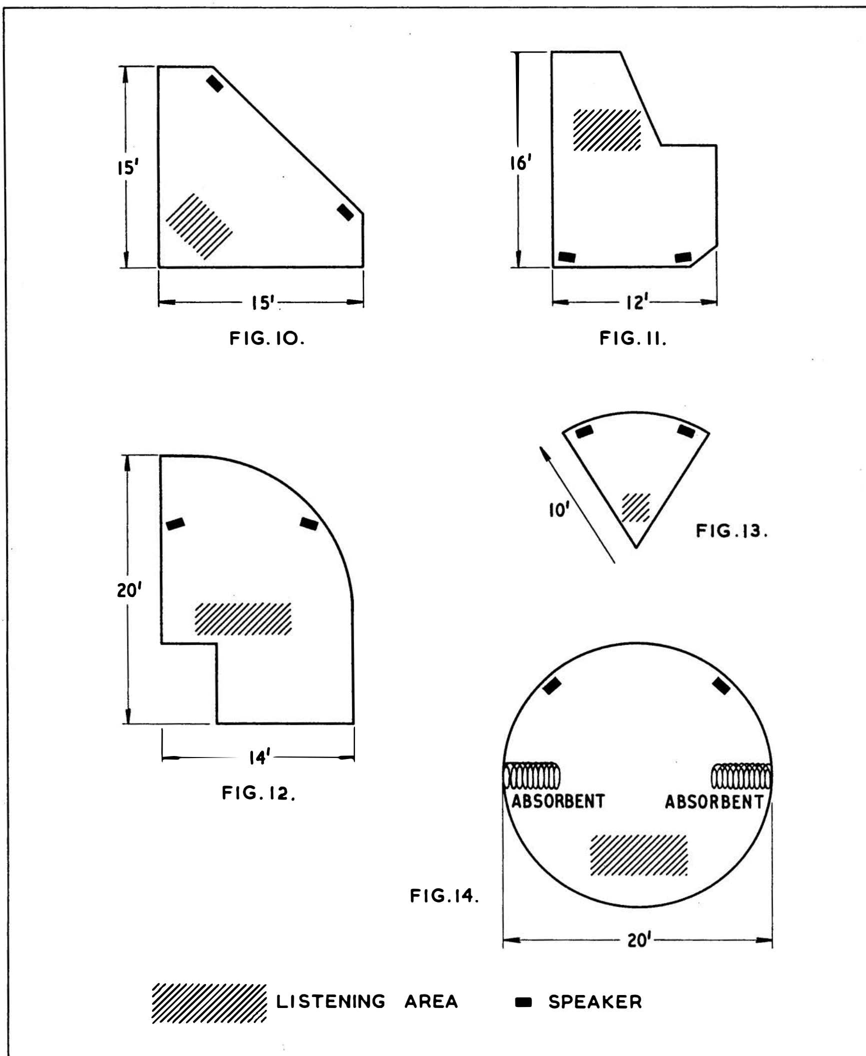


FIG. 10.
FIG. 11.
FIG. 12.
FIG. 13.
FIG. 14.

quencies, but even under such conditions fairly large speaker units may be needed if realistic levels are to be obtained. It becomes merely a matter of displacing sufficient volume of air per second. Very high frequency reproduction depends on the speaker unit and sufficient smooth output in the highest octave will almost inevitably be expensive. High fidelity is a luxury hobby (in the sense that one can exist quite easily without it) and as with other products, the best is expensive.

It is in the re-creation of the clarity and spatial properties of the live performance that speakers fall furthest behind. Anyone who attends concerts occasionally must be aware of the extraordinary clarity of orchestral sounds under favourable acoustics, even when everybody is playing fortissimo. They can all be heard separately without interaction because the air path between them and the listener is practically distortionless even at high levels. Technically, the intermodulation products due to the characteristics of the air itself are negligible; hence the 'easy' sound, so difficult to reproduce. Even assuming that the signals fed to the speakers are closely similar to the microphone outputs (certainly not always the case!), their transfer to audible waveforms presents enormous difficulties. Apart from the frequency response requirement, there is every chance for intermodulation to occur in various ways, so adding a certain 'muddiness' and lack of precision. Various techniques are used to reduce these distortions, but the majority of speakers cannot compare with power amplifiers for intermodulation performance.

* * *

Speakers vary considerably in the degree of 'coloration' they introduce from diaphragm misbehaviour or unwanted enclosure vibration. This represents another limitation on fidelity, but if only mild and of a 'natural' type it may pass unnoticed after a short period of listening. By 'natural' is meant the type of variation that would be heard if a musical instrument were played in different parts of a room. This can have a surprising effect on the tonal qualities of some instruments, but does not generally amount to a source of irritation. On the other hand, some speakers are so 'coloured' that they infuse any programme material with their own characteristics. This can be very tiring for those familiar with the original sounds, but may pass unnoticed or be accepted as natural by some who listen to speakers for much of the time.

High quality stereo reproduction represents a notable advance toward reality compared with mono on the majority of programme material. Even the solo voice or instrument can benefit, since the illusion of actual presence can be heightened by a nearer re-creation of the surrounding acoustics. Some of the earlier misapplications of stereo possibilities have given it a bad name in some quarters, but as someone said 'Handel never heard mono'. In fact he never heard stereo either, but something better still—a three-dimensional orchestra playing in three-dimensional acoustics. It must be accepted that at the present state of the art domestic stereo can at best simulate a large window opening on to the concert hall. Within this setting the signal information is restricted to that in a horizontal plane, although certain fortuitous impressions of height are obtainable.

Depending on the degree of success which the speaker designer has achieved in maintaining its distribution characteristics constant over a wide frequency range, so will the stability and sharpness of the sound images vary, especially at listening position far removed from the axial 'stereo seat'. To some this is all important, to others of little interest as long as the sound is clean. Most people prefer stereo reproduction to even double mono, but their reasons vary markedly.

* * *

In a moderately lively concert hall or reverberant cathedral a considerable portion of the sound is heard by reflection from the walls. This imparts a distinctive quality and atmosphere to aural impressions not as yet re-created by conventional stereo systems, which only cover a relatively small part of the original angular field. Encouraging demonstrations of 'ambiophony' have been given, where, under domestic conditions, delayed signals derived from the programme sources have been radiated around the listeners remote from the main stereo speakers. This can give a more convincing impression of actual presence in the original acoustic environment and may be an important factor in future stereo systems.

The foregoing survey of the ways in which speakers do *not* reach perfection need not deter those seeking a new source of entertainment and pleasure. Despite all the possible limitations, a close subjective relationship with the original sound may be obtained with stereo speakers; so close sometimes that direct comparison is possible without disgrace. A genuine feeling of participation may be evoked and a degree of pleasure and satisfaction felt approaching that obtained at the actual performance. Even better, the listener may occupy a more comfortable seat, set the sound level and balanced to his liking, take refreshment and even cough without censure!

On the other hand, the nearer the sound field approaches the original, the more obvious do certain psycho-acoustic anomalies become. Here is the listener, fully aware that he is sitting at home facing a blank wall, yet his brain has to accept the fact that a full orchestra appears to be playing some distance beyond the wall, acoustically opaque as it must be. In addition the image is flanked by two objects, at best resembling inactive furniture, at worst, obviously speakers. The use of suitable curtains can overcome a good deal of this difficulty, but the listener still has to visualise his room transported and grafted on to the concert hall. Possibly the only complete (and zero cost) solution is for the listener to close his eyes; extraneous noises apart, this is ideal, but not everybody wants to keep them closed all the time!

To many these considerations may be of little consequence, but, consciously or not, their whole attitude to reproduced sound may be affected. The very fact that the listener is aware that the sound is not live can predispose him to a certain distrust that what he hears is sufficiently close to the original. A sound level that would be quite acceptable in the auditorium may be regarded as 'much too loud' merely because he is aware that he is listening under domestic conditions. Of course, the limitations of stereo reproduction and residual distortions may play a role here, but even if the sound field were virtually perfect some reaction to realistically high levels might occur. Again, what what be ddescribed as a 'full' bass response at the original performance and accepted for what it was would almost certainly be labelled 'boomy' if heard in smaller domestic rooms. Effects passing as 'colour' when present at a concert might be suspected as distortion when reproduced via speakers.

It will be seen that some conditioning of the mind may be necessary when listening to stereo speakers, but, inconsistent illusions or not, their degree of faithfulness to the original always depends initially on the speaker/room/listener relationship, so it looks as if there will always be plenty of scope for experiments!

DIRECTORY OF SPEAKERS AND ENCLOSURES

● This directory is divided into two parts. **Part 1** deals with the range of drive units which, by makers' specifications, are within the Hi-Fi classification. **Part 2** deals with complete speaker systems and enclosures. These, as a general rule, embody the drive units of Part 1. For economy of space the following abbreviations are used: **H.C.**—handling capacity; **F.R.**—frequency range; **c/o**—cut-off; **v.c.i.**—voice coil impedance; **r.c.f.**—recommended crossover frequency (and in Part 2) **Rec.**—recommended units; Height by Width by Depth are the order of printed dimensions.

PART I—DRIVE UNITS

RICHARD ALLAN RADIO LTD., Bradford Road, Gomersal, Near Leeds, Yorkshire. Tel.: Cleckheaton 2442/3. Cables: Acoustics, Bradford.

CB12. 12 in. Single paper cone. Doped fabric surround. Voice coil $1\frac{1}{2}$ in. (copper). v.c.i. 8 or 15 ohms. Gap flux 12,000 gauss. Total flux 90,000 maxwells. Ceramic magnet. H.C. 8W. F.R. 20 c/s-9 Kc/s. r.c.f. 1,000 c/s. Price: £9.

CB12T. 12 in. Paper cone + tweeter inner. Doped fabric surround. Voice coil $1\frac{1}{2}$ in. (copper). v.c.i. 8 or 15 ohms. Gap flux 12,000 gauss. Total flux 90,000 maxwells. Ceramic magnet. H.C. 8W. F.R. 25 c/s-15 Kc/s. Price: £9 5s. 7d.

CG12. 12 in. Single paper cone. Doped fabric surround. Voice coil $1\frac{1}{2}$ in. (copper). v.c.i. 8 or 15 ohms. Gap flux 14,000 gauss. Total flux 105,000 maxwells. Ceramic magnet. H.C. 10W. F.R. 25 c/s-9 Kc/s. r.c.f. 1,000 c/s. Price. £10 2s. 6d.

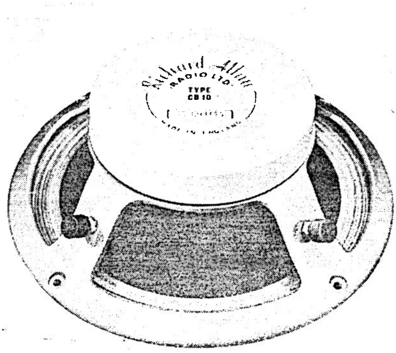
CG12T. 12 in. Paper cone + tweeter inner. Doped fabric surround. Voice coil $1\frac{1}{2}$ in. (copper). v.c.i. 8 or 15 ohms. Gap flux 14,000 gauss. Total flux 105,000 maxwells. Ceramic magnet. H.C. 10W. F.R. 25 c/s-15 Kc/s. Price: £10 8s.

CB4 Tweeter. 4 in. paper cone. Cambric surround. Voice coil $\frac{9}{16}$ in. Gap flux 10,000 gauss. Total flux 15,000 maxwells. H.C. 3W. v.c.i. 15 ohms. F.R. 2 Kc/s-17 Kc/s. r.c.f. 5 Kc/s. Price: £2 0s. 7d.

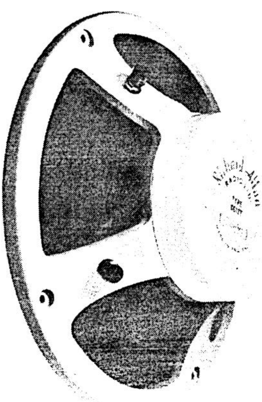
CR5. 5 in. paper cone. Neoprene surround. Voice coil 1 in. Gap flux 14,000 gauss. Total flux 56,000 maxwells. H.C. 6W. v.c.i. 8 or 15 ohms. F.R. 30 c/s-10 Kc/s. Specifically designed for low volume infinite baffle. Price: £6 1s. 10d.

812F. 8 in. mid-range. Paper cone, doped cambric surround. Voice coil 1 in. Gap flux 12,000 gauss. Total flux 48,000 maxwells. H.C. 5W. v.c.i. 8 or 15 ohms. F.R. 50 c/s-10 Kc/s. Price: £3 15s.

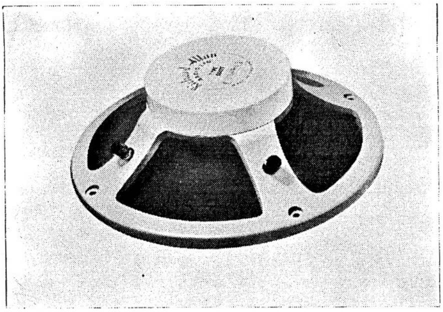
CG8. 8 in. paper cone, doped cambric surround. Voice coil 1 in. Gap flux 14,000 gauss. Total flux 56,000 maxwells. H.C. 6W. v.c.i.



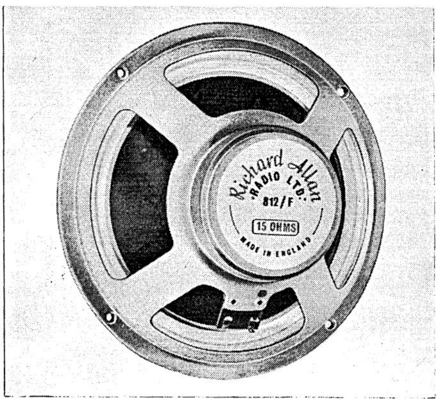
Richard Allan CB 10



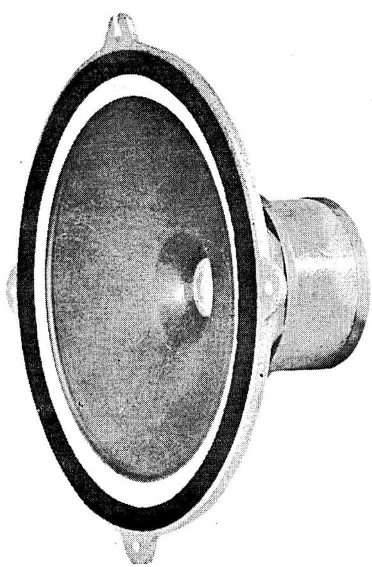
*Richard Allan CG*12*T*



Richard Allan CG 12*T*



Richard Allan 812/*F*



Bakers Selhurst 15 *in/CS*

8 or 15 ohms. F.R. 50 c/s-10 Kc/s. Price: £5 17s. 6d.

CG8T. 8 in. paper cone, doped cambric surround plus tweeter inner. Voice coil 1 in. Gap flux 14,000 gauss. Total flux 56,000 maxwells. H.C. 6W. v.c.i. 8 or 15 ohms. F.R. 50 c/s-17 Kc/s. Price: £6 3s. 11d.

CB10. 10 in. paper cone, doped cambric surround. Voice coil 1½ in. Gap flux 12,000 gauss. Total flux 90,000 maxwells. H.C. 8W. v.c.i. 8 or 15 ohms. F.R. 40 c/s-6 Kc/s. Price: £6 16s. 11d.

CB10T. 10 in. paper cone, doped cambric surround plus tweeter inner. Voice coil 1½ in. Gap flux 12,000 gauss. Total flux 90,000 maxwells. H.C. 8W. v.c.i. 8 or 15 ohms. F.R. 40 c/s-15 Kc/s. Price: £7 3s. 7d.

CG10. 10 in. paper cone, doped cambric surround. Voice coil 1½ in. Gap flux 14,000 gauss. Total flux 105,000 maxwells. H.C. 10W. v.c.i. 8 or 15 ohms. F.R. 40 c/s-6 Kc/s. Price: £7 16s. 8d.

CG10T. 10 in. paper cone, doped cambric surround plus tweeter inner. Voice coil 1½ in. Gap flux 14,000 gauss. Total flux 105,000 maxwells. H.C. 10W. v.c.i. 8 or 15 ohms. F.R. 40 c/s-15 Kc/s. Price: £8 3s. 2d.

CG12 Super. 12 in. paper cone, doped cambric surround. Voice coil 2 in. Gap flux 14,000 gauss. Total flux 182,000 maxwells. H.C. 15W. v.c.i. 8 or 15 ohms. F.R. 25 c/s-5 Kc/s. Price: £12 7s. 6d.

CG12 Super HD. 12 in paper cone and surround. Voice coil 2 in. Gap flux 14,000 gauss. Total flux 182,000 maxwells. H.C. 25W. v.c.i. 8 or 15 ohms. F.R. 60 c/s-5 Kc/s. Price: £12 7s. 6d.

CG15. 15 in paper cone, doped cambric surround. Voice coil 2 in. Gap flux 17,000 gauss. Total flux 220,000 maxwells. H.C. 20W. v.c.i. 8 or 15 ohms. F.R. 20 c/s-5 Kc/s. Price: £18.

CG15 HD. 15 in. paper cone and surround. Voice coil 2 in. Gap flux 17,000 gauss. Total flux 220,000 maxwells. H.C. 30W. v.c.i. 8 or 15 ohms. F.R. 60 c/s-5 Kc/s. Price: £18.

BAKERS "SELHURST" RADIO, 523 London Road, Thornton Heath, Surrey. Tel.: Thornton Heath 7798.

12 in. de-luxe fibre curvilinear cone, bakelised apex. Foam surround. Voice coil 1½ in. Gap flux 15,000 gauss. H.C. 15W. v.c.i. 3 or 15 ohms. F.R. 20-16,000 c/s. Price: £9 9s.

Super Twelve AV/D. 12 in. fibre curvilinear cone, bakelised apex. Foam surround. Voice coil 1½ in. Gap flux 17,000 gauss. Aluminium voice coil and drive. H.C. 20W. v.c.i. 15 ohms. F.R. 20-20,000 c/s. Price: £16 16s.

15 in./CS Auditorium. Fibre cone, bakelised apex. Foam surround. Voice coil 2 in. Gap flux 15,000 gauss. H.C. 15W. v.c.i. 8 or 15 ohms. F.R. 20 c/s-13 Kc/s. r.c.f. 5,000 c/s. Also supplied with normal roll surround rated at 35W. Price: £18 18s.

Guitar 50W. 15 in. moulded fibre cone of special type. Treated moulded fibre surround. Voice coil 2 in. diameter of heat-proofed seamless paxolin. Imp. 8 or 15 ohms. Gap flux 16,000 gauss. H.C. 15W. F.R. 20 c/s-12 Kc/s. r.c.f. 2-3 Kc/s. Price: £18 18s.

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CELESTION LTD., Ferry Works, Thames Ditton, Surrey. Tel.: Emberbrook 3402/6. Cables: Voicecoil, Thames Ditton.

Studio Series CX1512. 12 in. coaxial unit comprising paper cone bass speaker and pressure driven tweeter. Plastaflex surround. Bass voice coil 1¾ in. diameter, treble voice coil ¾ in. diameter, both copper wound. Imp. 15 ohms. Gap flux 13,000 gauss. Total flux 88,000 maxwells. H.C. 15W. F.R. 30 c/s-15 Kc/s. Price: £11 10s.

Studio Series CX2012. 12 in. coaxial unit comprising paper cone bass speaker and pressure driven tweeter. Hi-flex free surround. Bass voice coil 1¾ in. diameter copper wound, treble voice coil 1 in. diameter aluminium wound. Imp. 15 ohms. Gap flux 17,000 gauss. Total flux 180,000 maxwells. H.C. 20W. F.R. 30 c/s-18 Kc/s. Price: £16 10s.

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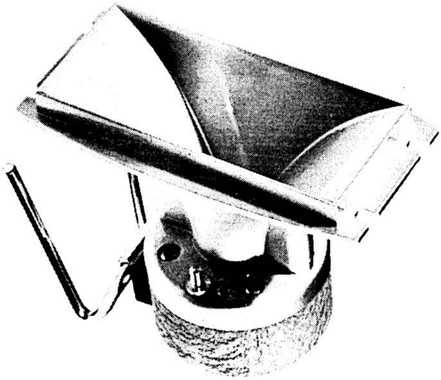
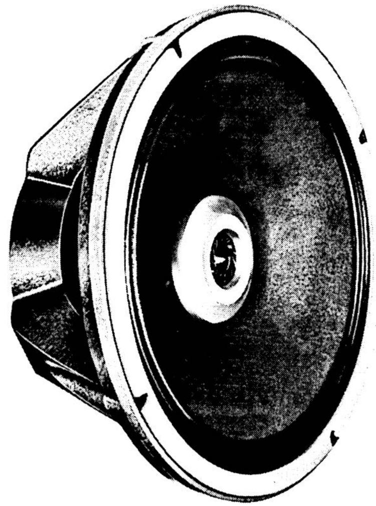
DECCA SPECIAL PRODUCTS, Decca Radio and Television Division of the Decca Record Company Ltd., Ingate Place, Queenstown Road, London, S.W.8. Tel.: Macauley 6677.



Eagle HT20 Rectangular Horn Tweeter



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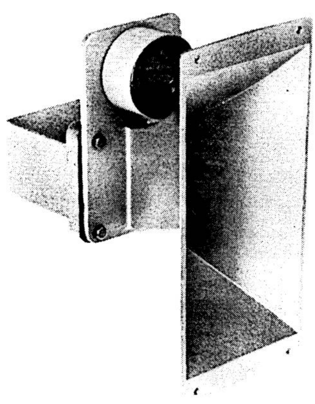
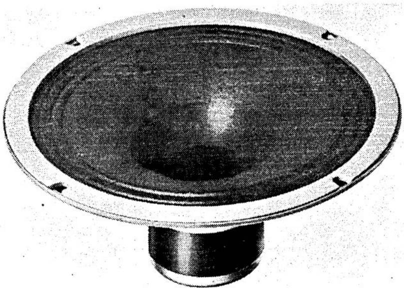
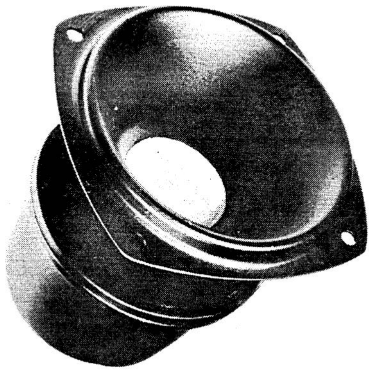
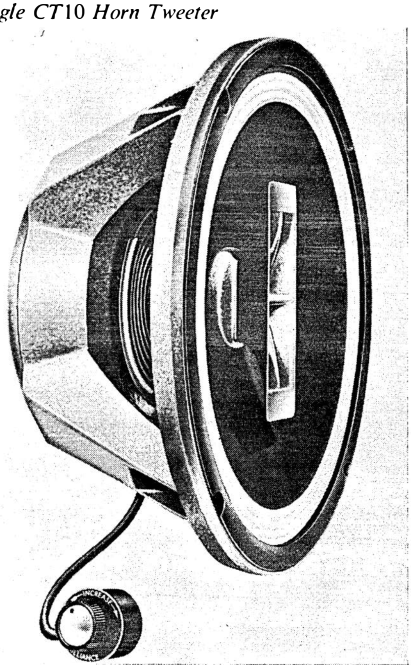


Kelly Mk 2 Ribbon





*Eagle CT*10 *Horn Tweeter*



*Celestion CX*2012

Kelly ribbon Mk. II. Ribbon HF unit. 2 micron aluminium ribbon element. Imp. 15 ohms at 400 c/s. Handling capacity 10W. F.R. 2·5-25 Kc/s. Rec. crossover 2·5 Kc/s. Rear face of ribbon sealed-in to permit mounting in enclosure without inter-modulation. Built-in transformer. Air coupling by catenoidal horn. Rigid diecast assembly. Price: £11 10s.

Kelly LF driver Mk. III/IIIA. 12 in. direct radiator. Curvilinear impregnated paper cone. Doped fabric concertina surround. $1\frac{1}{2}$ in. diameter voice coil. Imp. 15 ohms at 400 c/s. Gap flux 14,000 gauss. Total flux 110,000 maxwells. H.C. 15W. F.R. 30 c/s-5 Kc/s. Rec. crossover 2·5 Kc/s. $6\frac{1}{2}$ lb. ceramic ring magnet. Free air resonance 30-35 c/s. Weight: $8\frac{3}{4}$ lb. Price: £11 10s.

Kelly LF driver Mk. V/VG. 12 in. direct radiator. Curvilinear impregnated paper cone. Doped fabric concertina surround. Type VG has impregnated fibre surround. 2 in. diameter voice coil. Imp. 15 ohms at 400 c/s. Gap flux 14,000 gauss. Total flux 250,000 maxwells. H.C. 35W. F.R. 30 c/s-5 Kc/s. Rec. crossover 2.5 Kc/s. Free air resonance: Type V 25 c/s, Type VG 55 c/s. 11 lb. ceramic ring magnet. Weight: 13 lb. Price: £14.

Kelly LF driver Mk. VII/VIIG. 15 in. direct radiator. Curvilinear impregnated paper cone. Doped fabric concertina surround. Type V11G has impregnated fibre surround. 2 in. diameter voice coil embedded in polyester resin. Imp. 15 ohms at 400 c/s. Gap flux 17,000 gauss. Total flux 350,000 maxwells. H.C. 50W. F.R. 30 c/s-5 Kc/s. Rec. crossover 2·5 Kc/s. Price: £20.

★

DUODE LTD., Westfield Mills, Broad Lane, Bramley, Leeds, 13. Tel.: Pudsey 77536.

Duode Super 12. Linen moulded cone. Foam plastic surround. Incorporates original Barker-patented aluminium speech coil former fitted with latex sleeve. This applies negative feedback and gives response 20 c/s-20 Kc/s ± 2 dB. Price: £17 10s.

★

EAGLE PRODUCTS. Distributors: B. Adler & Sons (Radio) Ltd., 32a Coptic Street, London, W.C.1. Tel.: Museum 9606. Cables: Reldab.

CR12AE. 12 in. coaxial. Paper cone, plastic treated surround. 2 in. aluminium voice coil.

v.c.i. 16 ohms. Total flux 85,000 maxwells. H.C. 10W. F.R. 30 c/s-16 Kc/s. c.f. 1,800 c/s. Price: £8 8s.

8A7. 8 in. coaxial. Paper cone, plastic treated surround. 1 in. aluminium voice coil. v.c.i. 16 ohms. Total flux 53,000 maxwells. H.C. 6W. F.R. 50 c/s-16 Kc/s. Price: £3 7s. 6d. (U.K. purchase Tax 11s. 3d.).

CX300. 12 in. coaxial. Paper cone, plastic treated surround. 3 in. aluminium voice coil. v.c.i. 16 ohms. Gap flux (woofer) 12,000 gauss; (tweeter) 10,500 gauss. Total flux (woofer) 200,000 maxwells; (tweeter) 18,000 maxwells. H.C. 15W. F.R. 30 c/s-16 Kc/s. c.f. 2,500 c/s. Price: £12 12s.

CR30AE. 12 in. coaxial with additional tweeter. Paper cone, plastic treated surround. 2½ in. aluminium voice coil. v.c.i. 16 ohms. Gap flux (woofer) 10,500 gauss; (tweeter) 11,000 gauss. Total flux (woofer) 15,000 maxwells; (tweeter) 13,000 maxwells. H.C. 10W. F.R. 30 c/s-16 Kc/s. c.f. 1,800 c/s and 5,000 c/s. Price: £10 10s.

8CX.50. Twin unit comprising 8 in. woofer and horn tweeter. Roll surround. Imp. 16 ohms. Woofer 10,500 gauss, tweeter 12,000 gauss. 15W. F.R. 30 c/s-22 Kc/s. Resonant freq. 30 c/s. Crossover 3 Kc/s. Price: £9 15s.

HT.40. Horn tweeter with aluminium ribbon voice coil. Total flux 30,000 maxwells. 20W. F.R. 3 Kc/s-20 Kc/s. Crossover 3 Kc/s. Price: £4 9s. 6d.

CT10 Horn Tweeter. 3¼ in. Aluminium cone and surround. Voice coil 1 in. (aluminium). v.c.i. 16 ohms. H.C. 10W. F.R. 1,500 c/s-18 Kc/s. r.c.f· 3,000 c/s. Price: £1 9s. 6d.

HT20 Rectangular Horn Tweeter. 4 × 2 in. Aluminium cone. Voice coil 1 in. (aluminium). v.c.i. 16 ohms. Gap flux 13,500 gauss. H.C. 20W. F.R. 1,500 c/s-18 Kc/s. r.c.f· 3,000 c/s. Price: £3 9s. 6d.

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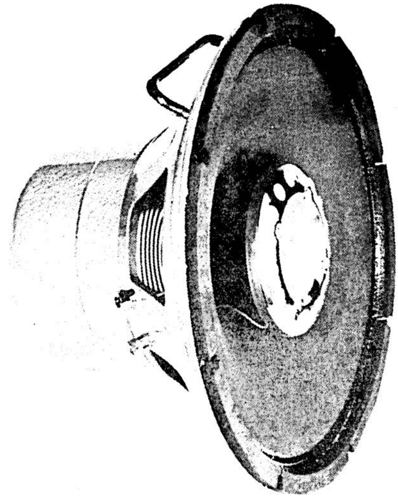
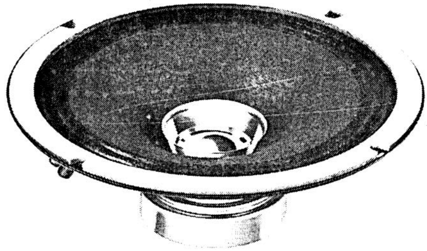
ELAC. Electro Acoustic Industries Ltd., Stamford Works, Broad Lane, Tottenham, London, N.15. Tel.: Tottenham 0505/9. Cables: Elac London, N.15.

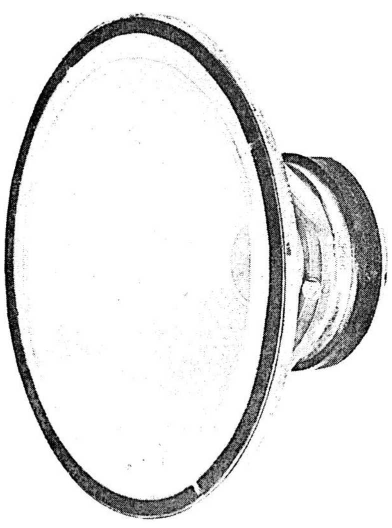
Elac Type 8N/148 (N 832). 8 in. Exponential paper cone. Paper surround, integral with cone. Voice coil 1 in. copper. v.c.i. 15 ohms. Gap flux 12,000 gauss. Total flux 48,300 maxwells. H.C. 5 watts. F.R. 55 c/s-



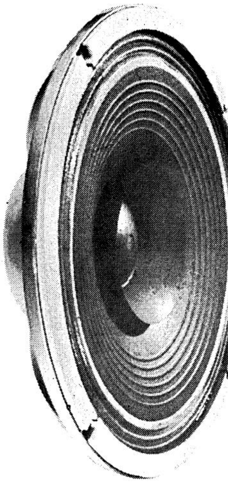
Eagle CX 300



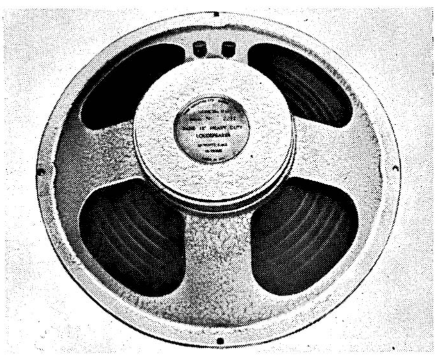
Elac Type 50/12



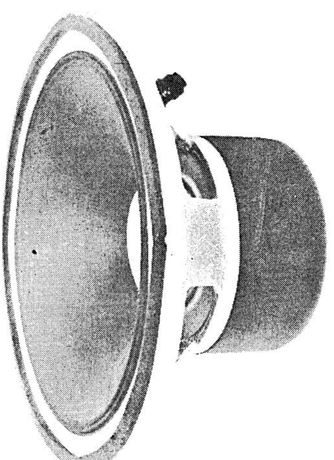
Duode super 12-*in*



Eagle CR12AE



Fane Model 152/17



Fane Model 121*A*

11 Kc/s (loaded conditions). r.c.f. High frequency crossover 8,000 c/s. Price: £2 15s. (U.K. purchase tax 8s. 10d.).

Elac 50/12 (Ceramic magnet). 8 in. Exponential paper cone, plus inner cone. Paper-plasticised surround. Voice coil 1 in. copper. v.c.i. 3 ohms. Gap flux 10,000 gauss. Total flux 40,300 maxwells. H.C. 5W. F.R. 55 c/s-12 Kc/s. r.c.f. High frequency crossover 8,000 c/s. Price including tax: £3 3s.

★

EMI SOUND PRODUCTS LTD., Hayes, Middlesex. Tel.: Hayes 3888. Cables: Emisound, London.

92390 PAL. $13\frac{1}{2} \times 8\frac{1}{8}$ in. elliptical. Paper main-cone/aluminium centre-cone. Paper surround. Voice coil 1 in. copper wire. v.c.i. 3 ohms. Gap flux 11,000 gauss. Total flux 43,500 maxwells. H.C. 10W. F.R. 40 c/s-7 Kc/s. r.c.f. 6,000 c/s. Price: £2 11s. 6d.

92390 PBL. Details as for PAL. v.c.i. 15 ohms.

92390 PEL. $13\frac{1}{2} \times 8\frac{1}{8}$ in. elliptical. Paper main cone/aluminium centre cone. PVC surround. Voice coil 1 in. copper wire. v.c.i. 3 ohms. Gap flux 13,000 gauss. Total flux 69,000 maxwells. H.C. 10W. (20W version also available). F.R. 20 c/s- 5 Kc/s. r.c.f. 4,500 c/s. Price: £5 19s.

92390 PFL. Details as for PEL. v.c.i. 15 ohms.

92390 PE. Combination loudspeaker: $13\frac{1}{2} \times 8\frac{1}{8}$ in. elliptical with $3\frac{1}{2}$ in. dia. tweeter. Paper main-cone/aluminium centre-cone/paper tweeter. PVC surround. Voice coil 1 in. copper wire. v.c.i. 3 ohms. Gap flux 13,000 gauss. Total flux 69,000 maxwells. H.C. 10W. F.R. 20 c/s-20 Kc/s. r.c.f. 5,000 c/s. L.C. filter is mounted on chassis. Price: £8 5s.

92390 PF. Details as for PE. v.c.i. 15 ohms.

97492 J. $2\frac{1}{2}$ in. hard PVC cone. Voice coil $\frac{1}{2}$ in. copper wire. v.c.i. 3 ohms. Gap flux 8,500 gauss. F.R. 5-15 Kc/s. r.c.f. 6,000 c/s. Price: £1 (U.K. purchase tax 3s. 5d.).

97492 E. Details as for Model J. v.c.i. 8 ohms.

97492 C. Details as for Model J. v.c.i. 15 ohms.

99110 N. $3\frac{3}{8}$ in. curved paper diaphragm. Paper surround. Voice coil $\frac{1}{2}$ in. copper wire.

v.c.i. 3 ohms. Gap flux 10,000 gauss. F.R. 3-20 Kc/s. r.c.f. 4,500 c/s. Price: £1 7s. 6d. (U.K. purchase tax 4s. 9d.).

99110 J. Details as for Model N. v.c.i. 8 ohms.

99110 M. Details as for Model N. v.c.i. 15 ohms.

★

FANE ACOUSTICS LTD., Hick Lane, Batley, Yorks. Tel.: Batley 1578. Cables: Fane, Batley.

Ionofane 601. Basic high frequency unit operating on the Ionophone principle which eliminates moving parts. F.R. level 3 Kc/s-30 Kc/s. Rec. crossover 3·5 Kc/s. H.C. HF portion of 20W music. Supplied complete with power unit. Price: £29 8s.

Model 121. 12 in. Paper cone. Foam surround. Voice coil 2 in. Gap flux 12,000 gauss. Total flux 160,000 maxwells. H.C. 20 W. v.c.i. 15 ohms. F.R. 30-5,000 c/s. r.c.f. 2,000 c/s. Price: £9.

Model 121A. Details as above, but aluminium voice coil. F.R. 30-10,000 c/s. r.c.f. 5,000 c/s. Price: £9 9s.

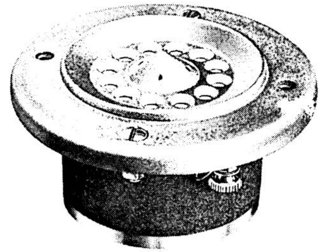
301 High Frequency Unit. Aluminium cone. Voice coil ¾ in. Gap flux 17,000 gauss. H.C. 12W. v.c.i. 15 ohms. F.R. 1,500-17,000 c/s. r.c.f. 2,000 c/s. Price: £3 15s.

Model 151. 15 in. loudspeaker. Paper cone. Foam surround. Voice coil 3 in. Gap flux 14,000 gauss. Total flux 361,000 maxwells. H.C. 35W. v.c.i. 15 ohms. F.R. 20-3,500 c/s. Price: £18.

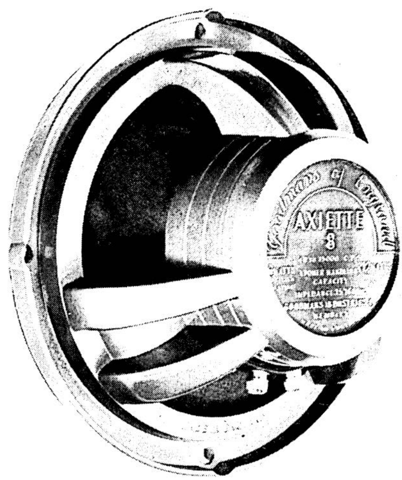
Model 122/12. 12 in. Paper cone. Foam rubber surround. Voice coil 2 in. (copper). v.c.i. 15 ohms. Gap flux 12,000 gauss. Total flux 160,000 maxwells. H.C. 15W. F.R. 20 c/s-5 Kc/s. r.c.f. 2,000 c/s. Price: £7 10s.

Model 122/14. 12 in. paper cone. Foam rubber surround. Voice coil 2 in. (copper). v.c.i. 15 ohms. Gap flux 14,000 gauss. Total flux 187,000 maxwells. H.C. 20W. F.R. 20-5,500 c/s. r.c.f. 2,000 c/s. Price: £9.

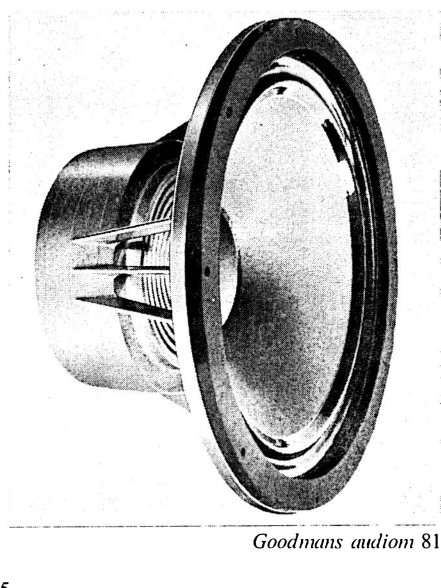
Model 122/17. 12 in. Paper cone. Foam rubber surround. Voice coil 2 in. (copper). v.c.i. 15 ohms. Gap flux 17,000 gauss. Total flux 227,000 maxwells. H.C. 25W. F.R. 20 c/s-7 Kc/s. r.c.f. 4,000 c/s. Price: £12.



Fane 301 *H.F. Unit*



Goodmans Axiette 8



Goodmans audiom 81

Model 153. 15 in. (Ceramic magnet). Heavy duty paper cone. Foam rubber surround. Voice coil 3 in. (copper). v.c.i. 15 ohms. Gap flux 14,500 gauss. Total flux 375,000 maxwells. H.C. 35W. F.R. 20-2,500 c/s. r.c.f. 1,500 c/s. Price: £16 10s.

Model 152/12. 15 in. Paper cone. Paper surround. Voice coil 2 in. (copper). v.c.i. 15 ohms. Gap flux 12,000 gauss. Total flux 160,000 maxwells. H.C. 20W. F.R. 25 c/s-4 Kc/s. r.c.f. 2,000 c/s. Price: £10.

Model 152/14. 15 in. Paper cone. Paper surround. Voice coil 2 in. (copper). v.c.i. 15 ohms. Gap flux 14,000 gauss. Total flux 187,000 maxwells. H.C. 25W. F.R. 25 c/s-5 Kc/s. r.c.f. 2,000 c/s. Price: £12.

Model 152/17. 15 in. Paper cone. Paper surround. Voice coil 2 in. (copper). v.c.i. 15 ohms. Gap flux 17,000 gauss. Total flux 227,000 maxwells. H.C. 30W. F.R. 25 c/s-6 Kc/s. r.c.f. 3,000 c/s. Price: £15.

Model 183. 18 in. Paper cone. Voice coil 3 in. Gap flux 14,500 gauss. Total flux 375,000 maxwells. H.C. 60W. F.R. 20 c/s-3 Kc/s. r.c.f. 2,000 c/s. Price: £25.

Model 122/10. 12 in. Paper cone. Paper surround. Voice coil 2 in. copper. v.c.i. 15 ohms. Gap flux 10,000 gauss. Total flux 100,000 maxwells. H.C. 20W. F.R. 30 c/s-5 Kc/s. r.c.f. 3,500 c/s. Price: £5 5s.

Model 122/10A. 12 in. Dual paper cones. Paper surround. Voice coil 2 in. aluminium. v.c.i. 15 ohms. Gap flux 10,000 gauss. Total flux 100,000 maxwells. H.C. 20W. F.R. 30 c/s-15 Kc/s. Price: £6 6s.

Model 851. 8 × 5 in. mid-range speaker. Paper cone. Paper surround. Copper voice coil. v.c.i. 15 ohms. Gap flux 15,000 gauss. Total flux 30,000 maxwells. H.C. 15W. in mid-range. F.R. 800 c/s-5 Kc/s. r.c.f. 800 and 3,500 c/s. Price: £3 (U.K. purchase tax 9s. 10d.).

★

GOODMANS INDUSTRIES LTD., Axiom Works, Wembley, Middx. Tel.: Wembley 1200. Cables: Goodaxiom, Wembley.

Axiette 8. 8 in. Paper cone. Plastic treated surround. Voice coil 1 in. Gap flux 13,500 gauss. Total flux 53,000 maxwells. H.C. 6W. v.c.i. 15 ohms. F.R. 40-15,000 c/s. Price: £4 15s. 7d. (U.K. purchase tax 15s. 4d.).

Axiom 10. 10 in. Paper cone. Plastic treated surround. Voice coil 1 in. Gap flux 13,500 gauss. Total flux 53,000 maxwells. H.C. 10W. v.c.i. 15 ohms. F.R. 40-15,000 c/s. Price: £5 13s. 11d. (U.K. purchase tax 18s. 4d.)

Axiom 80. 9½ in. Twin Diaphragm paper cone, free edge surround. Voice coil 1 in. Gap flux 17,000 gauss. Total flux 62,000 maxwells. H.C. 6W. v.c.i. 15 ohms. F.R. 20-20,000 c/s. Price: £18 8s. 11d. (U.K. purchase tax £2 19s. 2d.)

Trebax. Horn-loaded pressure tweeter. Aluminium diaphragm. Voice coil 1 in. H.C. suitable for inclusion in systems of up to 25W. v.c.i. 15 ohms at 10 Kc/s. F.R. 2,500-20,000 c/s. r.c.f. 5 Kc/s. Price: £6 16s. 11d.

Trebax 5K/20XL. Horn loaded pressure tweeter. Built in L/C crossover (5,000 c/s) and attenuator. Suitable for inclusion in systems of up to 20W. Dispersion angle 90°. Price: £7 13s. 9d.

Midax 650. Horn loaded pressure unit. Resin impregnated linen diaphragm. Diecast horn. Voice coil 1½ in. H.C. suitable for systems up to 25W. v.c.i. 15 ohms. F.R. 650-8,000 c/s. r.c.f. 950 and 5,000 c/s. Price: £10 6s. 3d.

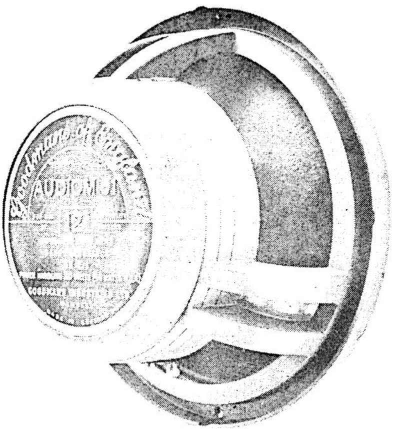
Audiom 51 bass. 12 in. Paper cone. Voice coil 1¾ in. (4·4 cm.). v.c.i. 15-16 ohms. Gap flux 13,000 gauss. Total flux 87,500 maxwells. H.C. 15W. Fundamental resonance 35 c/s. Price: £9 12s. 5d.

The Audiom 51 is available in two versions: Audiom 51 Bass-details as above, for use as bass unit in high fidelity systems. Audiom 51 Standard (50 c/s) for PA, guitars and all arduous conditions.

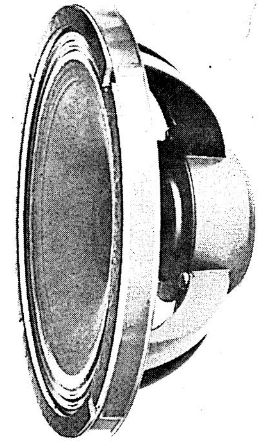
Audiom 61 bass. 12 in. Paper cone. Voice coil 1¾ in. (4·4 cm.). v.c.i. 15-16 ohms. Gap flux 16,500 gauss. Total flux 185,000 maxwell. H.C. 20W. Fundamental resonance 35 c/s. Price: £15.

The Audiom 61 is available in two versions: Audiom 61 Bass–details as above, for use as bass unit in high fidelity systems. Audiom 61 Standard (50 c/s) for PA, guitars and all arduous conditions.

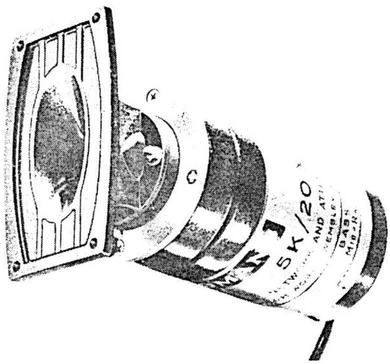
Axiom 201. 12 in. Twin diaphragm paper cone with pure plastic roll suspension. Voice coil 1¾ in. (4·4 cm.) (aluminium). v.c.i. 15-16 ohms. Gap flux 13,000 gauss. Total flux



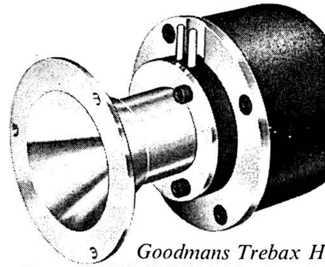
Goodmans Audiom 61



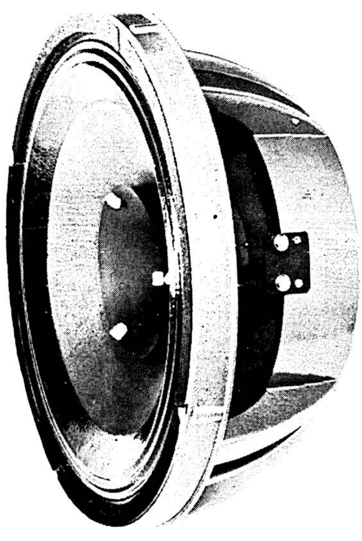
Goodmans Axiom 10



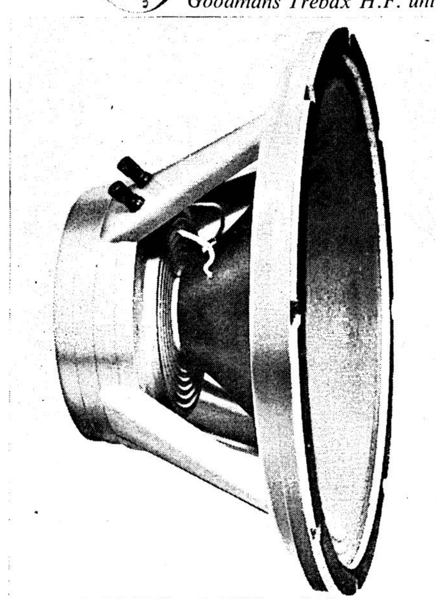
Goodmans Trebax 5K/20 *XL*



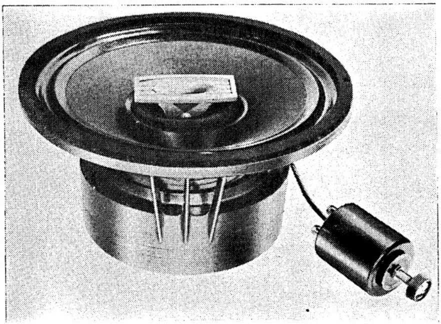
Goodmans Trebax H.F. unit



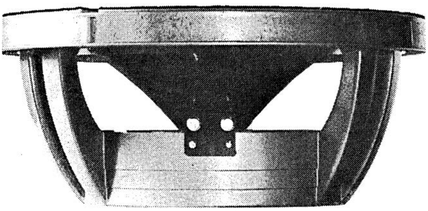
Goodmans Axiom 201



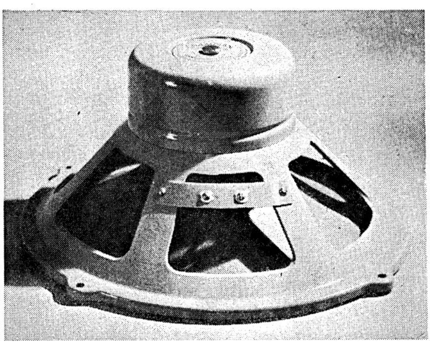
Goodmans audiom 91



Goodmans triaxiom 1220*C*



Goodmans Audiom 51 *Bass*



Grampian 1255/15

Isophon Orchester 12 *in. Dual Concentric*

87,500 maxwells, H.C. 15W. F.R. 30 c/s-16 Kc/s. Built-in mechanical crossover at 5,000 c/s. Price: £11 8s. 9d.

Axiom 301. 12 in. twin diaphragm paper cone with pure plastic roll suspension. Voice coil $1\frac{3}{4}$ in. (4·4 cm.) (aluminium). v.c.i. 15-16 ohms. Gap flux 16,500 gauss. Total flux 185,000 maxwells. H.C. 20W. F.R. 30 c/s-16 Kc/s. Built-in mechanical crossover of 5,000 c/s. Price: £15 18s. 9d.

Triaxiom 1220C. Three-way speaker assembly comprising 12 in. bass cone, a mid-range radiator, and a pressure driven horn-loaded HF unit with independent magnet system. Bass cone paper with pure plastic edge, mid-range cone bakelised paper, HF unit aluminium horn. Bass voice coil $1\frac{3}{4}$ in. diameter copper wound, HF voice coil 1 in. diameter aluminium wound. Imp. 15 ohms. Main gap flux 16,500 gauss. Total main gap flux 185,000 maxwells. H.C. 20W. F.R. 30 c/s-20 Kc/s. Built-in crossover at 2 Kc/s to mid-range and at 5 Kc/s to HF unit. Price: £19 9s. 1d.

Audiom 81 bass. 15 in. Paper cone. Pure plastic roll suspension. Voice coil 3 in. (7·6 cm.). v.c.i. 15-16 ohms. Gap flux 14,000 gauss. Total flux 269,000 maxwells. H.C. 25W. Fundamental resonance 30 c/s. Price: £25 6s. 3d.

The Audiom 81 is also available in 60 c/s version for special purposes.

The Audiom 81 bass (details above) with 30 c/s fundamental resonance is specially designed for use as the bass unit in a multiple system (with Midax and Trebax). In this case it must be mounted in the correct size of enclosure.

Audiom 91 Bass. 18 in. Paper cone. Voice coil 3 in. diameter. Imp. 15-16 ohms. Gap flux 14,000 gauss. Total flux 269,000 maxwells. H.C. 50W. Fundamental resonance 30 c/s. Price: £28 11s. 10d.

The Audiom 91 is also available with a resonance of 55 c/s (Standard version) for especially arduous conditions, PA, bass guitars, etc.

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GRAMPIAN REPRODUCERS LTD., Hanworth Trading Estate, Middx. Tel.: Feltham 2657/8/9. Cables: Reamp, Feltham.

Grampian 1255/15. 12 in. Paper impregnated cone and surround. Voice coil $1\frac{3}{4}$ in. Gap flux 14,500 gauss. Total flux 130,500 maxwells. H.C. 10W. v.c.i. 15 ohms. F.R. 35-15,000 c/s. Price: £10 10s.

T.C.12. 12 in. twin cone. Paper cones with plastic treated surround. Voice coil $1\frac{3}{4}$ in. diameter. Long type voice coil. Imp. 15 ohms. Gap flux 14,500 gauss. Total flux 130,500 maxwells. H.C. 10W. F.R. 35 c/s-15 Kc/s. Price: £10 15s.

★

ISOPHON-WERKE, Berlin-Tempelhof. U.K. Distributors: Britimpex Ltd., 16/22 Great Russell Street, London, W.C.1. Tel.: Museum 7600.

Orchester. 12 in. dual concentric. Voice coil $1\frac{1}{2}$ in. v.c.i. 4/16 ohms (switchable). Gap flux (LF) 11,000 gauss, (HF) 10,000 gauss. Total flux (LF) 104,000 maxwells, (HF) 8,000 maxwells. H.C. 10-20W., dependent on mounting. F.R. 25 c/s-20 Kc/s. Price (incl. tax): £19 19s.

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JORDAN-WATTS. Distributors: Boosey & Hawkes (Sales) Ltd., Sonorous Works, Deansbrook Road, Edgware, Middx. Tel.: Edgware 5581.

Jordan-Watts Modular. 6 in. square frame. Aluminium diaphragm with plastic surround. Voice coil $1\frac{1}{2}$ in. ceramic magnet. Imp. matching $7\frac{1}{2}$-16 ohms. H.C. 12W. F.R. 25 c/s-20 Kc/s. Price: £10 10s.

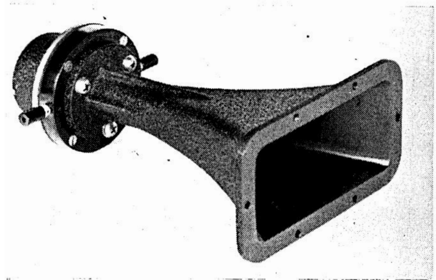
★

KEF ELECTRONICS LTD., Tovil, Maidstone, Kent. Tel.: Maidstone 55761. Cables: Kef, Maidstone.

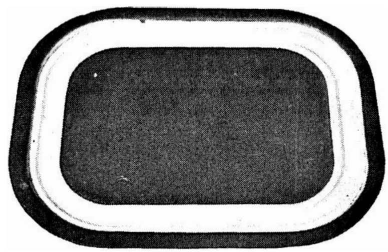
B139. 13 × 9 in. Exp. plastic and aluminium cone. Plastic coated fabric surround. Voice coil 2 in. (copper). v.c.i. 8-16 ohms. Gap flux 10,500 gauss. Total flux 137,000 maxwells. H.C. 15W. F.R. 30 c/s-4 Kc/s. r.c.f. 1,000 c/s. Price: £11 10s.

T15 tweeter. $1\frac{1}{2}$ in. Melinex dome. Centre pole Alcomax magnet. Melinex surround. Voice coil $1\frac{1}{2}$ in. (aluminium). v.c.i. 8-16 ohms. Gap flux 15,000 gauss. Total flux 53,500 maxwells. H.C. 15W. Treble only. F.R. 600-15,000 c/s. r.c.f. 1,000 c/s. Price: £6.

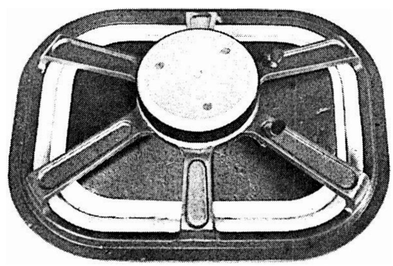
B1814. 18 × 14 in. Exp. plastic and aluminium cone. Plastic coated cloth surround. Voice coil 2 in. copper. v.c.i. 8-16 ohms. Gap flux 12,700 gauss. Total flux 165,000 maxwells. H.C. 25W. F.R. 20 c/s-2 Kc/s. r.c.f. 500 c/s. Price: £19.



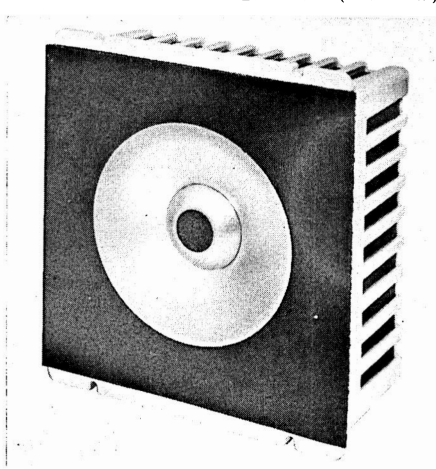
Goodmans Midax 650



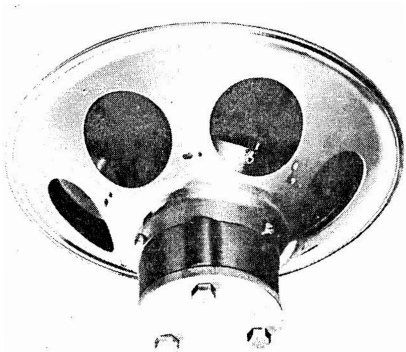
*KEF B*1814 (*front view*)



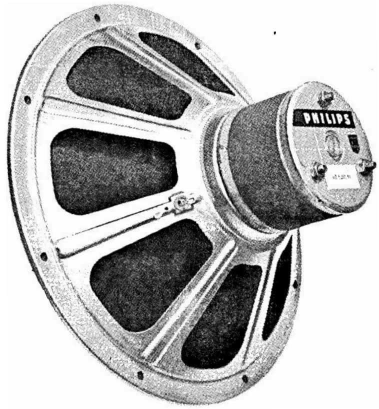
*KEF B*1814 (*rear view*)



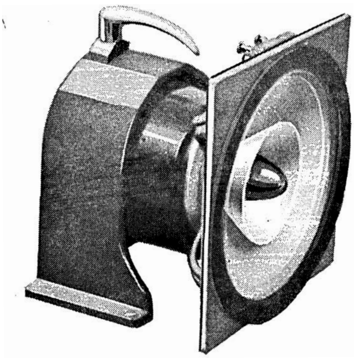
Jordon-Watts speaker drive module



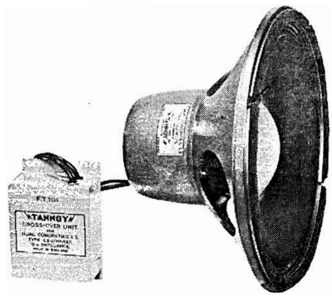
Philips 9710 *M*



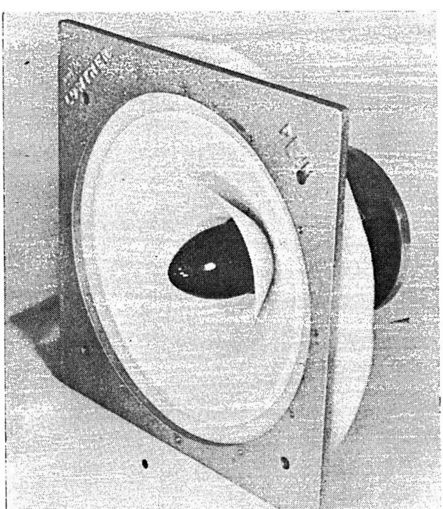
Philips AD 5200 *M*



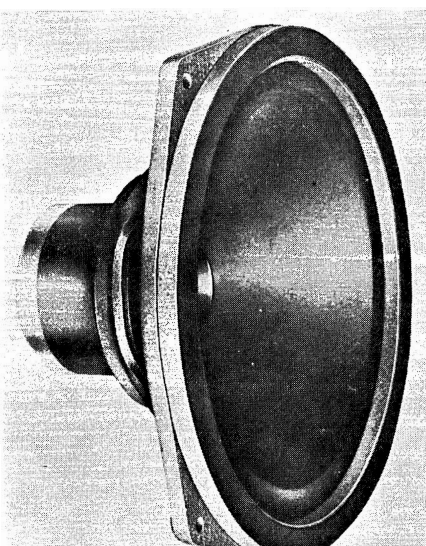
*Lowther P.M.*6



Tannoy Monitor "Twelve"



*Lowther PM*2 *Mk.* 1



*Vitavox K*15/40

K2 Baffle. Two units. Baffle size 22½ × 13½ in. Unit 1: 13 × 9 in.; plastic and aluminium cone; plastic coated cloth surround; voice coil 2 in. copper. Gap flux 10,500 gauss; total flux 137,000 maxwells. Unit 2: 1½ in. Melinex dome; Melinex surround; voice coil 1½ in. copper; gap flux 15,000 gauss; total flux 53,500 maxwells. Both units: v.c.i. 8-16 ohms; H.C. 15W. F.R. 40 c/s-15 Kc/s. r.c.f. 1 Kc/s. Price: £24 10s.

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KELLY. See Decca Special Products.

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LOWTHER MANUFACTURING CO., Lowther House, St. Mark's Road, Bromley, Kent. Tel.: Ravensbourne 5225. Cables: Lowther, Bromley.

P.M.6. 6 in. Selected paper cone. Plastic surround. Voice coil 39 mm. Gap flux 17,500 gauss. Total flux 196,000 maxwells. H.C. 6W.; 20W. programme material. v.c.i. 16 ohms. F.R. 30-18,000 c/s. Price: £18 18s.

P.M.2 Mk. I. 6 in. Selected paper cone. Plastic surround. Voice coil 39 mm. Gap flux 21,000 lines per sq. cm. Total flux 281,000 maxwells. H.C. 6W.; 20W. programme material. v.c.i. 15 ohms. F.R. 30-20,000 c/s. Price: £30.

P.M.2 Mk. II. 6 in. Selected paper cone. Plastic foam surround. Voice coil 39 mm. Gap flux 23,000 gauss. Total flux 350,000 maxwells. H.C. 6W.; 20W. programme material. v.c.i. 15 ohms. F.R. 25-22,000 c/s. Price: £40.

P.M.2 Mk. III. Details as P.M.2 Mk. I but with special bracket for securing within Acousta-Twin Enclosure.

P.M.3. 6 in. Selected paper cone. Plastic surround. Voice coil 39 mm. Gap flux 22,000 gauss. Total flux 307,750 maxwells. H.C. 6W.; 20W. programme material. v.c.i. 15 ohms. F.R. 20-20,000 c/s. Not sold separately from enclosure type T.P.1.

P.M.4. 6 in. Selected paper cone. Plastic surround. Voice coil 37 mm. Gap flux 24,000 gauss. Total flux 385,000 maxwells. H.C. 6W.; 20W. programme material. v.c.i. 16 ohms. F.R. 25-24,000 c/s. Price: £50.

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PHILIPS ELECTRICAL LTD., Century House, Shaftesbury Avenue, W.C.2. Tel.: Gerrard 7777. Cables: Phillamps, London.

9710M. 8 in. Dual cone. Paper corrugated surround. Voice coil 1 in. Gap flux 8,000 gauss. Total flux 97,000 maxwells. H.C. 10W. v.c.i. 7 ohms. F.R. 40-18,000 c/s. r.c.f. 500-1,000 c/s. Price: £4 19s. 6d. (U.K. purchase tax 16s.).

AD5200M. 12 in. Dual cone. Paper corrugated surround. Voice coil 1¼ in. Gap flux 11,000 gauss. Total flux 134,000 maxwells. H.C. 20W. Price: £10 10s.

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STENTORIAN. See Whiteley Electrical.

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TANNOY PRODUCTS LTD., West Norwood, London, S.E.27. Tel.: Gipsy Hill 1131. Cables: Tannoy, London.

Direct radiator. 12 in. Moulded fibre cone. Plastic treated surround. Voice coil 2 in. Gap flux 14,000 gauss. H.C. 15W. v.c.i. 20 ohms. F.R. 40-16,000 c/s. Price: £14 14s.

III LZ. 12 in. dual concentric. Moulded fibre cone. Plastic impregnated surround. Gap flux (L.F.) 10,000 (H.F.) 15,000 gauss. H.C. 10W. F.R. 23-20,000 c/s. r.c.f. (supplied) 1,300 c/s. v.c.i. 15 ohms. Price: £22 10s.

Monitor "Twelve". 12 in. Moulded fibre cone. Plastic treated surround. Voice coils (H.F. and L.F.) 2 in. Gap flux (L.F.) 11,500 (H.F.) 15,000 gauss. H.C. 30W. F.R. 25-20,000 c/s. r.c.f. 1,700 c/s (supplied). Price: £30 15s.

Monitor "Fifteen". 15 in. Moulded fibre cone. Plastic treated surround. Voice coils (H.F. and L.F.) 2 in. Gap flux (L.F.) 13,500 (H.F.) 18,000 gauss. H.C. 50W. F.R. 23-20,000 c/s. r.c.f. 1,000 c/s (supplied). Price: £37 10s.

Direct radiator for electronic instruments. 15 in. Moulded fibre cone. Plastic treated surround. Voice coil 2 in. v.c.i. 7·5 ohms. Gap flux 14,000 gauss. H.C. 40W. F.R. 25 c/s-14 Kc/s. Price: £22.

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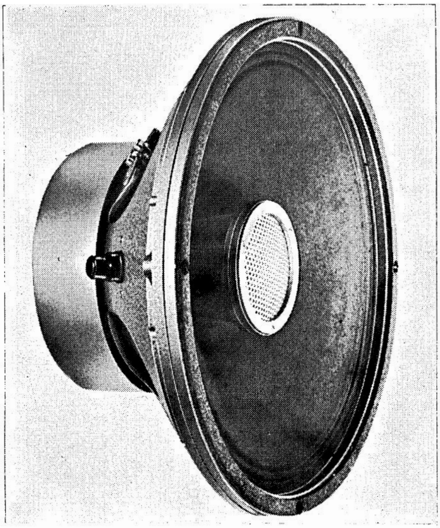
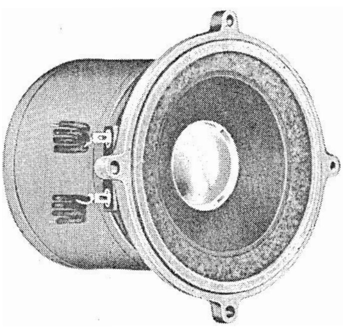
VITAVOX LTD., Westmoreland Road, London, N.W.9. Tel.: Colindale 8671. Cables: Vitavox, London, N.W.9.

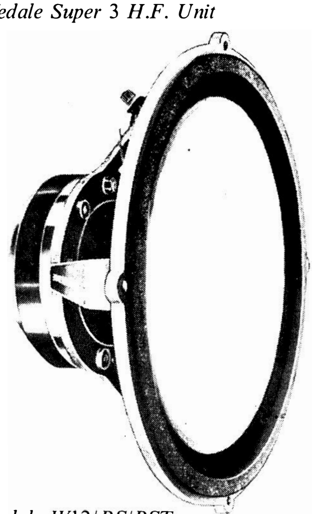
Duplex coaxial DU121. 12 in. paper cone. Plastic treated paper surround. 3 in. polyester film cone and surround. Voice coil (LF) 1·78 in. (HF) 0·65 in. Gap flux (LF) 16,000



Vitavox DU 121



Wharfedale Super 3 *H.F. Unit*



*Wharfedale W*12/*RS*/*PST*

gauss, (HF) 12,000 gauss. Total flux (LF) 180,000 maxwells, (HF) 15,000 maxwells. H.C. 15W. v.c.i. 15 ohms. F.R. 30 c/s-15 Kc/s nominal. Price: £19 19s.

AK123 Heavy Duty. 12 in. paper cone. [illegible] surround. Voice coil 1·78 in. Gap flux [illegible] gauss. Total flux 180,000 maxwells. H.C. 20W. v.c.i. 15 ohms. F.R. 50 c/s-8 Kc/s. Price: £14 10s.

AK124. 12 in. paper cone. Paper surround. Voice coil 1·78 in. Gap flux 16,000 gauss. Total flux 180,000 maxwells. H.C. 15W. v.c.i. 15 ohms. F.R. 30 c/s-13 Kc/s. Price: £14 10s.

K15/40. 15 in. paper cone. Paper surround. Voice coil $2\frac{1}{4}$ in. Gap flux 14,000 gauss. Total flux 260,000 maxwells. H.C. 40W nominal. F.R. 50 c/s-8 Kc/s. nominal. (H.C. and F.R. determined by enclosure). v.c.i. 15 ohms. Price: £26 5s.

AK150. 15 in. paper cone. Treated paper surround. Bass resonance 30-35 c/s. Voice coil 2·25 in. Gap flux 14,000 gauss. Total flux 260,000 maxwells. H.C. 25W nominal. F.R. 30 c/s-5 Kc/s. nominal. (H.C. and F.R. determined by enclosure). v.c.i. 15 ohms. Price: £27 5s.

AK151. Driver for bass horn of dual channel system. 15 in. paper cone, paper surround. Bass resonance 40-50 c/s. Voice coil $2\frac{1}{4}$ in. Gap flux 14,000 gauss. Total flux 260,000 maxwells. D.C. resistance of voice coil 5·5-6·5 ohms. H.C. and F.R. determined by associated horn characteristics. Price: £27 5s.

AK152. Driver for bass horn of dual channel system. Treated paper surround. Bass resonance 30-35 c/s. Other details as for AK151. Price: £28 5s.

S2 HF pressure unit. Diaphragm pressure-formed from lightweight aluminium alloy. Voice coil 3 in. diameter. Gap flux 16,000 gauss. Total flux 150,000 maxwells. H.C. above 200 c/s 10W. Nominal F.R. 200 c/s-16 Kc/s. Rec. crossover 500 c/s. Price: £35.

HF Dispersive Horn. Designed for use with S2 pressure unit. Case in aluminium alloy. Non-resonant. Cut-off frequency 300 c/s. Price: £18.

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WHARFEDALE WIRELESS WORKS LTD., Idle, Bradford. Tel.: Idle 1235-6. Cables: Wharfdel, Idle, Bradford.

8 in. Bronze/RS/DD. 8 in. full range unit. Paper double diaphragm cone. Fabric roll surround. Voice coil 1 in. aluminium. v.c.i. 12-15 ohms. Gap flux 10,500 gauss. Total flux 41,500 maxwells. H.C. 4W. F.R. 50 c/s-20 Kc/s. Price: £3 5s. (U.K. purchase tax 10s. 10d.).

10 in. Bronze/RS/DD. 10 in. full range unit. Paper double diaphragm cone. Fabric roll surround. Voice coil 1 in. aluminium. v.c.i. 12-15 ohms. Gap flux 10,500 gauss. Total flux 41,500 maxwells. H.C. 6W. F.R. 35 c/s-10 Kc/s. Price £3 19s. 6d. (U.K. purchase tax 13s. 3d.).

Golden 10/RS/DD. 10 in. Double diaphragm assembly. Roll surround. Voice coil 1 in. Gap flux 14,500 gauss. Total flux 60,000 maxwells. H.C. 8W. v.c.i. 12-15 ohms. F.R. 30-20,000 c/s. Price: £6 15s. (U.K. purchase tax £1 2s. 5d.).

Super 10/RS/DD. 10 in. Paper (double diaphragm) cone. Roll surround. Voice coil 1 in. Gap flux 16,000 gauss. Total flux 85,000 maxwells. H.C. H.C. 10W. v.c.i. 12-15 ohms. F.R. 30-20,000 c/s. Price: £9 7s. 6d. (U.K. purchase tax £1 11s. 2d.).

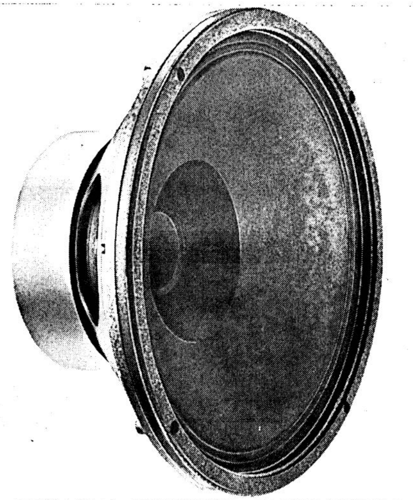
Super 12/RS/DD. 12 in. Double diaphragm assembly. Roll surround. Voice coil $1\frac{3}{4}$ in. (aluminium). Gap flux 17,000 gauss. Total flux 190,000 maxwells. H.C. 20W. v.c.i. 12-15 ohms. F.R. 25-20,000 c/s. Price: £17 10s.

W15/RS. 15 in. Paper cone. Roll surround. Voice coil 2 in. Gap flux 13,500 gauss. Total flux 180,000 maxwells. H.C. 20W. v.c.i. 12-15 ohms. F.R. 25-2,000 c/s. r.c.f. 800 c/s. Price: £17 10s.

Super 3. 3 in. Bakelised paper cone with integral dome. Foam plastic surround. Voice coil 1 in. (aluminium). Gap flux 14,500 gauss. Total flux 60,000 maxwells. H.C. 6W. above 1,000 c/s. v.c.i. 2-3 or 10-15 ohms. F.R. 1,000-20,000 c/s. r.c.f. 4,000 c/s. Price: £5 (U.K. purchase tax 16s. 8d.).

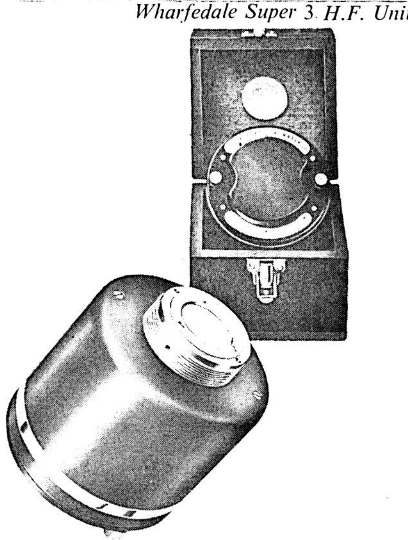
Super 8/RS/DD. 8 in. Double diaphragm paper cone. Roll surround. Voice coil 1 in. (aluminium). v.c.i. 10-15 ohms. Gap flux 14,500 gauss. Total flux 60,000 maxwells. H.C. 6W, 12W peak. F.R. 40 c/s-20 Kc/s. Price: £5 15s. (U.K. purchase tax 19s. 2d.).

PST/4. 4 in. Paper and polystyrene cone. Cloth surround. Voice coil $\frac{3}{4}$ in. v.c.i. 10-15 ohms. Gap flux 11,500 gauss. Total flux 28,800 maxwells. H.C. 5W, 10W peak. F.R. 300 c/s-15 Kc/s. r.c.f. 300 c/s. Price: £2 15s. (U.K. purchase tax 9s. 2d.).



Vitavox AK121

Wharfedale Super 3 H.F. Unit



Vitavox S2

W12/RS/PST. 12 in. Paper and polystyrene cone. Roll surround. Voice coil $1\frac{3}{4}$ in. (copper). v.c.i. 15 ohms. Gap flux 14,000 gauss. Total flux 156,000 maxwells. H.C. 15W, 30W peak. F.R. 25 c/s-4 Kc/s. r.c.f. 3,000 c/s. Price: £10 15s.

RS/12/DD. 12 in. Paper cone. Roll surround. Voice coil $1\frac{3}{4}$ in. (aluminium). v.c.i. 15 ohms. Gap flux 14,000 gauss. Total flux 156,000 maxwells. H.C. 15W, 30W peak. F.R. 25 c/s-17 Kc/s. Price: £11 10s.

W12/EG. 12 in. full range unit. Paper double diaphragm cone. Corrugated paper surround. Voice coil $1\frac{3}{4}$ in. copper. v.c.i. 12-15 ohms. Gap flux 14,000 gauss. Total flux 156,000 maxwells. H.C. 15W RMS, 30W peak. F.R. 40 c/s-17 Kc/s. Price: £10 10s.

W15/EG. 15 in. Paper cone. Corrugated paper surround. Voice coil 2 in. copper v.c.i. 12-15 ohms. Gap flux 13,500 gauss. Total flux 180,000 maxwells. H.C. 20W RMS, 40W peak. F.R. 35 c/s-5 Kc/s. r.c.f. 1,000 c/s. Price: £17 10s.

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WHITELEY ELECTRICAL RADIO CO. LTD., Victoria Street, Mansfield, Notts. Tel.: Mansfield 1762-5. Cables: Whitebon, Mansfield.

Stentorian HF.812. 8 in. Composite (paper and cambric) cone. Cambric surround. Voice coil 1 in. Gap flux 12,000 gauss. Total flux 47,400 maxwells. H.C. 5W. v.c.i. universal (3, 7·5 and 15 ohms). F.R. 50-12,000 c/s. Price: £3 5s. 6d. (U.K. purchase tax 11s.).

H.F.816. 8 in. Composite (paper and cambric) cone. Cambric surround. Voice coil 1 in. Gap flux 16,000 gauss. Total flux 63,000 maxwells. H.C. 6W. v.c.i. universal 3, 7·5 and 15 ohms. F.R. 50-14,000 c/s. Price: £5 7s. 10d. (U.K. purchase tax 18s. 2d.).

H.F.817. 8 in. Paper cone. Cambric surround. Voice coil 1 in. Gap flux 17,000 gauss. Total flux 67,000 maxwells. H.C. 10W in cabinet. v.c.i. 15 ohms. F.R. 60-22,000 c/s. Price: £8 18s. 8d. (U.K. purchase tax £1 10s. 1d.).

H.F.912. 9 in. Composite (paper and cambric) cone. Cambric surround. Voice coil 1 in. Gap flux 12,000 gauss. Total flux 47,400 maxwells. H.C. 7W. v.c.i. universal (3, 7·5 and 15 ohms). F.R. 40-13,000 c/s. Price: £3 9s. 4d. (U.K. purchase tax 11s. 8d.).

H.F.916. 9 in. Composite (paper and cambric) cone. Voice coil 1 in. Gap flux 16,000 gauss. Total flux 63,000 maxwells. H.C. 7W. v.c.i. universal (3, 7·5 and 15 ohms). F.R. 40 c/s-14 Kc/s. Bass resonance 45 c/s. Price: £5 11s. 8d. (U.K. purchase tax 18s. 10d.).

H.F.1012. 10 in. Composite (paper and cambric) cone. Cambric surround. Voice coil 1 in. Gap flux 12,000 gauss. Total flux 47,400 maxwells. H.C. 10W. v.c.i. universal 3, 7·5 and 15 ohms. F.R. 30-14,000 c/s. Price: £3 18s. 9d. (U.K. purchase tax 13s. 3d.).

H.F.1016. 10 in. Composite (paper and cambric) cone. Cambric surround. Voice coil 1 in. Gap flux 16,000 gauss. Total flux 63,000 maxwells. H.C. 10W. v.c.i. 3, 7·5 and 15 ohms. F.R. 30-15,000 c/s. Price: £6 5s. 10d. (U.K. purchase tax £1 1s. 2d.).

H.F.1016 Major. 10 in. Paper cone. Cambric surround. Voice coil 1 in. (aluminium). v.c.i. 15 ohms. Gap flux 16,000 gauss. Total flux 64,000 maxwells. H.C. 10W. F.R. 60 c/s-16 Kc/s or 30 c/s-16 Kc/s. (depending upon cabinet). Price: £8 1s. 4d. (U.K. purchase tax £1 7s. 2d.).

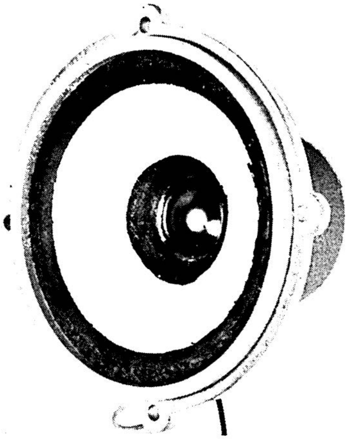
10 in. Concentric Duplex. Composite (paper and cambric) cone. Cambric surround. Voice coil 1 in. Gap flux (L.F.) 12,000 (H.F.) 13,000 gauss. Total flux 47,400 maxwells. H.C. 10W. v.c.i. 15 ohms. F.R. 30-14,000 c/s. r.c.f. 3,000 c/s built-in. Price: £10 12s. 1d. (U.K. purchase tax £1 15s. 8d.).

H.F.1214. 12 in. Composite (paper and cambric) cone. Cambric surround. Voice coil 1·5 in. Gap flux 14,000 gauss. Total flux 106,000 maxwells. H.C. 15W. v.c.i. 15 ohms. F.R. 25-14,000 c/s. Price: £10 15s. 9d.

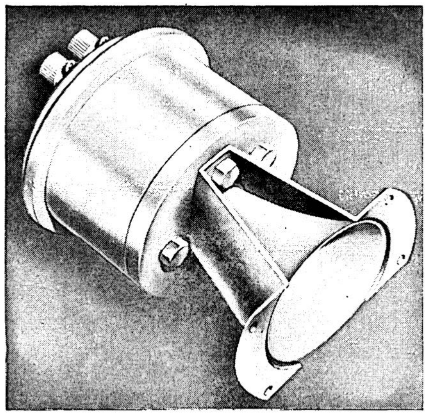
H.F.1216. Composite (paper and cambric) cone. Cambric surround. Voice coil $1\frac{1}{2}$ in. Gap flux 16,000 gauss. H.C. 15W. F.R. 20-16,000 c/s. Price: £16 10s. 9d.

12 in. Concentric Duplex. Composite (paper and cambric) cone. Cambric surround. Series-gap Alcomax III magnet. LF gap flux 14,000 gauss. HF gap flux 17,000 gauss. Total flux 220,000 lines. v.c.i. 15 ohms. Built-in cross-over network. F.R. 25 c/s-17,000 c/s. Bass resonance 35 c/s. H.C. 15W. Pressure die-cast Mazak chassis. HF metal diaphragm protected and loaded by central pressure horn. Price: £28 17s. 6d.

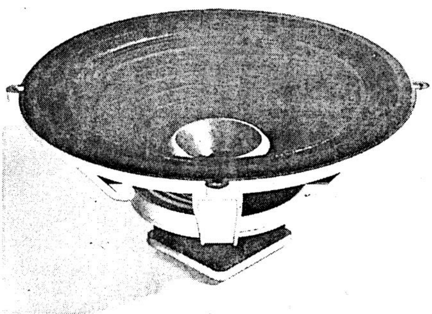
15 in. Concentric Duplex. Composite (paper and cambric) cone. Cambric surround. Voice



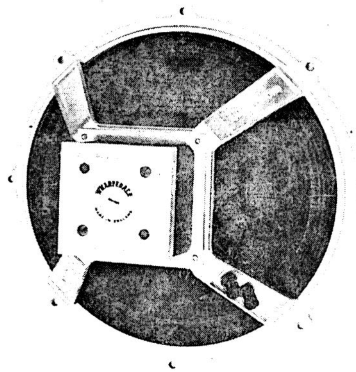
Wharfedale PST/4 H.F. Unit



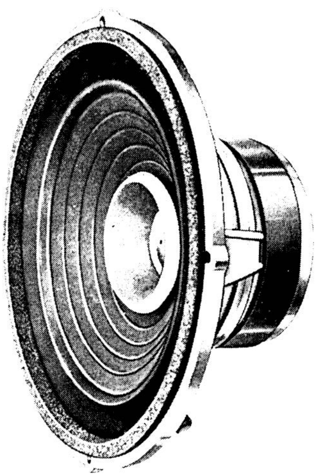
Whiteley T10 H.F. Unit



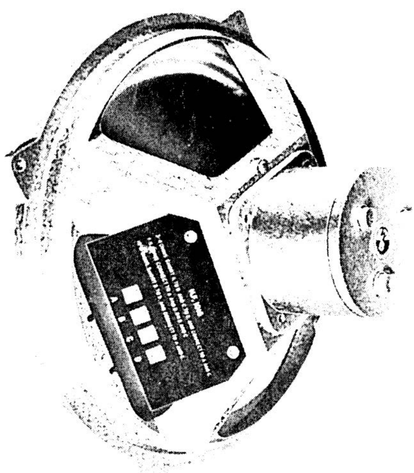
Wharfedale 10 in. Bronze RS/DD



Wharfedale W15/EG

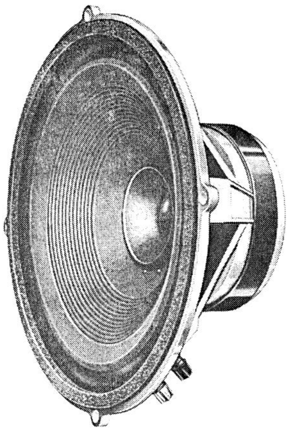


Wharfedale Super 8/RS/DD

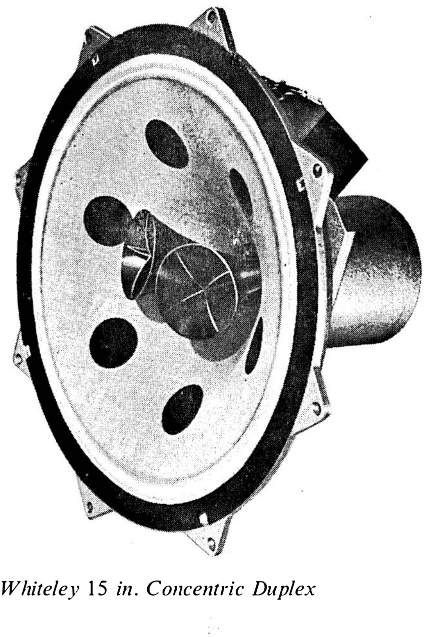


Whiteley H.F. 1016

Whiteley T 359 *H.F. Unit*



Wharfedale super 12/*RS*/*DD*



Whiteley 15 *in. Concentric Duplex*

coil 2 in. Gap flux (L.F.) 14,000 (H.F.) 17,000 gauss. Total flux 350,000 maxwells. H.C. 25W. v.c.i. 15 ohms. F.R. 20-18,000 c/s r.c.f. 3,000 c/s built-in. Price: £47 5s.

H.F.1514. 15 in. Composite (paper and cambric) cone. Cambric surround. Voice coil 2 in. Gap flux 14,000 gauss. Total flux 178,000 maxwells. H.C. 25W. v.c.i. 15 ohms. F.R. 25-5,000 c/s. r.c.f. 1,500-3,000 c/s. Price: £27 6s.

T.10 Tweeter. Aluminium cone and surround. Voice coil 1 in. Gap flux 14,000 gauss. Total flux 44,000 maxwells. H.C. 5W. v.c.i. 15 ohms. F.R. 2,000-14,000 c/s. r.c.f. 3,000 c/s. Price: £4 12s. 9d.

T.12 Tweeter. Aluminium cone and surround. Voice coil 1·5 in. Gap flux 17,000 gauss. Total flux 110,000 maxwells. H.C. 12W. v.c.i. 15 ohms. F.R. 2,000-17,000 c/s. r.c.f. 3,000 c/s. Price: £13 17s. 9d.

T.816. 8 in. Paper cone and surround. Voice coil 1 in. Gap flux 16,000 gauss. Total flux 63,000 maxwells. H.C. 15W. v.c.i. 15 ohms. F.R. 1,500 to 17,000 c/s. r.c.f. 1,500 c/s. Price: £5 2s. 1d. (U.K. purchase tax 17s. 2d.).

T.359. 3½ in. Paper cone and surround. Voice coil 0·625 in. Gap flux 9,000 gauss. Total flux 14,900 maxwells. H.C. 15W with crossover. v.c.i. 5 or 15 ohms. F.R. 3,000-17,000 c/s. r.c.f. 3,000 c/s. Price: £1 7s. 7d. (U.K. purchase tax 4s. 8d.).

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L. G. WOOLLETT & COMPANY LTD., 21 Anerley Station Road, London, S.E.20. Tel.: Sydenham 9003.

12 in. L.R. Low resonance 12 in. dynamic unit. Paper cone with foam surround. H.C. 15W RMS. F.R. 20 c/s-5 Kc/s. Special unit for use with Woollett electrostatic treble speakers. Price: £12 12s.

Type 6C. Constant charge push-pull electrostatic. Imp. 15 ohms. H.C. 15W RMS. F.R. 1·5 Kc/s-20 Kc/s. Integral crossover. Price: £12 12s.

Type 5C. Constant charge push-pull electrostatic. Imp. 15 ohms. H.C. 15W RMS. F.R. 1·5 Kc/s-20 Kc/s. Integral crossover. Attenuator. Rear sealed for mounting in bass cabinet behind horizontal 9 × 6½ in. hole. Price: £14 14s.

DIRECTORY OF SPEAKER ACCESSORIES

RICHARD ALLAN RADIO LTD., Bradford Road, Gomersal, Near Leeds, Yorkshire. Tel.: Cleckheaton 2442/3. Cables: Acoustics, Bradford.

CN.104 Crossover Unit. A two-way half-section parallel network. Crossover frequency 5,000 c/s. All terminations 15 ohms. Price: £2 2s.

CN.1284 Crossover Unit. A three-way crossover with main crossover operating from half wave parallel network and subsidiary crossover capacity fed. Crossover frequencies 1,100 and 5,000 c/s. All terminations 15 ohms. Price: £6 5s.

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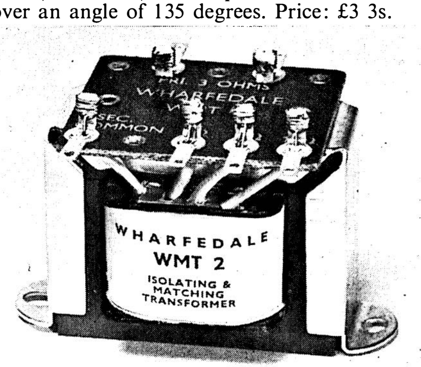
DECCA SPECIAL PRODUCTS, Decca Radio and Television Division of The Decca Record Co. Ltd., Ingate Place, Queenstown Road, London, S.W.8. Tel.: Macaulay 6677.

Kelly Crossover CO/1/15. Designed to feed power at correct levels and frequencies to the Kelly LF drive units and Mk II HF ribbon. Crossover frequency 2·5 Kc/s. Low pass slope 12 dBs per octave. High pass slope initially 12 dBs per octave and final slope 40 dBs per octave. Attenuation to frequencies below 700 c/s greater than 40 dB. Imp. 15 ohms. Price: £3 3s.

Kelly Acoustic Lens. For use with Kelly ribbon HF speaker Mk II to disperse high frequencies so that a stable stereo image is obtained over a wider area than normal. Up to 15 Kc/s the sound pattern is constant to within 3 dBs over a 150 degree angle. From 15 Kc/s to 20 Kc/s this dispersion is maintained over an angle of 135 degrees. Price: £3 3s.



Wharfedale WMT2

EAGLE PRODUCTS. Distributors: B. Adler & Sons (Radio) Ltd., 32a Coptic Street, London, W.C.1. Tel.: Museum 9606/7. Cables: Reldab, London.

CN3. Universal three-way crossover network. Provides six combinations of crossover frequencies and incorporates brilliance and presence controls. Two-way with 2,500 or 5,000; three-way with 350 and 5,000; 350 and 2,500; 700 and 2,500; 700 and 5,000. Price: £4 19s. 6d.

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EMI SOUND PRODUCTS LTD., Hayes, Middlesex. Tel.: Hayes 3888. Cables: Emisound, London.

XO/4500/4 or 15. Crossover frequency 4,500 c/s. Rate of attenuation 12 dB per octave. L.S. matching 3 or 15 ohms. Price: £6 6s.

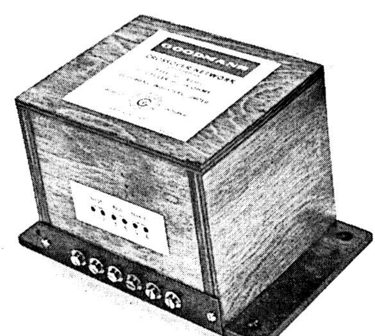
★

GOODMANS INDUSTRIES LTD., Axiom Works, Wembley, Middx. Tel.: Wembley 1200. Cables: Goodaxiom, Wembley.

XO/5000-Crossover Unit. A two-way half-section crossover network, operating at 5,000 c/s. All termination 15 ohms. Price: £2 2s. 2d.

XO/950-Crossover Unit. A two-way half-section, crossover network, operating at 950 c/s. All terminations 15 ohms. Price: £5 17s. 2d.

X0/950/5000. Crossover Network. A multiple crossover network comprising four half-section L.C. filters. Crossover frequencies



Goodmans XO/950

are 950 c/s and 5,000 c/s. All attenuation rates are 12 dB/octave. All terminations 15 ohms. Price: £7 14s. 8d.

ARU Units. These units combine both reflex port and acoustic resistance in one complete unit. The port area and resistance are calculated to suit a particular cabinet volume and speaker cone resonance, thus being usable with a variety of cabinet designs and driving units. Price: £3 11s. 3d. to £4 4s.

★

VITAVOX LTD., Westmoreland Road, London, N.W.9. Tel.: Colindale 8671. Cables: Vitavox, London, N.W.9.

CN232 Crossover. Half section. Crossover 500 c/s. Attenuation 12 dB/octave. All terminations 15 ohms. Balance control giving 0-8 dB HF attenuation incorporated. Price: £10.

CN233 Crossover. Half section. Crossover 1 Kc/s. Attenuation 12 dB/octave. All terminations 15 ohms. Balance control giving 0-8 dB HF attenuation incorporated. Price: £9 10s.

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WHARFEDALE Wireless Works Ltd., Idle, Bradford, Yorks. Tel.: Idle 1235-6. Cables: Wharfdel, Idle, Bradford.

QS/800. Crossover frequency 800 c/s. $\frac{1}{4}$-section. Rate of attenuation 6 dB per octave. LS matching 7-16 ohms. Size: 5 × 4 × $2\frac{1}{4}$ in. Weight: 15 oz. Price: £2 17s. 6d.

HS/400/3. Crossover frequency 400 c/s and 5,000 c/s. $\frac{1}{2}$-section 3-way. Rate of attenuation 12 dB per octave. LS matching 7-16 ohms. Size: 7 × 5 × 3 in. Weight: 2 lbs. Price: £6 5s.

WMT1 Matching Transformer. Auto transformer for matching 10-16 ohms or 7-9 ohms speakers to sets with 2-5 ohms output or vice versa. Response 20-15,000 c/s ±1 dB. Handling capacity 15W. Can also match speakers of different imps. to crossover unit in 2 or 3 speaker systems. Size: $2\frac{7}{8}$ × $2\frac{3}{4}$ × $2\frac{3}{4}$ in. Weight: $12\frac{1}{2}$ ozs. Price: 13s. 6d.

WMT2 Isolating and Matching Transformer. Similar to WMT1, but having separate windings with heavy insulation. Response 20 c/s-15 Kc/s ±1 dB. H.C. 15W. Size: $2\frac{1}{4}$ in. high, $2\frac{7}{8}$ in. wide. Weight: $13\frac{3}{4}$ oz. Price: 13s. 6d.

WHITELEY ELECTRICAL RADIO CO. LTD., Victoria Street, Mansfield, Notts. Tel.: Mansfield 1762-5. Cables: Whitebon, Mansfield.

CX500 Crossover Unit. A two-way half-section crossover network operating at 500 c/s. All terminations 15 ohms. Price: £1 8s. 9d.

CX1500 Crossover Unit. As CX500, but operating at 1,500 c/s. Price: £2 2s.

CX3000 Crossover Unit. As CX1500, but operating at 3,000 c/s. Price: £1 13s. 3d.

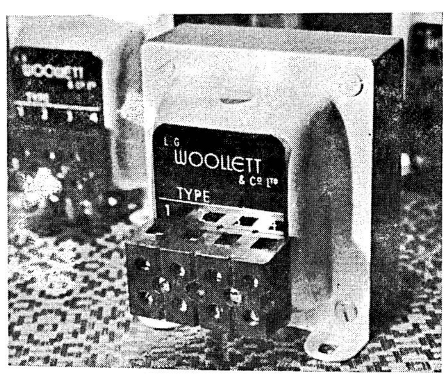
Constant impedance volume control. T-pad type attenuator having 10 steps of attenuation. Impedance presented by the load remains constant while the volume level is varied. In three versions for 3, 8 or 15 ohms. Price: £1 3s. 3d.

★

L. G. WOOLLETT AND COMPANY, LTD., 21 Anerley Station Road, London, S.E.20. Tel.: Sydenham 9003.

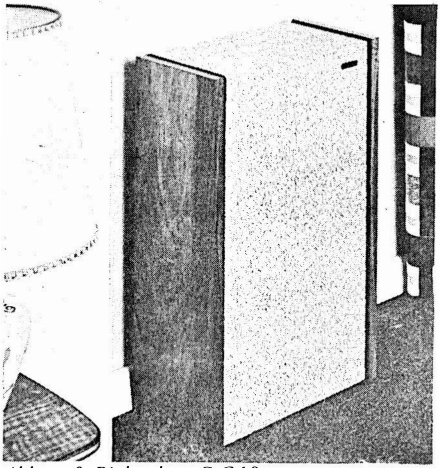
XS1. Speaker matching transformer. Converts 15 ohms to 7·5 ohms and 7·5 ohms to 3·75 ohms. Bifilar wound. Grain oriented laminations. Ratio 1:0·707 auto. F.R. 16 c/s-30 Kc/s ±0·6 dB. Price: £3 8s. 6d.

XS2. Speaker isolating and matching transformer. Converts 15 ohms to 3·75 ohms. Grain oriented laminations. Ratio 1:1 double wound. F.R. 16 c/s-100 Kc/s ± 0·6 dB. Attenuates −6 dB and −12 dB while maintaining heavy damping on speaker and offering correct load to amplifier. NOTE: Not suitable for mains isolating in live chassis equipment. Price: £2 18s. 6d.

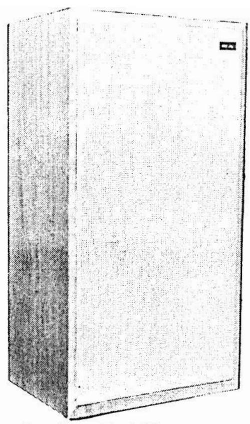


Woollett XS1 and XS2

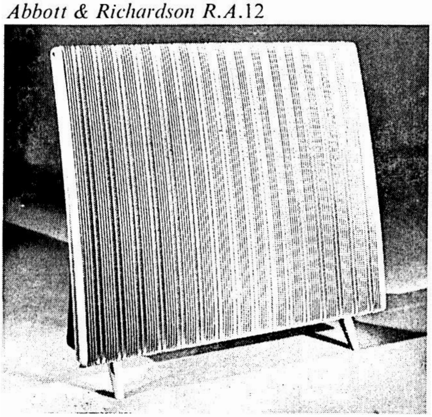
PART 2—SPEAKER ENCLOSURES



Abbott & Richardson S.C.10



Abbott & Richardson R.A.12



Quad Electrostatic

ABBOTT & RICHARDSON, 7 Agnew Road, Forest Hill, London, S.E.23. Tel.: Forest Hill 1031.

R.A. Reflex Enclosure (GRA10). Complete system. Forward facing full range speaker with tapering depth. Two units: 10 in. bass, horn-loaded pressure unit for treble. Rec. Goodmans Axiom 10, Goodmans Trebax 5K/20XL. Twin $\frac{1}{4}$-section crossover network. Finish: Walnut, oak, mahogany or teak. Size: 31 × 17½ × 10½ max. to 7½ in. min. Price: (with specified units) £23, enclosure only £12 10s.

R.A.12. Based on Goodmans specifications and fitted with ARU. Available with 12 in. twin-cone drive unit and in two-way and three-way systems. Finish: Mahogany or teak. Size: 37½ × 21½ × 13 in. Price (with 12 in. twin-cone driver): £32.

Enclosures built to customers own requirements. Home demonstrations in the London area. R.A. enclosures also available from Lee and Son (Development Company), 98 Lordship Lane, London, S.E.22.

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ACOUSTICAL MANUFACTURING CO. LTD., St. Peter's Road, Huntingdon, Hunts. Tel.: Huntingdon 361 and 574. Cables: Acoustical.

Quad Electrostatic Loudspeaker. Full range doublet covering 45 c/s to 18 Kc/s. Attenuation outside band asymptotic to 18 dB/8ve. Total integrated radiation at max. output equivalent to 95 phons in rooms of up to 5,000 cu. ft. with average reverberation. Dispersion approx. 70 deg. horizontal; 15 deg. vertical. Imp. 30-15 ohms, 40 c/s to 8 Kc/s falling above 8 Kc/s. Designed for use with standard Quad II Amplifier. Suitable for A.C. supplies 100-120 or 200-250V. 50-60 c/s. Free standing unit requires no enclosure or cabinet. Weight: 35 lb. Price: £52 complete.

★

AKAI: Distributors: The Pullin Optical Co. Ltd., 11 Aintree Road, Perivale, Greenford, Middlesex. Tel.: Alperton 1541/7.

●SS-55. Pair of speakers with enclosures to form a complete stereo speaker system. Price: £38 (U.K. purchase tax £6 6s. 5d.).

●**SS-88.** Pair of speakers with enclosures to form a complete stereo speaker system. Price: £32 6s. 6d. (U.K. purchase tax £5 7s. 9d.).

●**SS110.** Pair of speaker enclosures each containing 10 in. bass unit and 3½ in. tweeter. Vinyl covering. The two units snap together for carrying. Price: £45 (U.K. purchase tax £7 10s.).

The above speaker systems are primarily for use with Akai tape recorder.

★

RICHARD ALLAN RADIO LTD., Bradford Road, Gomersal, Near Leeds, Yorkshire. Tel.: Cleckheaton 2442/3. Cables: Acoustics, Bradford.

SC5. Minette. Infinite baffle bookshelf enclosure. 5 in. bass unit, 4 in. tweeter. F.R. 50 c/s-17 Kc/s. H.C. 10W. Size: 11½ × 7 × 6½ in. Weight: 9 lb. Price: £17 10s. 6d. including units.

SC8. Infinite baffle enclosure. Recommended units CG8 and CB4. F.R. 60 c/s-17 Kc/s. H.C. 8W. Size: 19 × 12 × 6¾ in. Price: £8 14s. 4d. (cabinet only).

SC10. Infinite baffle enclosure. Recommended units CG10, CB4 and CN104 crossover network. F.R. 50 c/s-17 Kc/s. H.C. 10W. Size: 24 × 15 × 7¼ in. Price: £11 19s. (cabinet only).

SC12. Infinite baffle enclosure. Bass unit CG12 Super, mid-range unit 812F, tweeter CB4. F.R. 40 c/s-17 Kc/s. H.C. 15W. Size: 30 × 19½ × 7¼ in. Price: £36 complete with units.

★

AUDIO SERVICES (HI-FI) LTD., 82 East Barnet Road, New Barnet, Herts. Tel.: Barnet 6605.

Dyna-Static Mk. II. Infinite baffle enclosure. Forward facing. Two units: 13 × 8 in. 16,000 gauss bass unit. Shackman patented electrostatic unit. Crossover 800 c/s. F.R. 30 c/s-20 Kc/s. Weight: 70 lb. Size: 33 × 18 × 12 in. Price: £48.

Dyna-Sonic Model 2T. Forward-facing. Three units: 13 × 8 in. bass unit, two 2½ in. tweeters. Crossover 2 Kc/s. F.R. 40 c/s-17 Kc/s. Size: 31 × 18 × 12 in. Price: £25.

Dyna-Sonic 2T 16,000. Similar to model 2T, but with 16,000 gauss bass unit. Price: £29 10s.

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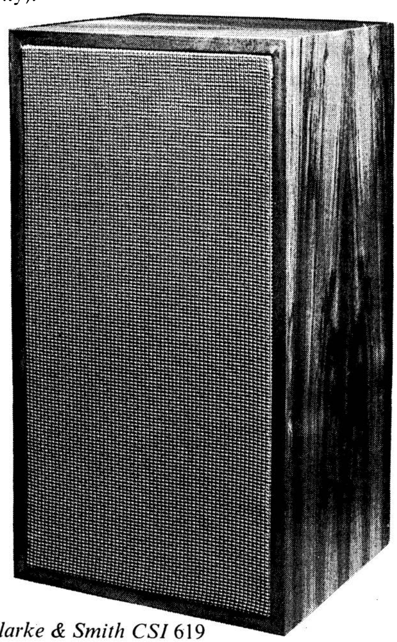
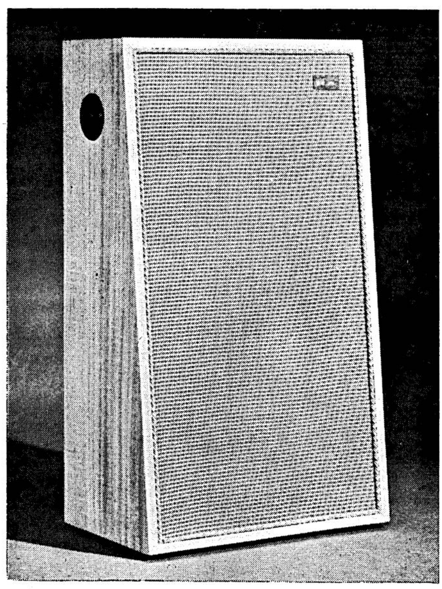
BANG & OLUFSEN. U.K. Sales Division: Eastbrook Road, Eastern Avenue, Gloucester. Tel.: Gloucester 26841. Cables: DEBELEC, Gloucester.



Clarke & Smith CSI 619



Abbott & Richardson GRA 10

Type B. Compact enclosure to handle 5W. Two units; one 6 × 4 in. plus 2½ in. tweeter. Crossover at 4 Kc/s. F.R. 60 c/s-20 Kc/s. Finished in teak or rosewood. Suitable for vertical or horizontal use. Size: 11 × 5½ × 10½ in. Weight: 7 lb. Price: £10 17s. (U.K. purchase tax £1 15s.).

Type M. Free-standing vertical or horizontal enclosure. One 8 in. main driver plus 2½ in. tweeter. Crossover 4 Kc/s. 7W. power handling capacity. F.R. 50 c/s-20 Kc/s. Finish in teak or rosewood. Size: 19 × 9½ × 9¾ in. Price: £13 11s. 3d. (U.K. purchase tax £2 3s. 9d.).

Type V. Teak or rosewood finished enclosure with 7 × 5 in. driver and 2½ in. tweeter. F.R. 55 c/s–20 Kc/s. Handling capacity 5W. Crossover 3 Kc/s. Size: 19½ × 13¾ × 3⅛ in. Price: £12 13s. 3d. (U.K. purchase tax £2 0s. 9d.).

Type S. Horizontal or vertical free-standing enclosure finished in choice of teak or rosewood. One 8 in. driver plus 2½ in. tweeter. Crossover 3 Kc/s. F.R. 40 c/s-20 Kc/s. Handling capacity 10W. Size: 25 × 11¾ × 11¾ in. Price: £17 12s. (U.K. purchase tax £2 16s. 8d.).

Type K. Three-unit floor standing enclosure finished in teak or rosewood. 12 in. bass driver, 5 in. mid-range unit, 2½ in. tweeter. Crossover at 700 c/s and 4 Kc/s. F.R. 30 c/s-20 Kc/s. Handling capacity 18W. Size: 32¼ × 19 × 15½ in. Price: £34 12s.

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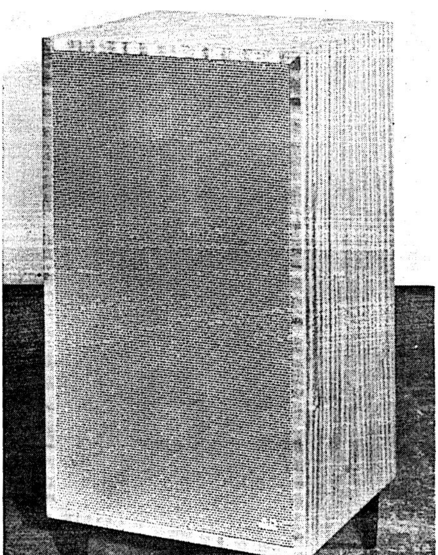
BRAUN AG. Distributors: Argelane Ltd., 251 Brompton Road, London, S.W.3. Tel.: Kensington 9611.

L25. Infinite baffle. Wide range twin-cone 7 in. driver. F.R. 70 c/s-18 Kc/s. Floor or wall mounting. Wood case finished laminated white plastic. Anodised aluminium grille. Size: 19¼ × 11¼ × 5¼ in. Price: £20.

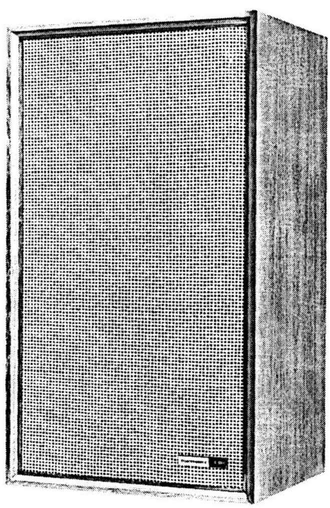
L40. Infinite baffle. 8⅜ in. bass and mid-range unit, 4 in. tweeter. F.R. 50-18 Kc/s. Wood cabinet finished in white or dark grey laminated plastic. Anodised aluminium grille. Size: 22⅝ × 9⅞ × 11¼ in. 15 ft. lead with plug supplied. Price: £27 10s.

L46. Infinite baffle. 8 in. bass driver, 3¼ in. tweeter. F.R. 40 c/s-20 Kc/s. Floor or wall mounting. Wood cabinet finished in white or dark grey plastic laminate. Anodised aluminium grille. 15 ft. lead and plug. Size: 26 × 14⅜ × 4⅜ in. Price: £36.

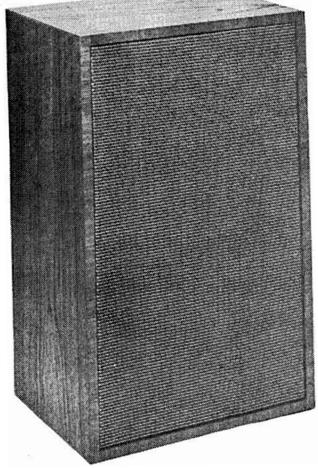
L60/4. Infinite baffle. 10⅞ in. bass driver, 3⅝ in. tweeter. F.R. 40 c/s-20 Kc/s. Wood cabinet finished in white plastic laminate. Anodised aluminium grille. 15 ft. lead with plug. Chrome stand optional extra. Size: 26 × 14⅜ × 11¼ in. Price: £42.



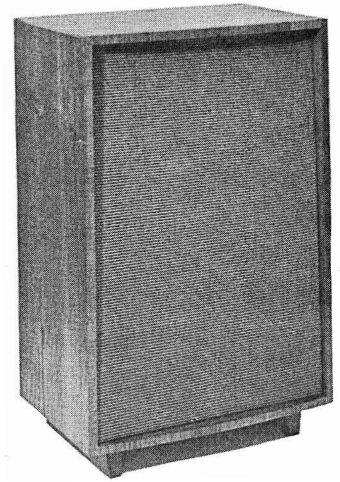
A. Davies bass reflex



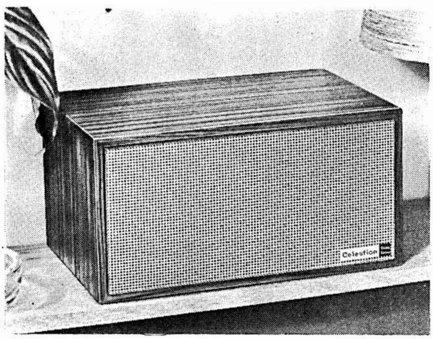
Elac LK 500



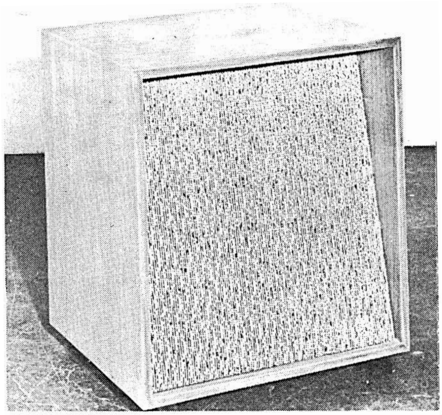
Design G.D.10



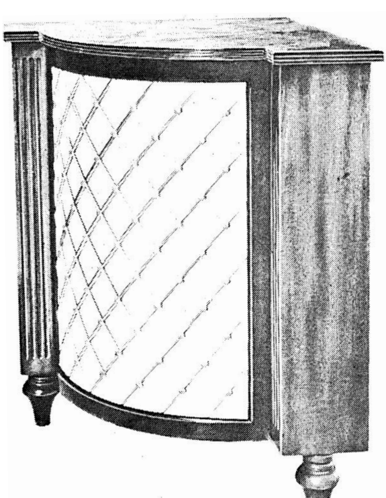
Design G.D.12



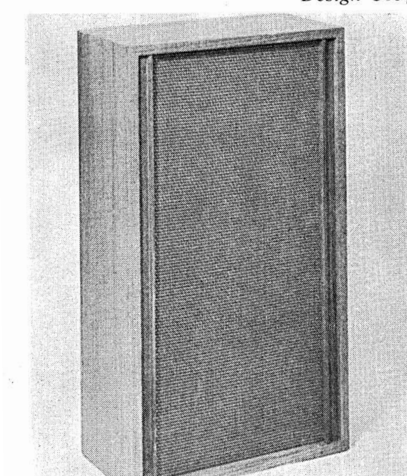
Celestion Ditton



Design C15/20



Decca Decola Separates



Design G.D.8

L61. Infinite baffle. 10 in. bass driver, two mid-range 4 in. units, $3\frac{5}{8}$ in. tweeter. F.R. 30 c/s-20 Kc/s. HF level control permits attenuation over 4 Kc/s. Flat to −12 dB. Wood enclosure finished white laminated plastic. Anodised aluminium grille. Optional stand. Size: 26 × $14\frac{3}{8}$ × $11\frac{1}{4}$ in. Price: £75.

L80. Infinite baffle. Leak sandwich $13\frac{1}{4}$ in. bass driver, 4 in. mid-range, Kelly ribbon tweeter. F.R. 25 c/s-25 Kc/s. Wood enclosure finished white laminated plastic. Anodised aluminium grille. Stand optional. Size: $16\frac{7}{8}$ × 34 × $12\frac{7}{8}$ in. Price: £130.

★

BURNE-JONES & CO. LTD., 18 Brunswick Road, Sutton, Surrey.

B.J. Treble 20. Omni-directional multi-horn. One 4 in. unit. Crossover built-in. Response 1,000-18,000 c/s. Size: 6 × 5 in. Weight: $1\frac{1}{2}$ lb. Price: £3 15s. plus tax.

B.J. Treble Twin. Omni-directional horn. Two 4 in. drive units. Crossover included. Response 900-18,000 c/s. Size: 9 × $4\frac{3}{4}$ × 6 in. Weight: 2 lb. Price: £7 2s. 9d. plus tax.

★

CELESTION LTD., Ferry Works, Thames Ditton, Surrey. Tel.: Emberbrook 3402/6. Cables: Voicecoil, Thames Ditton.

Ditton 10. Infinite baffle compact system. Long-throw 5 in. bass unit, pressure driven HF unit. Built-in half-section crossover 3,500 c/s. F.R. 35 c/s-15 Kc/s. Available in walnut or teak. H.C. 10W. Size: $12\frac{3}{4}$ × $6\frac{3}{4}$ × $8\frac{1}{4}$ in. Weight: 13 lb. Price: £16 3s. 2d. (U.K. purchase tax £2 14s. 10d.).

★

CLARKE & SMITH MANUFACTURING CO. LTD., High Fidelity Components Division, Melbourne Works, Wallington, Surrey. Tel.: Wallington 9252. Cables: Electronic, Wallington.

CSI 619. Infinite baffle. Complete system. Forward-facing. Three units: bass $13\frac{1}{2}$ × $8\frac{1}{8}$ in. (92390 PFL); pair of tweeters $3\frac{3}{8}$ in cone (99110J). Crossover (Type 99970F) 4,500 c/s. F.R. 50 c/s-18 Kc/s. Size: 24 × 13 × $11\frac{1}{2}$ in. Finish: natural walnut veneer, matt finished. Price: £26 5s.

A. DAVIES & COMPANY, 3/11 Parkhill Place, off Parkhill Road, Hampstead, London, N.W.3. Tel.: Gulliver 5775.

Sherwood type. Based on Goodmans design for Axiom speakers. Approved for Goodmans Axiom 201, Axiom 301 and Goodmans three-way system. Padded front with contemporary Tygan pattern in black and white. Finish: Sapele, oak, walnut, teak, afromosia. Full polish or satin finish. Size: $23\frac{1}{2}$ × $27\frac{1}{2}$ × $19\frac{1}{2}$ in. Price (without units or ARU172): de luxe version £19, standard finish version £17.

Bass reflex. Suitable versions are made for good quality 8 in., 10 in. and 12 in. speakers. Cabinets lined with 1 in. acoustic felt. Finish: Sapele, walnut, oak, teak. Full polish or satin finish. Sizes: all cabinets are 34 in. high; 8 in. model 15 in. wide, 12 in. deep; 10 in. model $15\frac{3}{4}$ in. wide, $13\frac{1}{2}$ in. deep; 12 in. model $17\frac{1}{2}$ in. wide, $15\frac{1}{2}$ in. deep. Prices: Standard finish, 8 in. £11 10s.; 10 in. £12; 12 in. £12 10s. (Teak 10s. extra). De luxe versions £2 extra.

Speaker enclosures and cabinets made to customers requirements.

★

DECCA SPECIAL PRODUCTS, Decca Radio and Television Division of the Decca Record Co. Ltd., Ingate Place, Queenstown Road, London, S.W.8. Tel.: Macaulay 6677.

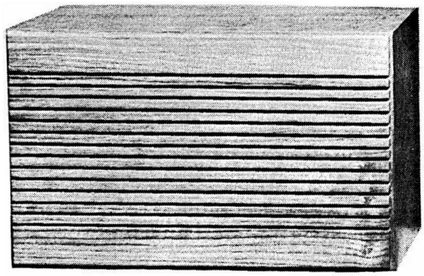
301 (re-styled). Vented enclosure. Special-cone 13 × 8 in. driver, exclusive Decca 3 in. HF unit. Crossover 5 Kc/s. Finished in medium polished teak. Size: $21\frac{1}{2}$ × $12\frac{1}{2}$ × 9 in. H.C. 6W. Price: £15 15s.

Stereo Decola "Separates". Bass reflex, treble stacked and angled arrays. One bass 12 × 8 in. elliptical, six treble $2\frac{1}{2}$ in. dia. circular units. Crossover 400 c/s. F.R. 30 c/s-20 Kc/s. Size: $30\frac{1}{2}$ × $20\frac{1}{2}$ × $20\frac{1}{2}$ in. Price (complete): £53 11s.

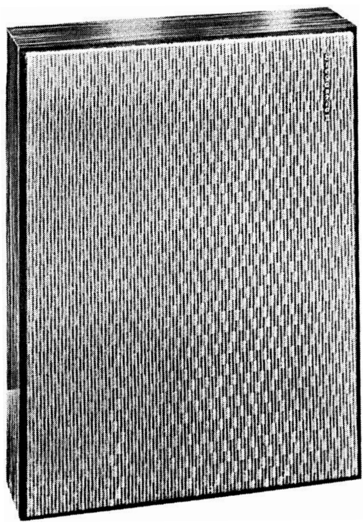
DESIGN FURNITURE LTD., Calthorpe Manor, Banbury, Oxfordshire. Tel.: Banbury 4341.

GD8. Approved by Goodman Industries Ltd. for Axiette 8. 8 in. loudspeaker. Size: $31\frac{1}{2}$ × $17\frac{1}{2}$ × $8\frac{1}{2}$ in. Can be used vertically or horizontally. Walnut, sapele mahogany or teak finish. Price: £12.

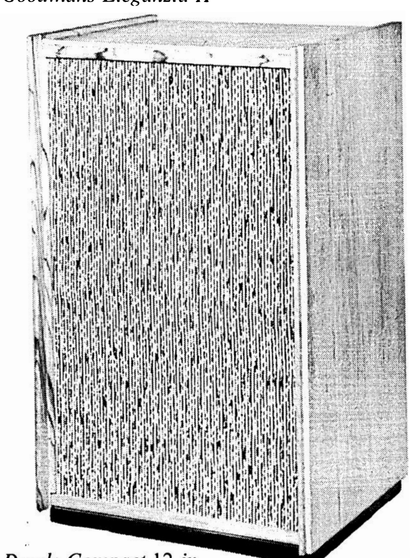
GD10. Approved by Goodman Industries Ltd. for Axiom 10. Size: 29 × 18 × $11\frac{1}{2}$ in.



D.N.H. B-455/T



Goodmans Eleganzia II



Duode Compact 12-in

Can be used vertically or horizontally. Walnut, sapele mahogany, teak or rosewood finish. Price: £13.

GD12. Approved by Goodman Industries Ltd. for Axiom 201, Axiom 301, Triaxiom 1215 and 1220, Audiom 51 Bass and Audiom 61 Bass. Size: $22\frac{1}{2} \times 35\frac{1}{4} \times 14\frac{1}{8}$ in. Walnut, sapele mahogany, teak or rosewood finish. Price: £15. (Acoustic Resistance Unit £3 5s. 6d. extra.)

C15/20. Designed for use with the Celestion CX1512 and CX2012 Co-axial 12 in. speakers. Mounted on castors. Cut-out provided for "brilliance control" supplied with CX2012 de luxe model. Size: 36 × 21 × 10 in. Walnut or teak finish. Price: £16 10s.

★

D.N.H. Den Norske Hoyttalerfabrikk A/S. Distributor: Douglas A. Lyons and Associates Ltd., 32 Grenville Court, Dulwich, London, S.E.19. Tel.: Gipsy Hill 2833. Cables: Daliona, London, S.E.19.

B-455/T. Infinite baffle. High efficiency 6 in. driver with 4 in. HF unit. F.R. 50 c/s-18 Kc/s. H.C. 10W. Imp. 4 and 15 ohms. Choice of slotted teak front or fabric front. 0·31 cu. ft. Standard finish teak. Size: $10\frac{1}{2} \times 6\frac{3}{4} \times 7\frac{1}{2}$ in. Weight: 8·3 lb. Price: £12 12s.

B-520/T. Infinite baffle. 2·2 cu. ft. 12 in. bass driver. 4 in. tweeter. F.R. 40 c/s-18 Kc/s. Imp. 4 and 15 ohms. H.C. 20W. Choice of slotted teak front or fabric front. Standard finish teak. Slim-line construction. Size: $23\frac{1}{2} \times 16\frac{1}{2} \times 6\frac{1}{2}$ in. Weight: 22 lb. Price: £21 10s.

★

DUAL. Distributors: Celsa Electric Co. Ltd., Celsa House, Kelway Place, London, W.14. Tel.: Fulham 9761/2.

CL3. Compact speaker enclosure suitable for free-standing or shelf mounting. Three units: 10 in. bass driver, 4 in. mid-range radiator, 3 in. tweeter. Handling capacity 15W. Size: $23\frac{1}{2} \times 13 \times 7$ in. Price: £38 17s.

★

DUODE LTD., Westfield Mills, Broad Lane, Bramley, Leeds, 13. Tel.: Pudsey 77536.

Duode Compact. Full-range enclosure incorporating special Duode Super 12 in. with Barker-patented aluminium speech coil former covered with latex sleeve. Speaker design applies negative feedback and gives response 35 c/s-20 Kc/s. Price: £34.

★

ELAC. Electroacustic GmbH. Kiel, West Germany. Distributors: Mitchell Enterprises Ltd., 61 West Street, Dorking, Surrey. Tel.: Dorking 4229.

LK10. Reflex enclosure. Wide-range $8\frac{1}{4}$ in. drive unit plus tweeter. $1\frac{1}{4}$ in. diameter voice coil. Magnetic flux 95,000 maxwells. F.R. 45 c/s–16 Kc/s. H.C. 18W. Imp. 6-18 ohms. Finish: Oiled walnut. Back of cabinet also veneered permitting use in centre of room. Internally damped. Size: $11\frac{3}{8} \times 21\frac{1}{4} \times 9\frac{3}{4}$ in. Weight: $27\frac{1}{2}$ lb. Price: £28 15s.

LK100. Reflex enclosure with four drive units. Bass unit $9\frac{1}{4}$ in. diameter with $1\frac{1}{4}$ in. speech coil and gap flux 14,700 gauss. Mid-range 5 in. unit and two 2 in. tweeters. Cross-over at 4,000 c/s and 750 c/s. F.R. 30 c/s-18 Kc/s. H.C. 22W. Imp. 8 ohms. Finish: Oiled walnut. Back of cabinet also veneered permitting use in centre of room. Size: $13\frac{3}{4} \times 25\frac{3}{8} \times 11\frac{1}{4}$ in. Weight: 36 lb. Price: £47 10s.

LK500. Reflex enclosure with four drive units. $9\frac{3}{4}$ in. bass speaker, $6\frac{1}{2}$ in. mid-range speaker, two $2\frac{1}{2}$ in. tweeters. Crossover at 500 c/s and 5 Kc/s. F.R. 25 c/s-20 Kc/s. H.C. 36W. Imp. 8 ohms. Finish: oiled walnut. Back of cabinet is also veneered permitting use in centre of room. Size: $13\frac{3}{4} \times 25\frac{1}{2} \times 11\frac{1}{4}$ in. Weight: $34\frac{1}{2}$ lb. Price: £57 10s.

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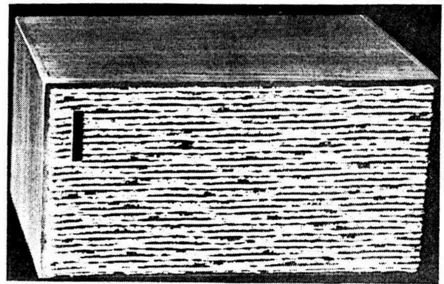
EMPIRE SCIENTIFIC. Distributors: Howland-West Ltd., 11 Howland Mews, Howland Street, London, W.1. Tel.: Langham 1381.

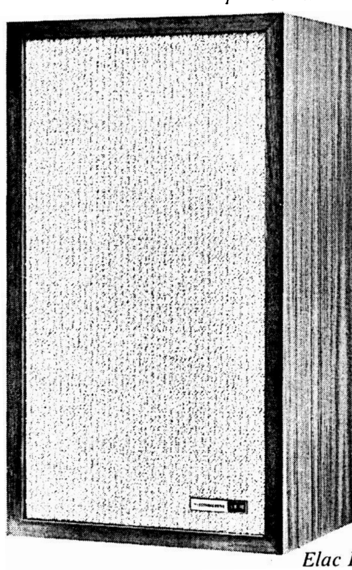
Grenadier 8000. Divergent lens enclosure. 12 in. bass unit, mid-range direct radiator, domed HF tweeter. F.R. 30 c/s-20 Kc/s. Circular design gives completely omni-directional sound. Finish: Satin walnut. Size: 29 in. high, $15\frac{1}{4}$ in. diameter. Price: £115 10s.

Grenadier 9000M. Divergent lens enclosure. 15 in. bass unit, mid-range direct radiator, domed HF tweeter. F.R. 20 c/s-20 Kc/s. Circular design gives completely omni-directional sound. Finish: Satin walnut. Size: 29 in. high, 22 in. diameter. Price to be announced.



Goodmans Maxim

Empire Grenadier 8000



Elac LK 10

FANE ACOUSTICS LTD., Hick Lane, Batley, Yorks. Tel.: Batley 1578. Cables: Fane, Batley.

Ionofane 602. HF Ionophone unit combined with a new 5 in. high flux mid-range speaker and a 12 dB/octave crossover network. Housed in a small polished cabinet. Intended for the user who already has a good bass unit. Terminals provided for connecting bass speaker enclosure. Price: £47 5s.

Ionofane 603. Complete full-range speaker system. It comprises an Ionophone HF unit, a new 5 in. mid-range radiator, and a heavy duty 15 in. bass driver. The units, with crossover, are housed in a Design Furniture cabinet. Price: £78 15s.

Trio. Cabinet-baffle, forward facing. Three drive units. 12 in., 8 in., and H.F. unit. Fane units rec. Crossover included. Response 40-17,000 c/s. Size: 24½ × 24 × 8½ in. Weight: 13 lb. Price: £17 10s.

Quartet. Cabinet-baffle, forward facing. Four drive units. 12 in., 8 in., and two H.F. units. Size: 25½ × 25½ × 8¾ in. Weight: 32 lb. Price: £35. Cabinet only not supplied.

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GOODMANS INDUSTRIES LTD., Axiom Works, Wembley, Middlesex, England. Tel.: Wembley 1200. Cables: Goodaxiom, Wembley.

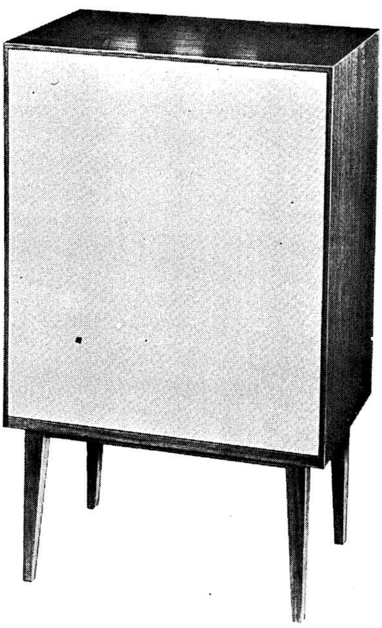
Eleganzia II. Acoustically sealed enclosure, exceptionally slim. Forward facing. Two units, 12 in. bass unit especially designed for this enclosure, employing Goodmans Superfoam diaphragm, and one back-loaded mid-range and H.F. unit. Crossover unit 900 c/s. F.R. 35 c/s-15 Kc/s. H.C. 15 watts. Imp. 15/16 ohms. Size: 27 × 20 × 6¼ in. Weight: 42 lb. Price £27 10s.

Maxim. Infinite baffle. Forward facing. Incorporates two units specially designed for this box. Crossover included. F.R. 45 c/s-20 Kc/s. H.C. 8W. Imp. 15 ohms. Size: 10½ × 5½ × 7¼ ins. Weight: approx. 7 lbs. Price: £15 (U.K. purchase tax £2 10s. 6d.).

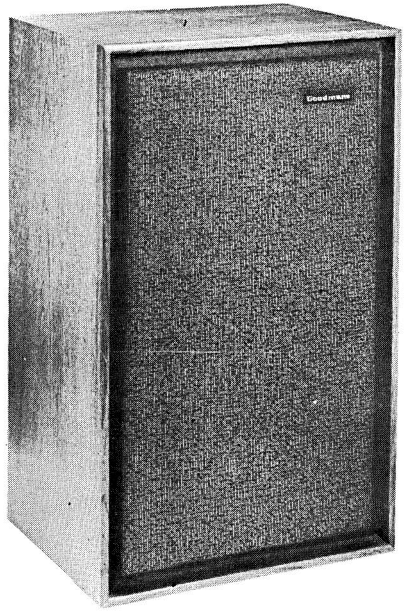
Magnum-K. Infinite baffle containing three units. 12 in. bass speaker, mid-range direct radiator, back-loaded direct HF radiator. Built-in multiple section crossover, 1·5 Kc/s and 6 Kc/s. F.R. 30 c/s-20 Kc/s. H.C. 25W. Air-cushion suspension to bass unit. Two attenuators allow sound tailoring to room acoustics. Classic styling in teak or walnut. Imp. 4-8 ohms. Price: £36 15s.

★

GRUNDIG (GREAT BRITAIN) LTD., Newlands Park, Sydenham, London, S.E.26. Tel.: Sydenham 2211. Cables: Grundig, London, S.E.26. Telex.: 22854.



Grundig Box 70



Goodmans Magnum-K

Box 70. Infinite baffle 2·8 cu. ft. Four-speaker system comprising 12 in. bass unit, three $7\frac{1}{8} \times 5\frac{3}{16}$ in. mid- and upper-frequency units. Response 30 c/s-16 Kc/s. Natural walnut matt finish. Black matt steel legs. Handling capacity 25W. Size: $33\frac{1}{2} \times 19\frac{3}{4} \times 12\frac{1}{2}$ in. Price: £51 9s.

Box 100. Infinite baffle 3·9 cu. ft. Nine-speaker system comprising 12 in. bass unit, two $7\frac{7}{8} \times 5\frac{3}{16}$ in. mid-range units, six $6 \times 2\frac{3}{16}$ in. tweeters. Cross-over 500 c/s and 5,000 c/s. Handling capacity 25W. Natural walnut matt finish. Black matt steel legs. Size: $33\frac{1}{2} \times 21 \times 16$ in. Price: £72 9s.

★

C. E. HAMMOND & CO. LTD., 90 High Street, Eton, Windsor, Berks. Tel.: Windsor 63388. Telex.: 84316.

Hammond Europa. Infinite baffle enclosure. Four units: One 12 in. dual cone bass unit, one 5 in. closed back mid-range unit, two 2 in. cone tweeters. Crossover 750 c/s and 4 Kc/s. F.R. 25 c/s-18 Kc/s. Size: $33\frac{1}{2} \times 16 \times 11\frac{1}{4}$ in. Weight: 25 lb. Imp. 16 ohms only. Finish: Teak with wood grille fillet, satin metal fillet extra. Price: £30 9s.

Hammond L7. Infinite baffle enclosure. One $8\frac{1}{4}$ in. twin-cone unit. F.R. 45 c/s-18 Kc/s. Imp. 8 or 16 ohms. Finish: Teak or Rosewood. Size: $20 \times 30 \times 4\frac{3}{4}$ in. Weight: 6 lb. Price: £11 0s. 6d.

★

HEATHKIT. See Kit section.

★

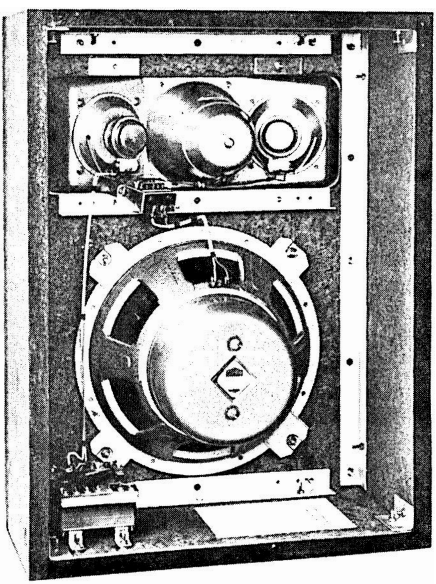
THOMAS HEINITZ, 100 Queensway, London, W.2. Tel.: Bayswater 2077.

C.Q. Junior. Controlled Q reflex enclosure. Units special Goodmans or Peerless 10×6 in. F.R. 45 c/s-15 Kc/s depending on unit. Finishes: Teak, walnut, mahogany, all-white (others to order at no extra charge). Size: $16\frac{1}{2} \times 9\frac{1}{2} \times 10\frac{1}{4}$ in. Weight: 7 lb. Price: £8 18s. 4d.

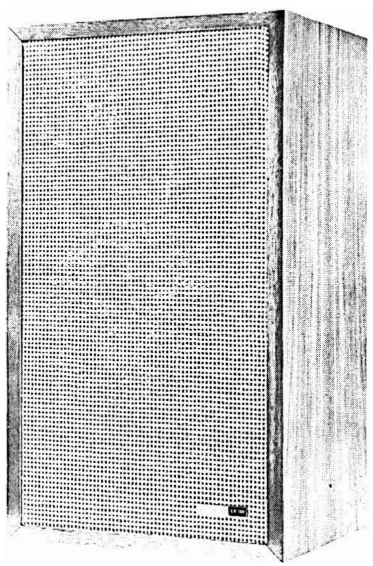
★

ISOPHON-WERKE, Berlin-Templehof. U.K. Distributors: Britimpex Ltd., 16/22 Great Russell Street, London, W.C.1. Tel.: Museum 7600.

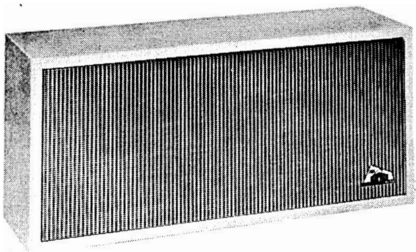
HSB10. Two-speaker system. Totally closed box damped internally. Forward-facing. Two units: 7 in. bass unit and 3×5 in. mid-range/HF speaker. H.C. 10W. Crossover 1,000 c/s. F.R. 50 c/s-20 Kc/s. Size: $19\frac{3}{4} \times 9 \times 6\frac{1}{8}$ in. Weight: $14\frac{1}{2}$ lbs. Price (with units): £18 7s. 6d. (incl. tax).



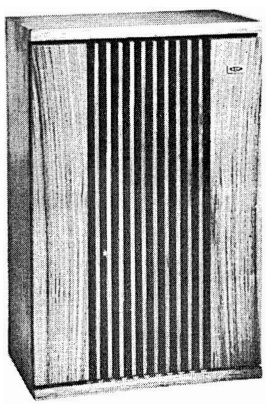
*Isophon G*3037



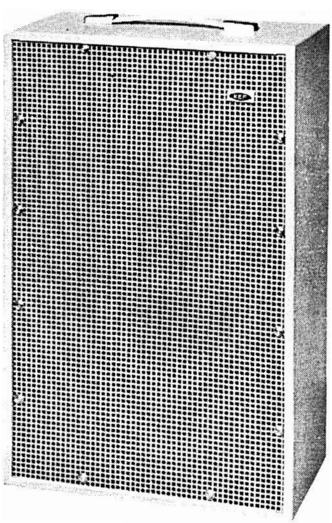
Elac LK 100



Isophon HSB10 Two-speaker System



KEF Duette



KEF Portable Celeste

HSB20. Three-speaker system. Totally closed box damped internally. Forward-facing with switch at back to amplify high-midrange. Three units: 8 in. bass unit and two 3 × 5 in. midrange/HF speakers. H.C. 20W. Crossover 1,500 c/s. F.R. 35 c/s-23 Kc/s. Size $24\frac{3}{8}$ × 11 × $8\frac{5}{8}$ in. Weight: $24\frac{1}{4}$ lbs. Price (with units): £32 11s. (incl. tax).

HSB45. Three-speaker system. Totally closed box damped internally. Forward-facing with control at the back adjusting level +3 −7 dB to room conditions. Three units (arranged angularly for wide radiation): 10 in. bass unit and two 3 × 5 in. midrange/HF speakers. H.C. 45W. Crossover 1,500 c/s. F.R. 25 c/s-23 Kc/s. Size: $25\frac{3}{8}$ × $13\frac{1}{2}$ × $11\frac{1}{4}$ in. Weight: $39\frac{3}{8}$ lbs. Price (with units): £61 19s. (incl. tax).

G3037. Folded horn diffuser. Four-speaker system 12 in. bass unit mounted in bitumenised soundproof case, wide angle diffuser, two 4 in. tweeters. H.C. 15W. F.R. 30 c/s-18 Kc/s. Size: $23\frac{5}{8}$ × $17\frac{3}{4}$ × $7\frac{7}{8}$ in. Weight: $29\frac{1}{4}$ lbs. Price (with units): £33 1s. 6d. (incl. tax).

★

JORDAN-WATTS. Distributors: Boosey & Hawkes (Sales) Ltd., Sonorous Works, Deansbrook Road, Edgware, Middx. Tel.: Edgware 5581.

Mini 12. Infinite baffle. Power handling 12W. Forward facing. Shelf or wall mounting. Incorporates one Jordan-Watts Modular unit. F.R. 80 c/s-20 Kc/s. Size: $16\frac{1}{2}$ × 8 × $3\frac{1}{2}$ ins. Weight: 13 lbs. Price: £16 12s. 6d.

A12. Reflex enclosure. Power handling 12W. Forward facing. Incorporates one Jordan-Watts Modular unit. F.R. 40 c/s-20 Kc/s. Size: $24\frac{1}{2}$ × $12\frac{1}{2}$ × $5\frac{1}{2}$ ins. Weight: 17 lbs. Price: £22.

A25. Reflex enclosure. Power handling 25W. Forward facing. Incorporates two Jordan-Watts Modular units. F.R. 20 c/s-20 Kc/s. Size: 30 × $13\frac{1}{2}$ × $7\frac{1}{2}$ ins. Weight: 25 lbs. Price: £36 15s.

B50. Reflex enclosure. Power handling 50W. Forward facing. Incorporates four Jordan-Watts Modular units. F.R. 20 c/s-20 Kc/s. Size: 34 × 15 × $10\frac{1}{2}$ ins. Weight: 48 lbs. Price: £64 6s. 3d.

★

KEF ELECTRONICS LTD., Tovil, Maidstone, Kent. Tel.: Maidstone 55761. Cables: Kef, Maidstone.

Celeste. Totally enclosed. Forward facing. Two drive units 13 × 9 in. and 1½ in. dia. Crossover 1,000 c/s. Size: 18 × 10¾ × 6¾ in. Weight: 24 lb. Price: £26 10s.

Portable Celeste. Totally enclosed. Forward-facing. Two units: B139 13 × 9 in.; T15 1½ in. dia. Crossover 1,000 c/s quarter-section. Size: 20 × 12½ × 7½ in. Weight: 26 lb. Price: £28.

Duette. Totally enclosed. Forward-facing. Two units: B139 13 × 9 in.; T15 1½ in. dia. Crossover 1,000 c/s half-section. F.R. 40 c/s-15 Kc/s. Size: 24 × 15 × 9½ in. Weight: 40 lb. Price: £35.

Duette de Luxe. Similar specification to Duette but housed in elegant prize winning design enclosure by Robert Heritage, RCA, FSIA. Price: £39 19s.

Group 4 Cantata. Designed for Group 4 hi-fi assembly but also available separately. Interior arrangement similar to the Celeste but larger enclosure gives improved bass response. Cabinet styling by Wright and Connor. Size: 24 × 16 × 6 in. Weight: 27¾ lb. Imp. 15 ohms. H.C. 15W RMS System. Resonance 60 c/s. F.R. 40 c/s-20 Kc/s. Finish teak veneer with brushed silver trim and lustre black grille fabric. Price: £28.

★

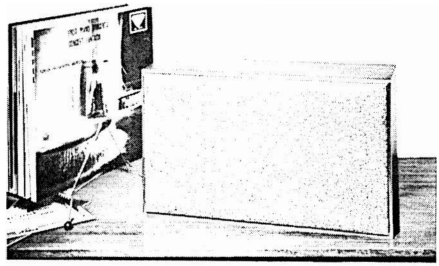
KIRKMAN (CRAWLEY) LTD., 40 The Broadway, Crawley, Sussex. Tel.: Crawley 26670.

Home Concert Hall. Wall-loaded reflex horn. Units: Two Richard Allan new Bronze Eight, two Lorenz LPH65 tweeters with diffusing cones. Crossover 1 Kc/s phase compensated. F.R. 40 c/s-20 Kc/s. Switched HF attenuator. HF units co-incident in azimuth and phase with bass units. Polar response: horizontal omni-directional, vertical converging above 250 c/s. Finish: waxed African walnut. Size: 29 × 16 × 7½ in. Price: £35.

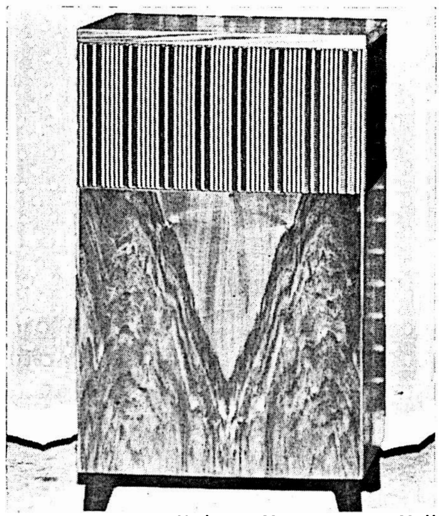
★

L.N.B. AUDIO SERVICES, 25 Cambridge Street, Loughborough, Leics.

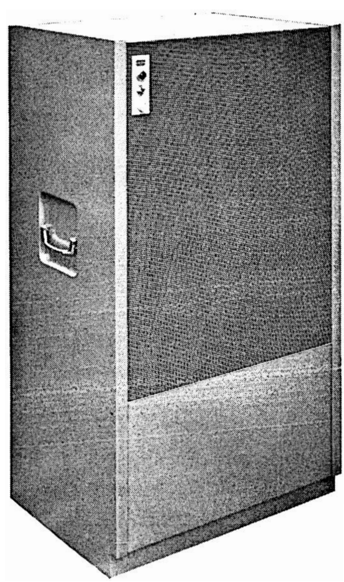
Labyrinth 10 Mk. I. Free-standing enclosure consisting of 9 ft. folded pipe designed to minimize resonances and extend response. Rec. unit: Wharfedale Golden 10/RS/DD. F.R. 30 c/s-20 Kc/s. Finish: Sapele/mahogany



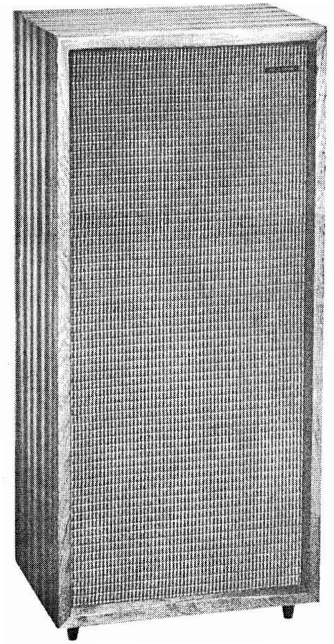
KEF Celeste



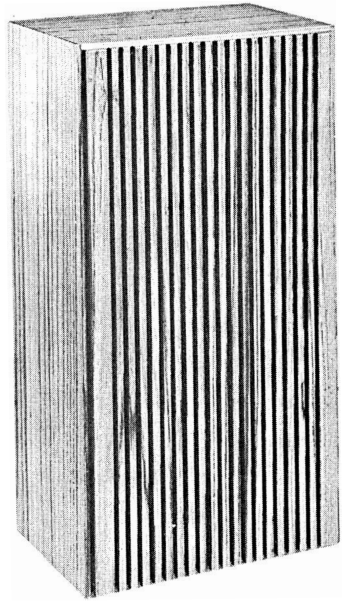
Kirkman Home Concert Hall



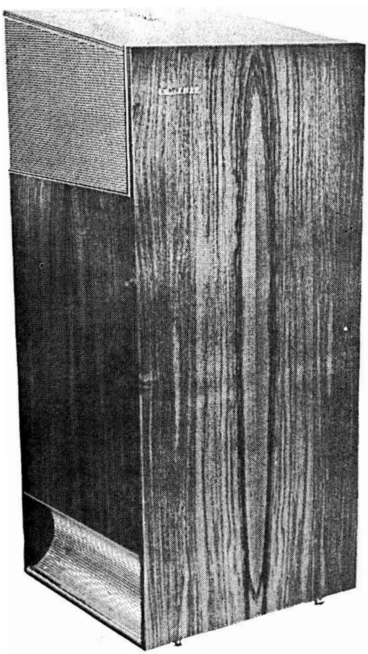
Lockwood LE1/AS



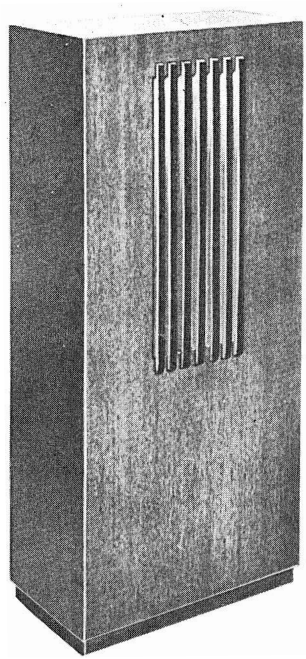
Mordaunt Arundel, Warwick or Sterling



*Luxor SH*207



Lowther Acousta Twin



Jordan-Watts A25 Reflex Enclosure

or African walnut. Both with Vynair front. Size: $29\frac{3}{4} \times 19 \times 12$ in. Weight: 36 lb. Price: £18 18s. (cabinet only).

Labyrinth 8 Mk. II. Free-standing enclosure consisting of 7 ft. folded tunnel designed to minimise resonances and extend response. Material: $\frac{1}{2}$ in. chipboard in rigid tube construction. Rec. unit: Wharfedale Super 8/RS/DD. F.R. 40 c/s-20 Kc/s ± 5 dB. Finish: Sapele/mahogany with utile surround and vynair front or African walnut with beech surround and vynair or tygan front. Size: $24 \times 15 \times 9$ in. Weight: 26 lb. Price: (sapele) £13 10s., (walnut) £14 14s. (cabinet only).

★

LANSING ROLLS LTD., 49 Foxdell Way, Chalfont St. Peter, Bucks. Tel.: Chalfont St. Giles 3444.

Lansing Rolls Mk. II. Horn loaded type enclosure. Four units: 12 in bass, 8×5 in. mid-range radiator, two 2 in. tweeters. Crossover 950 and 5,000 c/s. Imp. 15 ohms. H.C. 35W. Size: $31 \times 19\frac{1}{2} \times 16$ in. Price: £68 10s.

★

H. J. LEAK & CO. LTD., 57-59 Brunel Road, East Acton, London, W.3. Tel.: Shepherds Bush 1173. Cables: Sinusoidal, Ealux, London.

Sandwich. Forward facing. Two units, bass 13 in., treble 3 in. Half section crossover filter. Cabinet can be placed in vertical or horizontal position. The unique sandwich construction diaphragm behaves as a rigid piston, thus eliminating break-up distortion and resulting in a remarkably smooth frequency response. Size: $26 \times 15 \times 12$ in. Weight: 45 lb. Price: £39 18s.

★

LOCKWOOD & CO. (WOODWORKERS) LTD., 63 Lowlands Road, Harrow, Middx. Tel.: Byron 3704.

Mini-slim. Reflex, forward facing. 12 in. units. Rec. Tannoy 12 in. dual concentric, Tannoy III LZ dual concentric. Size: $27\frac{1}{2} \times 19 \times 9\frac{1}{8}$ in. Price (with specified units): £51 15s., £43 10s.

Minor Slim. Reflex, forward facing. 12 or 15 in. units. Rec. Tannoy 12 or 15 in. dual concentric, and units listed for Mini-slim. Size: $33\frac{1}{8} \times 20 \times 11\frac{1}{4}$ in. Price (with specified units): £62 10s., £55 15s., £48 10s.

Major Slim. Reflex, forward facing. 12 or 15 in. units. Rec. Tannoy 12 in. and 15 in. dual concentric. Size: $38 \times 24 \times 11\frac{1}{4}$ in. Price: £61 15s., £68 10s.

These reproducers can also be supplied complete with units by Goodmans, K.E.F., Vitavox, Stentorian and Wharfedale. Prices on application.

LEI/AS Mk. 2 and LEI/WAS. Studio quality monitoring speakers. Full details and prices on request.

★

LOWTHER MANUFACTURING CO., Lowther House, St. Mark's Road, Bromley, Kent, England. Tel.: Ravensbourne 5225. Cables: Lowther, Bromley.

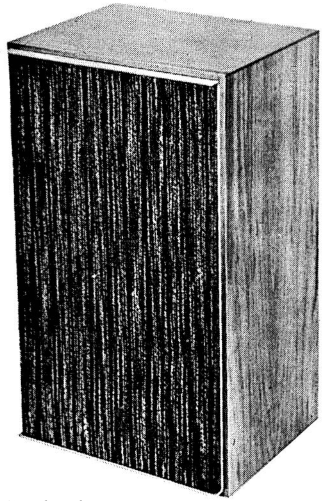
Corner Reproducer TP1. Folded bass horn/direct h.f. horn type. One specially designed 6 in. pressure unit PM3. Acoustical crossover. Response 40-22,000 c/s. Size: $47 \times 32 \times 31$ in. from corner. Weight: 70 lb. Price of Standard Model A: £108; Model B £125.

Acousta Cabinet. Models FH/V, FH/H. Folded horn type, forward facing, with rear folded horn. Vertical on runners, or horizontal on 12 in. legs. One unit, 6 in. or 8 in. Rec. Lowther PM6. Response 40-18,000 c/s. Size: $32 \times 18\frac{1}{4} \times 14\frac{1}{2}$ in. Weight: 60 lb. Price without unit £21. Special finishes £23 10s. Selected veneers £26 10s.

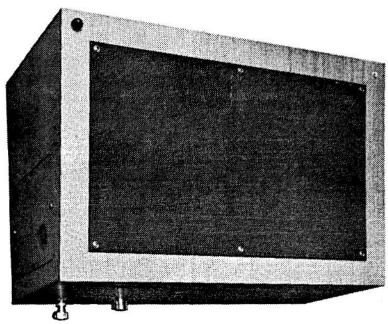
Audiovector. Compound horn. Upward facing mid- and high-frequency horn with rear folded horn. One 6 in. unit. Acoustic crossover. Range 40-22,000 c/s. Rec. PM2, PM2 Mk. 11 or PM4. Size: $26\frac{1}{2} \times 19 \times 34$ in. Weight: 75 lb. Price with specified units £108, without units £58.

Acousta-twin. Dual folded horn. Side facing and rear folded horn system for mono and stereo reproduction. Two PM6 or PM2 Mk. 3 6 in. drive units. Acoustic crossover. Response 40-18,000 c/s. Size: $40 \times 16\frac{1}{2} \times 18$ in. Price: £43. Special finishes £46 10s. Selected veneers £48 (enclosure only). £80 16s. or £103 complete.

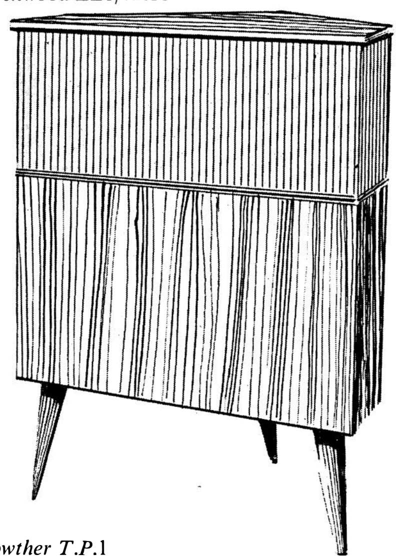
Corner Acousta. Folded horn. Rearward facing into corner. Bass outlets coupling into corner of room. One 6 in. high flux unit. Rec. Lowther PM6. F.R. 40 c/s-18 Kc/s. Size: $32 \times 9\frac{1}{2} \times 18$ in. Price (without unit) £21. Special finishes £23 10s. Selected veneers £26 10s.



Leak Sandwich



Lockwood LE1/WAS



Lowther T.P.1

LUXOR. Distributors: Britimpex Ltd., 16/22 Great Russell Street, London, W.C.1. Tel.: Museum 7600. Cables: Brytron, London, W.C.1.

SH105. Floor standing enclosure comprising four units. One high flux 10 in. bass driver, one 5 in. mid-range speaker and two 2 in. HF units. F.R. 50 c/s-18 Kc/s. Imp. 8 ohms. Finish: teak, oak or mahogany. Size: $17\frac{3}{4}$ × $25\frac{5}{8}$ × $4\frac{3}{4}$ in. Price: £20 9s. 6d.

SH207. Compact floor or shelf mounting enclosure with specially designed 10 × 7 in. elliptical speaker. Imp. 4 ohms. Finish: teak, oak or mahogany. Price: £10 10s.

★

METZ. Distributors: Mitchell Enterprises Ltd., 61 West Street, Dorking, Surrey. Tel.: Dorking 4229.

Belform 117R/118L. Reflex enclosure. Two drive units, 14 × $8\frac{1}{2}$ in. and 4 in. diameter treble. Built-in crossover. Finish: matt walnut or ivory polyester. Ivory polyester front grille, polished metal feet for horizontal use. Size: 23 × 9 × 12 in. Price: £24 15s.

325. Reflex enclosure. Two units, $14\frac{1}{4}$ × $8\frac{1}{2}$ in. and 4 in. diameter treble. Built-in crossover. Finish: matt walnut or ivory polyester. Slotted polished wood front panel. Size: 11 × 21 × 9 in. Price: £25 2s. 6d.

Belform 119. Reflex enclosure. Similar specification to 117R/118L but for vertical use. Size: $14\frac{1}{2}$ × 26 × 8 in. Price: £26.

★

V. J. MONK LTD., 140/141 Plumstead Road, London, S.E.18. Tel.: Woolwich 2369.

Variline. Folded column enclosure similar to the Paraline in performance having an adjustable reflector board which can be "tuned" to individual requirements. Rec. unit Elac 8N/148. F.R. nominally 40 c/s-12Kc/s. Finish: Walnut, mahogany or teak beaumel (laminated plastic). Imp. 15 ohms. H.C. 5W. May be wall mounted or free-standing. Size (closed): 36 × 22 × 5 in. Weight: 30 lb. with unit. Price: Cabinet only £13 13s., with speaker £16 16s.

★

MORDAUNT SOUND REPRODUCERS, 1 Stanley Road, Napier Road, Bromley, Kent. Tel.: Ravensbourne 9212.

Stirling. Totally enclosed. Forward facing. Two units: 12 in. bass. $1\frac{1}{2}$ in. hemispherical treble. Crossover 1750 c/s. F.R. 40 c/s-18 Kc/s. Size: 29 × 15 × 11 in. Price (with units): £33 12s.

Arundel Mark II. Totally enclosed. Forward facing. Two units, 12 in. bass, ribbon tweeter. Crossover 2,750 c/s. F.R. 30 c/s-25 Kc/s. H.C. 12/15 watts. Size: 33 × 15 × 11 in. Weight: 44 lb. Price: £44 2s.

Conway. Totally enclosed. Forward facing. Two units, 12 in. bass, ribbon tweeter. Crossover 2,750 c/s. F.R. 25 c/s-25 Kc/s. H.C. 12-15W. Size: 33 × 18 × 12 in. Price: £50 8s., Acoustic lens approximately £3 3s. extra.

Edinburgh. Totally enclosed. Forward-facing 15 in. bass driver with special cone treatment. Ionofane HF unit. Special crossover at 3·5 Kc/s. F.R. 20 c/s-35 Kc/s. Size: 36 × 24 × 12 in. Price: approximately £78 15s.

★

MUSICRAFT HI-FI CENTRE, 63 High Street, Hounslow, Middlesex. Tel.: Hounslow 4640.

Modular. Complete forward-facing system, using reflex enclosure principle for bass loading. Designed to match Modular tape and equipment cabinets. Designed for single 12 in. unit. Celestion CX1512 recommended. Size: 20 × 20 × 20 in. Finish in sapele mahogany or teak. Price: £12 12s. (cabinet only without unit).

★

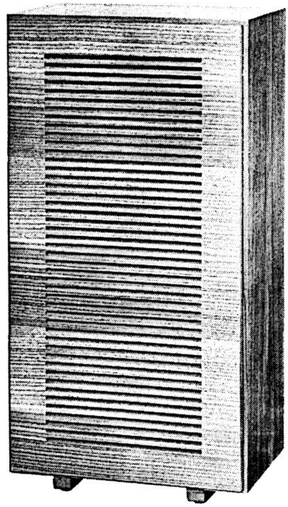
PYE LTD., High Fidelity Division. P.O. Box 49, Cambridge. Tel.: Cambridge 58985. Cables: Pyrad, Cambridge.

Brahms HF3BS. Infinite baffle for floor, shelf or wall mounting. Two drive units, 10 × 6 in. twin-cone bass and mid-range speaker, 4 in. tweeter. F.R. 40 c/s-16 Kc/s. 15W. Finish: light walnut with black trim. Size: $21\frac{1}{2}$ × $11\frac{3}{4}$ × $6\frac{1}{2}$ in. Price: £15 2s. 5d. (U.K. purchase tax £2 14s. 7d.).

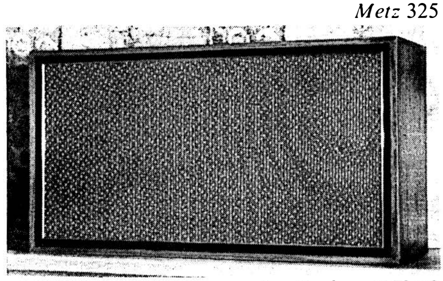
★

RADFORD ELECTRONICS LTD., Ashton Vale Estate, Bristol 3. Tel.: Bristol 662301/2.

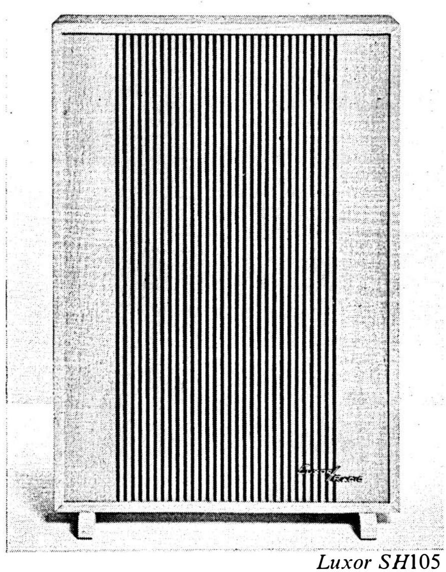
Bookshelf. Two drive units equalised and integrated by an eight-element network. Flat-faced expanded polystyrene foil-stressed bass



Metz 325



Pye Brahms HF3BS



*Luxor SH*105

driver. 2 in. voice coil. Gap flux 13,500 gauss. Sealed direct radiator pressure type HF unit. Enclosure sealed and internally lagged. Flat response down to 60 c/s with gradual roll off below. H.C. 30W. Size: 21 × 12 × 8 in. Weight: 28 lb. Price: £25.

Executive. Same units as the Bookshelf but with a more complex 11 element integrating network. Acoustic phase corrector fitted. Dimensions same as Bookshelf except 8½ in. deep and the panel to which the fret material is fixed is removable from the front. H.C. 30W. Weight: 30 lb. Price: £32 10s.

Monitor. Three drive units and 18 element network. Crossover at 500 c/s and 5 Kc/s. Response 40 c/s-13·5 Kc/s ± 1 dB. Cabinet 1 in. thick Afromosia. H.C. 45W. Size: 25¾ × 15 × 11½ in. Weight: 38 lb. Price: £45.

Studio. Identical driving system as the Monitor but with the rear of the bass driver acoustically loaded to extend flat response to below 30 c/s. Size: 35 × 17¼ × 15 in. Weight: 60 lb. Price: £65.

★

RECORD HOUSING, Brook Road, London, N.22. Tel.: Bowes Park 7487.

Nordyk. Reflex forward facing. One drive unit. Rec. 8 in. Goodmans and Wharfedale. Response 40 c/s-15 Kc/s. Prices (cabinet only): £7 7s. in walnut or mahogany; £8 8s. in teak.

Viking. Forward-facing corner reflex. Two drive units. 8 in. or 10 in. plus tweeter. Response 40 c/s-15 Kc/s. Size: 32 × 19 × 12 in. Prices (cabinet only): £11 11s. in walnut or mahogany; £12 12s. in teak.

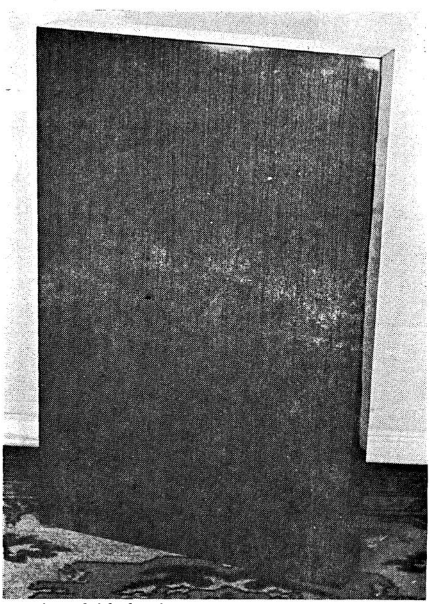
Folded Horn Enclosure. Forward facing free-standing. One 8 in. unit. Rec. Goodmans Axiette 8 or Wharfedale Super 8. Size: 27½ × 16¼ × 10 in. Prices (cabinet only): £9 19s. in walnut or mahogany; £10 19s. in teak.

Hi-flex 10/12. Reflex enclosure with slotted wood fascia. Two drive units. 10 in. or 12 in. with tweeter. Rec. Goodmans Axiom 301 with Trebax 5K.120.XL or Goodmans Axiom 201 with two Lorenz LPH65 tweeters. Acoustic design by Ralph West, styling by Wright and Connor Design. Size: 32 × 18 × 11 in. Available in walnut, mahogany or teak. Price: £11 19s.

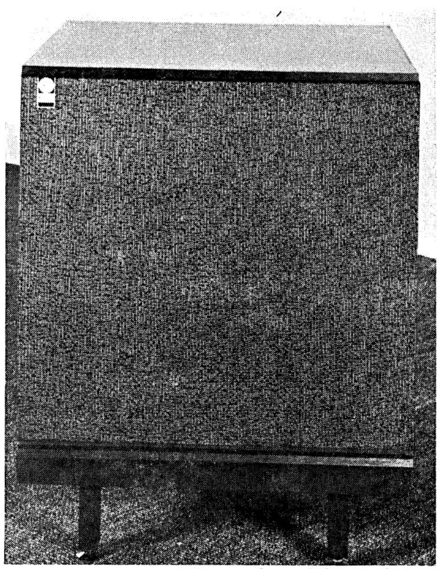
★

THE RECTAVOX COMPANY, Central Buildings, Wallsend, Northumberland. Tel.: Wallsend 624845 (STD ONE-2).

Omni 8. Specially shaped reflex enclosure providing unique versatility of positioning. Designed for 8 in. drive unit with provision for tweeter. Frequency range dependent on drive unit employed. Finish: Teak, walnut



Variline folded column



Musicraft modular enclosure

or mahogany laminated plastic veneers with satin-chrome brass frame. Size: 24½ in. maximum dimension. Price: (enclosure only) £17.

Omni. Reflex enclosure with special shape giving low resonant frequency and unique versatility of positioning. Units: K.E.F. B139 foil-stressed expanded polystyrene diaphragm bass and mid-range driver, K.E.F. T15 hemispherical dome tweeter. Crossover four-element ½-section 1 Kc/s. F.R. 45 c/s-18 Kc/s ±3 dB. Finish: Teak, walnut or mahogany laminated plastic wood grain veneers, Tygan fret material, satin-chrome brass frame. Size: 24½ in. maximum dimension, fret front 18¾ × 11⅝ in. Weight: 40 lb. Price: £39 10s.

★

ROGERS DEVELOPMENT (ELECTRONICS), LTD., Rodevco Works, 4-14 Barmeston Road, Catford, S.E.6. Tel.: Hither Green 7424 and 4340. Cables: Rodevco, London.

Cadet III. Compact shelf or floor-standing enclosure. 12 in. bass unit with separate tweeter. Enclosure internally damped with Fibroceta. F.R. 30 c/s-18 Kc/s. H.C. 10-12W. Imp. 15 ohms. Finish: Teak or dark Australian walnut Formica laminate with Vynair front. May be used horizontally or vertically. Size: 20 × 13¾ × 9 in. Price (either finish): £25.

Cadet Mk. II Horn Speaker. Folded horn gives rear loading on 8 × 5 in. main unit. Middle frequencies from front of elliptical unit and highs from 3 in. unit. Crossover at 4 Kc/s. Response, 50 c/s-15 Kc/s. Imp. 15 ohms. Size: 33½ × 20½ × 8¾ in. Price: £20 5s. (U.K. purchase tax £3 9s.).

Wafer speaker system. Infinite baffle. 5 in. unit plus tweeter. F.R. 40-16,000 c/s. H.C. 12W. Imp. 15 ohms. Size: 13⅛ × 16⅝ × 2½ in. Woodgrain finish Formica. Price: £14 10s. (U.K. purchase tax £2 9s. 6d.).

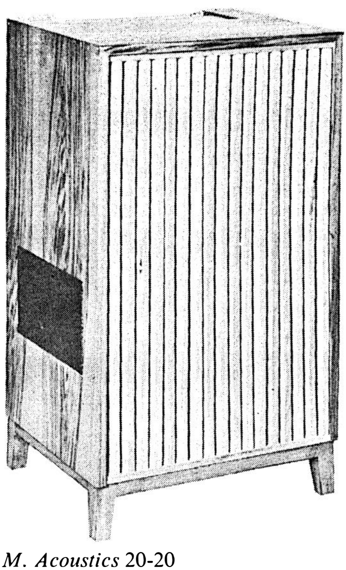
★

R.T.M. ACOUSTICS, 387 Mare Street, Hackney, London, E.8. Tel.: Amherst 9591.

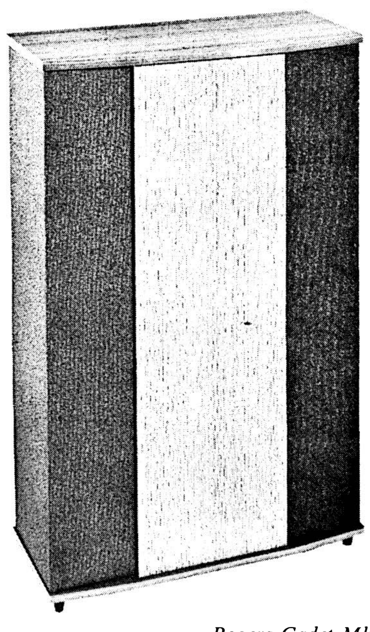
RTM 20-20. Exponential horn. 12 in. bass driver, ½ in. Vitavox treble driver. Two separate horns with mechanical and electrical crossover at approximately 600 c/s. F.R. 20 c/s-20 Kc/s. H.C. 18W. Imp. 15 ohms or switched transformer to order. Adjustable polar diagram from highly directional to completely omni-directional. Independent controls for middle and top frequencies. Mahogany, walnut or teak. Other finishes to order. Size: 35 × 20 × 16½ in. Weight: 74 lb. Price: £61 19s.

★

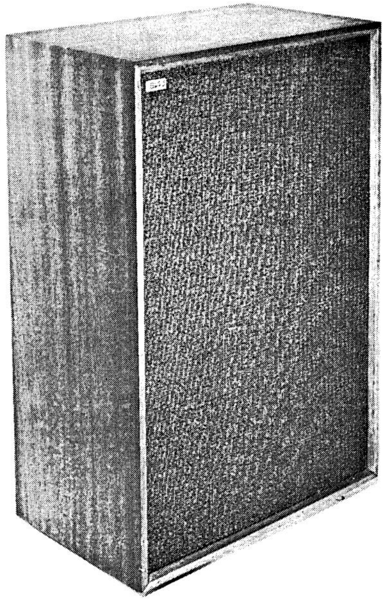
S.H.B. Svenska Hogtalarefabrken AB. Distributors: Metro-Sound (Sales) Ltd., Bridge Works, Wallace Road, Canonbury, London, N.1. Tel.: Canonbury 8641. Cables: Metro-sound, London, N.1.



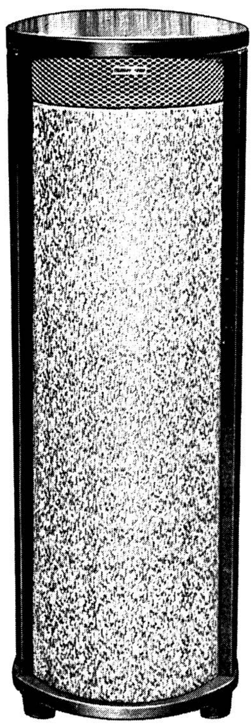
R.T.M. Acoustics 20-20



Rogers Cadet Mk. II



L.N.B. *8-in Labyrinth*



Sugden Craftsman Major

B.7. Speaker enclosure. Infinite baffle. H.C. 8W. F.R. 45 c/s-15 Kc/s. Double layer cone system. Imp. 3-4 ohms or 15-16 ohms. Cabinet finished white or teak. Size: $16\frac{1}{2} \times 11\frac{3}{4} \times 3\frac{1}{2}$ in. Price: £10 10s. (U.K. purchase tax £1 15s. 5d.).

Mini-B Speaker Enclosure. Infinite baffle. H.C. 8W. F.R. 50 c/s-15 Kc/s. Double layer cone system. Imp. 3-4 ohms or 15-16 ohms. Cabinet in Scandinavian teak with blue-grey facing: Size: $10 \times 5\frac{3}{4} \times 7$ in. Price: £10 (U.K. purchase tax £1 13s. 8d.).

★

THE SOUNDCRAFT CO., 1 Stanley Road, Bromley, Kent. Tel.: Ravensbourne 5673.

Stanley. Forward facing folded horn. One 8-in. drive unit. Size: $31\frac{1}{2} \times 12 \times 13\frac{3}{4}$ in. Price: cabinet only, £13 13s.

Langdon. Forward facing folded horn. One 8-in. drive unit. Size: $33 \times 15 \times 16$ in. Price: cabinet only, £17 17s.

FH12. Forward facing folded horn. Two drive units, 8 in., 10 or 12 in. and tweeter. Size: $32\frac{1}{2} \times 14$ in. Depth according to speaker fitted. Price: approx. £15 15s.

★

STENTORIAN. See Whiteley Electrical.

★

A. R. SUGDEN & CO. (ENGINEERS) LTD., Market Street, Brighouse, Yorks. Tel.: Brighouse 2142. Cables: Connoisseur, Brighouse.

Connoisseur Craftsman Minor. Column reflex with upward facing ports. Omni-directional 360°. 15 ohms impedance at 400 c/s. One unit, 8 in. foam surround with H.F. dome. 812/FS recommended. Response 40-12,000 c/s. Size: $36 \times 11\frac{1}{2}$ in. max. dia. Weight: 17 lb. Price: enclosure, £10 8s. 9d.; 8 in. unit for above 812/FS £2 7s. 6d. (U.K. purchase tax 7s. 10d.).

Connoisseur Craftsman Major. Column reflex with upward facing ports. Omnidirectional 360°. 15 ohms impedance at 400 c/s. One 8 in. foam surround unit, one 3 in. tweeter. G8/FS and LPH/65 recommended. Capacitor filter. Response 30-17,000 c/s. Size: $43 \times 14\frac{1}{2}$ in. max. dia. Price: enclosure only, £15 10s. 8d.; G8/FS £3 (U.K. purchase tax 10s.); LPH/65 £2 (U.K. purchase tax 6s. 8d.).

Connoisseur "Junior". Column reflex. Upward facing port, omni-directional 360°. One unit: 3 or 15 ohm available. 6½ in. foam surround. F.R. 50 c/s-12 Kc/s. Size: 26 × 9 in. max. diam. Weight: 10 lbs. Price: (with unit) £7 11s. 10d.

Connoisseur Minor Mk. II. Column reflex. Upward facing ports, omni-directional 360°. One unit: 8 in. foam surround with H.F. dome. Imp. 15 ohms at 400 c/s. F.R. 40 c/s-12 Kc/s. Size: 34 × 10½ in. Weight: 18 lbs. Price: (enclosure only) £9 11s. 6d.; (unit) £2 7s. 6d. (U.K. purchase tax 7s. 10d.).

Connoisseur Major Mk. II. Column reflex. Upward facing port, omni-directional 360°. Two units: 8 in. foam surround, 2½ in. HF unit. Imp. 15 ohms at 400 c/s. Filter capacitor. F.R. 30 c/s-17 Kc/s. Size: 40 × 13 × 13 in. Weight: 28 lbs. Price: (enclosure only) £12 12s.; (8 in. drive unit) £3 (U.K. purchase tax 10s.); (2½ in. HF unit) £2 (U.K. purchase tax 6s. 8d.).

★

SYMPHONY AMPLIFIERS LTD., 16 Kings College Road, London, N.W.3. Tel.: Primrose 3314/5.

Symphony Bass Reflex Cabinets. A range of forward facing systems to take 8, 10 or 12 in. units. Price, ready built, £5 10s. to £12 10s. Also available in Kit form.

★

TANNOY PRODUCTS LTD., West Norwood, London, S.E.27. Tel.: Gipsy Hill 1131. Cables: Tannoy, London.

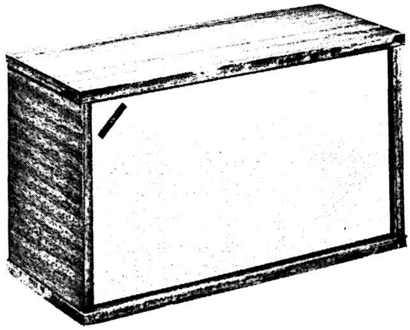
Guy R. Fountain Autograph. Folded horn. Front and rear horn-loaded unit, forward facing for corner placing. 15 in. dual concentric unit. Response 20-20,000 c/s. Size: 58½ × 43 × 26½ in. Price: £165.

Lancaster. Reflex (single port) forward facing. Corner placing. One 12 in. Monitor. Size 33 × 25 × 16¾ in. with 2 in. plinth. Price: £50.

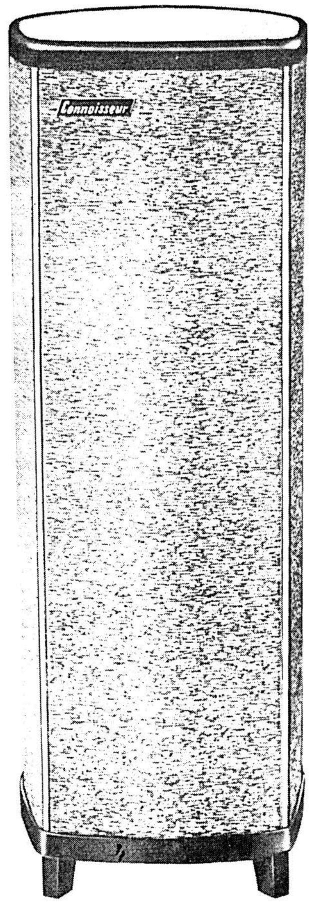
Lancaster. Reflex (single port) forward facing. Free standing. One 12 in. Monitor. Size: 33½ × 21½ × 12½ in. with 2 in plinth. Price: £50.

Lancaster. Aperiodic corner enclosure. One Monitor 15 in. drive unit. Size: 33 × 25 × 16¾ in. with 2 in. plinth. Price: £57 10s.

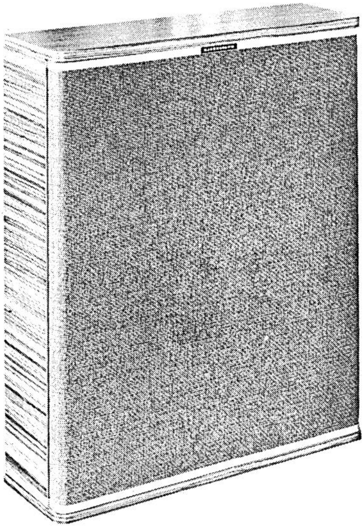
York. Reflex. Forward facing unit, dual throated ports, for corner placing. 12 in. or

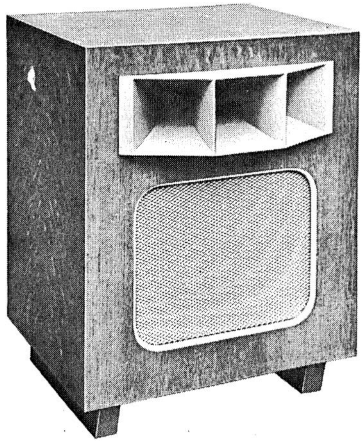


Tannoy III LZC



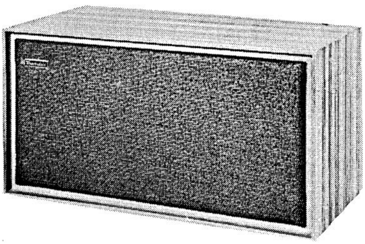
Sugden Connoisseur Major Mk II

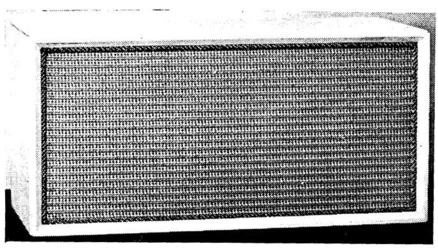




Vitavox Bitone 3200

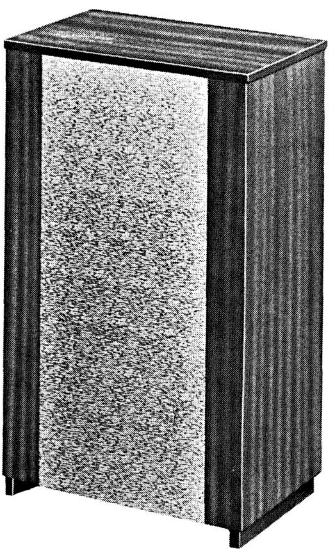
Wharfedale Dalesman

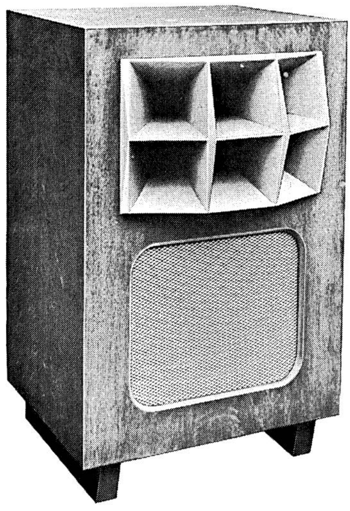




Wharfedale PST/8

Wharfedale Linton





Record Housing folded horn

Vitavox Bitone 6200

15 in. dual concentric unit. Response 35-20,000 c/s. Size: 45½ × 32 × 22½ in. Price: with 12 in. unit, £66; with 15 in. £75.

Lancaster. Aperiodic free standing enclosure. One Monitor 15 in. drive unit. Size: 33½ × 21½ × 12½ with 2 in. plinth. Price: £57 10s.

Rectangular York. Reflex (single port). Forward-facing. Complete with 15 in. dual concentric unit (Monitor 15). Crossover 1,000 c/s. F.R. as for speaker units. Size: (front to back) 15 × 23½ × 42 in. Price: £75.

G.R.F. Folded horn. Rear horn loaded, forward facing unit, for corner. One 15 in. dual concentric unit. Response 20-20,000 c/s. Size: 48 × 38 × 29 in. Price: £122.

Rectangular GRF. Single folded horn. Forward-facing with front exits. Complete with 15 in. dual concentric unit (Monitor 15). Special crossover 1,000 c/s. F.R. as speaker unit. Size (front to back): 17¼ × 23½ × 42 in. Price: £105.

III LZC. Mk. II. Infinite baffle forward facing. Tannoy III LZ dual concentric unit. Response 30-20,000 c/s. Size: 14 × 10¾ × 23¼ in. Price: £32 10s.

★

TRUVOX LTD., Neasden Lane, London, N.W.10. Tel.: Dollis Hill 8011. Cables: Truvoxeng, London, N.W.10.

LS100. Tuned-port bass reflex enclosure suitable for vertical or horizontal operation. Free-standing. Heavy internal lagging. Units: 12 in. roll-surround bass unit with ceramic magnet, Celestion HF pressure unit. ¼-section L/C crossover operates at 4 Kc/s. F.R. 40 c/s-15 Kc/s. Finish: Arormosia. Size: 27¼ × 18 × 7½ in. Weight: 29 lb. Price: £26 5s.

★

VARALINE. See V. J. Monk Ltd.

★

VITAVOX LTD., Westmoreland Road, London, N.W.9. Tel.: Colindale 8671. Cables: Vitavox, London, N.W.9.

Klipshorn. Double channel horn system. Folded LF horn with AK152 drive unit. Forward facing HF horn with S2 pressure unit. Filter network incorporated. Crossover 500 c/s. Response 30 c/s-15 Kc/s. High translational efficiency. Size: 51 × 30 × 27 in. Weight: 210 lb. with drive units. Price: £165.

Bitone Series 3200. Double channel sound system comprising three-cell horn (distribution 60° wide × 20° high) with 12 in. LF driver in vented enclosure. Filter network 1 Kc/s crossover attenuation 12 dB per octave. HF balance control 0-8 dB attenuation. H.C. 20W. F.R. 50 c/s-15 Kc/s. Size: 24 × 20 × 19 in. Weight: 70 lb. Price: from £60.

Bitone Series 6200. Similar specification to 3200 but with six-cell horn giving distribution 60° wide × 40° high. Size: 29 × 20 × 20 in. Weight: 78 lb. Price: from £73.

★

WHARFEDALE WIRELESS WORKS LTD., Idle, Bradford. Tel.: Idle 1235-6. Cables: Wharfedel, Idle, Bradford.

PST/8. Acoustic resistance, forward facing. One 8 in. drive unit. Rec. Super 8/RS/DD or 8 in. Bronze FS/AL. Size: 24 × 12 × 12 in. Weight: 17 lb. Price: without unit £7 10s. whitewood, or £10 10s. veneered and polished.

Linton. Two-speaker system, incorporating 8 in. Flexiprene-surround bass unit, 3 in. treble unit. Veneered finish. Can be used vertically or horizontally. Free-standing. Size: 19 × 10 × 9½ in. Price: £18 7s. 4d.

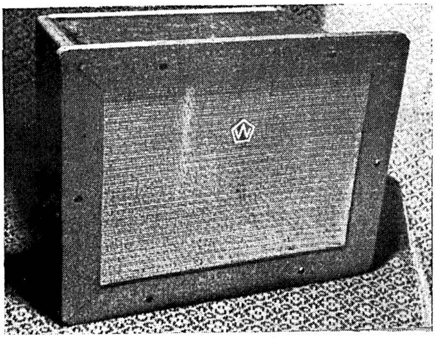
Dalesman. Two-speaker system, incorporating 12 in. Flexiprene-surround bass driver, 5 in. treble unit. Veneered finish. Slimline construction. Can be used free-standing or wall mounting. Size: 25 × 20 × 6¼ in. Price: £25 10s.

Dovedale. Two-speaker system, incorporating 12 in. Flexiprene-surround bass driver, Super 5 in. treble unit. Free-standing. Veneered finish. Size: 24 × 14 × 12 in. Price: £31 10s.

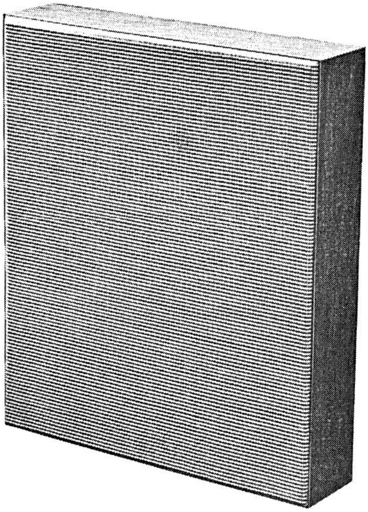
W3. Three-speaker system, incorporating WLS/12, a 5 in. Bronze, and Super 3. Separate vol. controls for the two H.F. units. Crossover 1,000 c/s. Size: 28 × 14 × 12 in. Price: veneered, complete, £39 10s.

W4. Four-speaker system, incorporating WLS/12, two 5 in. Bronze, and Super 3. H.F. units are arranged for omni-directional radiation and have independent mid and treble vol. controls. Size: 35 × 24 × 12 in. Price veneered, complete, £49 10s.

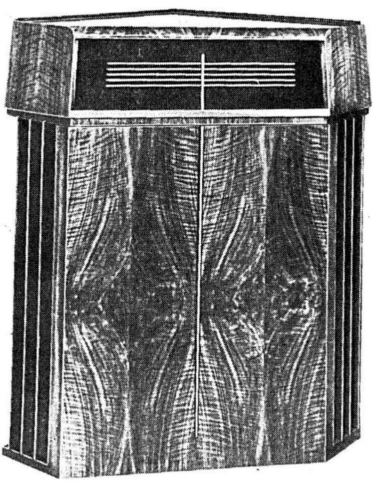
Airedale Reflex. Omni-directional. Three units, 15 in. bass, 8 in. middle, 3 in. treble. Crossovers 400 and 5,000 c/s. F.R. 20 c/s-20 Kc/s. Size: 39 × 28½ × 14 in. Weight: 91 lb. Price: £65.



Woollett Electrostatic 5C and BC



Stentorian LC92



Vitavox Klipshorn

WHITELEY ELECTRICAL RADIO CO., LTD., Victoria Street, Mansfield, Notts. Tel.: Mansfield 1762/3/4/5. Cables: Whitebon, Mansfield.

Model C3. Stentorian Junior Console. Bass reflex for corner position. 1 or 2 drive units. Rec. HF816 or HF1012 with T10 tweeter, if required. Crossover 3,000 c/s. Response HF816. 50-14,000 c/s; HF1012 and T10 30-14,000 c/s. Size: 33 × 22½ × 18½ in. Price without units, £11 10s.

Model C2. Stentorian Senior Corner Console. Bass reflex for corner position. 10 in. or 12 in. drive unit with tweeter, if required. Crossover 3,000 c/s. Response with HF1012 and T10 30-40,000 c/s; with HF1214 and T12 25-17,000 c/s. Size: 35 × 30 × 19 in. Price without units, £14 5s.

Model C4. Corner Console. Similar design to Model C2 but suitable for smaller room. Designed for Stentorian HF810 or HF812. Size: 26 × 17 × 7½ in. Price: £6 5s. without unit.

Model C14. Thoresby Bass Reflex Corner Console. Designed to utilise acoustic properties of walls. Takes 8 in. or 10 in. units with provision for tweeter. Size: 31 × 19⅜ × 17 in. Choice of mahogany (C14) or walnut (C14A) finish. Prices: (mahogany) £11 17s. 6d.; (walnut) £12 2s. 6d.; without units.

Model C15. Thoresby Bass Reflex Console. Designed for 8 in. or 10 in. units with provision for tweeter. Size: 31 × 19⅜ × 18 in. Choice of mahogany (C15) or walnut (C15A) finish. Prices: (mahogany) £12 17s. 6d.; (walnut) £13 5s.; without units.

Model C17. Thoresby Slim Line. Designed to accommodate any of the Stentorian range of 8 in. or 10 in. units. Provision made for cone type or pressure tweeter and crossover. Substantially constructed and acoustically proportioned for balanced response. Size: 31 × 20 × 9¼ in. Choice of mahogany (C17) or walnut (C17A). Prices: (mahogany) £10 5s.; (walnut) £10 10s.; without units.

Model C18. Thoresby Stereo Column. Dome-shaped diffuser above speaker gives 360 degrees radiation. Speaker mounted horizontally near the top. Finished in walnut. Price: £14 without units.

Stentorian Clumber enclosure. Compact shelf- or floor-mounting speaker enclosure in walnut. A matched 9 in. unit in reflex arrangement with internal absorption filters. H.C. 9W. Imp. 15 ohms. F.R. 100 c/s-13 Kc/s. Price: £12 11s. 2d. (U.K. purchase tax £2 2s. 4d.).

Stentorian LC. 92. Slim-line acoustic labyrinth incorporating 9 in. drive unit with graded cone and extended treble response. Cabinet in walnut with satin melamine finish. Imp. 15 ohms. Size: 29 × 24 × 6 in. deep. Weight: 25½ lb. Price: £19 19s. with unit.

★

L. G. WOOLLETT & COMPANY LTD., 21 Anerley Station Road, London, S.E.20. Tel.: Sydenham 9003.

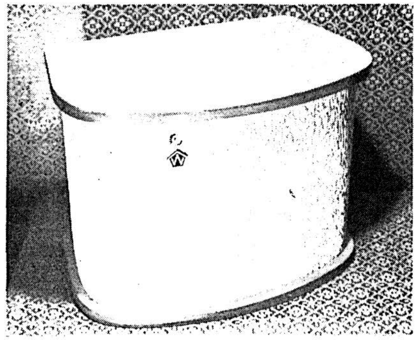
Leven Type 5. Electrostatic mid-range and HF system. Constant charge push-pull electrostatic unit. Crossover 1·5 Kc/s, −6 dB/octave. F.R. 1·5 Kc/s-20 Kc/s. H.C. 15W. RMS. Imp. 15 ohms. Cabinet contains mains polarising unit, crossover, phase correcting network, depolarising circuit, pre-set treble attenuator (12 dB range). Mains 200-250V (100-125V to order). Finish: Veneered wood, synthetic resin finish with white/brown flecked gold Vynair. Size: 11½ × 8¾ × 8¼ in. Weight: 4 lb. 12 oz. Price: £17 17s.

Lomond. Infinite baffle enclosure intended for use as bass speaker in conjunction with Leven HF unit. Speaker unit 12 in. foam surround. F.R. 20 c/s-5 Kc/s. 15W RMS. 15 ohms imp. Cabinet finish as for Leven. Size: 39½ × 17 × 17 in. Weight: 40 lb. Price: £36 15s.

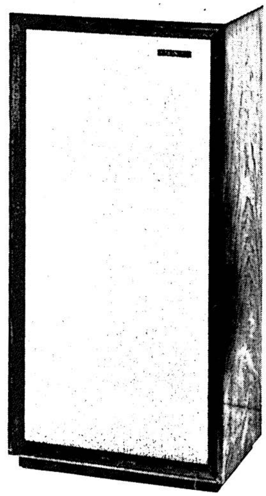
Lomond Full-Range. Infinite baffle. Two units. Moving coil treble, 12 in. bass with foam surround. Equalising crossover unit. F.R. 20 c/s-13 Kc/s. H.C. 15W RMS. Imp. 15 ohms. Finish as for Leven. Size: 39½ × 17 × 17 in. Weight: 42 lb. Price: £40 19s.

Kelsey. Infinite baffle frontal-loaded enclosure intended for use as a bass speaker. Unit 12 in. foam surround. F.R. 20 c/s-5 Kc/s. H.C. 15W RMS. Imp. 15 ohms. Finish: veneered wood with synthetic resin finish. Size: 33¾ × 18 × 14 in. Weight: 52 lb. Price: £44 2s.

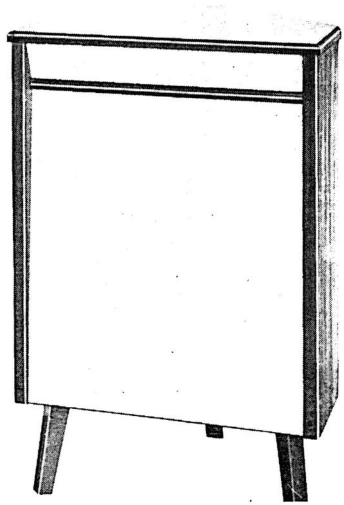
Thirlmere. Infinite baffle. Two units: electrostatic treble and 12 in. foam surround bass. Crossover ¼-section 1·5 Kc/s. F.R. 20 c/s-20 Kc/s. H.C. 15W RMS. Imp. 15 ohms. Mains polarising unit included. Mains 200-250V (100-125V to order). Finish: Mahogany with metallic gold trim, white/brown flecked gold Vynair. Size: 47 in. high, 16 in. diameter. Price: £51 9s.



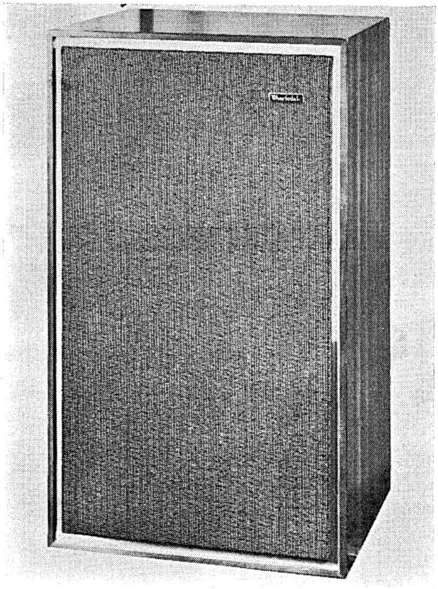
Woollett 6c



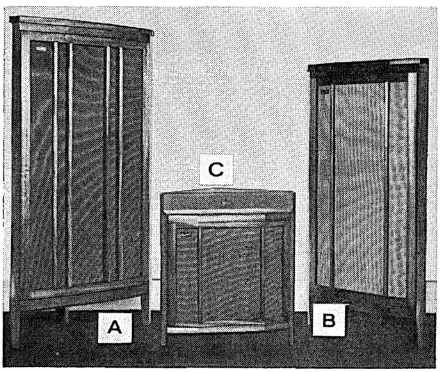
Tannoy Rectangular Chatsworth



Whiteley Thoresby Bass Reflex



Wharfedale Dovedale



Worden Panosona—three versions

Kelsey. Full range. Infinite baffle. Details as for Thirlmere plus indicator lamp on front. Size: $33\frac{3}{4} \times 18 \times 14$ in. Weight: 56 lb. Price: £55 13s.

★

WORDEN AUDIO DEVELOPMENTS LTD., 54 Chepstow Road, London, W.2. Tel.: Bayswater 4996.

Panosona Reproducer. Double horn with diffusing chamber. Corner reproducer, designed for near plane-wave distribution from one speaker unit. Available in three versions: Model A, $54 \times 24 \times 14\frac{1}{2}$ in. to corner; F.R. from below 30 c/s-18 Kc/s. Price: (enclosure only) £31. Wharfedale Special Super 10 drive unit with 16,000 gauss magnet, £9 7s. 6d. (U.K. purchase tax £1 11s. 2d.). Model B, $48 \times 21\frac{1}{2} \times 12\frac{1}{2}$ in. to corner; F.R. 30 c/s to over 15 Kc/s. Price: (enclosure only) £28. Wharfedale Special Golden 10 drive unit with 14,500 gauss magnet, £6 15s. (U.K. purchase tax £1 2s. 5d.). Model C, $25 \times 22\frac{1}{2} \times 13$ in. to corner; F.R. from below 40 c/s-15 Kc/s. Price: (enclosure only) £19 10s. Wharfedale Special Super 8 drive unit with 14,500 gauss magnet, £5 15s. (U.K. purchase tax 19s. 2d.).

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ZENITH RADIO CORPORATION. Distributors: United Mercantile Co. Ltd., 13/14 Queen Street, London, W.1. Tel.: Grosvenor 4901. Cables: Ramsaco, Telex, London.

●**Stereo Speaker Kits.** Two sets of Zenith speakers, each set consisting of one 12 in., one horn, two $3\frac{1}{2}$ in. units. Supplied complete with crossovers. Price: £93 (U.K. purchase tax £14 18s. 5d.).

THE PREVALENCE OF MAGNETS, OR TAPE RECORDING FOR THE INNOCENT

by Arthur W. Wayne

TAPE recording is one of the few hobbies in which, given resonable luck, the first cost is very nearly the last. Apart from wear, which in a good recorder is very little indeed, the only expense lies in the purchase of tapes, and as these are, say, the equivalent of petrol for a car (except for the fact that they can be used over and over again), it will be seen that, for what can be a genuinely creative occupation, the tape-recordist is in a remarkably fortunate position. However, again as with a car, some knowledge of the fundamentals of both what the recorder is and how and why it works, is a very worthwhile addition to the user's education. It can, on occasion, save him quite a lot of money, too!

Basically, tape recording consists of making millions of tiny magnets, and then converting them into dynamos. Should this statement seem to some readers to be rather less than clear, it will be well to consider the processes involved. Take a bar of iron, such as that represented in **fig. 1a.** Although it appears to be homogeneous, it is actually composed, from the physicist's point of view, of an agglomeration of molecules, the smallest particles in which matter can normally exist.

Now, in the case of certain materials, of which iron is the most familiar, the molecules group themselves into what are known as magnetic *domains.* These possess what we call north and south poles, which is one way of saying that, if all constraints were eliminated, they would tend to set themselves so that they face towards the earth's south and north poles. However, in our bar, these domains are arranged in different directions, or, as the technical man puts it, they are randomly oriented; and the result is that the magnetisations tend to cancel each other out.

Assuming that the arrows in **fig. 1b** are the domains with the heads representing the north poles, then the situation will be quite clear. If, on the other hand, we can by some means arrange for these north poles all to lie in the same direction, they will then tend to act in concert; and when this occurs, the bar becomes what we know as magnetised: i.e. if freely suspended, it will orient itself as a whole towards the earth's poles, and, incidentally, will attract —or repel—magnetic substances. (Note that north poles automatically include the south poles at the other ends of the domains as, ordinarily, a single polarity cannot exist.) It must be understood that the above is a very much over-simplified description of the phenomenon, this being a very involved and indeed impossibly difficult concept to explain simply to the non-technical person.

One way of achieving this magnetisation is to subject the bar with its randomly oriented domains to an external magnetic field, and the proportion of magnetism remaining when the exciting field is removed, is a measure of the '*remanence*' or '*retentivity*'. Various alloys of iron (most of which are called steels) as well as a number of other substances possess this property to a substantial degree, but such materials are usually difficult to magnetise in the first instance. The degree of the 'difficulty' is stated in terms of '*coercitivity*'. In other words, if it is wanted for keeps, it is hard to get!

Quite clearly, a magnetic material of high coercitivity and *remanence** is not going to be too useful to the average tape-recordist. He will

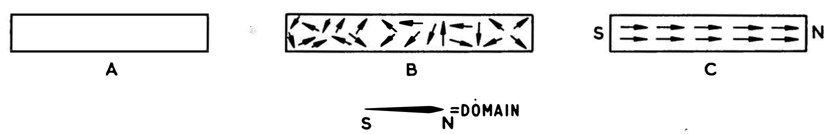

FIG. 1.

*Capacity for retaining magnetism.

want to orient the millions of tiny magnets referred to above (the 'domains') reasonably easily. At the same time physical conditions limit the power available for demagnetising or redisorienting the domains—which is the process involved in wiping the tape. Conversely, neither coercitivity or remanence should be too low, as the first will limit the orienting power conserved in the domains, while the second will too easily permit the domains to return to their their random positions—*i.e. any magnetisation impressed upon the material will tend to be lost*

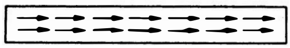

FIG. 2.

to external influences. Incidentally, coercitivity is quantitively stated in **oersteds** and remanence in **gauss,** these strange terms being the names of the scientists who first defined the respective conditions.

The tapes ordinarily used for recording consist of a plastic ribbon coated with iron in the form of its oxide Fe_2O_3, and the tiny particles forming the coating are needle-shaped or 'acicular'. (For those interested, the prefix γ (gamma) indicates the polymorphic form of iron, face-centred cubic lattice, stable between 906° and 1403°C.) However, so far as the recordist is concerned, the particles are chosen for extremely fine grain and regular size, and some idea of the degree of these characteristics may be derived from the fact that, in a slightly different and, from our point of view, useless, guise, Fe_2O_3 is known to us as jewellers rouge. This must not be forgotten, because Fe_2O_3, whatever its type, is an abrasive.

Having provided our tape, the next activity is to record on it. As the coating is a magneti - able oxide of iron, it would appear that one way of doing this would be to devise some method of magnetising it in regular series, corresponding to the vibrations of which sound is the aural manifestation. For instance, if we want to record a 100 c/s note, all we need to do is to arrange for a magnetizing force to provide a field near the tape 100 times per second. (How this is to be done will be discussed later, but it is quite simple in principle.)

Taking **fig. 2** to be a piece of tape, and the sets of arrows to be magnetizations, it is quite clear that, if these arrow-sets be drawn, at the rate of 100 sets per second, across a device that can register their passing and convey the registrations to an amplifier-cum-speaker combination, a 100-cycle note will be heard. In fact, we have converted the domains plus the device into the dynamos referred to previously, a dynamo being a machine for transforming mechanical into electrical energy. This, in very broad outline, is the whole essence of tape recording and reproduction; but the working details, as with so many simple scientific concepts, present some rather more awkward problems. However, we will now look at tape recording from the more practical aspect.

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As most of us know, the complete recorder is basically in two parts, the electronic and the mechanical. The mechanical side—the deck—need not concern us to any great extent, as its manufacture is very much a job for experts. Although really nothing but a simple transport mechanism, as will be seen from **fig. 3,** its design, construction and adjustment present the most formidable mechanical difficulties. It provides a stable platform on which are mounted the motor(s) for pulling the tape across the *heads,* which are devices for (a) providing the magnetizing fields, for recording, (b) accepting them for replay, as well as (c) making available the means for wiping the tape. Very often in amateur and semi-professional machines, (a) and (b) are electronically combined in the one head.

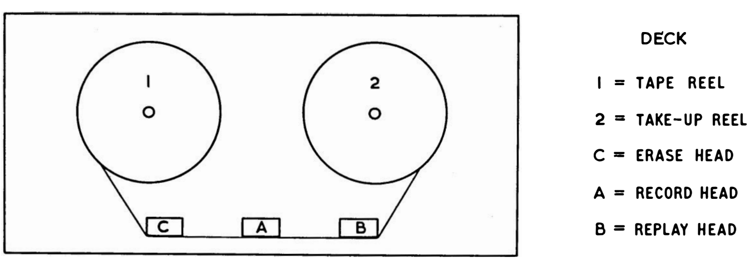


FIG 3

Electrical and mechanical switches are included to start and stop the motor(s), as well as to permit the tape to run in either direction; and interlocks, varying from deck to deck, go a long way to countering the attentions of the ignorant, the ham-handed, or the merely forgetful. Apart from the heads, which are really part of the electronics, this is all we need to know about the mechanical aspect of our apparatus.

Our real concern as intelligent recordists is with the electrical aspect. Here we come into our own, as the processes involved are comparatively simple and, more important, *most of the gear can be made with our own respective fair hands;* and for those who prefer to leave it to the professionals, there will still be the satisfaction of knowing what happens and why it sometimes doesn't.

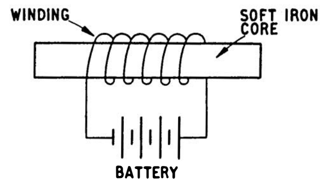
★ ★ ★

The first consideration is the recording head; and as this, except for one small extraneous detail is, as suggested above, completely reversible in its action, it is very often utilised for replaying as well. The recording head is the device employed for magnetically impressing the impulses (illustrated in **fig. 2**) on the tape. It is, actually, an electro-magnet. There are two kinds of magnet, the permanent magnet, familiar to us all from childhood, and the electro-magnet, probably the most common example of which is to be found on the domestic electric bell.

If a coil of insulated wire be wound around a core of soft iron, and the end of the coil be connected to a battery, the core will become magnetized so long as the bettery is in circuit (**fig. 4**). When the battery is disconnected, the core reverts almost to its original unmagnetized condition, and the very small fraction remaining may, at the moment, be ignored. Here we have an electromagnet, and its uses for recording should be obvious because, if we can drive the coil at the rate of the 100 pulses per second discussed, we shall have created the 100 magnetic fields around the core, and these will, of course, similarly influence the tape as it is drawn past its tip (**fig. 5B**). To play the 100-cycle note back, the tape is first rewound and then drawn past the tip again—but this time with the ends of the coil connected to a sensitive amplifier. The magnetized pulses on the tape will, of course, induce corresponding magnetism—or flux, as it is known—in the core, and this in turn affects the coil, inducing impulses of electric current in it which, on being amplified and fed into a speaker, emerge as the recorded 100-cycle note (**fig. 5B**).

It will be realised that such an arrangement would hardly be the epitome of efficiency, as all of the magnetism available at the remote end of the core is entirely lost; and a more usual construction would be that of **fig. 6A.** Here the core of **fig. 4** is, in effect, bent round to form the familiar horseshoe shape, albeit a little distorted; and because of the close proximity of the two poles, the *magnetic flux* is concentrated in the gape between, the *reluctance** of air being much greater than that of iron. Also, the influence of *both* poles is available for magnetizing the domains, suitable agglomerations of which may, after magnetization, be considered as small bar magnets, each with a north and a south pole.

Fig. 6B shows a more common practical construction of a record or replay head, the core



AN ELECTROMAGNET

FIG.4.

being of laminated construction, all the laminae being carefully insulated from each other so as to limit loss due to hysteresis and to eddy currents. The laminations would be made of *high-permeability material,*† many of which are sold under trade names, 'Mu-metal' being one of the best known. Hysteresis is the name given to the different shapes of the magnetization and demagnetization curves, which represents, in effect, work done, and from our angle, energy lost. So now we nearly have our tape recorder: but not quite.

★ ★ ★

We have now to consider the limitations of the magnetic material used for recording. When a piece of iron is magnetized, the magnetization (symbol 'B') does not follow the magnetizing force (symbol 'H') at all linearly. To commence with, there is a certain resistance of the domains to being moved around at all; then when their inertia is overcome the rise in magnetism does follow the force fairly well for a while; but when all the domains have been oriented, the iron is said to be saturated, and however much more H is applied, B cannot increase.

The iron behaves very much like a soaked sponge. In fact, the curve, or transfer characteristic, instead of being the almost straight line that we have come to expect from a valve, is of the shape of **fig. 7A,** and a pure sine-wave, recorded on a tape, will take the form of **fig. 7B.** Quite clearly the signal is very distorted, and, as a matter of interest, because the distortion is the same on each side of the abcissa, i.e. sym-

*Resistance to magnetic flux.

†Reciprocal of reluctance.

metrical, it assumes an odd-harmonic character. Symmetrical distortion generates odd harmonics, the 3rd, 5th, 7th, 9th, etc. (There is another form of iron distortion—in the sense that non-linearity is distortion—inherent in the magnetization process, that of hysteresis, which has already been briefly described, but this characteristic influences more the possibilities, in our context, of the heads, and does not concern us at the moment.)

It is possible to reduce considerably most of these undesirable manifastations, however, by the use of *bias*. Bias is a deliberately introduced disturbance of the magnetic domains, and it is always considerably higher in power level than the recording signal itself. It may be either DC or AC, although, for certain important reasons, AC is the bias ordinarily used for audio recording. Its apparent action is to shake the domains around, so to speak, so as to reduce them to a more supine acceptance of what we wish them to do; but its precise operation is still a little unclear, most analyses being not entirely convincing, except perhaps to their authors.

However, from the practical point of view, the presence of bias is entirely beneficial; and as its provision and application are very simple matters, let us leave the reasons why to our betters, and be thankful for this quite substantial mercy. Bias enables far more signal at far less distortion to be put on the tape than would be possible in its absence; also because its generation also provides the erase current used in almost all present-day commercial tape machines, bias is, as it were, available gratis. Too much, however, can have unfortunate side-effects, particularly in the way of high-note losses and noise; but the relationships between bias, signal-level, noise, and distortion on a tape are more complex than would justify discussion here. It is a case of 'Tu ne quaesieris, scire nefus'!

It would seem from the foregoing that, having provided a suitable tape, transport mechanism, amplifier, bias source, and head, we are out of the wood—or would perhaps out of the iron be the proper expression—so far as recording a signal is concerned. Well, we certainly could so record, but the results would not be particularly satisfactory. For various reasons, among which are basic physical conditions in the recorded medium—for instance, the ideal magnets (**fig. 2**) become shorter and shorter as the recorded frequency increases, so that the north and south poles of each individual magnet tend to cancel each other out, weakening the internal fields—the bias which is also an erasing signal to a certain extent, unfortunately more effective from this angle at the higher frequencies than at the low, capacitances in the head windings, and eddy current and hysteresis losses; all combine to degrade the high note response. (Eddy currents are currents induced in the core as a result of transformer action at AC, between windings and core. (The core, if solid, acts a single turn short-circuited secondary, and laminated construction sets a decided limit to the currents and ensuing losses.) The signal currents are kept to their job of magnetizing the iron and not dissipating their energy in heating it up.

It is obvious there is little we can do to

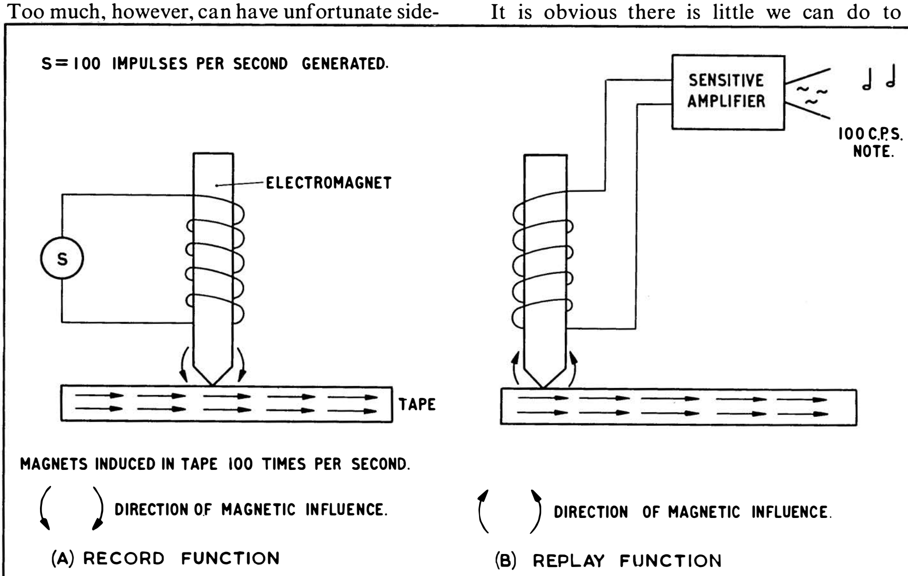


FIG. 5.

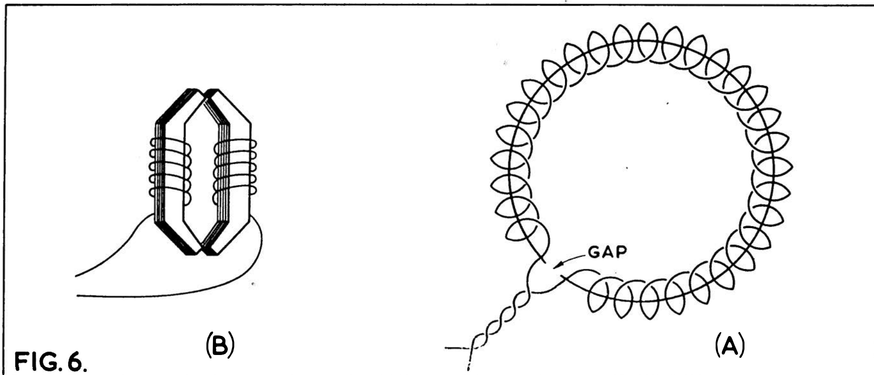


FIG. 6.

correct these matters from the magnet end, so we are left with the problem to solve from the one item over which we have control—the amplifier feeding the head. We have to make one that distorts; that is, one which provides an output not linearly related to the input signal. In fact, the output must bear an inverse relationship to the losses in the head and tape, and in theory this is simple. (It is now assumed that the reader is acquainted with the general ideas underlying amplifiers and their circuits.)

Fig. 8A is a simple amplifier capable of providing sufficient gain and power to drive a typical recording head, assuming that the head could be considered as a straightforward device such as a motor. But the head is not such a device. Firstly, it is a highly inductive component, or put it another way, it is a frequency-conscious network whose impedance increases with frequency, so that less recording signal at these frequencies is able to force its way through the windings. So it *must* be fed from a generator capable of providing a constant current, and the best way to arrange this is to drive the signal from a source, the resistance of which is so high that the impedance of the head is never at any usable frequency more than a small fraction of the total reactance in circuit.

Obviously, the simplest method is to place a high resistance between the true generator—(V2)—and the head, as in **fig. 8B,** where R swamps all other reactances. An analogy would be the weighing out of rice in scales. If we are measuring out, say, $\frac{1}{4}$ oz, and the scales are reasonably sensitive, 20 grains added to the original heap will almost certainly bring the pan down against the $\frac{1}{4}$ oz weight: but if 1 lb is being weighed, the 20 grains are hardly 'ikely to affect the issue at all. The 1 lb of rice swamps the small accretion—in wartime parlance, the high resistance saturates the defence.

This hurdle seems to be disposed of—but is it? Assuming R= 100 K —a common figure—and Z of the head at 10 Kc/s = 10k —another common value—then, in somewhat inaccurate but expressive figures, only one-tenth of the original signal is available for recording, the rest being lost in R. Fortunately, the power requirements of a recording head are very low, being measured in milliwatts, so that the situation could be worse; but that ten times required increase in output cannot be entirely ignored. And there are further demands to be made on what might turn out to be a rather reluctant V2.

★ ★ ★

We discussed above the high-frequency losses occurring during recording, and a method of compensating for them by using a distorting amplifier. Some idea of the compensation necessary will be clear when it is realised that for a near professional recorder, the losses between approximately 1,500 and 15,000 c/s can amount to about 20 dB, i.e. a factor of ten; so that V2, which could be excused for wilting a little, might be expected to supply up to around ninety times the output voltage required of it in the hypothetical condition of **fig. 8A.** Now a reasonable recording output voltage for V2 pentode at 1,000 c/s might be 10 volts; but what about 10V × 9 = 15,000 c/s? Luckily the whole 20 dB rise is not always required. When it is, a power valve is the only legitimate answer. But we have to turn the screw a little tighter yet. For a plain linear rise of frequency, a simple RC network serves admirably. But the required rise is neither plain nor linear. 12 dB of it has to be squeezed into the last octave, between 7,500 Kc/s and 15 Kc/s, and after 15 Kc/s the whole output must disappear with quite dramatic suddenness, something like the Demon King going down the trap-door.

There are various methods available to the engineer for achieving these excursions in compensatory amplification, and one effective commercial circuit is shown in **fig. 9.** In this amplifier, the input marked 'Low' is for signals at low level, down to 2 mV or so, which are amplified by the EF86 pre-amplifier valve and then passed on to the gain-control through a break-in jack that accepts a signal at high level. In fact, the EF86 brings the low level input up to a value about equal to that of the high level input, which is for a maximum of about 300 mv. This high level, after being amplified by the triode portion of the 6BR8 combined triode-pentode amplifier, is taken to the pentode section of the valve for final amplification before driving the head connected via pin 1 of an octal socket-and-plug arrangement. (All other pins on the socket are used only as anchor-points, and are not relevant to this particular description.) A 100,000 constant-current resistor is interposed between output and head pin, as is also a resonant trap tuned to the bias frequency to prevent bias getting into the amplifier, being amplified therein, and perhaps overloading the output valve before the desired signal has even an opportunity to prevent itself.

★ ★ ★

The trap is of the type known as parallel-resonant, and it has the property of presenting an impedance to signals of the frequency to which it is tuned. With inductors and capacitors of good quality, the reactance of the network—the 'Q' of the circuit—can be very high indeed. We meet this network elsewhere in the amplifier, where it will be seen to be in series with the low resistance and of the potentiometer formed by resistors (A) and (B). Ignoring the parallel combination of inductor S/L8 and any one of its associated switched capacitors, it is clear that only a very small proportion of the signal from the 6BR8 triode will reach the pentode for final amplification; but the presence of the 'rejector' circuit effectively offers a high-reactance increment to (A) at its resonant frequency, so allowing (B) to dominate the proceedings and permitting the pentode to develop a considerably greater fraction of the possible available gain. As a matter of interest, the resonant frequencies of the circuit depending on which of the capacitors are selected are 14,000 c/s, 9,500 c/s, and 4,500 c/s, corresponding to $7\frac{1}{2}$, $7\frac{3}{4}$ and $1\frac{7}{8}$ ips.

Also to be seen in **fig. 9** are the bias generator, more often known as the oscillator, designed around the EL84, and the modulation meter circuit for monitoring—i.e. checking—the signal being impressed on the tape.

And now to the playback function. It would seem that here an ordinary amplifier would suffice, but again it is not so simple. Physical fundamentals, including one of the most ubiquitous of natural phenomena—rate of change—once more intrude, and in some ways the design and construction of a good replay amplifier perhaps offers more difficulties than that of the recording amplifier. After all, apart from the metering and bias circuits, the recording amplifier should have an essentially flat response, the only compensation required being for the top losses, while the head itself is right at the end of the amplifying chain, where its own possible faults are not likely to be processed by the electronics; but the replay amplifier requires very substantial bass equalisation (always a very potent possible source of hum) and, to make the situation as awkward as possible, very high gain as well, so introducing the possibility of instability.

The necessity for high gain is very simply explained—the output from the replay head is very low indeed, 2 mV, i.e. 1/500th of a volt being reasonable for a well-designed head; and about 30 dB (i.e. rather more than 30 times) extra gain is also needed at 50 c/s as compared with 2,500 c/s. (As has been noticed in the recording amplifier, boost for any selected frequency(ies) can be obtained only by throwing away the gain of those frequencies for which boost is not required, and it is clear that the tape replay amplifier has to be designed for a total gain that includes the inescapable bass boost.) This boost from 2,500 c/s down to

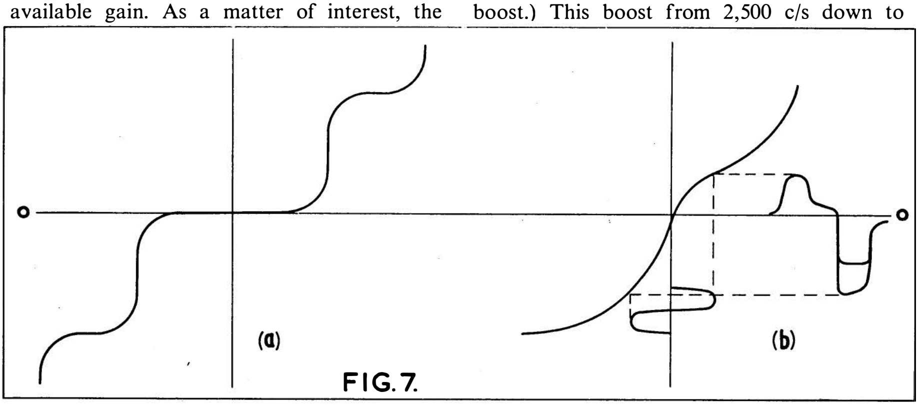


FIG. 7.

50 c/s is dictated by the fact that the available signal from the head is dependant on the number of idealised magnets passing the gap in any unit length of time.*

We already know that the magnet length is a function of frequency—or more accurately, wavelength—and that the lower the frequency the longer the magnets: and, of course, the corollary is that the longer the magnets the less of them there will be in any unit length: and the less of them in any unit length then the fewer passing the head gap and the less current induced in the windings, and so on. To reduce the concept to an absurdity, if the tape does not move at all, then no magnets pass the gap and there will of course be no current at all, either! Should this not be clear, observe the lights on a dynamo-equipped bicycle. The slower the bicycle goes, the dimmer the light glows, until the rider falls off and the light goes out. The actual loss as the wavelength increases is at the rate of 6 dB per octave, that is, for each octave lower the output is halved; and to put the response straight, boost at the same rate must be supplied by the replay amplifier. This, fortunately, is very easy, a simple resistance capacitance ('RC') network being provided by a beneficient nature for that very purpose and to that very degree. The only (slightly) involved operation is the choosing of the correct values of R and C to achieve the turnover point†, the place where the boost begins to level out to the required theoretical straight, in the normal CCIR case at about 2,500 c/s. (This is not quite correct, but it gives a comfortable round number. It is accurate enough for most commercial purposes.)

Such RC combinations are known as time-constants, a convenient label actually the produce of microfarads and ohms, expressed as fractions of a second: and the standard CCIR time constant for many years being specified at 100μ (μ = micro = millionths of a second) at 7½ ips, although, with improvements in general design, a lesser figure is now preferred. (To many listeners, the improvement is not immediately particularly apparent.) All should now be, as it were, on the level; but there are other losses for which compensation must be made.

We have already met the head losses, where the upper frequencies are degraded by the effect of the sum of the winding capacitances between layers and between windings and frame, as well as the finite gap width and its relation to the ideal bar magnets in the tape: and also the tape self-demagnetization losses at these frequencies. As BS1568:1953 Amendment 1 expressly states: 'With the reproducing heads used in practice, compensation for the head losses must be added to the replay amplifier', and the obvious way to effect it is to include a resonant circuit such as that in **fig. 11,** which is a diagram of the replay section of the amplifier of **fig. 9.** Here the input is heavily damped by the 27K resistor to ground, so as to avoid resonance effects between the inductance of the head winding and its capacitance, which can—and very often do—give spurious treble-lift effects at unwanted frequencies. After amplification by V1, the output is shunted by R and C to give the required response falling with frequency—bass boost, looked at the other way round; but in series with this network and ground it will be seen there is interposed a parallel resonant rejector network which offers a high impedance to the frequency to which it is tuned, so forcing that frequency to go via V2 grid rather than permit it to be by-passed to earth along with the rest.

In practice, the rejector is damped by a resistor, the value of which is determined during test, as both height and steepness of the peaking slope are normally required to be much lower than the corresponding boost in the recording circuit. This selection during test applies also to R when setting up the amplifier with its deck. R2 is a series resistor for reducing the bass boost on the lower speeds, and is short-circuited at 7½ ips. V2 merely amplifies linearly the frequency distorted signal passed on to it from V1, and feeds it, via the 250K potentiometer, to the output socket.

As a matter of interest, with a standard good commercial deck, a tape fully modulated on the

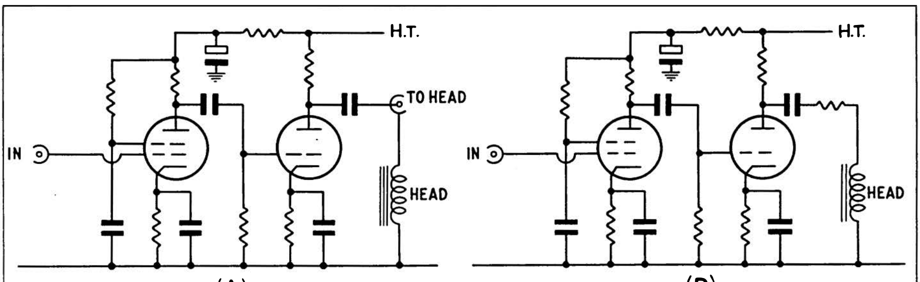
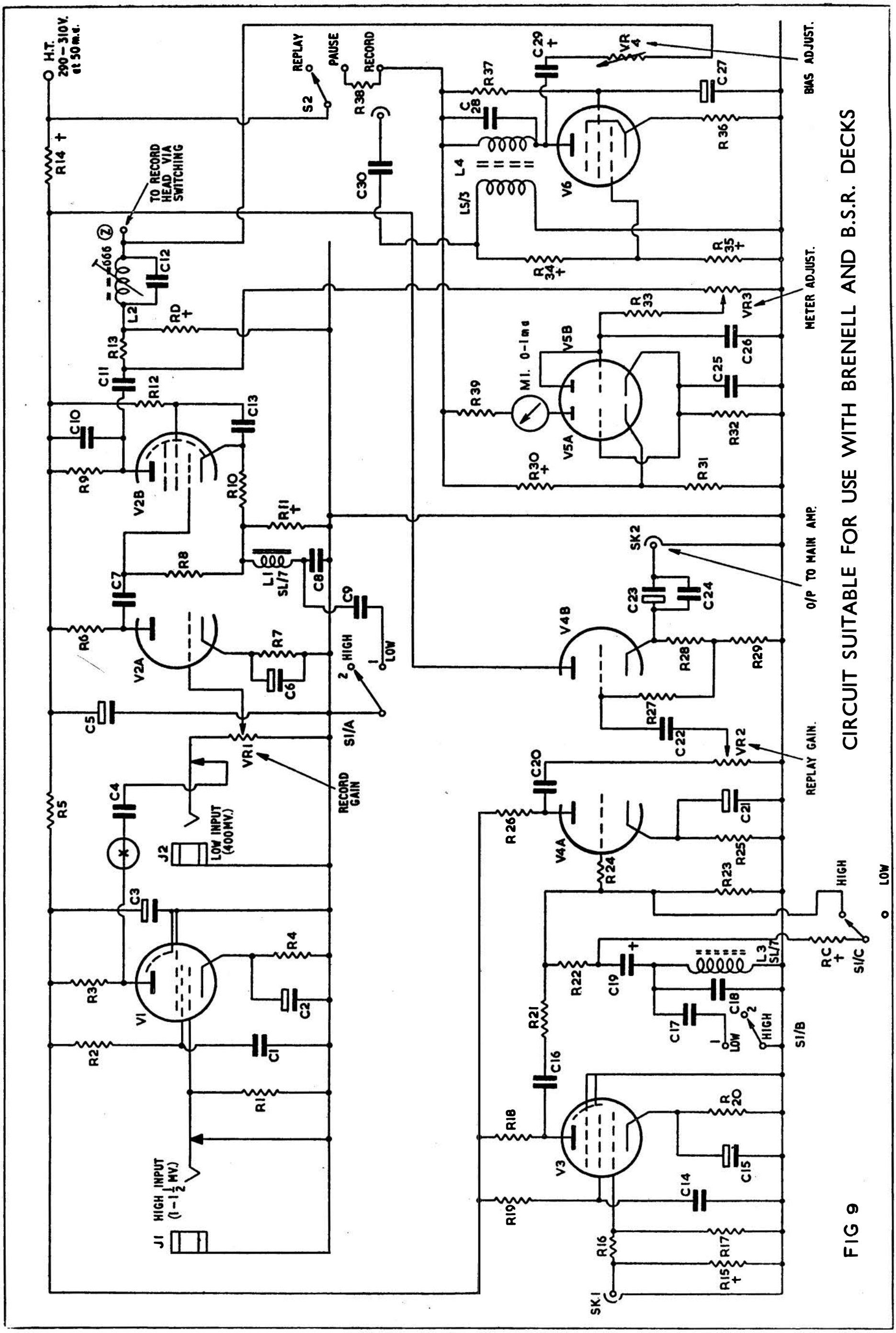


FIG.8.

*The rate-of-change of magnetism.

†A very informative article on this matter will be found on pp. 65–70 of *Wireless World* February 1952.



CIRCUIT SUITABLE FOR USE WITH BRENELL AND B.S.R. DECKS

FIG 9

amplifier of **fig. 9** will give a level output between 40 c/s and 15,000 c/s output of up to 2 volts at $1\frac{1}{2}\%$ peak distortion at the output socket of **fig. 10.**

There remains one last detail, means for erasing (wiping) the tape of any previously recorded signal, so as to permit re-recording of fresh programme material on it. For this purpose, a head similar in general construction to

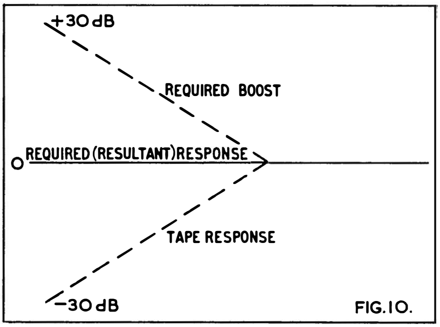


FIG. 10.

the ordinary tape is provided in such a position on the deck that the tape must pass before it antecedent to passing the record head. It is usually of considerably lower impedance than the record and/or replay heads, to allow the oscillator to drive a heavy current through the windings, the intention being to create such a strong AC field that the tape domains are entirely torn from their regular orientations, and randomly dispersed ready for re-magnetization by the record head. The gap of the erase head is normally much wider than that of the other heads, it clearly being of advantage to subject every increment of the tape to as long an influence of the erase flux as possible.

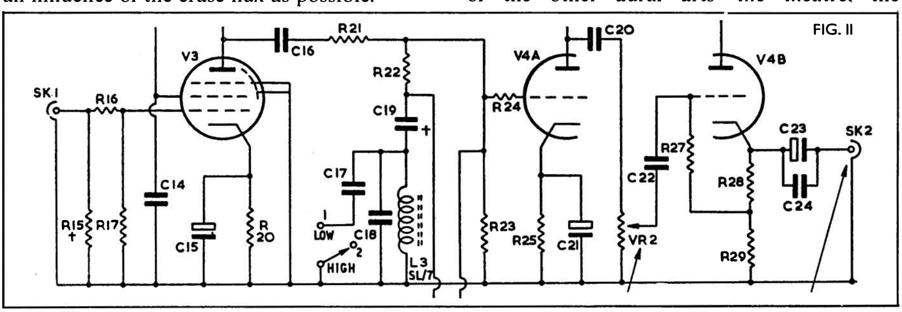
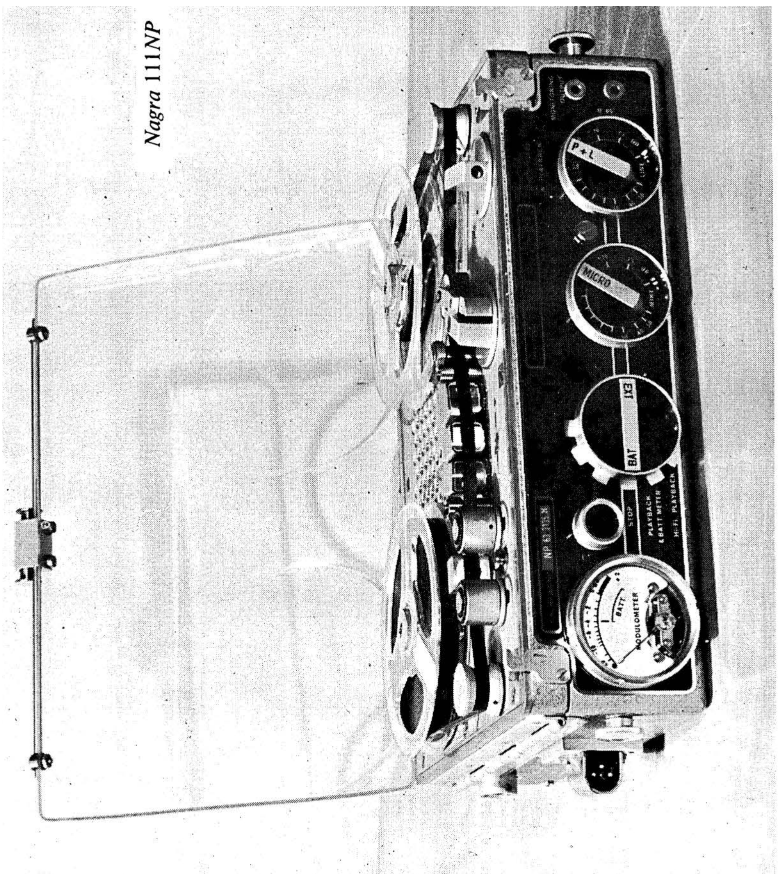


FIG. 11

The foregoing is, of course, a very much, almost over-simplified description of tape recording, but it does give a description (somewhat idealised) of the processes involved. But having caught our rabbit what do we do with it? This the individual must decide for himself; but to me, once the simple entertainments angle has been exploited to the full—and much pleasure can be derived from it—the chief value of the recorder lies in its illimitable possibilities for education in its widest sense. Most recordists have a fairly strong interest in music; and, speaking now as a professional musician, the real fascination in this art lies in the surprising depth and invention of musical composition in general. It is one of the most technical of activities, and the tape recorder offers possibly the best, and certainly the most inexpensive method of appreciating and, later, analysing intelligently the immense wealth of invention and technique underlying the simplest examples of it. It is impossible—and I write from considerable training and experience—to appreciate and apprehend all the many points and facets of any composition, from the most involved of advanced orchestral works to the latest pop hit, on the first, or second, or third hearing: but more and more is revealed to the intelligent and appreciative listener—and, of course, all tape-recordists are intelligent and appreciative of the wider cultures!—with repetition: and such repetition is possible at unprohibitive cost only by the use of a tape recorder.

The understanding and real enjoyment of the subtleties of good orchestration, for instance, require repetition of performance to enable the listener to relate what has been written with what the composer is trying to convey: immediate comparisons of performances between one orchestra and conductor and another, or as between two players are possible *only* with a recorder, and such comparisons can be invaluable from the point of view of widening of the recordist's outlook or merely confirming his prejudices: and these comparisons and repetitions apply equally to the manifestations of the other aural arts—the theatre, the fashionable sermon, the historical speech, and many others. For learning or teaching languages, the tape recorder, we know, has no rivals; and, as remarked at the beginning of this article, it can all be done almost free of cost—the recording medium, the tape, is usable again and again, and the recorder itself lasts for ever—or, at least, nearly for ever. Writing now as a manufacturer, we do have to live!


P+L
MICRO
EXT
BAT
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PLAYBACK
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Nagra 111NP

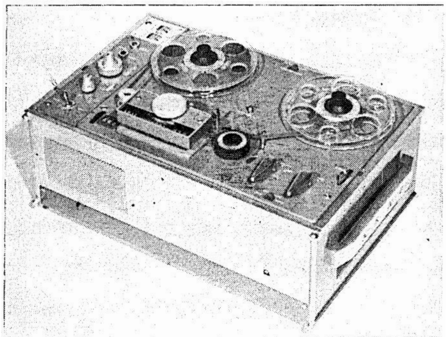
DIRECTORY OF TAPE RECORDERS

★ The abbreviations used for the specifications in this directory are as follows: **F.R.** = frequency response; **i/s** = inches per second; **P.s.n.** = power supply needed; < = better than; **M.E.** = magic eye; **W. and F.** = wow and flutter; **Replay char.** = replay characteristic; **H. and N.** = hum and noise. ● = Stereo equipment.

PROFESSIONAL and SEMI-PROFESSIONAL

AKAI. Distributors: The Pullin Optical Co. Ltd., Ellis House, Aintree Road, Perivale, Greenford, Middlesex. Tel.: Alperton 1541/7.

●**Model 345.** Stereo recorder. $\frac{1}{4}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. W. and F. $7\frac{1}{2}$ i/s, 0·08%; $3\frac{3}{4}$ i/s, 0·14%. H. and N. −42 dB referred to 250 c/s. F.R. $7\frac{1}{2}$ i/s, 40 c/s-21 Kc/s ±6 dB; $3\frac{3}{4}$ i/s, 40 c/s-12·5 Kc/s ±6 dB. Replay char. NARTB. Inputs: mic. 0·8 mV; radio 50 mV. Cathode-follower line output. Three motors. $10\frac{1}{2}$-in. spool. Rewind 45 secs., 1,200 ft. VU meters. Partly transistorised. Three heads. Tape lifter. Operates vertically or horizontally. 10W per channel output. Size: $17\frac{3}{8}$ × 16 × $12\frac{1}{2}$ in. Weight: 72-6 lb. Price: £229 19s.



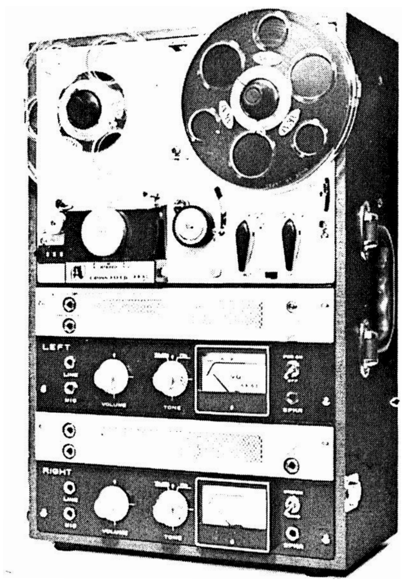
Akai 44*S*

●**Model M8.** Stereo recorder. $\frac{1}{4}$-track. Speeds 15, $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $7\frac{1}{2}$ i/s <0·15%; $3\frac{3}{4}$ i/s <0·25%; $1\frac{7}{8}$ i/s <0·35%. F.R. $7\frac{1}{2}$ i/s 30 c/s-25 Kc/s (±3 dB 40 c/s-21 Kc/s), $3\frac{3}{4}$ i/s 40 c/s-18 Kc/s ±3 dB, $1\frac{7}{8}$ i/s 40 c/s-10 Kc/s ±4 dB. Crossfield heads. Sound-on-sound recording. Vertical stereo system. Twin channel amplifiers, 6W each. Two-speed dynamically balanced motor. Built-in 4 in. speakers. Conductive cooling system. Tape cleaner. Stereo/mono record and playback. Professional VU meters. Instant stop and start. Automatic start and shut off. Weight $47\frac{1}{4}$ lb. without accessories. Price: £153 6s.

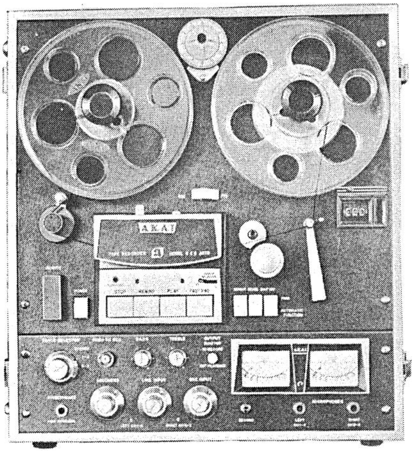
●**Model ST1.** Transistorised stereo/mono portable recorder. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. W. and F. $7\frac{1}{2}$ i/s <0·17%; $3\frac{3}{4}$ i/s <0·28%. F.R. $7\frac{1}{2}$ i/s 40 c/s-15 Kc/s ±3 dB, $3\frac{3}{4}$ i/s 40 c/s-9 Kc/s ±3 dB. Rewind time $2\frac{1}{2}$ mins. for 1,200 ft. Two 7 × 5 in. speakers. Micro-gap head. $\frac{1}{4}$-track. Sound-on-sound recording. Two illuminated VU meters. Output 3W per channel. Price: £129 3s.

●**Model X4.** See battery-operated recorder section.

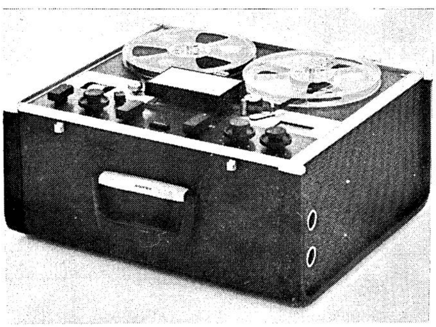
●**Model 44S.** Stereo/mono recorder. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. 15 i/s with alternative capstan



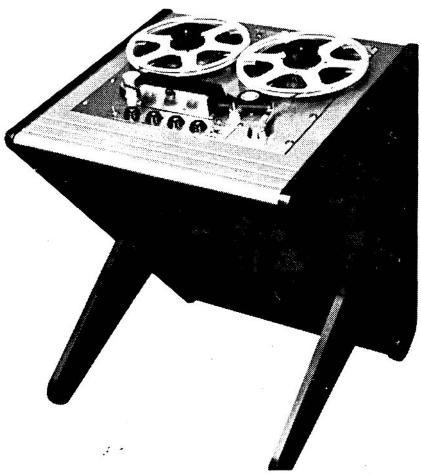
Akai M8



Akai 345



Ampex F-44



Ampex 352 console.

and bush. W. and F. $7\frac{1}{2}$ i/s $<0{\cdot}15\%$, $3\frac{3}{4}$ i/s $<0{\cdot}25\%$, $1\frac{7}{8}$ i/s $<0{\cdot}35\%$. Operates in vertical or horizontal position. Micro-gap head. Output 3W per channel. Stereo headphone jack. Built-in 5 in. monitoring speaker. Price: £112 7s.

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AMPEX (GREAT BRITAIN) LTD., Acre Road, Reading, Berkshire. Tel.: Reading 84411. Cables: Videotape, Reading.

Ampex 300 series. Professional recorders. One to eight tracks. Speeds 15 and $7\frac{1}{2}$ i/s. Three motors. 14-in. spools up to 1 in. wide. F.R. 15 i/s, 30-18,000 c/s; $7\frac{1}{2}$ i/s, 40–12,000 c/s, both ± 2 dB. Large scale VU meter. H. and N. -60 dB full track, -55 dB multi-track. W. and F. less than $0{\cdot}1\%$ at 15 i/s. Prices on application.

Ampex 351. Professional recorder in console, portable or rack-mounted form. Full or $\frac{1}{2}$-track. Speeds 15 and $7\frac{1}{2}$ i/s, or $7\frac{1}{2}$ and $3\frac{3}{4}$ i/s. Three motors. $10\frac{1}{2}$ in. NAB spools. F.R. 15 i/s, 30-18,000 c/s; $7\frac{1}{2}$ i/s, 40-12,000 c/s; $3\frac{3}{4}$ i/s, 50-8,000 c/s, all ± 2 dB. Large scale VU meter. H. and N. -70 dB full track, -65 dB $\frac{1}{2}$-track and 15 i/s. W. and F. less than $0{\cdot}15\%$ at 15 i/s. Size (console): 48 × 24 × 28 in. Weight: 168 lb. Price (15 and $7\frac{1}{2}$ i/s) on application.

Ampex 352. Professional reproducer only in console or rack-mounted form. Full or $\frac{1}{2}$-track, or stereo. Speeds 15 and $7\frac{1}{2}$ i/s. Three motors. $10\frac{1}{2}$ in. NAB spools. F.R. 15 i/s, 30-18,000 c/s; $7\frac{1}{2}$ i/s, 40-12,000 c/s, both ± 2 dB. H. and N. -70 dB full track, -65 dB half track. W. and F. less than $0{\cdot}15\%$ at 15 i/s. Size (console): 35 × 24 × 24 in. Weight: 199 lb. Price on application.

Ampex 602. Professional portable recorder. Speed $7\frac{1}{2}$ i/s. One motor. 7-in. spools. F.R. 40-10,000 c/s ± 2 dB. Large scale VU meter. H. and N. -55 dB full track, -50 dB half track. W. and F. less than $0{\cdot}17\%$. Size: $16\frac{1}{2} \times 13\frac{3}{4} \times 8$ in. Weight: 28 lb. Price: £295.

●**Ampex 602-2.** Stereo version of Ampex 602. Size: $24\frac{1}{2} \times 13 \times 8$ in. Weight: 42 lb. Price: £486.

●**PR-10.** Professional recorder. Stereo or mono versions. Full or $\frac{1}{2}$-track. $\frac{1}{4}$-track version available shortly. Speeds 15, $7\frac{1}{2}$ i/s or $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. W. and F. 15 i/s, $0{\cdot}15\%$; $7\frac{1}{2}$ i/s, $0{\cdot}18\%$; $3\frac{3}{4}$ i/s, $0{\cdot}25\%$. H. and N. -60 dB at 15, $7\frac{1}{2}$ i/s, full track. F.R. 15 i/s, 30 c/s-15 Kc/s ± 2 dB; $7\frac{1}{2}$ i/s, 30 c/s-12 Kc/s ± 2 dB. Replay char. NAB/CCIR/AME (15 i/s only) plug-in equalisers. Various inputs by plug-in transformers and pre-amps. Outlet from pre-amp +4 dBm into 600 ohms. One motor. 7-in. spool. Rewind $1\frac{1}{2}$ mins. VU meter. Remote control. Size (transport); $19 \times 8\frac{3}{4} \times 6$ in.; (electronics): $19 \times 5\frac{1}{4}$

× $5\frac{3}{8}$ in. Weight (unmounted): 44 lb.; (in case): 53 lb. Price (mono): £485.

●**E65.** Transistorised stereo recorder. $\frac{1}{2}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. W. and F. 0·3%, $7\frac{1}{2}$ i/s. H. and N. −50 dB, $7\frac{1}{2}$ i/s; −44 dB, $3\frac{3}{4}$ i/s, F.R. $7\frac{1}{2}$ i/s, 150 c/s-10 Kc/s ±2 dB; $3\frac{3}{4}$ i/s, 150 c/s-5 Kc/s ±2 dB. Replay char. NAB. Inputs: line 0·5V, mic. 0·5 mV. Outlets from pre-amp: 1, headset 2 K, 1V; 2, line 2 K, 1V; 3, to speaker/amplifier. One motor. 7-in. spool. $1\frac{1}{2}$ mins. rewind. Special educational and language study recorder. Size: 8 × $13\frac{3}{4}$ × $16\frac{1}{2}$ in. Weight: 30 lb. Price to be announced.

●**F-44 series.** Professional stereo/mono recorder. $\frac{1}{4}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. W. and F. $7\frac{1}{2}$ i/s, 0·12%; $3\frac{3}{4}$ i/s, 0·18%. H. and N. −53 dB, $7\frac{1}{2}$ i/s; −48 dB, $3\frac{3}{4}$ i/s. F.R. $7\frac{1}{2}$ i/s, 50 c/s-15 Kc/s ±2 dB; $3\frac{3}{4}$ i/s, 50 c/s-10 Kc/s + 2-4 dB. Replay char. N.A.B. Inputs: line 0·15V, 500 K; mic. 0·5 mV, 2·2 megohms. Cathode-follower output 1V. One motor. Level meters. Three heads. Details of individual models:

F-4450. Unmounted, for use in custom installation (optional walnut cabinet). Size: 13 × 15 × $7\frac{1}{2}$ in. Weight: 28 lb.

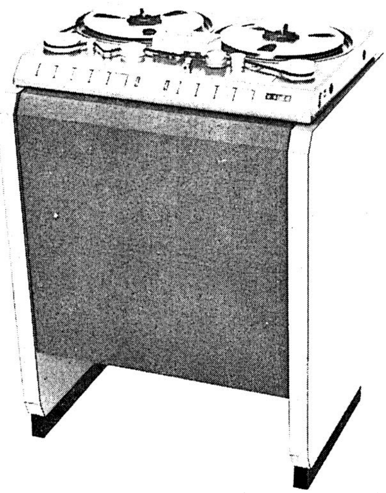
F-4452. Unmounted, for use in component systems. Size and weight as for F-4450.

F-4460. Portable. Size: 14 × $17\frac{1}{2}$ × $9\frac{1}{4}$ in. Weight: 36 lb.

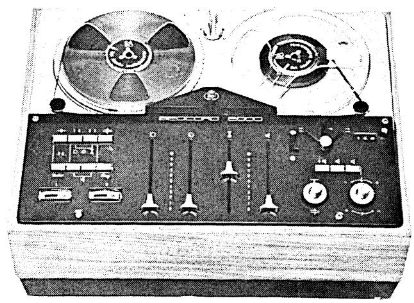
Model 2044. Portable self-contained amplifier and speaker system for use with F-44 series. Size: 14 × $17\frac{1}{2}$ × $9\frac{1}{4}$ in. Weight: 26 lb.

MR70. Professional standard console style master recorder. Speeds: $7\frac{1}{2}$ and 15 i/s or 15 and 30 i/s. Tape sizes: $\frac{1}{4}$ in. 1 or 2 channels, $\frac{1}{2}$ in. 2, 3, or 4 channels, 1 in. 3, 4, 6, or 8 channels. Spool size $11\frac{1}{2}$ in. EIA, NAB or CCIR reels. Automatic equalisation. Fully Nuvistorised. F.R. 30 c/s-20 Kc/s ±2 dB. (±1 dB 50 c/s-15 Kc/s) at 15 i/s. Plug-in 150 Kc/s bias/erase oscillator. W. and F. 15 i/s less than 0·05% RMS, $7\frac{1}{2}$ i/s less than 0·08% RMS. Start time: tape speed within ±0·2% of nominal speed in 0·5 sec. Timing accuracy better than ± 0·15%. Mains 115-242V in six steps. Wide range of versions to order. Prices on application.

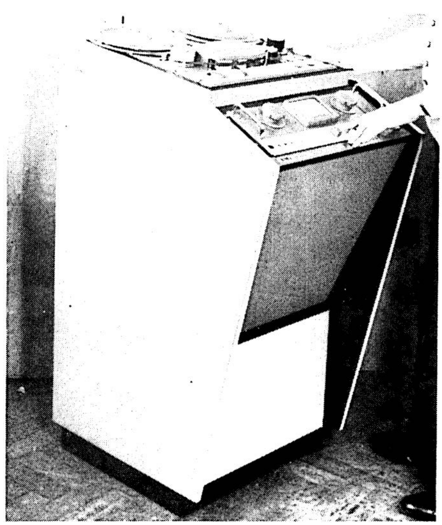
●**2000 series.** Stereo tape recorders in three versions. Model 2073 portable recorder, Model 2083 furniture style tape deck, Model 2053 rack mounting tape deck. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. F.R. $7\frac{1}{2}$ i/s 30 c/s-18 Kc/s, ±2 dB. Signal to noise −52 dB. W. and F. 0·001% at $7\frac{1}{2}$ i/s. Automatic reverse. Automatic threading. Dual capstan drive. Automatic switch-off, including amplifiers. Three heads. Vertical or horizontal operation. $\frac{1}{4}$-track stereo. Valves and transistors. M.E. Provision for automatic slide



EMT Studer C37 Console



Bang & Olufsen Beocord 2000



E.M.I. BTR4

projector synchronizing. Size: $18\frac{5}{8} \times 13 \times 7$ in. Weight 30 lb. in case with speakers. Prices: 2073 £206 7s. 6d.; 2083 £193 15s. 4d.; 2053 £180 13s. 3d.

●**1000 series.** Similar specification to 2000 series except 1000 series do not include automatic reverse or automatic threading. Price: 1073 portable £162 17s. 11d.

●**800 series.** Stereo tape recorders available as deck with pre-amplifiers, deck with pre-amplifiers and power amplifiers, or deck with pre-amplifiers and power amplifiers in oiled walnut cabinet. Straight-line threading. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Twin VU meters. Independent controls for each channel. Dual capstan drive. Fully transistorised. Automatic switch off. Digital position indicator. Prices to be announced but expected to below £150.

ARENA, Denmark. Sole U.K. importers: **Highgate Acoustics,** 71/73 Great Portland Street, London, W.1. Tel.: Museum 2901.

●**Arena BK 6.** Transistorised stereo recorder. $\frac{1}{4}$-track. Speeds: $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $7\frac{1}{2}$ i/s, 0·13%; $3\frac{3}{4}$ i/s, 0·16%; $1\frac{7}{8}$ i/s, 0·2%. H. and N. −52 dB. F.R. $7\frac{1}{2}$ i/s, 45 c/s-18 Kc/s; $3\frac{3}{4}$ i/s, 45 c/s-11 Kc/s; $1\frac{7}{8}$ i/s, 45 c/s-7 Kc/s (±2 dB). Replay char. NARTB. Inputs: mic 1 mV, 5K; line 10 mV, 150 K; gram 150 mV, 680K. Outlet from pre-amp. One Papst motor (low noise, outside rotor). 7 in. spools. 2 mins. rewind. Two VU meters with dB calibration. Pause control, sound on sound. Superimpose. Facility for playing both tracks through one speaker. Instant reset tape counter. One internal speaker. Size: $7 \times 14 \times 15$ in. Weight: 29 lb. Carrying handle. Deck covering lid. Rexine covered wood cabinet. Price to be announced.

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BANG & OLUFSEN. U.K. Sales Division, Eastbrook Road, Eastern Avenue, Gloucester.

*E.M.I. RE*301

Tel.: Gloucester 26841. Cables: DEBELEC, Gloucester.

●**Beocord 2000.** Transistorised stereo recorder in $\frac{1}{4}$-track and $\frac{1}{2}$-track versions. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Spool size 7 in. W. and F. 0·075% at $7\frac{1}{2}$, 0·11% at $3\frac{3}{4}$, 0·18% at $1\frac{7}{8}$. H. and N. $\frac{1}{4}$-track −50 dB, $\frac{1}{2}$-track −55 dB. F.R. 40 c/s-16 Kc/s at $7\frac{1}{2}$, 40 c/s-12 Kc/s at $3\frac{3}{4}$, 50 c/s-6 Kc/s at $1\frac{7}{8}$, all ±2 dB. Replay char. CCIR. Inputs: mic. 150 µV 200 ohms, mag. PU 2 mV 33K, crystal PU 1V 220K, radio diode 2 mV 45 K. Outputs: line 800 mV, LS 8W per channel. Two VU meters. Rewind time 3 mins. 1,800 ft. One Papst motor. Own deck. Superimpose. Pause. Position indicator with PB reset. Straight-through amplifier. Mains 110-240V 50 c/s. Size: $17\frac{3}{4} \times 13\frac{3}{4} \times 10\frac{1}{2}$ in. Weight 35 lb. Price: table model £117 12s.; portable model £122 17s.

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EMI ELECTRONICS LTD., Hayes, Middx. Tel.: Hayes 3888. Cables: Emidata, London.

●**TR52/D.** Professional portable stereo/mono recorder. Speeds $7\frac{1}{2}$ and $3\frac{3}{4}$ i/s. One motor, 7-in. spools. F.R. $7\frac{1}{2}$ i/s, 50–10,000 c/s; $3\frac{3}{4}$ i/s, 50-6,000 c/s, both ±2 dB. W. and F. less than 0·25% at $7\frac{1}{2}$ i/s. Crosstalk.−45 dB. VU meter. Size: $20 \times 17\frac{1}{2} \times 13\frac{1}{2}$ in. Weight: 80 lb. Price: £245.

RE301. Stereo/mono recorder in transportable rack or trolley form. $\frac{1}{2}$-track. Speeds 15, $7\frac{1}{2}$ i/s, or $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. W. and F. 0·2% at 15 i/s, 0·25% at $7\frac{1}{2}$ i/s, 0·3% at $3\frac{3}{4}$ i/s. H. and N. 50 dB below peak level. F.R. 15 i/s, 50 c/s-15 Kc/s; $7\frac{1}{2}$ i/s, 50 c/s-10 Kc/s; $3\frac{3}{4}$ i/s, 50 c/s-6 Kc/s (all ±2 dB). Replay char. CCIR. Inputs: mic. 30/50 ohms, less than 100µV for peak recording level. Line floating and bridging for 600 ohms, less than 200 mV for peak record level. One motor. $8\frac{1}{4}$-in. spool. $1\frac{3}{4}$ mins. rewind. Plug-in record and replay amplifiers. VU meter. Size: $14\frac{3}{16} \times 19\frac{1}{4} \times 18\frac{1}{8}$ in. Weight: 97 lb. Price: £278.

●**Type BTR4.** Professional stereo/mono recorder. Full, twin, three, four track. Speeds $3\frac{3}{4}/7\frac{1}{2}$ or $7\frac{1}{2}/15$ i/s. W. and F. 15 i/s, better than 0·1%; $7\frac{1}{2}$ i/s, 0·1%; $3\frac{3}{4}$ i/s, 0·15%. H. and N. (2% distortion) −60 dB unweighted. F.R. 15 i/s, 30 c/s-20 Kc/s; $7\frac{1}{2}$ i/s, 30 c/s-12 Kc/s; $3\frac{3}{4}$ i/s, 40 c/s-8 Kc/s (±2 dB). Replay char. CCIR, NARTB, aux. switched. Input 10 K bridging, and 200 or 600 ohm line. Balanced floating output at 35, 200 or 600 ohms. Three motors. $11\frac{1}{4}$-in. spools (European). Rewind (NAB spool) $1\frac{1}{4}$ mins. VU meter. Separate track erasure on multi-channel machines. Size (deck): $19 \times 17 \times 12$ in., 80 lb.; (amplifier): $19 \times 16\frac{1}{4} \times 7$ in., 32 lb. Basic price £600.

EMT WILHELN FRANZ GMBH, Switzerland. Sole U.K. Agents: F. W. O. Bauch Ltd., Chaddlewood, Cockfosters Road, Cockfosters, Barnet, Herts. Tel.: Barnet 3170.

●**Studer A62.** Professional transistorised studio recorder. Stereo/mono. Full track or ½-track. Speeds, 15, 7½ i/s. W. and F. 15 i/s, 0·04%; 7½ i/s, 0·06%. H. and N. 15 i/s, −60 dB; 7½ i/s. −56 dB. F.R. 30 c/s-15 Kc/s ±1·5 dB. Replay char. CCIR or NARTB (either by request). Inputs: −6 dBm to +22 dBm, balanced 1 K. Outlet from pre-amp. Three motors. 10-in. spools. 1½ mins. rewind. No speaker or power amplifier. Size: 19 × 14 × 8¼ in. Weight: 57 lb. (complete chassis). Price (mono): £566; (stereo): £712.

●**Studer C37.** Professional studio recorder. Full track mono or ½-track stereo. Speeds 15, 7½ i/s. W. and F. (0·5-250 c/s) 15 i/s, 0·4%; 7½ i/s, 0·05%; (0·5-6 c/s) 15 i/s, 0·015%; 7½ i/s, 0.025%. H. and N. 15 i/s, −70 dB; 7½ i/s, −66 dB. F.R. 30 c/s-15 Kc/s +1 dB −2 dB. Replay char. CCIR or NARTB (either by request). Inputs: 0·7-7V (0 dBm to +20 dBm); balanced input imp. greater than 15 K. Outlet from pre-amp. Three motors. 12-in spools. 2 mins. rewind 2,400 ft. No speaker or power amplifier. Size: 21 × 26 × 17 in. Weight: 172 lb. Price (complete chassis): mono, £1,141; stereo, £1,316.

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FERROGRAPH CO. LTD., Ferrograph House, 84 Blackfriars Road, London, S.E.1. Tel.: Waterloo 1981.

631. ½-track mono recorder. Speeds 7½, 3¾, 1⅞ i/s. Spool size 8¼ in. W. and F. less than 0·16% at 7½ i/s. H. and N. −52 dB. F.R. 7½ i/s 30 c/s-15 Kc/s, 3¾ i/s 40 c/s-10 Kc/s, both ±3 dB. 1⅞ i/s 50 c/s-5 Kc/s ±8 dB. Inputs: 3 mV at 1 megohm, 150 mV at 80K. Outputs: 2½W into internal 10 × 6 in. speaker or into external 15 ohms load, 0·75V at 80K. Three motors. Synchronous capstan motor with ball-bearing races. Rewind time 1 min. for 8¼ in spool. Sustained-peak record level meter. Single-screw azimuth adjustment. Pause control. Gear-driven angled tape position indicator. Bias and erase links fitted. Tropicalised. Takes endless loop cassette. Auto-stop at end of reel. Space for additional head. Separate bass and treble. Mains 200-250V 50 c/s standard. Suffix A 117V 60 c/s, suffix E 110V 50 c/s. Size: 17¾ × 18¼ × 9⅝ in. Weight: 48 lb. Price: £92 8s.

631H. Similar specification to 631 but having speeds of 15, 7½, 3¾ i/s and CCIR characteristics of 200, 100 and 35 μsecs. Price: £96 12s.

●**632.** ½-track stereo recorder having separate record, replay heads and amplifiers and an output monitor stage with built-in speaker. Inputs: 2 mV at 1 megohm, 35 mV at 500K. Outputs: 1W into 5 in. internal monitoring speaker, 1V per track at approximately 1K. Input/output comparison switch. Input-mixing facilities with separate controls. Other details similar to 631 model. Price: £121 15s.

●**632H.** Specification as for 632 but with tape speeds 15, 7½, 3¾ i/s and recording characteristics as for model 631H.

●**634.** Speeds 7½, 3¾, 1⅞ i/s. Intended especially for the North American market. Provides facilities for twin ¼-track recording and playback. Layout and controls similar to other stereo models. Price on application.

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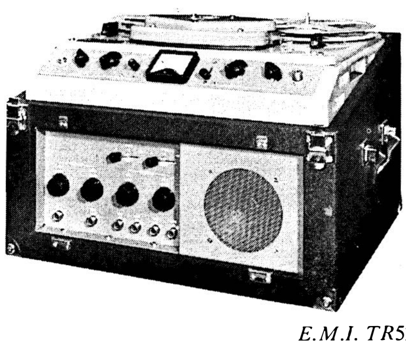
LEEVERS-RICH EQUIPMENT LTD., 319b Trinity Road, Wandsworth, London, S.W.18. Tel.: Vandyke 9054. Cables: Leemag, London, S.W.18.

Series E ¼ in. professional recorders. Available in rack mounting (R), console (M), or portable (P) versions.

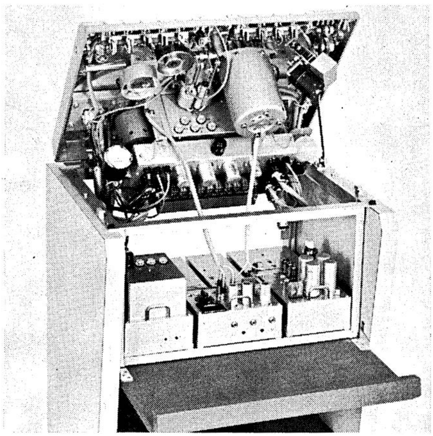
E141, E242. Speeds 15 and 7½ i/s, or 30 and 15 i/s, or 7½ and 3¾ i/s. Spool 11½ in. Three motors. Full track, half track or dual track. F.R. 40 c/s-20 Kc/s at 15 i/s ±2 dB. Noise: full track −59 dB, half track −55 dB. W. and F. better than 0·1%. VU level meter, PPM to order. Plug-in record, replay and monitor amplifiers. Prices from £550.

Series H ½ in. professional recorder.

H444. Four track heavy duty recorder suitable for high quality master recordings. Speeds 15 and 7½ i/s. Spools 10½ in. NAB. Three motors. Four tracks. F.R. to BS.1568:1960. NAB to special order. Noise better than −55 dB. Cross-talk better than 45 dB below



E.M.I. TR52



EMT Studer C37 (interior view)

adjacent track level at 1 Kc/s. Input: 80 mV into 600 ohms (terminating) or 20K (bridging). Plug-in record, replay amplifiers. VU meter in each channel. Prices from £1,060.

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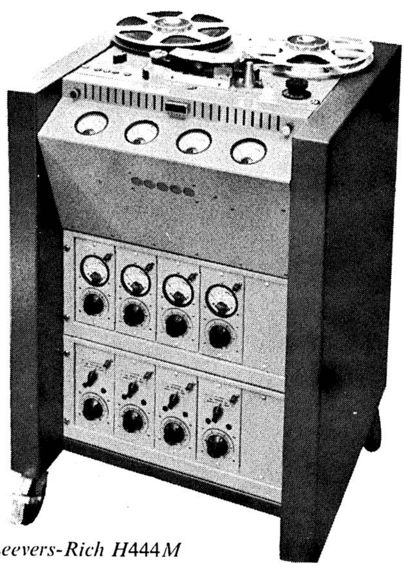
PHILIPS. Distributors: Peto Scott Electrical Instruments Ltd., Addlestone Road, Weybridge, Surrey. Tel.: Weybridge 45511. Cables: Megacycle, Weybridge.

●**EL3566.** Professional recorder. Stereo/mono full and ½-track. Speeds 15, 7½ i/s. W. and F. 15 i/s, 0·1%; 7½ i/s, 0·15%. H. and N. 15 i/s, better than −55 dB; 7½ i/s, better than −52 dB. F.R. 15 i/s, 60 c/s-10 Kc/s +0-2 dB, 40 c/s-15 Kc/s +0-4 dB; 7½ i/s, 60 c/s-8 Kc/s +0-2 dB, 40 c/s-12 Kc/s +0-4 dB. Replay char. CCIR. Inputs: mic. 0·1 mV, 400 ohms; line 0 dBm, 600 ohms balanced. Monitor (headphones) and line outputs. Three Papst motors. 11 in. spools. 2 min. rewind, 3,300 ft. VU meter. Provision for adding pilot-tone head. Time indicator in mins. and secs. Suitable for 19 in. rack mounting. Size (deck): 20 × 15½ × 10½ in.; (amplifier, mono): 20 × 15½ × 5¼ in. Weight (deck): 60 lb.; (amp): 24 lb. Price on application.



Leevers-Rich H444M

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REVOX. Distributors: C. E. Hammond & Co. Ltd., 90 High Street, Eton, Windsor, Berks. Tel.: Windsor 63388. Telex.: 84316.

●**Model 736.** Stereo recorder. ½ or ¼-track versions. Speeds 7½, 3¾ i/s. W. and F. less than 0·1% at 7½ i/s. H. and N. −60 dB. F. R. 7½ i/s, 30 c/s-18 Kc/s + 2-3 dB; 3¾ i/s, 40 c/s-12 Kc/s +2-3 dB. Replay char. DIN. Inputs (3 per channel): mic. 3 mV, 2 megohms, diode 3-50 mV, 47K; radio 50 mV, 1 megohm. Outlet from pre-amp. Three motors. 10½ in. NAB spool. 1½ min. rewind, 2,400 ft. 2 VU meters. Three heads, remote control, switchable tape tension, superimpose, mixing, echo, on and off tape monitoring, multiplay. Size: 18½ × 12¼ × 11½ in. Weight: 45 lb. Price (chassis model): £123 18s.; (with portable case): £130 4s.

●**Model 736/HS.** Details as for Model 736, but with 15 i/s tape speed. Price: £152 5s.

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SONY. U.K. Sales Division, Eastbrook Road, Eastern Avenue, Gloucester. Tel.: Gloucester 26841. Cables: DEBELEC, Gloucester.

●**TC500.** Stereo recorder. ¼-track. Speeds 7½, 3¾ i/s. W. and F. less than 0·15%. 7½ i/s; less than 0·2%. 3¾ i/s. F.R. 7½ i/s, 30 c/s-18 Kc/s; 3¾ i/s, 30 c/s-13 Kc/s (±2 dB). Replay char. NARTB. H. and N. −50 dB. Inputs (mic./aux.) high impedance. Outlet from pre-amp. One motor. 7 in. spools. 2 VU meters. Sound on sound recording, tape counter, mic./aux. input mixing facilities. Size: 18½ × 16$\frac{3}{16}$ × 12¼ in. Weight: 55 lb. Price (with ext. speakers, 2 mics., all leads): £110 5s.

TC777A. Transistorised mono recorder. ½-track. Speeds 7½, 3¾ i/s. W. and F. 7½ i/s, 0·15%. F.R. 7½ i/s, 30 c/s-17 Kc/s; 3¾ i/s, 30 c/s-10 Kc/s (±2 dB). Replay char. NARTB. Inputs: mic. low impedance, aux. high impedance. Outlet from replay head. Three motors.

7 in. spools. VU meter. Three heads. Remote control. Size: $16\frac{1}{8} \times 10\frac{11}{16} \times 18\frac{3}{4}$ in. Weight: 42 lb. Price: £162 15s.

●**TC600.** $\frac{1}{4}$-track valve and transistor mains operated stereo recorder. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. Spool 7 in. W. and F. 0·15% at $7\frac{1}{2}$, 0·2% at $3\frac{3}{4}$. F.R. 30 c/s-18 Kc/s at $7\frac{1}{2}$ i/s, 50–15 Kc/s at $3\frac{3}{4}$ i/s. Replay char. CCIR. Low imp. input −72 dB, high imp. input 80 mV. Line output 1·5V. VU meter. Rewind time $3\frac{1}{2}$ mins. 1,800 ft. Superimpose. Pause. Position indicator with PB reset. One motor. Own deck. Mains 110-240V 50 c/s. Size: $16\frac{3}{4} \times 18\frac{3}{16} \times 10\frac{3}{4}$ in. Weight: 48 lb. Price: £133 7s.

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TANDBERG. U.K. distributors: Elstone Electronics Ltd., Edward Street, Templar Street, Leeds, 2. Tel.: Leeds 3-5111.

●**Tandberg Series 6.** Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ i/s. F.R. 30-20,000 c/s. $\frac{1}{4}$-track. 7 in. spools. H. and N. −55 dB. W. and F. 0·1% M.E. level ind. Outlet from pre-amp. No power amplifier or speaker. Superimposing. Size: $15\frac{1}{4} \times 11\frac{7}{8} \times 6$ in. Weight: 25 lb. Price: £115 10s. Alternative $\frac{1}{2}$-track model also available: £115 10s.

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TEAC. Distributors: C. E. Hammond & Co. Ltd., 90 High Street, Eton, Windsor, Berks. Tel.: Windsor 63388.

●**Series R310.** Stereo/mono recorders. Model 311: full track mono; Model 312: $\frac{1}{2}$-track mono; Model 313: $\frac{1}{2}$-track stereo; Model 314: $\frac{1}{4}$-track stereo. Speeds 15, $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. W. and F. less than 0·15% at 15 i/s. H. and N. −60 dB (full track); −55 dB ($\frac{1}{2}$-track); −50 dB ($\frac{1}{4}$-track). Replay char. JIL, NARTB or SPEC. Inputs: mic. 1 megohm, −55 dBm; line 100K, −2 dBm. Line output 600 ohms +4 dBm; output from pre-amp. high imp. −2 dBm. Three motors, $10\frac{1}{2}$ in. NAB spool. $1\frac{1}{2}$ min. rewind, 2,400 ft. 2 VU meters. Mixable inputs, on and off tape monitoring. Size (deck): $19 \times 15\frac{3}{4} \times 17\frac{3}{4}$ in.; (pre-amp): $19 \times 5\frac{1}{4} \times 7\frac{3}{4}$ in. Weight (deck): $48\frac{1}{2}$ lb.; (pre-amp): 12 lb. Model 313, additional $\frac{1}{4}$-track playback head. Model 314, additional $\frac{1}{2}$-track playback head. Prices on application.

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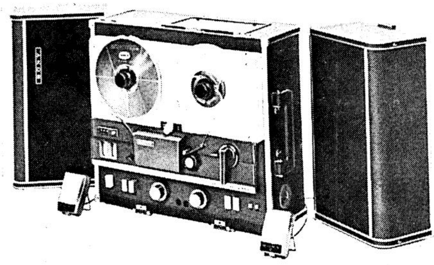
VORTEXION LTD., 257/263 The Broadway, Wimbledon, London, S.W.19. Tel.: Liberty 6242/3. Cables: Vortex, Wimbledon.

Model WVA. Complete semi-pro. mono recorder. $\frac{1}{2}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. W. and F.

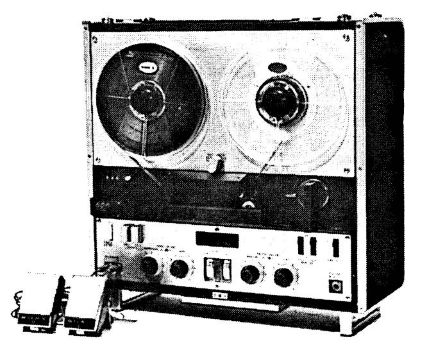


Sony TC 500 *Stereo*

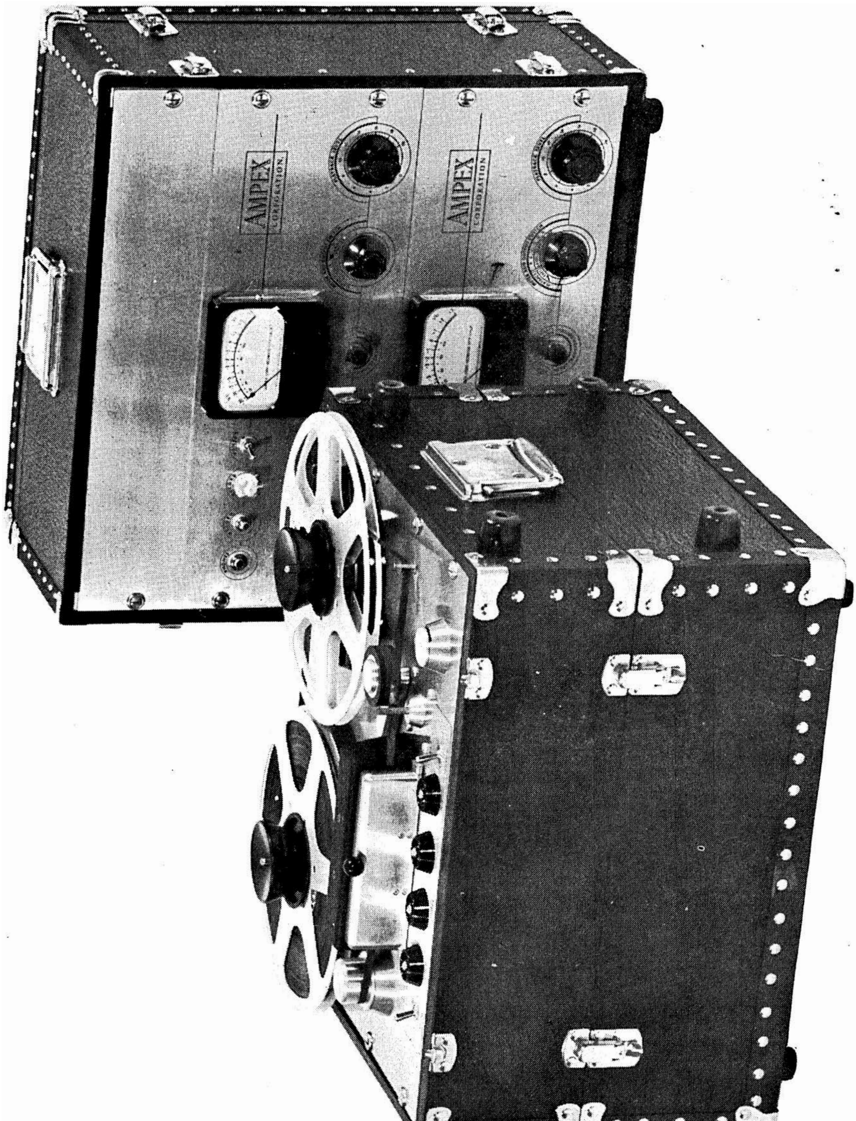
$7\frac{1}{2}$ i/s, 0·16%; $3\frac{3}{4}$ i/s 0·2%. H. and N. (after erasure) −50 dB. F.R. $7\frac{1}{2}$ i/s, 40 c/s-15 Kc/s; $3\frac{3}{4}$ i/s, 40 c/s-12 Kc/s (all ±3 dB). Replay char. CCIR. Inputs: mic., 12 μV on 30 ohms; gram/radio 20 mV on $\frac{1}{2}$ megohm. Output 15 ohms at $3\frac{1}{2}$W. Three motors, $8\frac{1}{4}$ in. spools, less than 1 min. rewind for 1,750 ft. tape. Level meter. Size: $8\frac{1}{4} \times 22\frac{1}{2} \times 15\frac{3}{4}$ in. Weight: 51 lb. Pause control. Price: £96 7s. with speeds of $1\frac{7}{8}$, $3\frac{3}{4}$, $7\frac{1}{2}$ i/s; £107 3s. with speeds $3\frac{3}{4}$, $7\frac{1}{2}$, 15 i/s.

Model WVB. Details as for WVA, but facilities for monitoring, adding echo, superimpose. Price: £115 10s. with speeds of $1\frac{7}{8}$, $3\frac{3}{4}$, $7\frac{1}{2}$ i/s; £128 with speeds of $3\frac{3}{4}$, $7\frac{1}{2}$, 15 i/s.

●**Model CBL.** Stereo/mono recorder. $\frac{1}{2}$-track, with $\frac{1}{4}$-track playback also available. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. W. and F. $7\frac{1}{2}$ i/s, 0·16%; $3\frac{3}{4}$ i/s, 0·2%. H. and N. (after erasure) −50 dB. F.R. $7\frac{1}{2}$ i/s. 40 c/s-15 Kc/s; $3\frac{3}{4}$ i/s, 40 c/s-12 Kc/s (all ±3 dB). Replay char. CCIR. Inputs: mic. 40μV on 30 ohms; gram/radio 100 mV on $\frac{1}{2}$ megohm (mixable on each amplifier). Output 15 ohms at $3\frac{1}{2}$W each amplifier. Three motors. $8\frac{1}{4}$ in. spools, less than 1 min. rewind for 1,750 ft. tape. Level meter. Size: $16\frac{3}{8} \times 27\frac{1}{2} \times 8\frac{5}{8}$ in. Weight: 69 lb. Pause control, monitoring, echo, superimpose. Price: £172 with speeds of $1\frac{7}{8}$, $3\frac{3}{4}$, $7\frac{1}{2}$ i/s; £180 with speeds of $3\frac{3}{4}$, $7\frac{1}{2}$, 15 i/s.



*Sony TC*600



Ampex Model 351-2 professional portable stereo recorder

GENERAL PURPOSE TAPE RECORDERS

ABBEY TAPE RECORDERS, 1a Compton Terrace, Hoppers Road, London, N.21. Tel.: Palmers Green 7492.

Major. Mono recorder, $\frac{1}{2}$-track. Magnavox Studio deck. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. H. and N. -45 dB. F.R. $7\frac{1}{2}$ i/s, 50 c/s-12 Kc/s; $3\frac{3}{4}$ i/s 60 c/s-8 Kc/s; $1\frac{7}{8}$ i/s, 60 c/s-5 Kc/s (all ± 3 dB). Replay char. CCIR. Inputs: gram 250 mV, 500K; mic. 5 mV, 2 megohms. Outlet from pre-amp. Three motors. 7 in. spool. 65 secs. rewind, 1,200 ft. M.E. Pause control, superimpose. Size: $14\frac{1}{2} \times 17\frac{1}{2} \times 8$ in. Weight: 36 lb. Price: £37 16s.

Minor. Mono recorder, $\frac{1}{2}$-track. Speed $3\frac{3}{4}$ i/s. BSR deck. W. and F. 0·26%. F.R. 60 c/s-8 Kc/s. Inputs: gram 250 mV, 500K; mic. 5 mV, 2 megohms. One motor. $5\frac{3}{4}$ in. spool. DM70 level indicator. Size: $10\frac{1}{2} \times 14\frac{1}{2} \times 7$ in. Weight: 17 lb. Price: £18 18s.

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ALBA (RADIO/TELEVISION) LTD., Tabernacle Street, London, E.C.2. Tel.: Clerkenwell 1322. Cables: Abalgramo, Ave, London.

R17. Mono recorder. $\frac{1}{4}$-track. Speed $3\frac{3}{4}$ i/s. W. and F. 0·4%. H. and N. -47 dB. F.R. 100 c/s-9 Kc/s. Replay char. CCIR. Input 3 mV, 100K. Outlet direct from pre-amp. One motor. $5\frac{3}{4}$ in. spools. Rewind 3 mins. for 850 ft. EM87 level indicator. Rev. counter, pause control. Size: $14 \times 12\frac{1}{2} \times 6$ in. Weight: $17\frac{1}{4}$ lb. Price: £28 7s.

R16. $\frac{1}{2}$-track model of R17. Price: £25 14s. 6d.

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BAIRD. Radio Rentals (U.K.) Ltd., Seymour Mews House, Wigmore Street, London, W.1. Tel.: Welbeck 9191.

Baird Tapemaster 282. $\frac{1}{2}$-track mono recorder. Speed $3\frac{3}{4}$ i/s. Spool size $5\frac{3}{4}$ in. W. and F. 0·4% RMS. H. and N. -50 dB. F.R. 60 c/s-8 Kc/s. Replay char. non-standard. Inputs: mic. 2-3 mV 6 megohms, radio 100 mV 500K. Output: LS 3-5 ohms. M.E. Valves. Rewind time 3 mins. for 850 ft. One motor. BSR TD2 deck. Pause. Mains 200-250V 50 c/s. Size: $14\frac{1}{2} \times 12 \times 5$ in. Weight: 18 lb. Price: £20 9s. 6d.

Alba R17

Baird Varsity 101

Baird Tapemaster 282

Brenell Mk 5 Series 3

Baird Varsity 101. $\frac{1}{4}$-track mono three-speed recorder. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Spool size 7 in. W. and F. 0·3% RMS. H. and N. −42 dB. at $7\frac{1}{2}$, −36 dB. at $3\frac{3}{4}$, −30 dB at $1\frac{7}{8}$ i/s. F.R. 70 c/s-11 Kc/s ±3 dB at $7\frac{1}{2}$, 70 c/s-8 Kc/s ±3 dB. at $3\frac{3}{4}$, 70 c/s-4·5 Kc/s ±3 dB. at $1\frac{7}{8}$. Replay char. NARTB. Inputs: Mic. 1 mV 20K, radio/PU 200 mV 250K. Inputs may be mixed by means of independent controls. Output 3·5W. Strip indicator. Transistor pre-amp., remainder valves. Rewind time $2\frac{1}{2}$ mins. for 850 ft. One motor. BSR TD10 deck. Superimposition by recording separate tracks and playing back in parallel. Position indicator. Pause. Mains. 210-250V 50 c/s. Size: 16 × $16\frac{1}{2}$ × 8 in. Weight: 24 lb. Price: £34 15s.

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BALMORAL ELECTRONICS LTD., Oxford Circus House, Oxford Street, London, W.1. Tel.: Regent 3311.

TRP2. Tape player only. Speed $3\frac{3}{4}$ i/s. Spool size $5\frac{3}{4}$ in. W. and F. less than 0·3%. $\frac{1}{2}$-track. Mains 200-250V AC. Output 2W. 7 × 4 in. high flux speaker. Outlet for LS 3 ohms. Rexine case with carry handle. Size: 14 × 7 × 10 in. Weight: 14 lb. B.S.R. deck. Tropicalised version available. Price: £16 16s.

Brenell Type M Series 3

C. BRADDOCK (BLACKPOOL) LTD., 266 Waterloo Road, Blackpool, Lancs. Tel.: Blackpool 45049.

Q-Cord. Battery/mains recorders. For details see Battery Operated Portables Section.

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BRENELL ENGINEERING CO. LTD., 231/5 Liverpool Road, London, N.1. Tel.: North 8271 (5 lines).

Mk. 5. Type M. Series 3. Speeds 15, $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$, i/s. Three motors. $8\frac{1}{4}$ in. spools. F.R. 15 i/s, 40-20,000 c/s; $7\frac{1}{2}$ i/s, 40-18,000 c/s; $3\frac{3}{4}$ i/s 40-13,000 c/s; $1\frac{7}{8}$ i/s, 40-6,000 c/s. Level meter. H. and N. −45 dB. W. and F. $1\frac{7}{8}$ i/s, <0·25%; $3\frac{3}{4}$ i/s, <0·15%; $7\frac{1}{2}$ i/s, <0·1%. Outlet from pre-amp. Mixing. Superimposing. Tape monitoring, Input monitoring. Size: 18 × 18 × 9 in. Weight: 40 lb. Price: £97 13s.

Mk. 5. Series 3. 15, $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ i/s. Three motors, $8\frac{1}{4}$ in. spools. F.R. 15 i/s, 40–15,000 c/s, ±2 dB. $7\frac{1}{2}$ i/s, 40-14,000 c/s; $3\frac{3}{4}$ i/s, 40-11,000 c/s; $1\frac{7}{8}$ i/s, 40-6,000 c/s. ±3 dB. M.E. level ind. (Meter available). H. and N. −45 dB W. and F. 0·05% at 15 i/s. Hi-fi outlet at 200 mV. Straight-through amp. Switched frequency correction. Pause control and monitoring. Size: 18 × 18 × 8 in. Weight: 38 lb. Price: £77 14s.; with meter £82 19s.

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BRITISH RADIO CORPORATION LTD., 21 Cavendish Place, London, W.1. Tel.: Langham 9291.

HMV 2204B. Mono recorder. $\frac{1}{4}$-track. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. <0·2%. F.R. $3\frac{3}{4}$ i/s, 60 c/s-10 Kc/s; $1\frac{7}{8}$ i/s, 60 c/s-6 Kc/s. Replay char. CCIR. Inputs: 1·5 mV, 10 megohms; 1·5 mV, 22K; 75 mV, 1 megohm. Outlet from pre-amp. 500 mV, 22K. One four-pole motor, $5\frac{3}{4}$ in. spools. $2\frac{1}{2}$ min. rewind. EM87 level indicator. Auto-stop. Remote pause. Tape position indicator. Piano key controls. Superimposition. Size: $15\frac{1}{2}$ × $14\frac{1}{4}$ × $7\frac{1}{4}$ in. Weight: 20 lb. Price: £37 16s.

Marconiphone 4204. Mono recorder, $\frac{1}{4}$-track. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. <0·2%. F.R. $3\frac{3}{4}$ i/s, 60 c/s-12 Kc/s; $1\frac{7}{8}$ i/s, 60 c/s-6 Kc/s. Replay char. CCIR. Inputs: 1·5 mV, 10 megohms; 1·5 mV, 22K; 75 mV, 1 megohm. Outlet from pre-amp. 500 mV, 22K. One four-pole motor. $5\frac{3}{4}$ in. spools, $2\frac{1}{2}$ min. rewind. EM87 level indicator. Auto-stop. Remote pause. Tape position indicator. Piano key controls. Superimposition. Size: $14\frac{3}{4}$ × 13 × $6\frac{3}{4}$ in. Weight: 19 lb. Price: £34 13s.

Marconiphone 4202. Mono recorder. $\frac{1}{2}$-track. Speeds $3\frac{3}{4}$ i/s. W. and F. <0·2%. F.R. 60 c/s-10 Kc/s. Replay char. CCIR. Inputs: 1·5 mV, 10 megohms; 1·5 mV, 22K; 75 mV 1 megohm. Outlet from pre-amp. 500 mV, 22K. One four-pole motor. $5\frac{3}{4}$ in. spools, $2\frac{1}{2}$ min. rewind. EM87 level indicator. Tape position indicator. Piano key controls. Size: $14\frac{3}{4} \times 13 \times 6\frac{3}{4}$ in. Weight: 19 lb. Price: £26 5s.

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BUSH RADIO LTD., Division of the Rank Organisation, Power Road, London, W.4. Tel.: Chiswick 6491. Cables: Supasetz, London, W.4.

TP50. Mono recorder with BSR TD2 deck. $\frac{1}{4}$-track. Speeds $3\frac{3}{4}$ i/s. W. and F. <0·2%. H. and N. −40 dB. F.R. 80 c/s-10 Kc/s. Inputs: mic. 0·35 mV, 1 megohm; radio 25 mV, 250K. Separate outlet from second track of replay head. One motor. $5\frac{3}{4}$ in. spool $2\frac{3}{4}$ min. rewind. "Spirit-level" type M.E. Monitor socket for phones. Pause control, digital counter. Size: $7\frac{3}{4} \times 14 \times 13\frac{3}{4}$ in. Weight: $25\frac{1}{2}$ lb. Price (including microphone): £39 18s.

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CINECORDER. See K.G.M. Electronics.

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CLARKE & SMITH MANUFACTURING CO. LTD., Melbourne Works, Wallington, Surrey. Tel.: Wallington 9252/7.

TR634. Transistorised mono recorder. $\frac{1}{2}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. W. and F. $7\frac{1}{2}$ i/s, 0·2%; $3\frac{3}{4}$ i/s, 0·3%. H. and N. $7\frac{1}{2}$ i/s, −50 dB; $3\frac{3}{4}$ i/s, −48 dB. F.R. $7\frac{1}{2}$ i/s, 50 c/s-15 Kc/s; $3\frac{3}{4}$ i/s, 50 c/s-9 Kc/s (±3 dB). Replay char. CCIR. Inputs: $1\frac{1}{2}$ mV, 15 μV, 60 mV. Outlet from pre-amp. 15 ohms. 70V line and 1V at 5K. Three motors, $8\frac{1}{4}$ in. spools. Level meter. Mixing. Tone controls. Size: $17\frac{1}{2} \times 17 \times 10$ in. Weight: 45 lb. Price: £108 3s.

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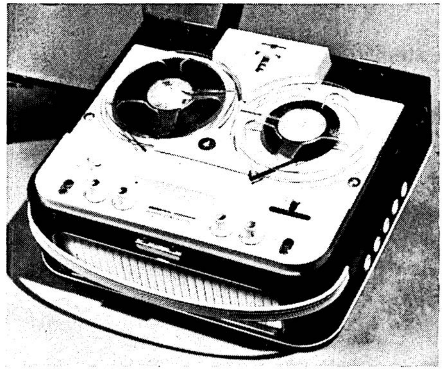
CONTRONICS LTD., Garth Works, Deepcut Bridge Road, Blackdown, Nr. Aldershot. Hants. Tel.: Deepcut 336.

Carol TR4. Mono recorder. $\frac{1}{2}$-track. Speed $3\frac{3}{4}$ i/s. W. and F. 0·4%. F.R. 50 c/s-8 Kc/s. Replay char. CCIR. Inputs: mic., radio, gram. Outlet from pre-amp. One motor. $5\frac{3}{4}$ in. spools. M.E. Line outlet. Size: $13\frac{3}{4} \times 12\frac{3}{4} \times 7$ in. Weight: 20 lb. Price: £20 9s. 6d.

Carol TR/7. Similar specification as TR4 but with built-in synchronising circuit for 8 mm. cine projectors. Weight 25 lb. Price: £45.



Bush TP50

See tape accessories section for Carol cine sync unit.

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COSSOR. See Philips Electrical Ltd.

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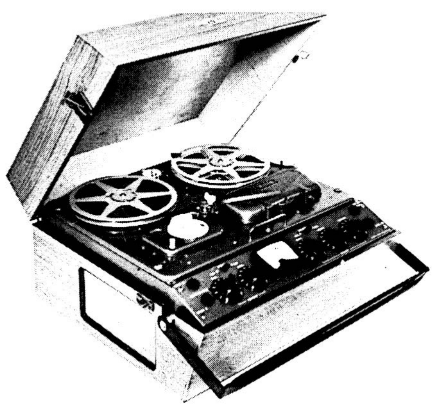
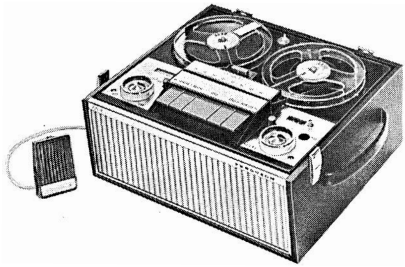
C.W.S. LTD., Radio and Television Department, Alma Park, Warley Street, Upminster, Essex. Tel.: Upminster 3200.

Defiant T12R. Mono recorder. $\frac{1}{2}$-track. Speed $3\frac{3}{4}$ i/s. W. and F. 0·2%. H. and N. −40 dB at 1 Kc/s. F.R. 100 c/s-8 Kc/s ±3 dB. Compromise replay char. Inputs: mic. 4 mV, radio 100 mV. One motor. $5\frac{3}{4}$ in. spools, 3 min. rewind. EM84 tuning indicator. Digital tape indicator. Superimpose. Size: $14 \times 13 \times 6$ in. Weight: 19 lb. Price: £27 6s.

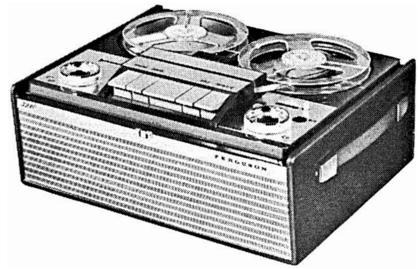
Defiant T15. Basic amplifier as T12R, but without superimpose, and using DM70 indicator. $\frac{1}{2}$-track. Tape counter. Size: $6\frac{1}{8} \times 13\frac{3}{8} \times 12\frac{3}{8}$ i/s. Price: £23 2s.



Clarke & Smith TR 634



Ferguson 3208



Ferguson 3210

Dansette Consort 2

Dansette Empress

CWS Defiant T 18

*C.W.S. Defiant T*15

T18. Mono $\frac{1}{4}$-track recorder. Speed $3\frac{3}{4}$ i/s. Spool $5\frac{3}{4}$ in. W. and F. 0·26%. H. and N. −40 dB. F.R. 80 c/s-10 Kc/s ±3 dB. Inputs: 180 μV 2K, 5 mV 47K, 100 mV 1 megohm. LS socket 10-15 ohms. Meter indicator. Transistorised. BSR TD2 deck. Superimpose. Mains. Size: $14\frac{1}{2}$ × $12\frac{1}{2}$ × 6 in. Weight: $16\frac{1}{2}$ lb. Price: £32 11s.

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DANSETTE PRODUCTS LTD., Dansette House, Honeypot Lane, Stanmore, Middx. Tel.: Wordsworth 0021.

Consort. Mono recorder, $\frac{1}{2}$-track. Speed $3\frac{3}{4}$ i/s. W. and F. 0·4%. H. and N. −50 dB. F.R. 60 c/s-10 Kc/s. Replay char. CCIR. Inputs: high imp. for mic., medium imp. for radio/gram. One motor. $5\frac{3}{4}$ in. spools, $3\frac{1}{2}$ min. rewind. M.E. Size: 14 × $12\frac{1}{2}$ × 7 in. Weight: $16\frac{1}{2}$ lb. Price: £23 2s.

CONSORT 4. Similar specification as above but $\frac{1}{4}$-track. Price: £25 4s.

Empress. Mono $\frac{1}{4}$-track recorder. BSR deck. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Position indicator. Inputs for mic. and radio or PU. Outlets for extension LS. Monitor stereo. 8 × 5 in. speaker. Output 3·5W. Response 75 c/s-13·5 Kc/s at $7\frac{1}{2}$ i/s. Spool size 7 in. Recorder accommodates two 7 in. spools, microphone and leads. Size: $17\frac{3}{8}$ × $15\frac{1}{2}$ × 8 in. Weight: 23 lb. Price: £38 17s.

★

ELIZABETHAN (TAPE RECORDERS) LTD., Crow Lane, Romford, Essex. Tel.: Romford 64101. Cables: Elizabethan, Romford.

Automatic 2. $\frac{1}{2}$-track mono mains portable recorder. Speed $3\frac{3}{4}$ i/s. W. and F. 0·4%. F.R. 60 c/s-10 Kc/s. Inputs: mic. 2 mV, PU 200 mV. Outlet from preamp. One motor. Spool size $5\frac{3}{4}$ in. Tape position indicator. Superimpose. Fully automatic recording level. Size: 15 × 14 × 5 in. Price: £24 3s.

Automatic 4. Details and specification as for Automatic 2 but $\frac{1}{4}$-track and no superimpose. Price: £26 5s.

★

FERGUSON RADIO CORPORATION LTD., Thorn House, Upper St. Martin's Lane, London, W.C.2. Tel.: Temple 2444. Cables: Fergusad, Lesquare, London.

Model 3208. Mono recorder. $\frac{1}{4}$-track. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $3\frac{3}{4}$ i/s, better than 0·2%; $1\frac{7}{8}$ i/s, 0·3%. H. and N. −40 dB. F.R. $3\frac{3}{4}$ i/s, 60 c/s-10 Kc/s; $1\frac{7}{8}$ i/s, 60 c/s-6 Kc/s. Replay char. CCIR. Inputs: mic. 1·5 mV, 10 megohms; radio 1·5 mV, 68K; gram 75 mV, 3·3 megohms. Outlets from replay head and pre-amp. One motor. $5\frac{3}{4}$ in. spools. $2\frac{1}{2}$ min. rewind, 850 ft. EM87 Electron beam level indicator. Pause key. Mic. stop/start switch. Auto-stop operated by foil on tape. Facility for stereo. Size: $13\frac{1}{2}$ × 12 × $6\frac{1}{2}$ in. Price: £34 13s.

Model 3210. Mono recorder. $\frac{1}{2}$-track. Speed $3\frac{3}{4}$ i/s. W. and F. better than 0·2%. H. and N. −40 dB. F.R. 60 c/s-10 Kc/s. Replay char. CCIR. Inputs: mic. 1·5 mV, 10 megohms; radio 1·5 mV, 68K; gram 75 mV, 3·3 megohms. Outlet from pre-amp. One motor. $5\frac{3}{4}$ in. spools. $2\frac{1}{2}$ min. rewind, 850 ft. EM87 electron beam level indicator. Pause key. Size: $13\frac{1}{2}$ × 12 × $6\frac{1}{2}$ in. Price: £25 4s.

Model 3212. Same as 3208.

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FIDELITY RADIO LTD., Olaf Street, London, W.11. Tel.: Park 0131. Cables: Amplify, London, W.11.

Playmaster Major De-Luxe. Mono recorder. $\frac{1}{4}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $7\frac{1}{2}$ i/s, 0·15%; $3\frac{3}{4}$ i/s, 0·25%; $1\frac{7}{8}$ i/s, 0·35%. H. and N. −50 dB. F.R. $7\frac{1}{2}$ i/s, 60 c/s-15 Kc/s; $3\frac{3}{4}$ i/s, 60 c/s-10 Kc/s; $1\frac{7}{8}$ i/s, 60 c/s-7 Kc/s. Inputs: mic. 2 mV, high imp; gram 200 mV, high imp. Replay char. CCIR. One motor. 7 in. spools. $3\frac{1}{2}$ min. rewind. Level meter. Transistor 1st stage. Ex. L.S. Stereo replay socket. Tape position indicator. Internal monitor. Bass and treble controls. Superimpose switch. Size: $19\frac{1}{2}$ × $16\frac{1}{4}$ × 8 ins. Weight: $30\frac{1}{2}$ lb. Price: £36 15s.

Playmaster-2. Mono recorder. $\frac{1}{2}$-track. Speed $3\frac{3}{4}$ i/s. W. and F. 0·25%. H. and N. −50 dB. F.R. 60 c/s-8 Kc/s. Replay char. CCIR. Inputs: mic 3 mV, high imp; gram 200 mV, high imp. Outlet from pre-amp. Ex. L.S. One motor. $5\frac{3}{4}$ in. spools. Rewind 3 mins. M.E. Size: $14\frac{3}{4}$ × 12 × $5\frac{3}{4}$ in. Weight: $15\frac{7}{8}$ lb. Price: £21.

Playmaster-4. $\frac{1}{4}$-track version of Playmaster-2. Tape position indicator. Price: £24 3s.

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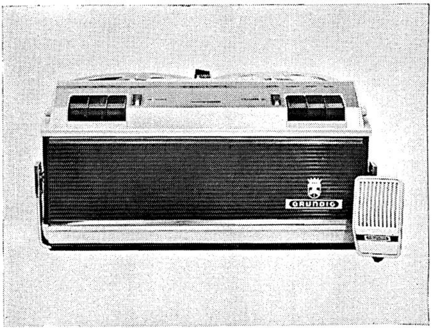
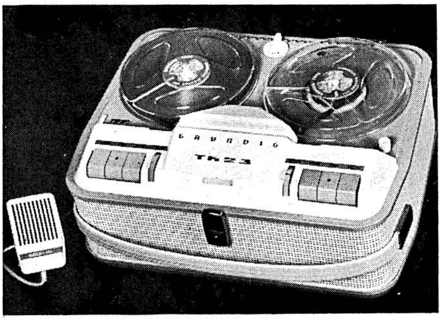
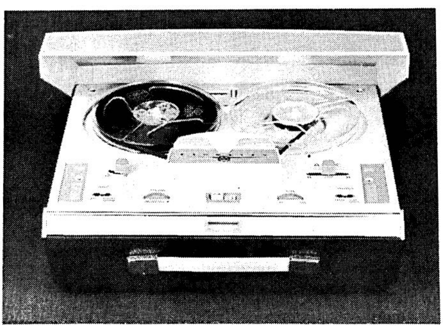
GENERAL SONIC RADIOS, 92 Caledonian Road, London, N.1. Tel.: Terminus 0322.



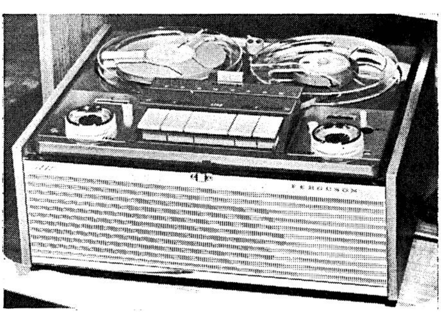
Grundig TK 17*L*



*Grundig TK*23



Fidelity Playmaster-4



Ferguson 3212

Sonic V. Collaro deck. $\frac{1}{4}$-track. 3 speeds. 7 in. spools. F.R. $7\frac{1}{2}$ i/s. 40-12,000 c/s ± 3 dB. M.E. level ind. W. and F. 0·15%. H. and N. -45 dB. Tone controls, superimposition, pause key. Outlet from pre-amp. Two loudspeakers fitted. Output: 5·3W. Size: 16 × 16 × $9\frac{1}{4}$ in. Weight: 33 lb. Price: £52 10s.

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GRUNDIG (GREAT BRITAIN) LTD., Newlands Park, Sydenham, London, S.E.26. Tel.: Sydenham 2211. Cables: Grundig, London, S.E.26. Telex.: 22854.

TK14L. Mono $\frac{1}{2}$-track recorder. Speed $3\frac{3}{4}$ i/s. Spool $5\frac{3}{4}$ in. W. and F. $\pm 0{\cdot}2$%. H. and N. -47 dB. F.R. 60 c/s-12 Kc/s $+3$ -5 dB. Replay char. NARTB. Inputs, mic, 2 mV 0·5 megohm, diode 80 mV 1 megohm. Outputs, 500 mV 15K, LS 5 ohms. M.E. Valves. Rewind time 3 mins. One motor. Own deck. Size: $13\frac{1}{4}$ × $13\frac{1}{2}$ × $6\frac{3}{4}$ in. Weight: 22 lb. Pause control. Position indicator. 110-240V 50 c/s. Price: £38 17s.

TK17L. Mono $\frac{1}{4}$-track recorder. Speed $3\frac{3}{4}$ i/s. Spool $5\frac{3}{4}$ in. W. and F. $\pm 0{\cdot}2$%. H. and N. -45 dB. F.R. 60 c/s-12 Kc/s $+3$ -5 dB. Replay char. NARTB. Inputs, mic. 2 mV 1·5 megohms, diode 2 mV 22K, PU 100 mV 1 megohm. Outputs, 700 mV 15K, LS 5 ohms. M.E. Valves. Rewind time 3 mins. One motor. Own deck. Pause. Position indicator. Monitor. 110-240V 50 c/s. Size: $13\frac{1}{4}$ × $10\frac{1}{2}$ × $6\frac{3}{4}$ in. Weight: 22 lb. Price: £45 3s.

TK18L. Mono $\frac{1}{2}$-track recorder. Speed $3\frac{3}{4}$ i/s. Spool $5\frac{3}{4}$ in. W. and F. $\pm 0{\cdot}2$%. H. and N. -48 dB. F.R. 60 c/s-12 Kc/s $+3$ -5 dB. Replay char. NARTB. Inputs, mic. 2-45 mV 1·5 megohms, diode 100 mV-1V 1 megohm. Outputs, 485 mV 15K, LS 5 ohms. Valves. Rewind time 3 mins. One motor. Own deck. Pause. Position indicator. Fully automatic recording level and synchronous recording. 110-240V 50 c/s. Size: $13\frac{1}{4}$ × $10\frac{1}{2}$ × $6\frac{3}{4}$ in. Weight: 22 lb. Price: £43 1s.

TK23L. Mono $\frac{1}{4}$-track recorder. Speed $3\frac{3}{4}$ i/s. Spool $5\frac{3}{4}$ in. W. and F. $\pm 0{\cdot}2$%. H. and N. -45 dB. F.R. 60 c/s-12 Kc/s $+3$ -5 dB. Replay char. NARTB. Inputs, 2 mV 1·5 megohms, diode 2 mV 22K, PU 100 mV 1 megohm. Outputs, 700 mV 15K, LS 5 ohms. M.E. Valves. Rewind time 3 mins. One motor. Own deck. Superimpose. Pause. Position indicator. Automatic and manual recording level. Synchronous recording. 110-240V 50 c/s. Size: $13\frac{1}{4}$ × $10\frac{1}{2}$ × $6\frac{3}{4}$ in. Weight: 22 lb. Price: £51 9s.

TK40. Mono $\frac{1}{4}$-track recorder. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Spool 7 in. ($5\frac{3}{4}$ in. with lid). W. and F. $7\frac{1}{2}$ $\pm 0{\cdot}1\%$, $3\frac{3}{4}$ $\pm 0{\cdot}12\%$, $1\frac{7}{8}$ $\pm 0{\cdot}2\%$. H. and N. $7\frac{1}{2}$, $3\frac{3}{4}$ -42 dB, $1\frac{7}{8}$ -38 dB F.R. $7\frac{1}{2}$ 60 c/s-18 Kc/s, $3\frac{3}{4}$ 60 c/s-15 Kc/s, $1\frac{7}{8}$ 60 c/s-9 Kc/s, $+3$ dB -5 dB. Replay char. NARTB. Inputs, mic 2 mV 1·5 megohms, diode 6 mV 39K, PU 475 mV 1 megohm. Outputs, $7\frac{1}{2}$, $3\frac{3}{4}$ 1150 mV 10K, $1\frac{7}{8}$ 750 mV 10K, LS 2·5W. M.E. Valves. Rewind time 1,700 ft. $2\frac{3}{4}$ mins. One motor. Own deck. Superimpose. Pause. Position indicator. Monitoring. Inching. Remote control. Auto-stop. Mixing. Tape jointing channel. Synchronous recording. 110-250V 50 c/s. Size: $16\frac{1}{8}$ × 15 × $7\frac{3}{4}$ in. Weight: 28 lb. Price: £91 7s.

TK41. Mono $\frac{1}{2}$-track recorder. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Spool 7 in. ($5\frac{3}{4}$ in. with lid). W. and F. $7\frac{1}{2}$ $\pm 0{\cdot}1\%$, $3\frac{3}{4}$ $\pm 0{\cdot}12\%$, $1\frac{7}{8}$ $\pm 0{\cdot}2\%$. H. and N. $7\frac{1}{2}$, $3\frac{3}{4}$ -47 dB, $1\frac{7}{8}$ -44 dB. F.R. $7\frac{1}{2}$ 60 c/s-18 Kc/s, $3\frac{3}{4}$ 60 c/s-15 Kc/s, $1\frac{7}{8}$ 60 c/s-9 Kc/s. $+3$ -5 dB. Replay char. NARTB. Inputs, mic. 2 mV 1·5 megohms, diode 2 mV 33K, PU 100 mV 1 megohm. Outputs, LS 7W 5 ohms, $7\frac{1}{2}$, $3\frac{3}{4}$ 700 mV 15K, $1\frac{7}{8}$ 470 mV 15K. M.E. Valves. Rewind time 1,700 ft. $2\frac{3}{4}$ mins. One motor. Own deck. Superimpose. Pause. Position indicator. 7W straight-through amplifier. Monitoring. Inching. Auto-stop. Remote control. Tape jointing channel. 110-250V 50 c/s. Size: $16\frac{1}{8}$ × 15 × $7\frac{5}{8}$ in. Weight: $28\frac{1}{2}$ lb. Price: £87 3s.

●**TK46.** Stereo/mono $\frac{1}{4}$-track recorder. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Spool 7 in. ($5\frac{3}{4}$ in. with lid). W. and F. $7\frac{1}{2}$ $\pm 0{\cdot}1\%$, $3\frac{3}{4}$ $\pm 0{\cdot}12\%$, $1\frac{7}{8}$ $\pm 0{\cdot}2\%$. H. and N. $7\frac{1}{2}$ -44 dB, $3\frac{3}{4}$ -45 dB, $1\frac{7}{8}$ -40 dB. F.R. $7\frac{1}{2}$ 60 c/s-18 Kc/s, $3\frac{3}{4}$ 60 c/s-15 Kc/s, $1\frac{7}{8}$ 60 c/s-9 Kc/s. $+3$ -5 dB. Replay char. NARTB. Inputs, mics, two 1·5 mV 1·5 megohms, diodes, two 1·5 mV 39K, PU's two 80 mV 2·2 megohms. Outputs, LS two 3W 5 ohms, two high impedance outputs, $7\frac{1}{2}$ 380 mV 15K, $3\frac{3}{4}$ 435 mV 15K, $1\frac{7}{8}$ 305 mV 15K. M.E. Valves. Rewind time 1,700 ft. $2\frac{3}{4}$ mins. One motor. Own deck. Pause. Position indicator. Monitoring. Inching. Auto-stop. Remote control. Synchronous, multi-synchronous and echo recordings. Tape jointing channel. Size: 20 × $15\frac{3}{4}$ × $8\frac{1}{4}$ in. Weight: 33 lb. Price: £112 7s.

TK6. Battery/mains recorder. For details see Battery Operated Portables Section.

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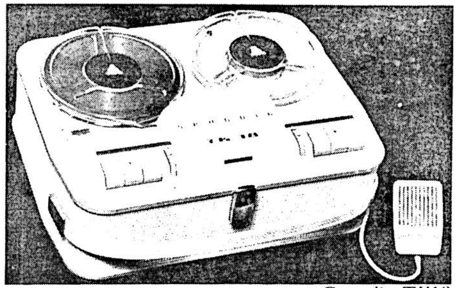
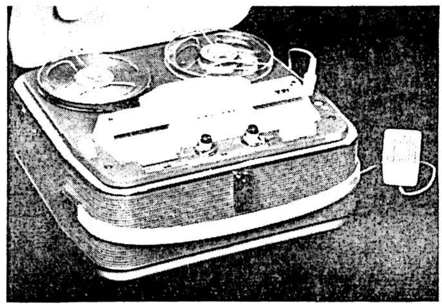
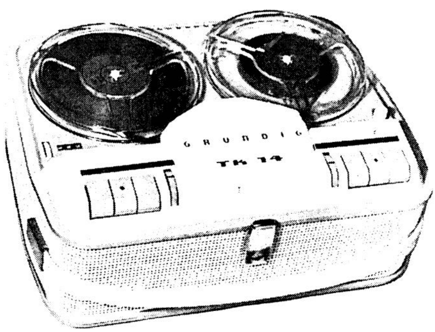
HITACHI. See Lee Products.



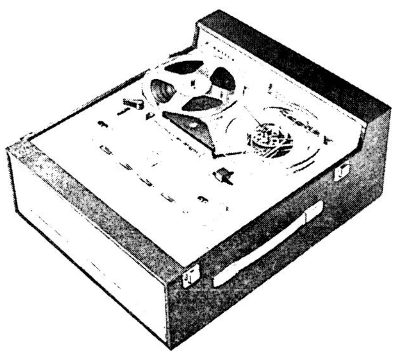
Grundig TK18



Grundig TK40

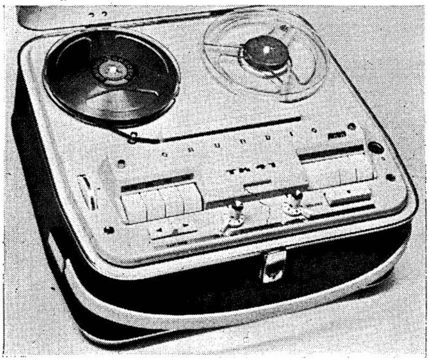


Grundig TK 14

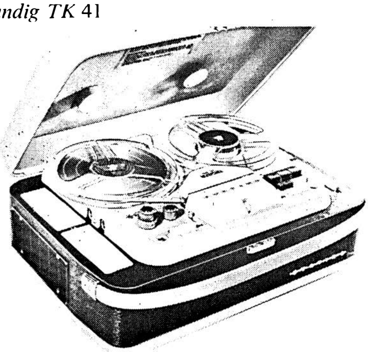


Fidelity Playmaster Major

Grundig TK 46



Grundig TK 41



Korting MT 3623

Korting MT 3624

HMV. See British Radio Corporation Ltd.

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K.G.M. ELECTRONICS LTD., Bardolph Road, Richmond, Surrey. Tel.: Richmond 7171. Cables: Kelec, Richmond, Surrey.

Cinecorder Model A. Mono recorder with B.S.R. deck. $\frac{1}{2}$-track. Speed $3\frac{3}{4}$ i/s. W. and F. 0·4%. F.R. 60 c/s-10 Kc/s. Replay char. CCIR. Two channel mixing with two inputs per channel. 4W, 15 ohm output. One motor. $5\frac{3}{4}$ in. spools. 10 in. elliptical speaker housed in detachable lid with 24 ft. cable. Separate bass and treble controls. Boost and cut. Superimposition. "Shift-track" tape control for dual recordings. Tapelift/Pause control for cueing, cross-fading. Remote control. Accessories: microphones and extension cables, perforated Cinetape, tape sprockets. Size: $16\frac{1}{2} \times 14 \times 8\frac{1}{2}$ in. Weight: 28 lb. Price: £75.

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KOLSTER-BRANDES LTD., Footscray, Sidcup, Kent. Tel.: Footscray 7733. Cables: Matchtone, Sidcup.

WT20. Mono recorder. $\frac{1}{2}$-track. Speed $3\frac{3}{4}$ i/s. W. and F. 0·2%. H. and N. −46 dB. F.R. 80 c/s-8 Kc/s −3 dB. Replay char. CCIR. Inputs: mic 2 mV, 1M; radio 500 mV, 100K. One motor. $5\frac{3}{4}$ in. spools. Rewind $1\frac{1}{2}$ mins. M.E. indicator. Extension L.S. socket. Size: $13\frac{7}{8} \times 12\frac{3}{8} \times 6\frac{1}{8}$ in. Price: £25 4s.

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KORTING. Distributors: Europa Electronics Ltd., Howard Place, Shelton, Stoke-on-Trent. Tel.: Stoke-on-Trent 29316.

MT2223. Mono recorder. $\frac{1}{4}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. H. and N. −42 dB. F.R. $7\frac{1}{2}$ i/s, 30 c/s-20 Kc/s ±3 dB; $3\frac{3}{4}$ i/s, 30 c/s-14 Kc/s ±3 dB. Inputs: radio 0·5 mV, 4·7K; mic 0·1 mV, 200 ohms; gram 200 mV, 2 Meg. Outputs: line 1·5V, 33K; speaker 4·5 ohms, 2W. One motor. 7 in. spool. Rewind 3 mins. M.E. indicator. Transistor input. Tape counter. Monitoring, Bass/treble control. Size: $14\frac{1}{2} \times 12 \times 7\frac{1}{2}$ in. Weight: 20 lb. Price: £58 16s.

●**MT3623.** Stereo recorder. $\frac{1}{4}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. H. and N. −42 dB. F.R. $7\frac{1}{2}$ i/s, 30 c/s-18 Kc/s ±3 dB; $3\frac{3}{4}$ i/s, 40 c/s-14 Kc/s ± 3 dB. Inputs: radio 0·5 mV, 4·7K; mic 0·1 mV, 200 ohms; gram 100 mV, 1 megohm. Outlets: line 0·7V, 33K; speaker 4·5 ohms, 2W. One motor. 7 in. spool. Rewind 5 mins. M.E. indicator. Transistor input. Tape counter.

Pause control. Superimpose. Monitoring. Bass/treble control. Size: $16\frac{1}{2} \times 12\frac{3}{4} \times 7\frac{1}{2}$ in. Weight: 24 lb. Price: £72 19s. 6d.

●**MT3624.** $\frac{1}{4}$-track mains operated stereo tape recorder. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Spool size 7 in. H. and N. −54 dB at $7\frac{1}{2}$, −52 dB at $3\frac{3}{4}$, −48 dB at $1\frac{7}{8}$. W. and F. ±0·12% at $7\frac{1}{2}$, ±0·2% at $3\frac{3}{4}$, ±0·3% at $1\frac{7}{8}$. F.R. 30 c/s-18 Kc/s at $7\frac{1}{2}$, 40 c/s-14 Kc/s at $3\frac{3}{4}$, 40 c/s-7 Kc/s at $1\frac{7}{8}$. Inputs: mics (2) 70 µV 200 ohms, PU 150 mV 1 megohm, radio (A) 300 µV 2K, radio (W) 2 × 700 mV 33K. Outputs: crystal headphones 220K, hi-fi amplifier 2 × 700 mV 33K, LS 2 × 3W 4 ohms. Transistors and valves. Position indicator. Bass and treble controls. Monitoring. Dubbing. Reverberation. Rewind time 4 mins. for 2,400 ft. Electro-magnetic pause. Automatic stop at end of tape. Two M.E. Three stereo sound heads. Size: $20\frac{3}{4} \times 14 \times 8$ in. Weight: 35 lb. Price: £102 18s. (less microphone), No. 169 dynamic microphone £4 4s.

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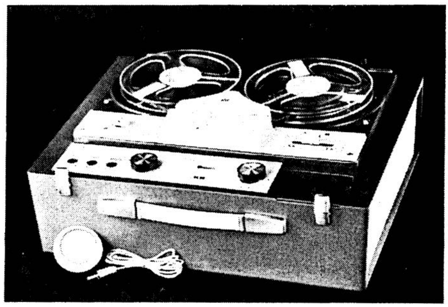
LEE PRODUCTS (G.B.) LTD., Elpico House, Longford Street, London, N.W.1. Tel.: Euston 5754. Cables: Leprod, London, N.W.1.

Hitachi TRA500. $\frac{1}{2}$-track mono recorder. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Spool size 5 in. F.R. 100 c/s-8 Kc/s at $3\frac{3}{4}$, 10 c/s-3·5 Kc/s at $1\frac{7}{8}$. Inputs: mic. 100K, radio 470K. Outlet for phone. Meter. Valves. Rewind time 2 mins. One motor. Own deck. Single knob control. Pause. Automatic record level. Mains 210/230V 50 c/s. Size: $13\frac{3}{4} \times 6\frac{3}{4} \times 11$. Weight: $11\frac{3}{4}$ lb. Price: £30 9s.

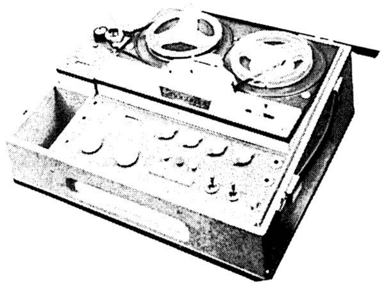
Hitachi TRA722. $\frac{1}{2}$-track mono recorder. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. Spool size 7 in. F.R. 50 c/s-12 Kc/s at $7\frac{1}{2}$ i/s, 50 c/s-7 Kc/s at $3\frac{3}{4}$ i/s. Inputs: mic. 1·5 megohms, radio/PU 200K. Outputs: LS 8 ohms, line 100K. Meter. Valves. Rewind time 4 mins. One motor. Own deck. Single hand control. Mains 210/230V 50 c/s. Size: $13\frac{3}{4} \times 6\frac{3}{4} \times 11$ in. Weight: $19\frac{3}{4}$ lb. Price: £44 2s.

Hitachi TRA505. $\frac{1}{4}$-track mono recorder with stereo playback facility. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Spool size 5 in. F.R. 100 c/s-8·5 Kc/s at $3\frac{3}{4}$ i/s, 100 c/s-5 Kc/s at $1\frac{7}{8}$ i/s. Inputs: mic 600K, radio diode 570K. Outputs: LS 8 ohms, line 100K. Meter. Valves. Rewind time 3 mins. One motor. Own deck. Provision for recording one track while listening to the other. Both tracks can be played back simultaneously, with individual volume adjustment. Mains 210/230V 50 c/s. Size $11 \times 5\frac{1}{2} \times 11\frac{1}{2}$ in. Weight 12 lb. Price: £51 9s.

Korting MT 2223

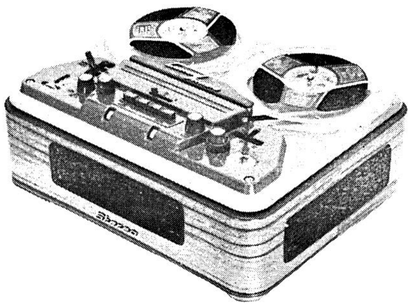


*Kolster-Brandes WT*20



KGM Cinecorder Model A

Hitachi TRA 722



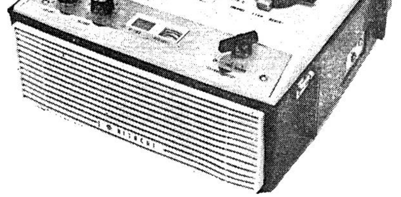
Luxor MP-423/424 Stereo

LOEWE-OPTA. Sole U.K. distributors: Highgate Acoustics, 71/73 Great Portland Street, London, W.1. Tel.: Museum 2901.

Optacord 408, 416, 416 DIA. Battery/mains recorders. For full details see battery operated portables section.

LUXOR INDUSTRI AKTIEBOLAG, Motala, Sweden. Distributors: Britimpex Ltd., 16-22 Great Russell Street, London, W.C.1. Tel.: Museum 7600. Cables: Brytron, London.

●**Luxor MP-423.** Stereo recorder. $\frac{1}{4}$-track. Speeds: $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $7\frac{1}{2}$ i/s, 0·1%; $3\frac{3}{4}$ i/s, 0·2%; $1\frac{7}{8}$ i/s, 0·35% (peak to peak). H. and N. −50 dB (weighted with recorded tape). F.R. $7\frac{1}{2}$ i/s, 50 c/s-19 Kc/s; $3\frac{3}{4}$ i/s, 50 c/s-12 Kc/s· $1\frac{7}{8}$ i/s, 80 c/s-6 Kc/s (all ±3 dB). Replay char. NARTB. Inputs: mic 7 mV; gram 200 mV; radio 30 mV, Imp. 1 megohm. Outlet from pre-amp. One motor. 7 in. spool. Rewind 2 min. for 7 in. tape. Two M.E.s. Separate balance control. Separate level indicator. Facilities for mixing. Size: $14\frac{1}{8}$ × $11\frac{3}{8}$ × $6\frac{3}{4}$ in. Weight: $24\frac{1}{4}$ lb. Price: £77 14s.



Hitachi TRA 505

●**MP-424.** Details as for MP-423. Size: $14\frac{3}{4}$ × $11\frac{3}{4}$ × $6\frac{1}{2}$ in. Weight: $28\frac{1}{2}$ lb. Price: £80 17s.

MARCONIPHONE. See British Radio Corporation Ltd.

MARTIN ELECTRONICS LTD. See Constructional Kits section.

NATIONAL. Matsushita Electric Co., Japan. Distributors: United Africa Mechanical and Electrical Ltd., United Africa House, Blackfriars, London, S.E.1. Tel.: Waterloo 2070.

RQ303. Mains operated $\frac{1}{2}$-track mono. recorder. Speed $1\frac{7}{8}$ i/s. Spool size $3\frac{1}{4}$ in. W. and F. less than 0·5%. F.R. 150 c/s-1·4 Kc/s. Input. mic. 25K. Outputs: LS 8 ohms, phone 700 mW. Neon indicator. Transistorised. Rewind time 70 secs. 200 ft. One shaded-pole motor. Own deck. Push-button operation. Mains 240V 50 c/s. Size: 8 × $7\frac{1}{2}$ × $3\frac{3}{4}$ in. Weight: 4 lb. Price: £16 16s.

●**RS753.** Stereo/mono $\frac{1}{4}$-track mains operated recorder. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Spool size 7 in. W. and F. less than 0·2% at $7\frac{1}{2}$ i/s. F.R. 60 c/s-15 Kc/s at $7\frac{1}{2}$, 60 c/s-10 Kc/s at $3\frac{3}{4}$, 60 c/s-5 Kc/s at $1\frac{7}{8}$. Inputs: two mics. 20K, two aux. 1 megohm. Outputs: two 8 ohm. LS 2·5W each, two 47 ohm lines. Two VU meters. Six transistors, three valves. One motor. Own deck. Multi-track recording and playback. Push-button operation. Mains 100, 115, 125, 200, 250V 50-60 c/s. Size: $13\frac{5}{8}$ × $9\frac{1}{2}$ × 14 in. Weight: $34\frac{1}{2}$ lb. Price: £84.

PHILIPS ELECTRICAL LTD., Century House, Shaftesbury Avenue, London, W.C.2. Tel.: Gerrard 7777. Cables: Phillamps, London.

●**EL3534.** Stereo recorder. $\frac{1}{4}$-track. Speeds: $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$, $\frac{15}{16}$ i/s. W. and F. <0·6% (peak-to-peak) at $3\frac{3}{4}$ i/s. H. and N. −40 dB. F.R. $7\frac{1}{2}$ i/s, 60 c/s-16 Kc/s; $3\frac{3}{4}$ i/s, 60 c/s-13 Kc/s; $1\frac{7}{8}$ i/s, 60 c/s-10 Kc/s; $\frac{15}{16}$ i/s, 60-4,500 c/s (all ±3 dB). Inputs: mic. 1 mV, 1K; diode 3 mV, 20K; gram 150 mV, 500K. Outlet from pre-amp. One motor. 7 in. spools. Moving coil level meter. Transistor amplifier. Multiplay. Loudspeaker and phones. Extension speaker output. Size: 10 × $18\frac{1}{2}$ × 15 in. Weight: 35 lb. Price (with stereo microphone and tape): £96 12s.

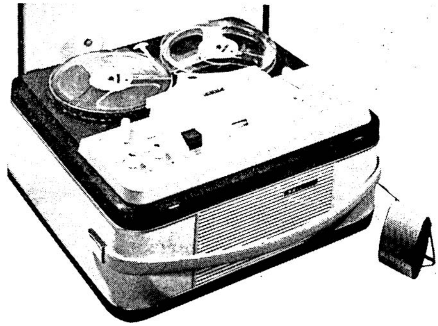
EL3549. Mono recorder. $\frac{1}{4}$-track. Speeds: $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$, $\frac{15}{16}$ i/s. W. and F. <0·6% (peak-to-peak) at $3\frac{3}{4}$ i/s. H. and N. −40 dB. F.R. $7\frac{1}{2}$ i/s, 60 c/s-16 Kc/s; $3\frac{3}{4}$ i/s, 60 c/s-13 Kc/s; $1\frac{7}{8}$ i/s, 60 c/s-10 Kc/s; $\frac{15}{16}$ i/s, 60-4,500 c/s (all ±3 dB). Inputs: mic. 1 mV, 1K; diode 3 mV, 20K; gram 150 mV, 500K. Outlets from replay head or pre-amp. One motor. 7 in. spools. Moving coil level meter. Pause control. Parallel track. Monitoring by loudspeaker or phones. Straight amp. Stereo output. Transistor amplifier. Extension loudspeaker output. Size: $8\frac{1}{4}$ × $16\frac{1}{2}$ × $15\frac{1}{2}$ in. Weight: 26 lb. Price (with microphone and tape): £65 2s.

EL3548. $\frac{1}{4}$-track mono recorder. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Spool 7 in. W. and F. <0·6% (p-p) at $3\frac{3}{4}$ i/s. H. and N. −40 dB. F.R. 60 c/s-13 Kc/s ±3 dB at $3\frac{3}{4}$ i/s; 60 c/s-10 Kc/s ±3 dB at $1\frac{7}{8}$ i/s. Inputs: mic. 0·25 mV 1·5K, diode 2·5 mV at 20K, gram 130 mV at 1 megohm. Outlets: diode 1V 20K, LS 2·5W 3-7 ohms, monitor headphones 200 mV 1·5K. Strip level indicator. Valves and transistors. Rewind time: 3 mins. for 1,800 ft. One motor. Own deck. Pause. Position indicator. Straight-through amplifier. Parallel track replay. Stereo output. Mixing. Mains: 110, 127, 200-250V 50 c/s. Size: $13\frac{3}{4}$ × $6\frac{3}{4}$ × $15\frac{3}{4}$ in. Weight: 18 lb. Price: £40 19s.

EL3552. $\frac{1}{2}$-track mono recorder. Speed $3\frac{3}{4}$ i/s. Spool $5\frac{3}{4}$ in. W. and F. <0·6% (p-p). H. and N. −40 dB. F.R. 80 c/s-12 Kc/s. Input 0·2 mV 3K. Outlet 750 mV 20K. Strip level indicator. Valves and transistors. Rewind time: 3 mins. for 1,200 ft. One motor. Own deck. Pause. Automatic record level control. Mains: 110, 127, 200-250V AC. Size: $14\frac{1}{2}$ × 10 × 5 in. Weight: 13 lb. Price: £25 4s.

Cossor CR1604. Mono recorder. $\frac{1}{4}$-track. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $3\frac{3}{4}$ i/s, <0·6% (peak to peak). H. and N. −40 dB. F.R. $3\frac{3}{4}$ i/s, 60 c/s-13 Kc/s; $1\frac{7}{8}$ i/s, 60 c/s-10 Kc/s (±3 dB). Inputs: mic. 1 mV, 1K; radio 3 mV, 20K; gram 150 mV, 500K. Outlets from replay head, and pre-amp. One motor. 7 in. spools. M.E. Pause control, stereo output, straight amplifier, monitor (L.S. or phones). Size: $14\frac{1}{4}$ × $14\frac{1}{4}$ × $7\frac{1}{4}$ in. Weight: 18 lb. Price: £40 19s.

Cossor CR1605. Mono recorder. $\frac{1}{4}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$, $\frac{15}{16}$ i/s. W. and F. <0·6% (peak-to-peak) at $3\frac{3}{4}$ i/s. H. and N. −40 dB. F.R. $7\frac{1}{2}$ i/s, 60 c/s-16 Kc/s; $3\frac{3}{4}$ i/s, 60 c/s-13 Kc/s; $1\frac{7}{8}$ i/s, 60 c/s-10 Kc/s; $\frac{15}{16}$ i/s, 60-4,500 c/s (all ±3 dB). Inputs: mic. 1 mV, 1K; diode 3 mV, 20K; gram 150 mV, 500K. Outlets from replay head or pre-amp. One motor. 7 in. spools. Moving coil meter. Pause control.

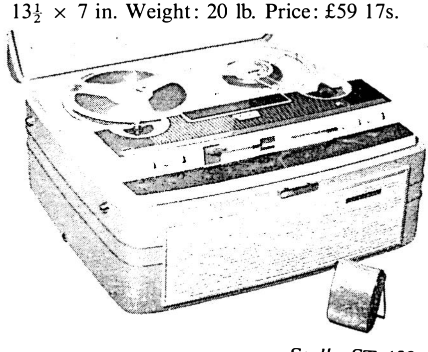


Philips EL 3549

Parallel track. Monitoring by loudspeaker or headphones. Straight amplifier. Stereo output. Extension loudspeaker output. Transistor amplifier. Size: 17 × $15\frac{1}{2}$ × $8\frac{1}{4}$ in. Weight: 26 lb. Price (with microphone and tape): £65 2s.

●**Cossor CR1606.** Transistorised stereo $\frac{1}{4}$-track recorder. Speed $3\frac{3}{4}$ i/s. Spool $5\frac{3}{4}$ in. W. and F. <0·6% (p-p). H. and N. −40 dB. F.R. 80 c/s-13 Kc/s ±3 dB. Inputs: mic. 0·3 mV 1K, diode 3 mV 20K, PU 150 mV 1 megohm. Outputs: 1V 20K, 1·5W 3-7 ohms. Meter indicator. Rewind time 3 mins. for 900 ft. One motor. Own deck. Pause. Position indicator. Mains 110, 127, 200-250V AC. Size: 14 × $11\frac{1}{2}$ × $6\frac{1}{4}$ in. Weight: 13 lb. Price: £30 9s.

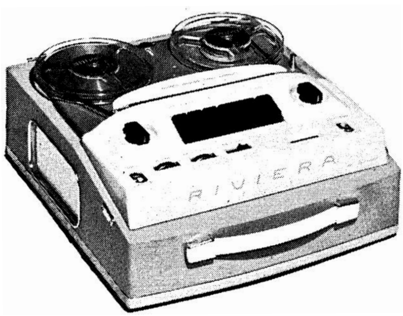
●**Cossor CR1607.** Transistorised stereo $\frac{1}{4}$-track recorder. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Spool $5\frac{3}{4}$ in. W. and F. <0·6% (p-p). H. and N. −40 dB. F.R. $3\frac{3}{4}$ 80 c/s-13 Kc/s ±3 dB, $1\frac{7}{8}$ 80 c/s-10 Kc/s ±3 dB. Inputs: mic. 1 mV 2K, diode 2·5 mV 20K, PU 150 mV 500K. Outputs: 1V 20K, monitor headphones 200 mV 1K, LS 1·5W 3-7 ohms. Meter indicator. Rewind time 3 mins. for 1,200 ft. One motor. Own deck. Pause. Position indicator. Straight through amplifier. Mains 110, 127, 200-250V AC. Size: 17 × $13\frac{1}{2}$ × 7 in. Weight: 20 lb. Price: £59 17s.



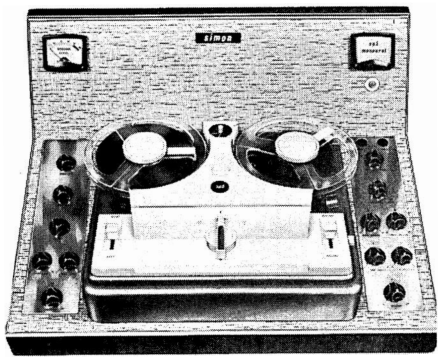
Stella ST 459

Stuzzi 604

Stuzzi 504 *and* 802 *FM*

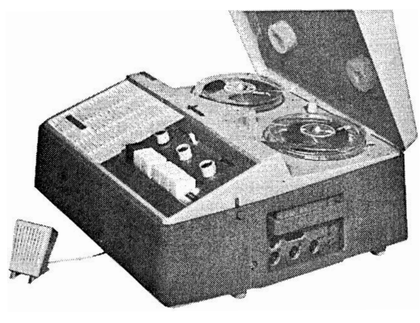


Sound Riviera 3-*speed* 2-*track*



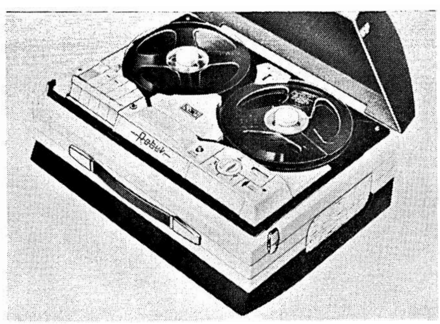
Simon SP5

Cossor CR1605



Cossor CR 1604

*Saba TK*230-*S*



Robuk RK 44

Stella ST458. Mono recorder, ¼-track. Speeds 3¾, 1⅞ i/s. W. and F. 3¾ i/s, 0·6% (peak-to-peak). H. and N. −40 dB. F.R. 3¾ i/s, 60 c/s-13 Kc/s; 1⅞ i/s, 60 c/s-10 Kc/s (±3 dB). Inputs: mic. 1 mV, 1K; radio 3 mV, 20K; gram 150 mV, 500K. Outlets from replay head, and pre-amp. One motor. 7 in. spool. M.E. Pause control, stereo output, straight amplifier, monitor (L.S. or phones). Size: 14¼ × 14¼ × 7¼ in. Weight: 18 lb. Price: £40 19s.

Stella ST459. Mono recorder. ¼-track. Speeds 7½, 3¾, 1⅞, 15/16 i/s. W. and F. <0·6% (peak-to-peak) at 3¾ i/s. H. and N. −40 dB. F.R. 7½ i/s, 60 c/s-16 Kc/s; 3¾ i/s, 60 c/s-13 Kc/s; 1⅞ i/s, 60 c/s-10 Kc/s; 15/16 i/s, 60-4,500 c/s (all ±3 dB). Inputs: mic. 1 mV, 1K; diode 3 mV, 20K; gram 150 mV, 500K. Outlets from replay head or pre-amp. One motor. 7 in. spools. Moving coil meter. Pause control. Parallel track. Monitoring (loudspeaker or phones). Straight amp. Stereo output. Transistor amplifier. Size: 17 × 15½ × 8¼ in. Weight: 26 lb. Price (with microphone and tape): £65 2s.

Stella ST460. Transistorised mono ¼-track recorder. Speed 3¾ i/s. Spool 5¾ in. W. and F. <0·6% (p-p). H. and N. −40 dB. F.R. 80 c/s-13 Kc/s ±3 dB. Inputs: mic. 0·3 mV 1K, diode 3 mV 20K, PU 150 mV 1 megohm. Outputs: 1V 20K, 1·5W 3-7 ohms. Meter indicator. Rewind time 3 mins. for 900 ft. One motor. Own deck. Pause. Position indicator. Mains 110, 127, 200-250V AC. Size: 14 × 11⅛ × 6¼ in. Weight: 13 lb. Price: £30 9s.

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PORTADYNE RADIO, Portadyne Works, 30-34 Gorst Road, N. Acton, London, N.W.10. Tel.: Elgar 7541-3.

TR300. Mono recorder. ½-track. Speed 3¾ i/s. W. and F. 0·4%. H. and N. −50 dB. F.R. 100 c/s-8 Kc/s ±3 dB. Replay char. CCIR. Inputs: mic 1 mV, 1 megohm; radio 20 mV, 47K. Output from pre-amp 1 mV, 10K. One motor. 5¾ in. spool. Rewind 3 min., 850 ft. DM70 level indicator. Size: 17¼ × 12¾ × 5½ in. Price: £20 9s. 6d.

★

Q-CORD. See C. Braddock (Blackpool) Ltd.

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REPS (TAPE RECORDERS) LTD., 44 Packington Road, Acton, London, W.3. Tel.: Acorn 4141.

R.10. Collaro Studio deck. Speeds: 7½, 3¾ and 1⅞ i/s. F.R. 7½, 40-16,000 c/s ±3 dB; 3¾, 40-10,000 c/s; 1⅞, 50-6,000 c/s. Level meter, H. and N. −50 dB. W. and F. 0·1%. Size: 15½ × 15 × 9 in. Weight: 31 lb. Price (with tape, crystal mic., and recording lead): £61 19s. two track; £72 9s. four track.

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ROBUK ELECTRICAL INDUSTRIES LTD., 559/561 Holloway Road, London, N.19. Tel.: Archway 1022.

Robuk RK4. Speeds: 7½, 3¾ and 1⅞ i/s. Three motors. 7 in. spools. F.R. 7½, 60-14,000 c/s ±3 dB; 3¾, 60-7,000 c/s ±3 dB; 1⅞, 60-3,500 c/s. M.E. level ind. H. and H. <−40 dB. W. and F. <0·2%. Outlet from pre-amp stage. Size: 16 × 11½ × 7¼ in. Price: £37 16s.

RK44. Details as above but ¼-track version. Price: £40 19s.

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SABA ELECTRONICS LTD., 3/5 Eden Grove, Holloway, London, N.7. Tel.: North 8161. Cables: Arc Eeslon.

●**TK230-S.** Transistorised pre-amp, valve output. ¼-track stereo recorder. Speeds 7½, 3¾ i/s. Spool 7 in. W. and F. 7½ ±0·15%, 3¾ ±0·25%. H. and N. better than 48 dB. F.R. 40 c/s-20 Kc/s at 7½ i/s, 40-15 Kc/s at 3¾ i/s. Inputs: two mics. 1 mV 200 ohms, radio 10 mV 100K, PU 200 mV 1 megohm. Outputs: 1V radio-stereo, 5W each channel to internal speakers or to 4-6 ohms extension units. 22½V output for mixer or slide synchroniser. Rewind time 5 mins. for 2,400 ft. Own deck. Superimpose. Pause. Position indicator. Track-to-track recording. Provision for slide projector. Size: 16½ × 15 × 7½ in. Weight: 28½ lb. Mains 125-240V AC. Price: £98 14s.

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SANYO. Sole U.K. agents: Sanyo Service & Sales, 23 Savage Gardens, Trinity Square, London, E.C.3. Tel.: (Service) Royal 7154, (Sales) Royal 4154.

Sanyo MR900. ½-track mains portable recorder. Speeds 7½, 3¾, 1⅞ i/s. F.R. 50 c/s-12 Kc/s at 7½ i/s, 50 c/s-9 Kc/s at 3¾ i/s, 100 c/s-4·5 Kc/s at 1⅞ i/s. Spool size 7 in. One motor. Rewind time 3 min. M.E. Own deck. Valves. Mains 230-250V AC. Size: 13½ × 14½ × 8 in. Weight: 17½ lb. Price: £61 19s.

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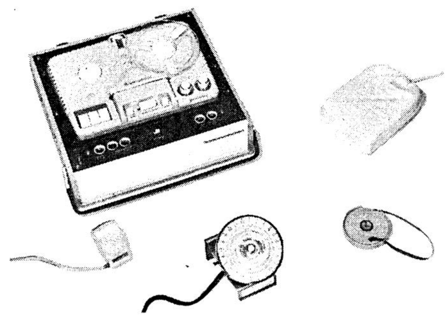
SILVERTONE. See W. Wood & Son Ltd.



Symphony Pre-Sleep Study Outfit

SIMON EQUIPMENT LTD., 48 George Street, London, W.1. Tel.: Welbeck 2371. Cables: Simsale, London.

SP/5. Speeds $7\frac{1}{2}$ and $3\frac{3}{4}$ i/s. Three motors. 7 in. spools. F.R. ± 3 dB. $7\frac{1}{2}$ i/s 30-20,000 c/s; $3\frac{3}{4}$ i/s, 30-10,000 c/s. Level meter. H. and N. < -50 dB weighted against frequencies below 50 c/s. W. and F. $7\frac{1}{2}$ i/s $<0{\cdot}15\%$; $3\frac{3}{4}$ i/s $<0{\cdot}2\%$. Monaural, can be converted to stereo. Re-record from one track to another. Monitoring of recorded signal. Outlet from pre-amp. Size: $22\frac{1}{2} \times 20 \times 9\frac{1}{4}$ in. Weight: 45 lb. Price monaural: £97 13s.; stereo: £111 6s.

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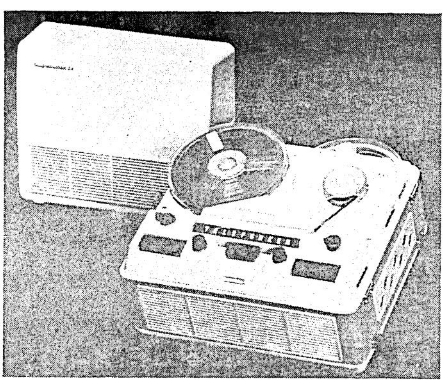
SONY. U.K. Sales Division, Eastbrook Road, Eastern Avenue, Gloucester. Tel.: Gloucester 26841. Cables: DEBELEC, Gloucester.

●**TC200.** Stereo recorder. $\frac{1}{4}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. W. and F. $7\frac{1}{2}$ i/s, less than $0{\cdot}19\%$; $3\frac{3}{4}$ i/s, less than $0{\cdot}25\%$. F.R. $7\frac{1}{2}$ i/s, 50 c/s-14 Kc/s; $3\frac{3}{4}$ i/s, 50 c/s-11 Kc/s (± 2 dB). Replay char. NARTB. Inputs: mic. low impedance, aux. high impedance. Outlet from pre-amp. One motor. 7 in. spool. 2 VU meters. Size: $15 \times 9 \times 15\frac{7}{8}$ in. Weight: 27 lb. Price (inc. ext. speakers, 2 mics., leads): £75 12s.



Telefunken Magnetophon 97

●**TC801.** Battery/mains recorder. For details see Battery Operated Portables section.

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STELLA. See Philips Electrical Ltd.

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STEREOSOUND PRODUCTIONS LTD. 12-14 Wakefield Road, Brighouse, Yorkshire. Tel.: Brighouse 1755.

Carousel Radiotape. Cabinet tape recorder with space to add a radio tuner. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Spool size 7 in. Position indicator. M.E. Pause. BSR deck. Treble boost control. Input for mic. and PU. 7 in. speaker. Walnut finish. Laquered brass trim. Space for tapes and mic. Size: $23\frac{3}{4} \times 13\frac{1}{2} \times 22\frac{3}{4}$ in. Price: £33 12s. Optional radio tuner (A.M.) £8 8s.

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STUZZI. U.K. Distributors: Recording Devices Ltd., 197 Lower Richmond Road, Richmond, Surrey. Tel.: Prospect 4463.

Stuzzi Tricorder. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ and $\frac{15}{16}$ i/s. Papst motor. $5\frac{3}{4}$ in. spools. F.R. $3\frac{3}{4}$ i/s, 40-16,000 c/s; $1\frac{7}{8}$ i/s, 40-8,000 c/s; $\frac{15}{16}$ i/s, 40-4,000 c/s. M.E. level ind. H. and N. -40 dB. W. and F. $0{\cdot}25\%$. Mixing. Variable Superimposing, Monitoring and remote control. Size: $13 \times 10 \times 6$ in. Weight: 18 lb. Price: £57 15s.

802FM. Mono recorder. $\frac{1}{2}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. W. and F. $0{\cdot}25\%$, $7\frac{1}{2}$ i/s; $0{\cdot}3\%$, $3\frac{3}{4}$ i/s. H. and N. -43 dB. F.R. $7\frac{1}{2}$ i/s, 40 c/s-20 Kc/s. Replay char. close to CCIR. Outlet direct from pre-amp. One motor. 7 in. spool. $2\frac{1}{2}$ min. rewind. M.E. Built-in transistorised F.M. V.H.F. radio. Size: $15\frac{1}{4} \times 11\frac{1}{4} \times 6\frac{1}{4}$ in. Weight: $19\frac{1}{2}$ lb. Price: £82 19s.

602. Mono recorder. $\frac{1}{2}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. W. and F. $7\frac{1}{2}$ i/s, $0{\cdot}25\%$; $3\frac{3}{4}$ i/s, $0{\cdot}3\%$. H. and N. -43 dB. F.R. $7\frac{1}{2}$ i/s, 40 c/s-20 Kc/s. Replay char. close to CCIR. Outlet from pre-amp. One motor. 7 in. spool. Rewind $2\frac{1}{2}$ mins. M.E. Size: $15\frac{1}{4} \times 11\frac{1}{4} \times 6\frac{1}{4}$ in. Weight: $19\frac{1}{2}$ lb. Price: £59 17s.

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SYMPHONY AMPLIFIERS LTD., 16 Kings College Road, London, N.W.3. Tel.: Primrose 3314/5.

Symphony Pre-Sleep Study Outfit. Comprises: Special recorder with full electronic control to permit time-switch control without incurring "flats". Large dial time switch for easy setting. Dynamic mic. Data tape, 900 ft; Induction tape (learning). Price: £55 13s.

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TANDBERG. U.K. distributors: Elstone Electronics Ltd., Edward Street, Templar Street, Leeds 2. Tel.: Leeds 35111.

●**Tandberg 74.** Stereo/mono recorder. $\frac{1}{4}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $7\frac{1}{2}$ i/s, 0·15%; $3\frac{3}{4}$ i/s, 0·2%; $1\frac{7}{8}$ i/s, 0·3%. H. and N. −53 dB. F.R. $7\frac{1}{2}$ i/s, 40 c/s-16 Kc/s; $3\frac{3}{4}$ i/s, 40 c/s-10 Kc/s; $1\frac{7}{8}$ i/s, 50 c/s-5 Kc/s (all ±2 dB). Replay char. NARTB. Inputs: 7 mV; mic. 1·5 mV. One motor. 7 in. spools, 2 mins. rewind. Two EAM86 M.E.s. Pause control. Playback on one channel while recording on other channel. Size: $15\frac{3}{8}$ × $11\frac{13}{16}$ × $6\frac{7}{8}$ in. Weight (instrument alone): $27\frac{1}{2}$ lb.; (with carrying case): $32\frac{1}{2}$ lb. Price: £97 13s.

●**Tandberg 72.** $\frac{1}{2}$-track version of Tandberg 74. Details as above, but H. and N. −56 dB.

Tandberg Series 8. Portable tape recorders in $\frac{1}{2}$-track and $\frac{1}{4}$-track versions, fabric covered or teak cases. Valves. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Speed tolerance ±2%. F.R. $3\frac{3}{4}$ i/s 30 c/s-13 Kc/s (±2 dB 60 c/s-10 Kc/s), $1\frac{7}{8}$ i/s 30 c/s-7 Kc/s (±2 dB 80 c/s-5·5 Kc/s). W. and F. Better than 0·2% at $3\frac{3}{4}$ i/s, better than 0·3% at $1\frac{7}{8}$ i/s. Distortion at maximum output 5%. Signal to noise: four-track 50 dB, two-track 53 dB. Inputs: mic. 2 mV 1 megohm, radio 2-7 mV adjustable, 300K-500K. Output 3W. Size: (portable case) $15\frac{3}{4}$ × $7\frac{1}{8}$ × $11\frac{7}{8}$ in., (teak cabinet) 15 × $6\frac{1}{2}$ × $11\frac{5}{8}$ in. Weight: (portable case) $22\frac{1}{2}$ lb., (teak cabinet) $20\frac{1}{2}$ lb. Prices: Model 822 (portable case $\frac{1}{2}$-track) £59 17s.; Model 823 (teak cabinet $\frac{1}{2}$-track) £56 14s.; Model 842 (portable case $\frac{1}{4}$-track) £65 2s.; Model 843 (teak cabinet $\frac{1}{4}$-track) £61 19s.

Tandberg Series 9. Model 92 $\frac{1}{2}$-track portable recorder. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Speed tolerance ±1·5%. Record/playback char. NAB. F.R. $7\frac{1}{2}$ 20 c/s-20 Kc/s, $3\frac{3}{4}$ 30 c/s-13 Kc/s, $1\frac{7}{8}$ 30 c/s-7 Kc/s. W. and F. $7\frac{1}{2}$ 0·15%, $3\frac{3}{4}$ 0·2%, $1\frac{7}{8}$ 0·3%. Distortion 5% at rated output. Signal to noise 56 dB. Inputs: mic. 2 mV 1 megohm, radio adjustable 2-7 mV 300K-500K. Output 3W. Size: 15 × $6\frac{3}{4}$ × $11\frac{5}{8}$ in. Weight: $20\frac{1}{2}$ lb. (with carrying case $25\frac{1}{2}$ lb.). Price: £72 9s.

Tandberg 74 Stereo

TAPE RECORDERS ELECTRONICS LTD. 197 Lower Richmond Road, Richmond, Surrey. Tel.: Prospect 4463. Cables: Rudionics, Richmond.

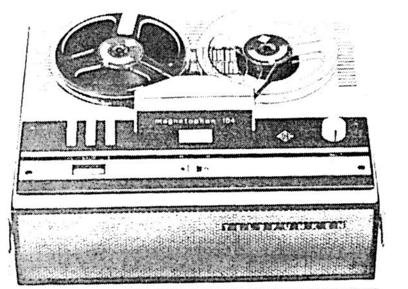
Sound TRE14. Mono $\frac{1}{2}$-track mains recorder. Speed $3\frac{3}{4}$ i/s. Spool $5\frac{3}{4}$ in. F.R. 60 c/s-13 Kc/s ±3 dB. Inputs: mic 1 mV 1 megohm, radio diode 3 mV 2·5K, radio/PU 150 mV 1 megohm. Output 3W. Outlets LS 3 ohms, line 100 mV 1K. Signal-to-noise ratio better than 40 dB. Tape position indicator. Tone control. Volume/record level control. DIN sockets. Size: $14\frac{3}{4}$ × 13 × 6 in. Strip indicator. Price: £25 4s.

Sound TRE23. Same specification as TRE14 but $\frac{1}{4}$-track. Price: £28 7s.

Sound TRE32. Mono $\frac{1}{2}$-track mains recorder. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Spool 7 in. Tape position indicator. Otherwise specification as for TRE14. Size: $15\frac{3}{4}$ × $13\frac{1}{2}$ × $6\frac{1}{2}$ in. Price: £31 10s.

Sound TRE34. Same specification as TRE32 but $\frac{1}{4}$-track. Price: £34 13s.

Sound TRE40. $\frac{1}{4}$-track mono mains recorder. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Spool 7 in. F.R. 60 c/s-



Telefunken Magnetophon M104

Magnetophon 85

*Truvox R*102

Telefunken Magnetophon 55

*Sony TC*200

13 Kc/s ± 3 dB. Inputs: mic. 1 mV 1 megohm, radio diode 3 mV 2·5K, radio PU 150 mV 1 megohm. Output 3W. Outlets LS 3 ohms, line 100 mV 1K. Signal/noise ratio better than 40 dB. DIN sockets. Strip level indicator. Separate bass and treble controls. Three speakers. Parallel track superimposing. Mixing. Straight-through amplifier. Tape position indicator. Size: $15\frac{3}{4} \times 13\frac{1}{2} \times 6\frac{1}{2}$ in. Price: £47 5s.

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TELEFUNKEN. Sole U.K. distributors: Welmec Corporation Ltd., Lonsdale Chambers, 27 Chancery Lane, London, W.C.2. Tel.: Chancery 9944. Cables: Welmcor, London.

Magnetophon 55. Mono recorder. $\frac{1}{2}$-track. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $\pm 0{\cdot}2\%$ at $3\frac{3}{4}$ i/s. H. and N. -46 dB. F.R. $3\frac{3}{4}$ i/s, 40 c/s-16 Kc/s; $1\frac{7}{8}$ i/s, 40 c/s-9 Kc/s. NARTB. Inputs: mic. 2 mV, 2 megohms; radio 2 mV, 47K, or 160 mV, 2 megohms. Outlet from pre-amp, 1·5V across 18K. One motor. $5\frac{3}{4}$ in. spool. Rewind (with DP tape) 4 mins. Fluorescent bar indicator. Size: $14\frac{1}{2} \times 13 \times 6$ in. Weight: 22 lb. Pause Control. Price: £45 3s.

●**Magnetophon 97.** $\frac{1}{4}$-track stereo mains operated portable recorder. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $7\frac{1}{2}$ 0·15%, $3\frac{3}{4}$ 0·2%, $1\frac{7}{8}$ 0·3%. H. and N. $7\frac{1}{2}$ -55 dB, $3\frac{3}{4}$ -50 dB, $1\frac{7}{8}$ -45 dB. F.R. 30 c/s-18 Kc/s at $7\frac{1}{2}$ i/s, 30 c/s-16 Kc/s at $3\frac{3}{4}$ i/s, 30 c/s-9 Kc/s at $1\frac{7}{8}$ i/s. Replay char. NARTB. Inputs: radio 2 mV 47K, mic. 2 mV 2 megohms. One motor. Spool size 7 in. Rewind time 4 mins. Fluorescent bar indicator. Size: $16\frac{1}{4} \times 7\frac{3}{4} \times 11\frac{1}{2}$ in. Price: £109 4s.

●**Magnetophon 98.** Stereo recorder. $\frac{1}{2}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $7\frac{1}{2}$ i/s, 0·15%; $3\frac{3}{4}$ i/s, 0·2%; $1\frac{7}{8}$ i/s, 0·3%. H. and N. $7\frac{1}{2}$ i/s, -55 dB; $3\frac{3}{4}$ i/s, -50 dB; $1\frac{7}{8}$ i/s, -45 dB. F.R. $7\frac{1}{2}$ i/s, 30 c/s-18 Kc/s; $3\frac{3}{4}$ i/s, 30 c/s-16 Kc/s; $1\frac{7}{8}$ i/s, 30 c/s-9 Kc/s. Replay char. NARTB. Inputs: radio 2 mV, 47K; mic. 2 mV, 2 megohms. Outlet from pre-amp. One motor. 7 in. spools, 4 min. rewind (long play tape). Fluorescent bar level indicator. Separate erase, record and playback heads facilitate "before" and "off" tape monitoring. Size: $7\frac{3}{4} \times 16\frac{1}{4} \times 11\frac{1}{2}$ in. Price: £109 4s.

Magnetophon 85 de Luxe. Mono recorder. $\frac{1}{2}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. W. and F. $7\frac{1}{2}$ i/s, 0·15%; $3\frac{3}{4}$ i/s, 0·2%. H. and N. -55 dB. F.R. $7\frac{1}{2}$ i/s, 40 c/s-18 Kc/s; $3\frac{3}{4}$ i/s, 40 c/s-16 Kc/s. Replay char. CCIR and NARTB, selected by switch. Inputs: radio 2 mV, 47K; mic. 2 mV, 2 megohms. Outlet from pre-amp. One motor.

7 in. spools, 3 min. rewind (long play tape). Fluorescent bar level indicator. Mixing facilities. Size: $8\frac{1}{2} \times 18\frac{1}{4} \times 16\frac{3}{4}$ in. Price: £95 11s.

Magnetophon 104. $\frac{1}{2}$-track mono mains portable recorder. Speed $3\frac{3}{4}$ i/s. F.R. 40 c/s-14 Kc/s. Replay char. NARTB. Inputs for mic. and radio. Spool size $5\frac{3}{4}$ in. One motor. Fluorescent bar indicator. Size: $15\frac{1}{2} \times 6\frac{3}{8} \times 11\frac{3}{4}$ in. Weight: 21 lb. Price: £40 19s.

Magnetophon 105. $\frac{1}{2}$-track mono mains portable recorder. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. F.R. 40 c/s-16 Kc/s at $3\frac{3}{4}$ i/s, 40 c/s-9 Kc/s at $1\frac{7}{8}$ i/s. Replay char. NARTB. Inputs for mic. and radio. One motor. Spool size $5\frac{3}{4}$ in. Fluorescent bar indicator. Size: $15 \times 6\frac{1}{2} \times 12\frac{1}{4}$ in. Weight: $25\frac{1}{2}$ lb. Price: £65 2s.

Magnetophon 300. See battery recorder section.

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TRUVOX LTD., Neasden Lane, London, N.W.10. Tel.: Dollis Hill 8011. Cables: Truvoxeng, London, N.W.10.

R104. Transistorised $\frac{1}{4}$-track mono recorder. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Spool 7 in. W. and F. $<0{\cdot}1\%$ at $7\frac{1}{2}$, $0{\cdot}15\%$ at $3\frac{3}{4}$, $0{\cdot}25\%$ at $1\frac{7}{8}$. H. and N. -50 dB. F.R. $7\frac{1}{2}$ 30 c/s-17 Kc/s ± 2 dB, $3\frac{3}{4}$ 40 c/s-10 Kc/s ± 2 dB, $1\frac{7}{8}$ 60-8 Kc/s ± 3 dB. Replay char. new CCIR. Inputs: mic. 1 mV 500K, rad/PU 50 mV 100K. Outputs: LS 5W, amp 1V 100 ohms. Level meter. Rewind time 1,200 ft. 1 min. Three motors, capstan motor outer-rotor type. Own deck. Superimpose. Pause. Four-digit position indicator. Straight-through amplifier. Source/tape monitor. Three heads. Multi-play. Mains 200–250V AC. Size: $16 \times 17\frac{3}{4} \times 8\frac{1}{2}$ in. Weight: 34 lb. Price: £82 19s.

R102. Transistorised $\frac{1}{2}$-track mono recorder. Specification as for R104. Price £79 16s.

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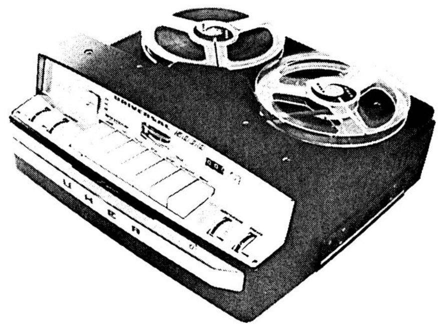
UHER. U.K. distributors: Bosch Ltd., 205 Great Portland Street, London, W.1. Tel.: Langham 1809.

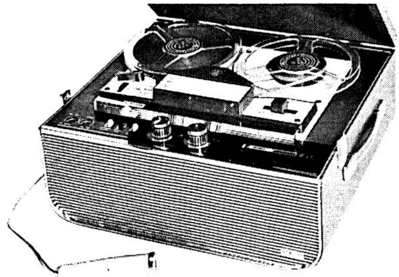
Uher Universal 5000. Transistorised mono recorder. $\frac{1}{2}$-track. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$, $\frac{15}{16}$ i/s. W. and F. $\pm 2\%$. H. and N. -50 dB. F.R. $3\frac{3}{4}$ i/s, 40 c/s-16 Kc/s; $1\frac{7}{8}$ i/s, 40 c/s-8 Kc/s; $\frac{15}{16}$ i/s, 40 c/s-4 Kc/s. Replay char. NARTB. Inputs: mic. 0·1 mV, 4K; radio 1 mV, 47K; gram 50 mV, 1 megohm. Outlet direct from pre-amp. One motor. $5\frac{3}{4}$ in. spools. Rewind 2 mins.

Magnetophon 98



Uher Universal 5000

Wyndsor Sabre II



Wyndsor 707 11-1 *V*

Three figure counter. Price (incl. 4-position remote control, mic. and $5\frac{3}{4}$ in. tape): £99 15s.

●**Uher Royal Stereo 784.** Transistorised stereo recorder. $\frac{1}{4}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$, $\frac{15}{16}$ i/s. W. and F. $7\frac{1}{2}$ i/s, $\pm 0{\cdot}15\%$. H. and N. -50 dB. F.R. $7\frac{1}{2}$ i/s, 50 c/s-20 Kc/s; $3\frac{3}{4}$ i/s, 50 c/s-16 Kc/s, $1\frac{7}{8}$ i/s, 50 c/s-9 Kc/s; $\frac{15}{16}$ i/s, 50 c/s-4 Kc/s. Replay char. NARTB. Inputs: mic. 0·15 mV, 2K; radio 5 mV, 50K; gram 350 mV, 1 megohm. Outlets direct from replay head, and pre-amp. One motor. 7 in. spool. Rewind 3 mins. Four figure counter. Pause control. 11-position selector. Mixing. Size: 15 × 14 × 7 in. Weight approx.: $23\frac{1}{2}$ lb. Price: £135 9s.

●**7000/724.** Mains operated mono-stereo $\frac{1}{4}$-track recorder. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. Spool 7 in. Fully transistorised. W. and F. $\pm 0{\cdot}2\%$. F.R. 40 c/s-18 Kc/s at $7\frac{1}{2}$ i/s, 40 c/s-14 Kc/s at $3\frac{3}{4}$ i/s. Volume intensity range 45 dB. Inputs for mic., diode and PU. Output 2 × 2W. Mains 110, 130, 150 and 220V. Price: £78 13s.

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VOLMAR LTD., 154 High Street, Brentford, Middx. Tel.: Isleworth 1161. Cables: Volmar, Brentford, Hounslow.

TR236. Mono recorder. $\frac{1}{2}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. F.R. $7\frac{1}{2}$ i/s, 80 c/s-12 Kc/s; $3\frac{3}{4}$ i/s, 80 c/s-8 Kc/s; $1\frac{7}{8}$ i/s, 80 c/s-5 Kc/s (all ± 3 dB). Replay char. CCIR. Inputs: mic. 3 mV, 500K; radio/gram 400 mV, 1 megohm. Three motors. 7 in spools. M.E. Pause control. Size: 19 × $16\frac{1}{4}$ × $10\frac{3}{4}$ in. Weight: 25 lb. Price £35 3s. 6d.

TR463. Mono recorder. $\frac{1}{4}$-track. Other details as for TR23. Price £38 6s. 6d.

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W. WOOD & SON LTD., Electronics Division, Kelvin Works, Power Road, Chiswick, London, W.4. Tel.: Turnham Green 9321. Cables: Compendium, London, W.4.

Silvertone RT15. Mono recorder. $\frac{1}{2}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. $7\frac{1}{2}$ i/s, 0·15%. H. and N. -40 dB. F.R. $7\frac{1}{2}$ i/s, 50 c/s-15 Kc/s; $3\frac{3}{4}$ i/s, 50 c/s-9 Kc/s; $1\frac{7}{8}$ i/s, 50 c/s-7 Kc/s. Replay char. CCIR. Inputs: mic. 2 mV, 1 megohm; radio 250 mV, 1 megohm. Extension speaker socket. Output from monitor when recording. Three motors. 7 in. spool. Rewind approx. 1 min. M.E. Pause control. Superimpose. Digital counter. Size: $14\frac{1}{2}$ × $15\frac{1}{2}$ × $7\frac{3}{4}$ in. Weight: 27 lb. Price: £36 15s.

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WYNDSOR RECORDING CO. LTD., (inc. Magnetic Recording Co.), Wyndsor Works, 2 Bellevue Road, Friern Barnet, London, N.11. Tel.: Enterprise 2226/7. Cables: Wyndreco, London.

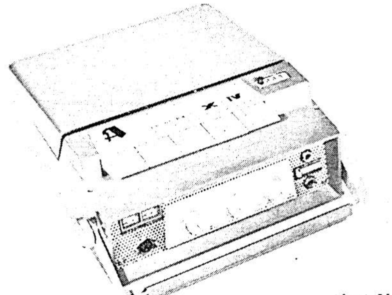
Sabre II. Mono $\frac{1}{2}$-track. Speed $3\frac{3}{4}$ i/s. Spool $5\frac{3}{4}$ in. F.R. 40 c/s-10 Kc/s ± 3 dB. Inputs 2 mV 1 megohm, 250 mV 1 megohm. Outputs 500 mV 1 megohm, 2·5W 3 ohms. Strip indicator. BSR deck. Superimpose. Pause. Size: 15 × $13\frac{3}{4}$ × 7 in. Weight: $18\frac{1}{2}$ lb. Price: £25 4s.

707-11. Mono $\frac{1}{2}$-track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Spool 7 in. F.R. $7\frac{1}{2}$ i/s 40 c/s-15 Kc/s ± 3 dB, $3\frac{3}{4}$ i/s 40 c/s-10 Kc/s ± 3 dB, $1\frac{7}{8}$ i/s 40 c/s-6 Kc/s ± 4 dB. Inputs 2 mV 1 megohm, 250 mV 1 megohm. Outputs 500 mV 1 megohm, 3-5W 3 ohms. Strip indicator. Valve. BSR deck. Size: $16\frac{1}{2}$ × $14\frac{1}{2}$ × $8\frac{1}{2}$ in. Weight: 22 lb. Price: £33 12s.

707-IV. Mono $\frac{1}{4}$-track. Outputs 8 mV at 3 Kc/s stereo, 3-5W at 3 ohms. Track change switch. Parallel replay switch. Other details as for 707-11. Price £36 15s.

BATTERY OPERATED PORTABLES

AKAI. Distributors: The Pullin Optical Co. Ltd., 11 Aintree Road, Perivale, Greenford, Middx. Tel.: Alperton 1541/7.



Akai X4

●**Model X4.** Stereo/mono transistorised portable recorder. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$, $\frac{15}{16}$, i/s. W. and F. $7\frac{1}{2}$ i/s $<0{\cdot}16\%$, $3\frac{3}{4}$ i/s $<0{\cdot}17\%$, $1\frac{7}{8}$ i/s $<0{\cdot}28\%$, $\frac{15}{16}$ i/s $<0{\cdot}35\%$. F.R. $7\frac{1}{2}$ i/s 40 c/s-20Kc/s ± 3 dB, $3\frac{3}{4}$ i/s 40 c/s-17 Kc/s ± 3 dB, $1\frac{7}{8}$ i/s 30 c/s-11 Kc/s ± 3 dB, $\frac{15}{16}$ i/s 30 c/s-5·5 Kc/s ± 3 dB. Interlocked push-button operation. Charging unit and rechargeable nickel-cadmium battery. Output 2W per channel. 16 hours recording or play-back with 5 in. reel of tape. Crossfield head. $\frac{1}{4}$-track. Two VU meters (also used to check battery voltage). Weight: $12\frac{1}{2}$ lb. with battery. Price: £137 11s.

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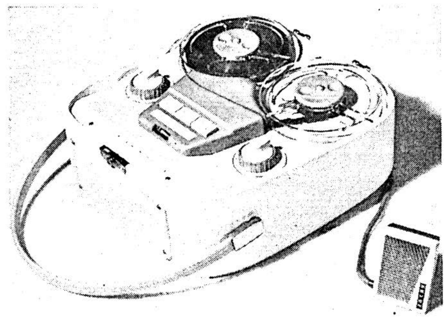
C. BRADDOCK (BLACKPOOL) LTD., 266 Waterloo Road, Blackpool, Lancs. Tel.: Blackpool 45049.



Q-Cord R119K

Q-Cord R119K. Transistorised mono recorder. Battery-mains with adaptor. $\frac{1}{2}$-track. Speed $3\frac{3}{4}$ i/s. W. and F. $<0{\cdot}5\%$. H. and N. -50 dB. F.R. 60 c/s–10 Kc/s ± 3 dB. Replay char. NARTB. Inputs: radio/mic./gram./tele-adaptor 2 mV 50K. Straight-through amplifier. Outlet from pre-amp at 10K. One motor. $4\frac{1}{4}$ in. spool. Rewind 4 mins. DM70 level indicator. Pause control. Can be used in any position. Size: $9\frac{1}{4} \times 4 \times 9\frac{3}{4}$ in. Price: £30 9s.

Q-Cord 203. 6 or 12V battery/mains with adaptor. Remote control. Size: $10 \times 4 \times 10\frac{1}{2}$ in. Other details as for R119K. Price: £30 9s.

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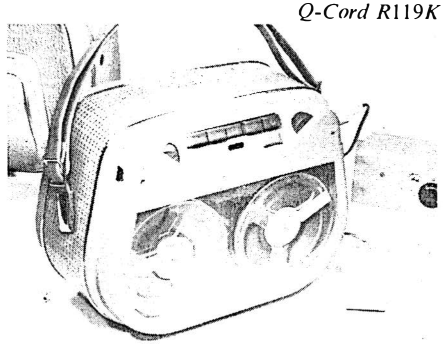
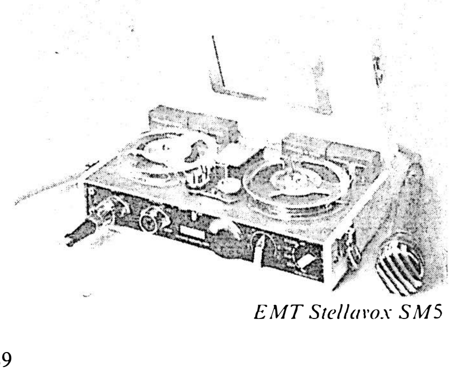


Butoba MT5

BUTOBA—Sole U.K. distributors, Denham & Morley Ltd., Denmore House, 175 Cleveland Street, London, W.1. Tel.: Euston 3656. Cables: Denmorl, Wesdo, London.

Butoba MT5. Transistorised battery portable. Speeds $3\frac{3}{4}$ and $1\frac{7}{8}$ i/s, $\frac{1}{2}$-track. W. and F. $3\frac{3}{4}$ i/s, $0{\cdot}11\%$; $1\frac{7}{8}$ i/s, $0{\cdot}16\%$. H. and N. -57 dB. Replay char. CCIR. Inputs: 200 μV, 200 ohms; 100 mV, 100K. Outlet from pre-amp. 5 in. spools, $2\frac{1}{2}$ min. rewind. Pause control. straight amplifier. M.E. level ind. Two motors. F.R. $3\frac{3}{4}$ i/s, 50-13,000 c/s; $1\frac{7}{8}$ i/s, 60-5,000 c/s. Battery life 20-40 hours. Eight 1·5V batteries. Size: $12 \times 9\frac{1}{4} \times 6$ in. Weight including batteries: 12 lb. Price: £61 19s. Mains converter: £11 11s.



EMT Stellavox SM5

Fi-Cord 202A

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COSSOR. See Philips Electrical Ltd.

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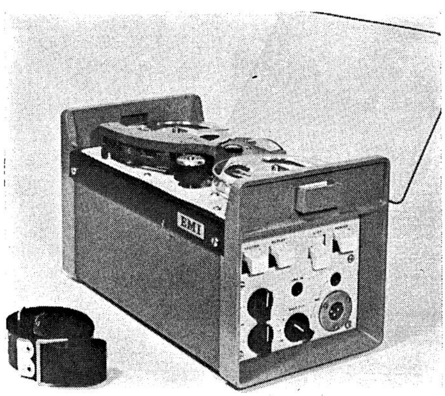
EMI ELECTRONICS LTD., Hayes, Middx. Tel.: Hayes 3888. Cables: Emidata, London.

L4. Professional portable transistorised recorder in three versions. Type A ½-track, Type B full-track, Type C adaptable for film and sound sync. Spool 4¼ in. Speeds 7½, 3¾ i/s. W. and F. better than 0·2% at 7½, 0·25% at 3¾. H. and N. −45 dB. F.R. 7½ 50 c/s-12 Kc/s ±2 dB, 3¾ 50 c/s-5 Kc/s ±6 dB. Inputs: Two mic. 50 μV 30-50 ohms, line 250 mV 20K. Outputs: line 600 ohms, LS 200 mW 65 ohms. Meter. Rewind time 2 min. 4¼ in. standard tape. One motor. Own deck. Four heads. Remote control. Operates with lid closed. Power: 14V rechargeable lead acid accumulator. Size: 7 × 11¾ × 5¾ in. Weight: 10¾ lb. Prices: Model A £120, Model B £120, Model C £130 (excluding fourth head and accessories).



E.M.I. L4

EMT WILHELM FRANZ G.m.b.H., Switzerland. Sole U.K. Agents: F. W. O. Bauch Ltd., Chaddlewood, Cockfosters Road, Cockfosters Barnet, Herts. Tel. Barnet 3170.

●**Stellavox SM5.** Professional transistorised battery portable recorder. Full track mono, ½-track stereo. Speed 7½ i/s. W. and F. 0·15% (±0·3% peak weighted). H. and N. (weighted) −50 dB. F.R. 60 c/s-12 Kc/s +2 −3 dB. CCIR or NARTB (either by request). Input 0·18 mV, greater than 4K. Outlet from pre-amp. One motor. 3⅜ in. spools. 1·5 min. rewind. VU meter. Re-chargeable battery. Size: 10 × 5½ × 2½ in. Weight approx.: 6 lb. Price: including accessories, £247 (mono); £276 (mono, with pilot-tone head, for use with film camera); £399 (stereo).

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FI-CORD LTD., Charlwoods Road, East Grinstead, Sussex. Tel.: East Grinstead 21351.

Fi-Cord 202A. Battery portable recorder. Speeds 7½, 3¾ i/s. W. and F. 7½ i/s less than 0·3 RMS, 3¾ i/s less than 0·4 RMS. Signal to noise ratio 45 dB unweighted at 7½ i/s. F.R. 7½ i/s 50 c/s-12 Kc/s ±3 dB, 3¾ i/s 50 c/s-8 Kc/s ±3 dB. Head gap 0·14 thou. Erase frequency 60 Kc/s. ½-track. Rewind time: 1½ mins. at 7½ i/s for 4 in. LP tape. Forward wind: 2½ mins. at 7½ i/s for 4 in. LP. tape. Separate batteries for motor and electronics. Internal batteries or provision for mains or car battery operation. Input <0·2 mV for fully modulated tape. Built-in 3 in. speaker. Output 180 mW and 1V at outlet socket. Size: 9 × 6½ × 4½ in. Weight: 6¾ lb. including batteries. Price: £69 6s. including LP tape and mercury batteries.

Accessories include leather carrying case £9 9s.; mains power pack £7 10s.; car battery power pack £5 10s.; Universal mixer £11 5s.; also cables, connectors, tapes, headset, microphones, etc.

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GRUNDIG (GREAT BRITAIN) LTD., Newlands Park, Sydenham, London, S.E.26. Tel.: Sydenham 2211. Cables: Grundig, London, S.E.26. Telex.: 22854.

TK6. Transistorised battery/mains ½-track mono recorder. Speeds 3¾, 1⅞ i/s. Spool 4¼ in. W. and F. 3¾ ±0·5%, 1⅞ ±0·8%. H. and N. −48 dB. F.R. 3¾ 50 c/s-13 Kc/s, 1⅞ 50 c/s-9 Kc/s. Replay char. NARTB. Inputs: mic 0·3-20 mV 10K, diode 5-100 mV 10K, PU 50-1500 mV 500K with special lead. Outputs: 550 mV

18K, LS 5 ohms 0·5W on battery, 1·6W on mains. Meter indicator. Transistors. Rewind time 1,200 ft. 2 mins. 10 secs. One motor. Own deck. Pause. Position indicator. Monitoring. 110-240V 50 c/s, 6 or 12 V car battery. 6 LPU2 batteries. Size: $12\frac{3}{4} \times 5\frac{1}{4} \times 9\frac{1}{2}$ in. Weight: $13\frac{3}{4}$ lb. Price: £72 9s.

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HITACHI, JAPAN. Distributed by Lee Products (G.B.) Ltd., 10-18 Clifton Street, London, E.C.2. Tel.: Bishopsgate 6711. Cables: Leprod, London.

Belsona TRQ-399. Battery portable recorder. $\frac{1}{2}$-track. Speeds $3\frac{3}{4}$ i/s, F.R. 150 c/s-7 Kc/s; $1\frac{7}{8}$ i/s, 150 c/s-4 Kc/s. Outlet from pre-amp. One motor. $3\frac{1}{4}$ in. spools. Level meter. One knob control. Remote control. Size: $8\frac{13}{16} \times 3\frac{3}{8} \times 6\frac{1}{8}$ in. Weight: $4\frac{1}{2}$ lb. Price: £36 15s.

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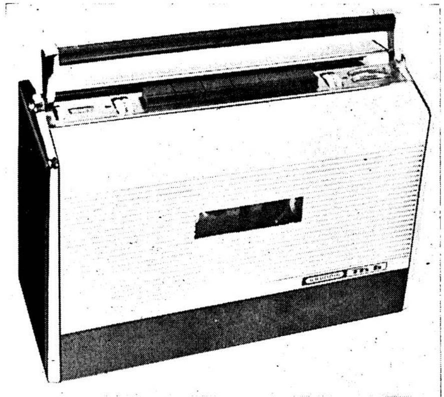
LOEWE-OPTA. Sole U.K. distributors: Highgate Acoustics, 71/73 Great Portland Street, London, W.1. Tel.: Museum 2901.

Optacord 408. $\frac{1}{2}$-track transistorised mono mains/battery recorder. Speed $3\frac{3}{4}$ i/s. Spool size $4\frac{1}{4}$ in. F.R. 90 c/s-10 Kc/s. Inputs: mic., radio/diode, aux. Output: 800 mW. Rewind time 2 mins. 20 secs. One motor. Own deck. High frequency controlled motor. Push-button controls. Record level and battery meter. W. and F. less than 0·3%. 10 transistors plus 4 diodes. Operates from AC mains 110V/240V 50-60 c/s, four 1·5V batteries or car battery 6V or 12V. Size: $9\frac{1}{2} \times 7\frac{1}{2} \times 3\frac{3}{8}$ in. Weight: $6\frac{1}{2}$ lb. Price: £40 19s.

Optacord 416. $\frac{1}{2}$-track transistorised mono mains/battery recorder. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Spool size $4\frac{1}{4}$ in. F.R. 50 c/s-12 Kc/s at $3\frac{3}{4}$, 90 c/s–6 Kc/s at $1\frac{7}{8}$. Inputs: mic., radio/diode, aux. Output: 1·8W. Rewind time 2 mins. 20 secs. One motor. Own deck, Operates from AC mains 110V/240V 50–60 c/s, five 1·5V batteries, five rechargeable deac cells, or car battery 6V or 12V. Meter level indicator and battery voltage check. Push-button control. Operates while carried. Remote-control microphone facility. Internal speaker can be switched off. Shock-proof polyester case. Size: $15 \times 9\frac{3}{4} \times 4\frac{1}{2}$ in. Weight: 9 lb. Price: £53 11s.

Optacord 416 DIA. Specification as for 416 but plus built-in synchronising unit for use with slide projector. Upper track records commentary, lower track takes pulses to control slide changes. Pulse frequency 50 c/s. Projector control relay S.P. 7A contact. Four additional transistors. Price: £65 2s.



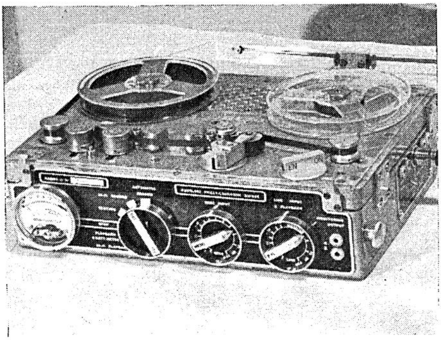
Grundig TK6

NAGRA. Distributed by: Livingston Laboratories Ltd., 31 Camden Road, London, N.W.1. Tel.: Gulliver 4191.

Nagra IIIB. Professional battery portable recorder. Mono. Full track. Speeds 15, $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. W. and F. $7\frac{1}{2}$ i/s, 0·2%. H. and N. 15, $7\frac{1}{2}$ i/s. −62·5 dB. F.R. 15 i/s, 30 c/s-18 Kc/s ±1 dB; $7\frac{1}{2}$ i/s, 40 c/s-15 Kc/s ±1·5 dB; $3\frac{3}{4}$ i/s, 50 c/s-7 Kc/s. Replay char. CCIR (or Ampex on request). Inputs: mic 0·2-10 mV, 200 ohms, or 0·1-5 mV, 50 ohms; line 0·5-10V, 100K, or 10 mV-1V, 2·5K. Outlet from pre-amp. One motor. 5 in. spool (7 in. with lid raised). Level meter. Mixing of various inputs. 3 heads. Monitor speaker. Batteries, twelve 1·5V torch cells, life approx. 20 hours. On alkaline accumulators, approx. 70 hours' life. Size: $8\frac{3}{4} \times 12\frac{1}{2} \times 4\frac{1}{4}$ in. Weight approx.: $15\frac{1}{2}$ lb. Price: £317 (plus £22 19s. 4d. import surcharge).

Nagra IIINP. Similar to IIIB, but fitted with the "Neopilot" system which provides the additional capability of achieving lip sync. in

Loewe-Opta Optacord 416



Nagra 111B

filming. The "Neopilot" head is used to record a 50 c/s or 60 c/s signal transversely on the tape. Price: £340 (plus £24 13s. 6d. import surcharge).

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NATIONAL. Matsushita Electric Co., Japan. Distributors: United Africa Mechanical and Electrical Ltd., United Africa House, Blackfriars, London, S.E.1. Tel.: Waterloo 2070.

RQ101S. Battery operated $\frac{1}{2}$-track mono recorder. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Spool size $3\frac{1}{4}$ in. F.R. 100 c/s-7 Kc/s at $3\frac{3}{4}$, 100 c/s-4 Kc/s at $1\frac{7}{8}$. Mic. input 20K. Output: LS 8 ohms. Neon indicator. Six transistors. Rewind time less than 3 mins. for 300 ft. One motor with controlled speed. Single switch control. Power requirements: Six U2 batteries, or will operate from mains via 9V adaptor. Size: $8\frac{1}{8} \times 3\frac{1}{8} \times$ 8 in. Weight: $3\frac{1}{4}$ lb. Price: £19 19s.

RQ115. Miniature battery operated $\frac{1}{2}$-track mono recorder. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Spool size $3\frac{3}{4}$ in. W. and F. less than 0·35% at $3\frac{3}{4}$ i/s.

*Philips EL*3586

F.R. 100 c/s-7 Kc/s at $3\frac{3}{4}$, 100 c/s-4 Kc/s at $1\frac{7}{8}$. Mic input unbalanced 30K. 8 ohms output. VU meter. Six transistors. Rewind time less than $1\frac{1}{2}$ mins. for 200 ft. One controlled-speed motor. Single lever control. Remote control on mic. Power requirements: 12 pen light cells, or will operate from mains via 9V adaptor. Size: $8 \times 2\frac{1}{2} \times 7\frac{7}{8}$ in. Weight: 4 lb. Price: £38 17s.

RQ116. Miniature battery operated $\frac{1}{4}$-track mono recorder. Similar specification to RQ115 but four-track. Price: £43 1s.

RQ150. Versatile mono battery-operated $\frac{1}{2}$-track recorder. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Spool size $3\frac{1}{4}$ in. F.R. 100 c/s-7 Kc/s at $3\frac{3}{4}$ i/s, 100 c/s-4 Kc/s at $1\frac{7}{8}$ i/s. Mic. input 20K. LS output 8 ohms. VU meter. Nine transistors. One regulated motor. Own deck. Slide and cine

Stella 471

synchronising. Voice operated on/off control. Self-threading tape. Remote control microphone. Monitoring through internal speaker when recording. Power requirements: Six U2 or 9V mains adaptor. Size: $12\frac{1}{8} \times 3\frac{1}{8} \times 9$ in. Weight: 5·9 lb. Price: £48 6s.

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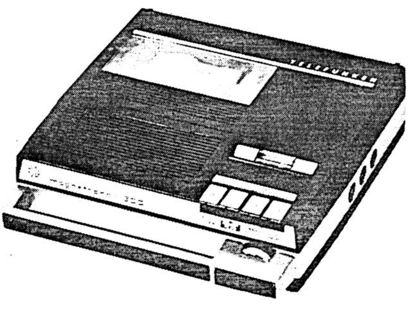
PHILIPS ELECTRICAL LTD., Century House, Shaftesbury Avenue, London, W.C.2. Tel.: Gerrard 7777. Cables: Phillamps, London.

EL3301. Mono $\frac{1}{2}$-track miniature battery recorder using $\frac{1}{8}$ in. tape and cassette loading. Speed $1\frac{7}{8}$ i/s. W. and F. <1% (p-p). H. and N. −40 dB. F.R. 100 c/s-7 Kc/s ±3 dB. Input: combined mic., diode, PU 0·3 mV 2K. Outputs: 0·5V 20K, 200 mV 1·5K for playback phones. Meter indicator. Transistorised. Rewind time 70 secs. One motor. Own deck.

Remote stop-start. Battery voltage indicator. Batteries: five U11 or equivalent. Size (including carrying case): $8\frac{1}{4} \times 6\frac{1}{2} \times 2\frac{1}{2}$ in. Weight: 4 lb. (including case and batteries). Price: £27 6s.

EL3586. Mono $\frac{1}{2}$-track transistorised recorder. Speed $1\frac{7}{8}$ i/s. Spool 4 in. W. and F. <1% (p-p). H. and N. −40 dB. F.R. 80 c/s-8 Kc/s ±3 dB. Input: combined mic., diode, PU 0·3 mV. 20K. Outputs, 0·5V, 20K, 0·5V. 1·5K for playback phones. Meter indicator. Rewind time $1\frac{1}{2}$ mins. for 300 ft. One motor. Own deck. Battery voltage indicator. Batteries six U2 or equivalent. Size: $11\frac{1}{2} \times 8\frac{7}{8} \times 3\frac{3}{4}$ in. Weight: 8 lb. including batteries. Price: £27 6s.

Cossor CR1621. Mono battery portable recorder. $\frac{1}{2}$-track. Speed $1\frac{7}{8}$ i/s. W. and F. <1% (peak-to-peak). H. and N. −40 dB. F.R.

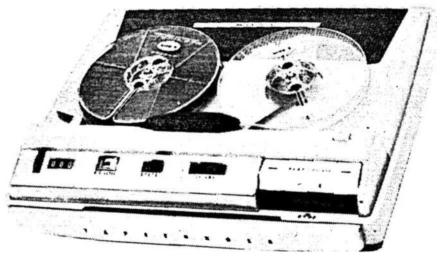


*Telefunken Magnetophon M*300

80 c/s-8 Kc/s ±3 dB. Inputs: mic./radio/gram 0·3 mV, 2K. Outlet from pre-amp. One motor. 4 in. spools. Moving-coil meter. Headphone playback, remote control, mains unit connection, battery voltage indicator. Size: $12 \times 9 \times 4\frac{1}{2}$ in. Weight: 8 lb. Price: £27 6s.

Stella ST471. Mono battery portable recorder. $\frac{1}{2}$-track. Speed $1\frac{7}{8}$ i/s. W. and F. 1% (peak-to-peak). H. and N. −40 dB. F.R. 80 c/s-8 Kc/s ±3 dB. Inputs: mic./radio/gram 0·3 mV, 2K. Outlet from pre-amp. One motor. 4 in. spools. Moving-coil meter. Headphone playback facility, remote control facility, connection for mains unit, battery voltage indicator. Size: $12\frac{1}{2} \times 9 \times 4\frac{1}{2}$ in. Weight: 8 lb. Price: £27 6s.

SANYO. Sole U.K. agents: Sanyo Service & Sales, 23 Savage Gardens, Trinity Square, London, E.C.3. Tel.: (Service) Royal 7154, (Sales) Royal 4154.



Sony TC 801

Sanyo MR200. Transistorised battery portable mono-recorder. $\frac{1}{2}$-track. Speeds $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. F.R. 150 c/s-7 Kc/s at $3\frac{3}{4}$ i/s, 150 c/s-4 Kc/s at $1\frac{7}{8}$ i/s. Extension speaker socket. One motor. $3\frac{1}{2}$ in. spools. Rewind less than 2 mins. Level meter. Size: $8\frac{1}{8} \times 10 \times 3$ in. Weight (excl. batteries): $5\frac{3}{4}$ lb. Power supply 9V DC. (six U2 cells). Price: (incl. carrying case and access. bag, mic., tape, earphone) £35 14s. Mains adaptor available £5 15s. 6d. Foot switch £4 14s. 6d. Telephone adaptor £1 3s.

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SHARP. Distributors: Wholesale Supplies (Swinton) Ltd., 16/18 Worsley Road, Swinton, Manchester. Tel.: Swinton 3232.

Sharp TRC-1004. Transistorised battery portable mono recorder. $\frac{1}{2}$-track. Speed $1\frac{7}{8}$ i/s. Powered by 4 U7 cells. W. and F. 0·8%. F.R. 200 c/s-3 Kc/s ±3 dB. Input imp. 1·5K for dynamic mic. Monitoring outlet for crystal earphone. One motor. 3 in. spools. Rewind 3 mins. Level meter. Size: $3\frac{3}{4} \times 7\frac{3}{8} \times 2\frac{1}{8}$ in. Speaker is in separate box. Price: £37 10s.

Uher 4000 *Report S*

SONY. U.K. Sales Division, Eastbrook Road, Eastern Avenue, Gloucester. Tel.: Gloucester 26841. Cables: DEBELEC, Gloucester.

Sony TC 801. Portable mono battery/mains recorder, ½-track. Speeds 3¾, 1⅞ i/s. Output, 250 mW. Recording level/battery indicating meter. Push button function selector. Built-in microphone. Tape counter. Nine transistors. Microphone with "hold" button. Back spacer for review. Earphone. Weight: 13 lb. Price: £70 7s.

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STELLA. See Philips Electrical Ltd.

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TELEFUNKEN. Sole U.K. distributors: Welmec Corporation Ltd., Lonsdale Chambers, 27 Chancery Lane, London, W.C.2. Tel.: Chancery 9944.

Magnetophon 300. ½-track mono mains/battery recorder. Speed 3¾ i/s. F.R. 40 c/s-14 Kc/s. W. and F. 0·2%. H. and N. −50 dB. Replay char. NARTB. Inputs for radio and mic. Spool size 5 in. VU meter. Size: 10½ × 3 × 10¾ in. Weight: 7 lb. Price: £51 9s., mains adaptor £13 13s., rechargeable battery £5 17s. 6d.

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UHER. U.K. distributors: Bosch Ltd., 205 Great Portland Street, London, W.1. Tel.: Langham 1809.

4000 Report S. Transistorised mono battery portable recorder. ½-track. Speeds 7½, 3¾, 1⅞, $\frac{15}{16}$ i/s. W. and F. 7½ i/s, ±0·15%. H. and N. −55 dB. F.R. 7½ i/s, 50 c/s-20 Kc/s; 3¾ i/s, 50 c/s-17 Kc/s; 1⅞ i/s, 50 c/s-10 Kc/s; $\frac{15}{16}$ i/s, 50-4,500 c/s. Replay char. NARTB. Inputs: mic. 0·1 mV, 2K; radio 1 mV, 47K; gram 25 mV, 1 megohm. Outlet direct from pre-amp. One motor. 5 in. spool. Means of operation: mains, car battery, 1·5V cells, rechargeable accumulator. Size: 10½ × 8½ × 3¼ in. Weight: 7 lb. Price (including remote control mic. and LP tape): £103 19s. Accumulator charger: £16 16s. Carrying case: £9 9s.

DECKS—GENERAL PURPOSE and SEMI-PROFESSIONAL

BRADMATIC LTD., 338 Aldridge Road, Streetly, Sutton Coldfield, Warwickshire. Tel.: Streetly 3171.

Bradmaster. Models 5B, 5CS, 5CD, 5D. Semi-prof. tape deck. $7\frac{1}{4}$ and $3\frac{3}{4}$ i/s. Three motors. Models 5B 7 in. spools; 5CS and 5CL $9\frac{3}{8}$ in. spools; 5D $10\frac{1}{2}$ in. NAB spools. F.R. $7\frac{1}{2}$ i/s, 40-15,000 c/s; $3\frac{3}{4}$ i/s, 40-7,500 c/s, both ± 4 dB (dependent on amp. used). Size and weight dependent on model. Price 5B: £42; 5CS: £45 10s.; 5CL: £47 10s.; 5D: £50. Available with full track or stereophonic heads to special order. Prices on application.

Model 5DF. Semi-prof. tape deck. 15 and $7\frac{1}{2}$ i/s. Three motors. $10\frac{1}{2}$ in. NAB spools. F.R. 15 i/s, 30-18,000 c/s; $7\frac{1}{2}$ i/s, 30-15,000 c/s, both ± 2 dB. W. and F., 0·1% at 15 i/s. Variable spooling control. Size: 20 × $14\frac{1}{2}$ in. Weight: 20 lb. Price: £62.

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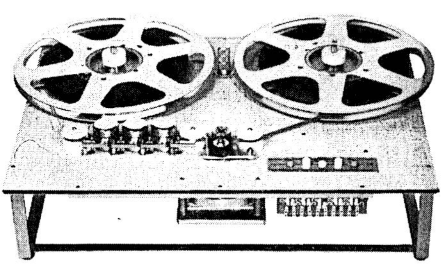
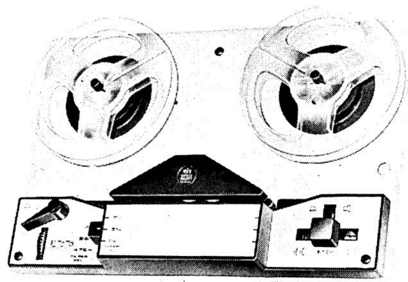
BRENELL ENGINEERING CO. LTD., 231/5 Liverpool Road, London, N.1. Tel.: North 8271 (5 lines).

Mark 5 Series 3. G.P. tape deck, 15, $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ i/s. Three motors. $8\frac{1}{4}$ in. spools. W. and F. 0·1% at $7\frac{1}{2}$ i/s accommodates up to four heads. Size: 15 × $11\frac{1}{2}$ × 5 in. Weight: 16 lb. Price: £38 with two heads.

Mark 510 Series 2. Deck mechanism. $\frac{1}{2}$ or $\frac{1}{4}$ track. Speeds 15, $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. 15 i/s, $<$0·05%; $7\frac{1}{2}$ i/s, $<$0·1%; $3\frac{3}{4}$ i/s, $<$0·15%; $1\frac{7}{8}$ i/s, $<$0·25%. Three motors (synchronous type for capstan). $10\frac{1}{2}$ in. NAB spools, 45 secs. per 1,200 ft. rewind. Pause. Accommodates 4 heads. Size: 15 × $11\frac{1}{2}$ × 6 in. Weight: 16 lb. Price (less heads): £46 12s. (with heads) price on application.



Bradmaster 5D



B.S.R. TD10

BSR LTD., Monarch Works, Powke Lane, Old Hill, Staffs. Tel.: Cradley Heath 69272. Telex 33282.

BSR TD2. G.P. deck $3\frac{3}{4}$ i/s. One motor. $5\frac{3}{4}$ in. spools. F.R.: with good amplifier equalisation 30-10,000 c/s ± 3 dB. 2 heads. W. and F. better than 0·26%. RMS. Size: 13 × $8\frac{3}{4}$ in. Price: £12 12s.; with 4 track head: £14.

BSR TD10. G.P. deck. $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. One motor. 7 in. spools. F.R. 30 c/s-10 Kc/s ± 3 dB. Two or three heads. W. and F. $7\frac{1}{2}$ i/s, 0·15%; $3\frac{3}{4}$ i/s, 0·26%; $1\frac{7}{8}$ i/s, 0·3%. Size: $12\frac{1}{4}$ × $8\frac{3}{8}$ in. Price: £14; (with 4-track heads): £15 15s.

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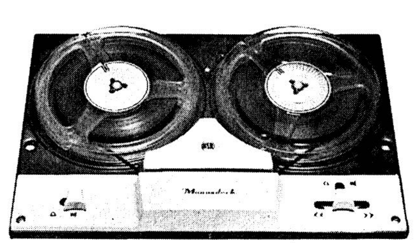
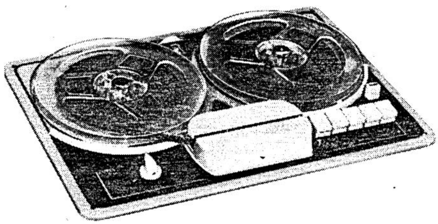
LORLIN ELECTRONIC CO. LTD., 18 Tudor Place, Tottenham Court Road, London, W.1. Tel.: Museum 4666/7/8.

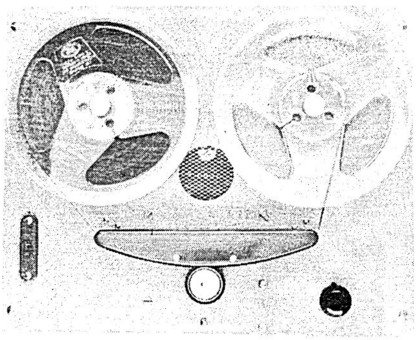
●**SB26.** Stereo/mono deck mechanism. $\frac{1}{4}$ or $\frac{1}{2}$ track. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. W. and F. better than 0·1% at $7\frac{1}{2}$ i/s. Three motors. 7 in. spools. Rewind 45 secs. Provision for fitting up to three



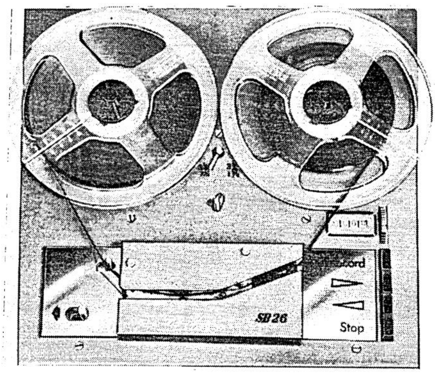
B.S.R. Monardeck TD2



Motek K 10



Planet CD2



Lorlin SB26

heads. Size: $13\frac{1}{8} \times 12\frac{1}{4}$ in. with $1\frac{1}{2}$ in. clearance above top of cabinet board and 5 in. below. For 7 in. reels, $\frac{5}{8}$ in. to be allowed on each side. Weight: $18\frac{1}{2}$ lb. Price ($\frac{1}{4}$-track stereo): £40 19s.; ($\frac{1}{2}$-track mono): £32 11s.

MODERN TECHNIQUES, Wedmore Street, London, N.19. Tel.: Archway 3114.

Motek K10. G.P. tape deck. $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Three motors. 7 in. spools. F.R. approx. 40-14,000 c/s at $7\frac{1}{2}$ i/s depending on amplifier used. W. and F. $<0{\cdot}2\%$ at $7\frac{1}{2}$ i/s. 2 heads. High imp. record head. Size: $15\frac{1}{4} \times 10\frac{3}{4}$ in. Price: £22 1s.

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PLANET PROJECTS LTD., Goodman Works, Belvue Road, Northolt, Middlesex. Tel.: Viking 1775.

●**C.D.2.** Tape deck. Speed $1\frac{7}{8}$ or $3\frac{3}{4}$ i/s. W. and F. Less than $0{\cdot}2\%$ at both speeds. Miniflux heads. $\frac{1}{2}$-track mono or $\frac{1}{4}$-track stereo. Two heads, one for each track. F.R. dependent on speed and heads. One Papst hysteresis motor. Spool size 7 in. Automatic track change and reversal of tape direction at end of spool, no fast rewind required. Uses standard $\frac{1}{4}$ in. tape. Single knob control. Provides over $8\frac{1}{2}$ hours uninterrupted playing at $1\frac{7}{8}$ i/s. Mains 220-230V 50 c/s. Size: $14\frac{3}{4} \times 11\frac{3}{4} \times 6$ in. Weight approximately 10 lb. Price: £65 (ex works).

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WRIGHT AND WEAIRE LTD., 84 Blackfriars Road, London, S.E.1. Tel.: Waterloo 1981. Cables: Writewea, London, S.E.

Wearite 6A, 6B, 6C. Semi-professional tape deck. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Three motors. Spool size $8\frac{1}{4}$ in. W. and F. $0{\cdot}16\%$ at $7\frac{1}{2}$ i/s. Size: $16\frac{1}{2} \times 13 \times 7$ in. Weight: 18 lb. Model 6A standard mono record/replay. Price: £44. Model 6B mono record/replay plus monitor head. Price: £49. Model 6C industrial dual track. Price: £53 10s.

●**Wearite GS.** Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Mono record/replay plus stereo replay. Price: £51 7s.

TAPE UNITS

BANG & OLUFSEN. U.K. Sales Division, Eastbrook Road, Eastern Avenue, Gloucester. Tel.: Gloucester 26841. Cables: DEBELEC, Gloucester.

●**Beocord 1500.** Transistorised stereo tape unit in $\frac{1}{4}$-track and $\frac{1}{2}$-track versions. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Spool size 7 in. W. and F. 0·075% at $7\frac{1}{2}$, 0·11% at $3\frac{3}{4}$, 0·18% at $1\frac{7}{8}$. H. and N. $\frac{1}{2}$-track −55 dB, $\frac{1}{4}$-track −50 dB. F.R. 40 c/s-16 Kc/s at $7\frac{1}{2}$ i/s, 40-12 Kc/s at $3\frac{3}{4}$ i/s, 50-6 Kc/s at $1\frac{7}{8}$ i/s. Replay char. CCIR. Inputs: mic. 150 µV 200 ohms, mag. PU 2 mV 33K, crystal PU 1V 220K, radio diode 2 mV 45K. Output: line 800 mV. Rewind time 3 mins., 1,800 ft. One Papst motor. Own deck. Superimpose. Pause. Position indicator. Two VU meters. Mains. 110-240V 50 c/s. Size $17\frac{3}{4} \times 13\frac{1}{4} \times 8\frac{5}{8}$ in. Weight 33 lb. Price: £93 9s.

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BRENELL ENGINEERING CO. LTD., 231/5 Liverpool Road, London, N.1. Tel.: North 8271 (5 lines).

●**STB2.** Stereo/mono deck mechanism with pre-amplifiers. $\frac{1}{2}$ or $\frac{1}{4}$-track. Speeds 15, $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s, W. and F. 15 i/s, <0·05%; $7\frac{1}{2}$ i/s, <0·1%; $3\frac{3}{4}$ i/s, <0·15%; $1\frac{7}{8}$ i/s, <0·25%. Outlet from pre-amp. Three motors, $8\frac{1}{4}$ in. or $10\frac{1}{2}$ in. NAB spools to order. Two illuminated level meters. Twin record and replay pre-amps. Tape monitoring facilities. Price ($8\frac{1}{4}$ in. spools): £150; ($10\frac{1}{2}$ in. spools): £170.

●**STB2.** Monitor amplifier for use with STB2 tape unit. Valves. 3W per channel. Distortion 2% at 3W. Response 25 c/s-25 Kc/s ±3 dB. Noise level −50 dB. Input 1V for 3W output. Output impedance 3 and 15 ohms. Complete with two 5 × 3 in. speakers. Price: £25.

★

GRAMDECK. U.K. distributors, Andrew Merryfield Ltd., 29/31 Wright's Lane, Kensington, London, W.8. Tel.: Western 3603. Cables: Technology, Kens, London.

Gramdeck. Head and drive mechanism for attachment to gramophone turntable. Speeds $7\frac{1}{2}$, 4·33, 3·2 and 1·6 i/s for the standard disc speeds. $5\frac{3}{4}$ in. spools. F.R. 60-10,000 c/s ±3 dB at $7\frac{1}{2}$ i/s. W. and F. 0·15%. Microphone to be used, Lustraphone LD61 medium impedance. Size: $13\frac{1}{2} \times 6$ in. Weight approx.: 2 lb. with tape. Price (including transistor pre-amplifier, tape and microphone): £9 19s. 6d.

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GRUNDIG (GREAT BRITAIN) LTD., Newlands Park, Sydenham, London, S.E.26. Tel.: Sydenham 2211. Cables: Grundig, London, S.E.26. Telex.: 22854.

●**TM45.** Mono/stereo $\frac{1}{4}$-track tape deck with pre-amps. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$. Spool 7 in. W. and F. $7\frac{1}{2}$ ±0·1%, $3\frac{3}{4}$ ±0·12%, $1\frac{7}{8}$ ±0·2%. H. and N. $7\frac{1}{2}$ −42 dB, $3\frac{3}{4}$ −45 dB, $1\frac{7}{8}$ −42 dB. F.R. $7\frac{1}{2}$ 60 c/s-18 Kc/s, $3\frac{3}{4}$ 60 c/s-15 Kc/s, $1\frac{7}{8}$ 60 c/s-9 Kc/s. Replay char. NARTB. Inputs, mics. two 1·5 mV 1·5 megohms, diode 1·5 mV 39K, PU 80 mV 2·2 megohms. Outputs, $7\frac{1}{2}$ 480 mV 15K, $3\frac{3}{4}$ 550 mV 15K, $1\frac{7}{8}$ 390 mV 15K.

Brenell STB2

Truvox PD104

M.E. Valves. Rewind time 1,700 ft. 2 min. 40 secs. One motor. Own deck. Pause. Position indicator. Inching. Synchronous and multi-synchronous recording. Echo using 608 mixer. 110-240V 50 c/s. Size: 14 × 13 × $6\frac{3}{4}$ in. Weight: $19\frac{1}{2}$ lb. Price: £73 10s.

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HEATHKIT. See Kit section.

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MARTIN ELECTRONICS LTD. See Constructional Kits section.

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SONY. U.K. Sales Division, Eastbrook Road, Eastern Avenue, Gloucester. Tel.: Gloucester 26841. Cables: DEBELEC, London.

●**TC250.** $\frac{1}{4}$-track mains operated transistorised stereo tape unit. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$ i/s. Spool 7 in. W. and F. less than 0·19% at $7\frac{1}{2}$ i/s, less than 0·25% at $3\frac{3}{4}$ i/s. F.R. 30 c/s-18 Kc/s at $7\frac{1}{2}$, 30 c/s-13 Kc/s at $3\frac{3}{4}$. Replay char. CCIR. Low impedance inputs −72 dB, high impedance inputs −12 dB. Output 1V at 600 ohms. VU meter. Rewind time $3\frac{1}{2}$ mins. 1,800 ft. One motor. Own deck. Superimpose. Pause. Position indicator. Mains 110-240V 50 c/s. Size: $14\frac{1}{4}$ × $6\frac{1}{4}$ × $11\frac{1}{2}$. Weight: $16\frac{1}{2}$ lb. Price: £57 15s.

TANDBERG. U.K. distributors: Elstone Electronics Ltd., Edward Street, Templar Street, Leeds 2. Tel. Leeds 3-5111.

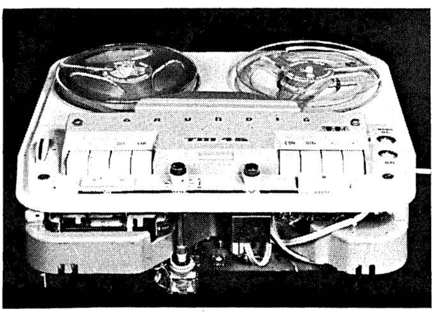
Tandberg Series 6. For details see Professional and Semi-Professional Tape Recorders section.

★

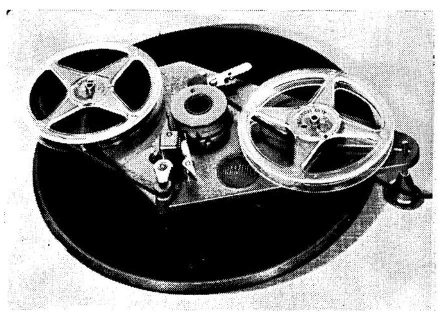
TRUVOX LTD., Neasden Lane, London, N.W.10. Tel.: Dollis Hill 8011. Cables: Truvoxeng, London, N.W.10.

●**PD104.** $\frac{1}{4}$-track transistorised stereo tape unit. Speeds $7\frac{1}{2}$, $3\frac{3}{4}$, $1\frac{7}{8}$ i/s. Spool 7 in. W. and F. <0·1% at $7\frac{1}{2}$, 0·15% at $3\frac{3}{4}$, 0·25% at $1\frac{7}{8}$. H. and N. −50 dB. F.R. $7\frac{1}{2}$ 30 c/s-17 Kc/s ±2 dB, $3\frac{3}{4}$ 40 c/s-10 Kc/s ±2 dB, $1\frac{7}{8}$ 60-8 Kc/s ±3 dB. Replay char. new CCIR. Inputs: mic. 1 mV 50K, rad/PU 50 mV 100K. Outputs: two 1V across 100 ohms. Two level meters. Rewind time 1,200 ft. 1 min. Three motors, capstan motor outer-rotor type. Own deck. Pause. Four-digit position indicator. Straight-through pre-amplifier. Source-tape monitor. Three heads. Mixing. Track-to-track copying. Mains 200-250V AC. Size: 16 × $16\frac{5}{8}$ × 8 in. Weight: 28 lb. Price: £93 9s.

PD102. $\frac{1}{2}$-track transistorised stereo tape unit. Specification as for PD104. Price: £97 13s.



Grundig TM45



Gramdeck

TAPE AMPLIFIERS AND MIXER UNITS

AMPEX (GREAT BRITAIN) LTD., Acre Road, Reading, Berkshire. Tel.: Reading 84411. Cables: Videotape, Reading.

Ampex 622 Speaker/amplifier. Comprises 8 in. drive unit in special enclosure. Acoustically flat from 60 to 10,000 c/s. The built-in amplifier has 10 watts output. F.R. 20-20,000 c/s $\pm$0·5 dB. Price: £86.

●**Ampex MX10.** Stereo mixer unit. Inputs: 4 mic., or 2 mic. 2 line. Mic. 200 ohms, Line 100K bridging. Gain −67 dBm mic., −27 dBm line will produce 1V output. Up to 4 mixers may be coupled to give 12 in., 2 out channels. Output: 1V normal, 30V max. unbalanced. F.R. 40-15,000 c/s. Signal/noise 65 dB for inputs of −55 dBm. Controls: 4 pots, two gang master gain. Key switches, Line/Mic. AC line switch, mixer couple switch. Key switches, channel A, B or both. Four channels in, two out. Self-powered 105-125V, 30W. Size: $5\frac{7}{32} \times 19 \times 5\frac{3}{16}$ in. Price: £175.

●**Ampex MX35.** Identical to MX10, except in physical appearance.

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ASSOCIATED ELECTRONIC ENGINEERS LTD., 10 Dalston Gardens, Stanmore, Middx. Tel.: Wordsworth 4474/5/6. Cables: Astronic, Stanmore.

Astronic A.1446. 6 channel electronic mixer unit. Designed for 5 low imp. sources each 10/30 ohms, 0·5 mV; 1 high imp. source 250K ohms, 0·2 volts. There are four output sockets supplying 0·7V into 600 ohms. A master gain fader is incorporated, and each channel has an indicator lamp to show which sources have been faded up. AC mains required. Size: $9 \times 11 \times 8\frac{1}{2}$ in. Price: £58 10s.

Astronic A.1658. Transistorised microphone mixer built on modular system. Three inputs with bass and volume controls on each channel. Also master gain and tone controls. Available with 30W amplifier module. Battery and mains operated versions. Size: $15 \times 7 \times 9$ in. Price: (battery) £42, (mains) £47 10s.

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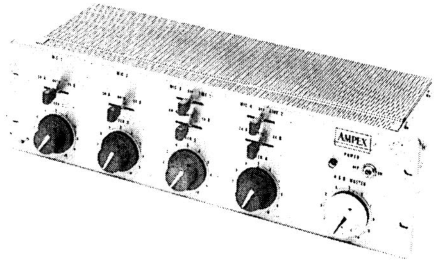
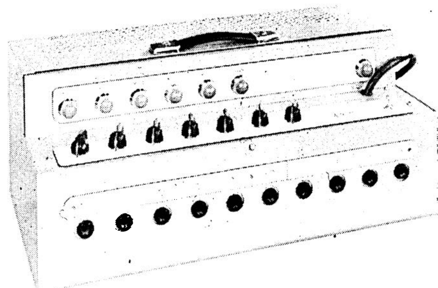
BRENELL ENGINEERING CO. LTD., 231/5 Liverpool Road, London, N.1. Tel.: North 8271 (5 lines).

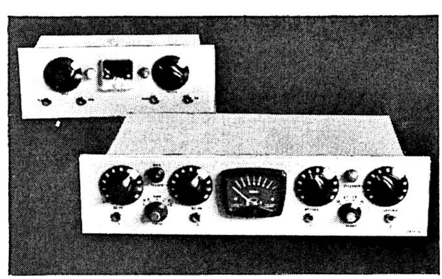


Ampex MX10 stereo mixer



Astronic A1446 mixer

Binson Echorec Baby



Deimos tape amplifier

Binson Echorec Mark 2

Mk. 5 Series 3 Record/playback amplifier. Inputs: mic. 2 Series 2 mV, radio/gram 75 mV, both high imp. Outputs: 200 mV at 50,000 ohms, and 4W into 15 ohms for direct connection to loudspeaker. Headphone monitoring M.E. level ind. or meter if required. Price: £26. Meter: £5 5s. extra.

Brenell Mixer Unit. 3 channel unit. High imp. sources. There are 4 sockets for jack plugs for the three inputs and the output lead, each input having a volume control. Price: £2 18s.

★

DEIMOS LTD., 8 Corwell Lane, Hillingdon, Middx. Tel.: Hayes 3561.

●**Deimos Tape Amplifier.** Stereo/mono Flexible tape amplifier system available with many alternative features to suit various decks and tape heads. Separate playback and record amplifiers. Basic input sensitivity: radio 50 mV, mic. 0·5 mV. Cathode follower output. Equalisation for any standard speed or playback characteristic. Level indicator optional, meter or M.E. Separate power supply available. Full details and prices on request.

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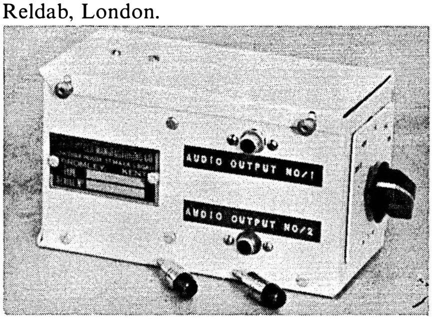
EAGLE PRODUCTS. Distributors: B. Adler & Sons (Radio) Ltd., 32a Coptic Street, London, W.C.1. Tel.: Museum 9606/7. Cables: Reldab, London.



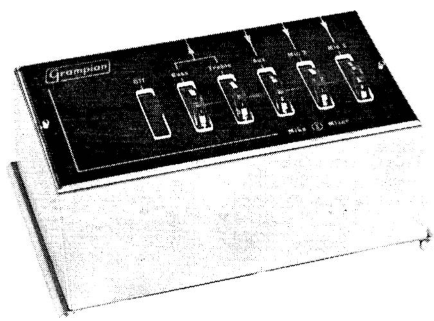
Lowther audio test unit

Model MM.4 4-Channel Microphone Mixer. 4 high imp. inputs, with individual gain controls; max. signal 1·5V. One output, max. signal 2·5V. Self-powered (9V battery). Size: 6 × $3\frac{1}{4}$ × 2 in. Price: £2 19s. 6d.

ELECTROMAN (POLDEW LTD.), 2 Laing's Corner, Mitcham, Surrey. Tel.: Mitcham 3282.

★

Transmatch TMU1. Transistor mono preamplifier. Inputs: guitar, gram, m/c and ribbon mics. (between 25 ohms-1K imp.). Output 100K or above. F.R. flat 40 c/s-20 Kc/s. Voltage gain 100 approx. (40 dB). Noise very low under optimum matching condition. Operates from internal PP3 battery, switched on by input jack plug. Size: $4\frac{7}{8}$ × $2\frac{3}{8}$ × $1\frac{1}{4}$ in. Price: £3 10s. 6d. (including PP3 battery).



Grampian Mike 3 *Mixer*

ELECTRONIC & SCIENTIFIC INSTRUMENTS (WORTHING) LTD., Distributors: Shirley Laboratories Ltd., 3 Prospect Place, Worthing, Sussex. Tel.: Worthing 30536.

Esimix Minor. Details as for Major. P.s.n. 250-300V DC, 10 mA; 6·3V, 0·6 amps. Price: £12 12s.; (4 mic. version): £13 13s.

Esimix Major. Four-channel electronic microphone and signal mixer. F.R. at full gain: 15 c/s-20 Kc/s ±2 dB. H. and N. better than −50 dB. Channels 1 and 2 (mic.): 2 mV input for 200 mV output; channels 3 and 4 (radio, etc.): 100 mV input for 200 mV output. Cathode-follower output, permitting the use of long connecting lines without risk of hum. Self-powered. 230-250V AC. Price: £19 19s.; (4 mic. version): £21.

Power Supply Unit available for Esimix Minor. Price: £3 13s. 6d.

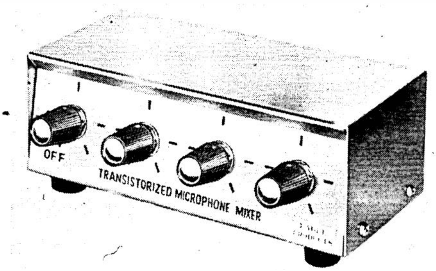
A. R. FRANKLIN & COMPANY LTD., 6 Kings College Mews, London, N.W.3. Tel.: Juniper 0480.

●**Mixers and tape amplifiers.** Built to customers specific requirements. Wide range of facilities offered.

★

GRAMPIAN REPRODUCERS LTD., 19 Hanworth Trading Estate, Feltham, Middx. Tel.: Feltham 2657. Cables: Reamp, Feltham.

Grampian Mike 3. Transistorised electronic mixer. Inputs: 2 low level mics. 300 mV, 600 ohms; 1 high level aux. for tape or radio 500 mV, 1 megohm (other imps. available). Output 1V, 600 ohms. F.R. 50 c/s-15 Kc/s ±1 dB on all inputs. Signal/noise: overall (all



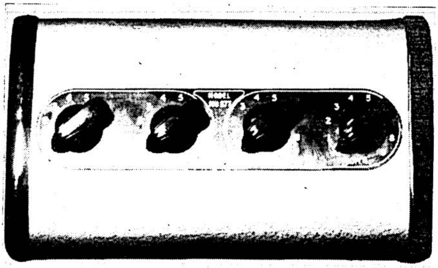
Eagle MM.4 Microphone Mixer

channels closed, tone controls level) 68 dB, full output; (all channels open, tone controls level) 50 dB, full output. Controls: supply switch, bass cut, treble cut, aux. gain, mic. 2 gain, mic. 1 gain. Three channels. Powered by internal 9V dry battery. Size: $8\frac{1}{4} \times 5\frac{1}{4} \times 3\frac{1}{2}$ in. Weight (incl. battery) less than 4 lb. Price: £20 10s. (battery extra).

★

GRUNDIG (GT. BRITAIN) LTD., Newlands Park, Sydenham, S.E.26. Tel.: Sydenham 2211. Cables: Grundig, London. Telex: 22054.

●**Stereo/Mono Mixer Type 608.** F.R. substantially flat, 30 c/s-20 Kc/s. Fully transistorised. Fed from two batteries type PP3 (or equivalent). Connecting sockets for two microphones (left-hand and right-hand channels), a further microphone, and connection of radio and stereo pickup. Mono/stereo output socket provided. Linear fading controls. Inputs from mono microphone or radio connected to appropriate socket can be mixed with stereo programme, and with aid of a "Directional Control" these mono inputs may be mixed with



Lustraphone MU577

either left- or right-hand channels, or combined with both. Coarse level controls provided, and two press buttons select appropriate mono signal and feed this to directional control. Size: $9\frac{1}{2} \times 8 \times 3$ in. Weight: $3\frac{3}{4}$ lb. Price: £18 18s.

★

JASON ELECTRONIC DESIGNS LTD., 18 Tudor Place, Tottenham Court Road, London, W.1. Tel.: Museum 4666.

●**JTL. Stereo tape pre-amplifier.** One input, 100 mV sensitivity. Output 0·5V. Equalisation for $7\frac{1}{2}$ and $3\frac{3}{4}$ i/s. M.E. level ind.

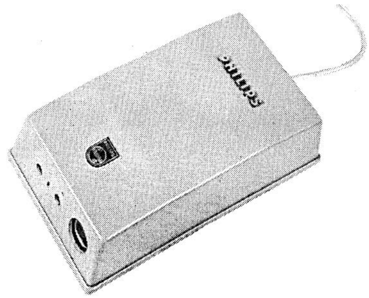
Controls: function, record amplifier level, playback amplifier level, recording track, playback track, monitor, H.F. bias level, signal/bias. Simultaneous record/replay. Self-powered. Push/pull oscillator. H. and N. 55 dB down on 2% distortion. Suitable for any deck. To operate with Jason J2-10 amplifier. Size: $15 \times 9\frac{1}{4} \times 4\frac{3}{8}$ in. Price assembled: £30 9s.; Kit: £22 1s.

★

THE LOWTHER MANUFACTURING CO., St. Mark's Road, Bromley, Kent. Tel.: Ravensbourne 5225. Cables: Lowther, Bromley.

Companion Supply Unit No. 2. H.T. and L.T. power supply suitable to power radio tuners.

Epigram mixer



Philips EL 3374 pre-amplifier

Pre-amp and tape bias amplifier. Output 250V at 40 mA, 6·3V at 3 amps. Price: £5 5s.

Companion Supply Unit No. 3. H.T. and L.T. power supply suitable to power radio tuners. Pre-amp and tape bias amplifier. Output 350V at 35 mA, 6·3V at 3 amps. Price: £5 15s.

★

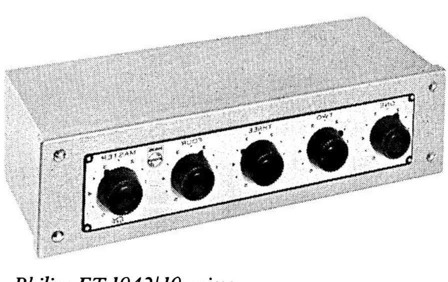
LUSTRAPHONE LTD., St. George's Works, Regent's Park Road, London, N.W.1. Tel.: Primrose 8844. Cables: Lustraphon, London.

M.U.577. Transistor mixer unit. Inputs: 1 and 2 are balanced and are suitable for low imp. mics. (line or high imps. to order). 3 and 4 are high imp. and suitable for radio or pu. High imp. output. F.R. substantially flat 50-14,000 c/s. Power by mercury cell with 1,000 hours life. Alternative input and output imp. to specification. Price, standard model: £22.

A range of transistorised power amplifiers, up to 50 wattts, and complete public address systems. Details on application.

★

MARTIN ELECTRONICS LTD. See Constructional Kits Section.



Philips ET 1042/10 mixer

MODERN ELECTRICS (RETAIL) LTD., 120 Shaftesbury Avenue, London, W.1. Tel.: Gerrard 9692 and Temple Bar 7587. Cables: Modcharex.

Binson Echorec Mark 2. Pre-amplifier and echo unit. Enables echo to be imposed on any audio signal in a wide choice of timing. Facilities for the imposition of swell and reverberation. Three channels which can be selected as required. Completely portable. Operates from AC Mains supply. An exclusive design of magnetic wheel with transistorised circuitry. Price: £176 8s.

Binson Echorec Baby. Single channel version of the Mark 2, for echo and swell. Price: £110 5s.

★

PENCO PRODUCTS, 36 Coniston Road, Kings Langley, Herts. Tel.: Kings Langley 3134.

Epigram Mix/4. 3 channel unit. Incorporates 3 transistors and is designed for 2 low imp. 15/30 ohms and one high imp. input. Power derived from $4\frac{1}{2}$V battery. Output is high imp. Rectangular case: 12 × 3 × $2\frac{1}{2}$ in. Price: £15 15s.

Epigram Mix/35. Details as above except that 5 transistors are included, giving extra gain, e.g. to by-pass input stage of recorder. Price: £26 5s. Specials to order.

Epigram Mix/35L. As Mix/35 but fitted with low noise transistors. Price: £29 8s.

★

PETO SCOTT ELECTRICAL INSTRUMENTS LTD., Addlestone Road, Weybridge, Surrey. Tel.: Weybridge 45511.

ET 1042/10. 4 channel mixer unit. Input imp. 50 ohms, 0·2 mV. Outputs: 50,000 ohms at 200 mV or 6,500 ohms at 10 mV. Four individual mic. input controls and master. F.R. 50-12,000 c/s with speech filter giving 6 dB cut at 60 c/s. S-N −70 dB. Self-powered, 200-250V 50 c/s AC. Suitable for all Philips amplifiers. Size: $13\frac{1}{2}$ × 7 × $3\frac{1}{16}$ in. Price: £35.

★

PHILIPS ELECTRICAL LTD., Century House, Shaftesbury Avenue, London, W.C.2. Tel.: Gerrard 7777. Cables: Phillamps, London.

●**EL3774/00.** Stereo pre-amplifier. In conjunction with Philips mono recorders EL3541, EL3541/H and EL3542, this pre-amplifier with additional equipment offers the following facilities:

Playback of pre-recorded two- or four-track stereo tapes. Simultaneous playback of two separate programmes recorded on tracks 1 and 3 (or tracks 4 and 2). Duoplay, i.e. playback of track 3 (or 2) and simultaneous recording of track 1 (or 4). Two synchronous programmes on separate tracks. NOTE: Certain models will require modification. Size: $6\frac{3}{8} \times 3\frac{1}{2} \times 1\frac{5}{8}$ in. Suitable for some Cossor and Stella recorders also. Price: £6 10s.

●**EL3787/00.** Stereo pre-amplifier. Suitable for Philips recorders EL3548 and EL3549, also some Cossor and Stella recorders. Provides same facilities as EL3774/00 plus Multiplay, i.e. copying from one track to the parallel track, while simultaneously adding an accompaniment. This process can be repeated several times. Connecting leads extra. Price: £6 10s.

★

SABA ELECTRONICS LTD., 3/5 Eden Grove, Holloway, London, N.7. Tel.: North 8161. Cables: Arc Eeslon.

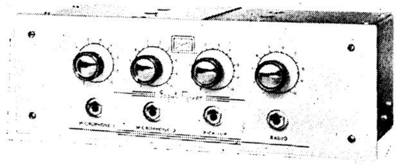
●**Regie-Mixer.** Transistorised stereo mixer. Inputs: 3 mV 3K, 15 mV 3K, 15 mV 3K, 500 mV 1 megohm. Output 80 mV. Independent slider controls on all inputs. Noise better than 40 dB. Power supply: B122 $22\frac{1}{2}$V battery or from TK230-S recorder. Size: $8\frac{1}{2} \times 7\frac{1}{2} \times 3\frac{1}{4}$ in. Price: £18 18s.

★

SHIRLEY LABORATORIES LTD., 3 Prospect Place, Worthing, Sussex. Tel.: Worthing 30536.

TW/PA4. Recording amplifier for use with high quality power amplifier. Inputs: 1·5 mV and 60 mV. Bias and erase oscillator. Full corrections. Valve voltmeter modulations level ind. For use with Wearite or Ferrograph tape decks (TW/PA4U for Planet decks), can be supplied to order for any deck. Size: $10 \times 5\frac{1}{2} \times 5\frac{1}{4}$ in. P.s.n. from main amp. or power pack can be supplied at £6 16s. 6d. Price: £34 13s.

●**TWA/1515HG.** Complete stereo record and replay amplifier. Inputs: radio 50 mV, gram 5 mV (RIAA), mic. 2 mV, tape 3 mV. Output 12W per channel (17W peak). F.R. 45 c/s-25 Kc/s ±1 dB on radio input. Low distortion



Stern Mullard mixer

bias and erase oscillator included. Valve voltmeter level indicator. H. and N. −85 dB. Controls: bass, treble, vol., pre-set balance, meter pre-set, bias pre-set, sel., rec/replay, equalisation, mono/stereo. Heavy duty power pack on separate chassis. Size (control unit): $23 \times 7\frac{1}{2} \times 7$ in.; (power unit): $10 \times 8 \times 7\frac{1}{2}$ in. TWP/1515HG for Planet decks. TWA/1515HG for Ferrograph decks. TWH/1515HG for Brenell and similar decks. Price: £115 10s.

TW/15HG. Single channel mono version of TWA/1515HG. Price: £53 11s.

★

SOUND NEWS PRODUCTIONS, 10 Clifford Street, New Bond Street, London, W.1. Tel.: Regent 2745.

Unimixer 1. 3 channel unit. Channels 1 and 2 have independently controlled duplicate sockets for low or high imp. microphones 30 ohms or 400K approx. Recommended load imp. not less than 500K ohms. F.R. from 30 ohm input 50-10,000 c/s ±3 dB. Price: £9 9s.

Unimixer 2. 3 channel unit. Inputs as above but high imp. is 5 megohms in channels 1 and 2. Power supply needed 200/300V DC at 5 mA, 6·3V at 0·3 amps balanced. Special connectors available to obtain power supplies direct from Ferrograph or Vortexion recorders without any alteration. Price: £15 15s.

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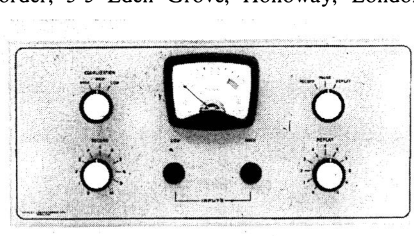
STERN-CLYNE LTD., Head Office and mail order, 3-5 Eden Grove, Holloway, London,



Shirley TW/PA4

N.7. Tel.: North 8161. Branches throughout: London, Liverpool, Manchester, Sheffield and Bristol.

HF/TR3 Mk. II. Tape amplifier. Inputs: mic. 2·5 mV, radio/pickup 300 mV. F.R. 35-17,000 c/s ± 3 dB at 15 i/s. Equalisation available for 15, $7\frac{1}{2}$ and $3\frac{3}{4}$ i/s or $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ i/s. 3W output into 3, $7\frac{1}{2}$ or 15 ohms. To Mullard design, suitable for Brenell, Collaro, Motek, Truvox and Wearite decks. Price, with separate power unit: £19. Plus £3 3s. for special matching to Wearite decks. Also available in kit form: £13 13s.

Type C Mk. II. Tape pre-amplifier. Inputs: mic. 0·5 mV, radio/pickup 250 mV. F.R. 30-17,000 c/s ± 3 dB at 15 i/s. Equalisation available for 15, $7\frac{1}{2}$ and $3\frac{3}{4}$ i/s or $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ i/s. 250 mV audio output. To Mullard design, suitable for Brenell, Collaro, Motek, Truvox and Wearite decks. Price, with separate power unit: £19 10s. Plus £3 3s. for special matching to Wearite 4A/5A decks. Also available in kit form: £14.

●**STP-1.** Stereo tape pre-amplifier. Inputs (each channel): radio 250 mV, imp. 500 K ohms; microphone 2 mV, imp. 2 megohms. Outputs: standard 250 mV (alternatives up to 2V). Response at $7\frac{1}{2}$ i/s 40-16,000 ± 3 dB. Equalisation for 15, $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ i/s. 2 in. moving coil meter. Controls: function, equaliser, record level (2), meter, meter set zero. Separate track switch. H. and N. -55 dB. P.s.n. 290V at 30 mA; 6·3V at 2 amps. Suitable for Brenell and Truvox (quarter-track Miniflux head) and Collaro (quarter-track Reuter head). Size: 14 × 6 × $3\frac{3}{8}$ in. Price £28. Available in kit form, price: £22.

★

TELE-RADIO (1943) LTD., 189 Edgware Road, London, W.2. Tel.: Paddington 4455.

Masterlink M3. Tape pre-amplifier. Mainly for Wearite series of decks, but suitable for Collaro and Brenell. Inputs: mic. 3 mV, 1 megohm; radio/pickup 100 mV, 1 megohm. Output: approx. 200 mV. Response at $7\frac{1}{2}$ i/s with Wearite deck 30-14,000 c/s. Equalisation for 15, $7\frac{1}{2}$, $3\frac{3}{4}$ and $1\frac{7}{8}$ i/s. EM84 level ind. Controls: bias, selector, indicator, equaliser, gain. Self-powered (separate power pack). Price: £22 1s.

Master-Mixer. 4-channel electronic mixer, complete with power supply, in matching case and finish to Masterlink M3. Separate output control. Input sensitivity 3 mV per channel at high imp. for maximum output of 250 mV. Inputs and output connection at rear by jack sockets. F.R. 20 c/s-20 Kc/s ± 2 dB. Modifications to specific requirements, also to low imp. channels available on request. Price: £22 1s.

★

TRIPLETONE MANUFACTURING CO. LTD., 241a The Broadway, Wimbledon, S.W.19. Tel.: Liberty 1189.

Transistorised Pre-Amplifier. For details see Amplifiers Section.

★

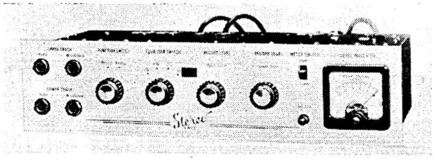
UHER. Distributors: Bosch Ltd., 205 Great Portland Street, London, W.1. Tel.: Langham 1809.

●**A121.** Stereo/mono mixer unit. Input: 0·1 mV, 2K. Output approx. 50 mV. F.R. 20 c/s-20 Kc/s. Five glider controls. Five channels. P.s.n. 9V. Price: £45 10s.

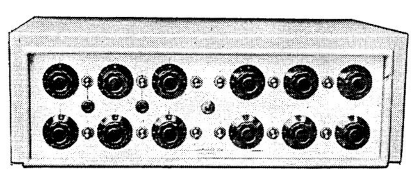
★

VORTEXION LTD., 257/263 The Broadway, Wimbledon. Tel.: Liberty 6242/3. Cables: Vortexion, Wimble, London.

Electronic Mixers. A variety of mixers are available: 3-channel with accuracy within 1 dB. Peak programme meter. 4-channel, 12-channel and 2 × 5 channel stereo. Tropicalised controls. Built-in screened supplies. Balanced line mic. inputs. 0·5V or alternative 1 mW, 600 ohms balanced, unbalanced or floating outputs. A version is available which has recording erase and bias, playback and echo facilities with metering of bias and signal. Prices on application.



Stern STP-1



Vortexion 12-way Mixer Unit

TAPE ACCESSORIES and COMPONENTS

AGFA LTD., 27 Regent Street, London, S.W.1. Tel.: Regent 8581.

Tape Accessory Kit. Plastic case containing red, green and white leader tape, adhesive splicing tape, silver stop foil, non-magnetic scissors, tape clips and splicing template. Price: £1 14s. 6d.

AKAI. Distributors: The Pullin Optical Co. Ltd., 11 Aintree Road, Perivale, Greenford, Middlesex. Tel.: Alperton 1541/7.

Endless tape spool. AE-1. Price: £3 11s.

Telephone pickup. AP-2. Price: £2 3s.

Tape splicer. AS-3. Price: £1 1s. 6d.

Monitor Receiver. AM-4 and AM-4P. Personal phones. AM-4 has right-angled plug, AM-4P has straight plug.

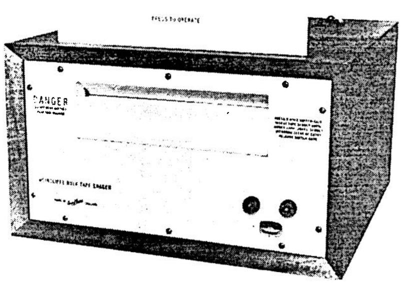
Head De-magnetiser. AH-6. Compact mains-operated accessory for removing completely magnetism in heads, guides, etc. Price: £2 10s.

Tape eraser. ATE-7. Compact bulk eraser with accommodation for 3 in. to $10\frac{1}{2}$ in. reels. Push-button control for power on/off and rotation. Price: £13 2s.

Stereo phones. ASE-8S. Comfortable light-weight stereo headphones. Price: £5 19s.

★

A.K.G. (Akustische and Kino-Gerate G.m.b.H.), Distributors: Politechna (London) Ltd., 182-184 Campden Hill Road, Kensington, London, W.8. Tel.: Park 0711/3, 5008.



Weircliffe Bulk Eraser

A.K.G. K50. Dynamic headphones. F.R. 20-25,000 c/s. Impedance 400 ohms per ear piece. Suitable for stereo or mono. Weight: 80 grams. Price: £7 10s. Ear pads available.

★

AMOS OF EXETER LTD., Weircliffe Court, Exwick, Exeter. Tel.: Exeter 72132. Cables: Amos, Exeter.

Weircliffe Bulk Erasers. Models 6, 7, 8. Cleaning time 6 secs. per tape. Model 6 takes reels up to $10\frac{1}{4}$ in. diameter of $\frac{1}{4}$-1 in. wide tape. Model 7 takes $6\frac{3}{4} \times 8$ in. cassettes of continuous $\frac{1}{4}$ in. tape. Model 8 takes 10-14 in. reels of $\frac{1}{4}$-2 in. wide tape. Size (Model 6 and 7): $11\frac{1}{2} \times 12\frac{1}{4} \times 7\frac{1}{2}$ in. Size (Model 8): $20\frac{1}{2} \times 20\frac{1}{2} \times 10\frac{1}{2}$ in. Weight (Model 6 and 7): 43 lb. Weight (Model 8): 92 lb. These sizes and weights refer to European models for 220-240V AC. North American models for 115V AC are slightly larger and heavier. Prices: (Models 6 and 7) £32 ex works; (Model 8) £64 ex works.

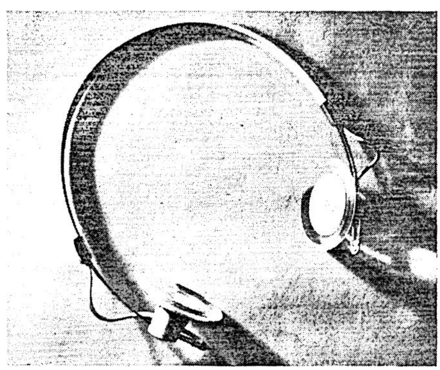
★

BASF Chemicals Ltd., 5a Gillespie Road, London, N.5. Tel.: Canonbury 2011.

Cutter Box. Contains automatic splicer, spare knife, 4 tape clips, stop foils, splicing tape, 3 leader tapes, spool labels and marking pencil. Price: £2 12s. 6d.

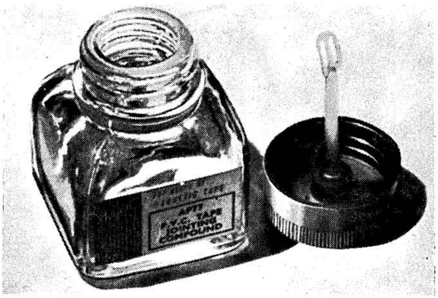
Splicing Set. Plastic box with bonding groove and 33 ft. of splicing tape. Price: 5s.

Tape Library Boxes. See tape section.



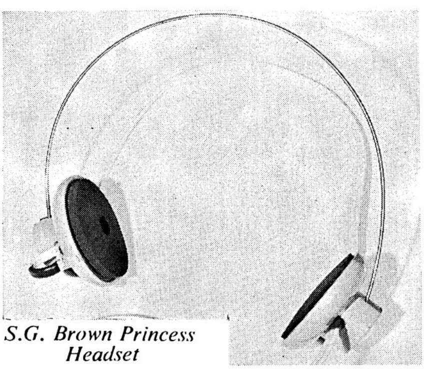
A.K.G. K50 headphones

BASF Tape Editing Kit



Emitape jointing compound AP77

A. Brown recorder cover



S.G. Brown Princess Headset

BEYER. Distributors: Fi-Cord International, Charlwoods Road, East Grinstead, Sussex. Tel.: East Grinstead 21351.

DT48. Studio quality dynamic headphones. Response 16 c/s-18 Kc/s. Output level ±1 dB 114 dB/mW. Impedance 5 or 25 ohms. Price: £30 15s. 6d.

DT49. Dynamic single earpiece. Response 30 c/s-13 Kc/s. Output level 111 dB/mW at 400 c/s. Impedance 15 ohms. Price £10 5s.

DT90. Dynamic peak performance headphone. Impedance 200 ohms. Price: £18.

●**DT96.** Ultra-lightweight dynamic headphones. Response 30 c/s-17 Kc/s. Output level 110 dB/mW ±3 dB at 400 c/s. Impedance 2 × 100 ohms, Price: £10 14s. 6d.

DT98. Type DT96 lightweight headphones with lip microphone attached. Designed primarily for use in language laboratories. Price: £21 9s.

DT508. Lightweight headphones with LR7 lead and potentiometer. Price: £10 5s.

Various accessories including eartips, plastic earpads, rubber earpads, leads and transformers.

★

BRADMATIC LTD., 338 Aldridge Road, Streetly, Sutton Coldfield, Warwickshire. Tel.: Streetly 3171.

A range of twin track high impedance sound heads, single hole fixing, pole pieces are cylindrically ground flush with caps. Screening cans available.

Type 5 RP. Combined record/replay head 0·0004 in. gap. Price: £3 5s.

Type 6 RP. Super fidelity record/replay head 0.0002 in. gap. Price: £3 15s.

Type 5R. Record only 0·0007 in. gap. Price: £3 5s.

Type D5E. Erase head. Price: £3 5s.

Full track versions of the above are also available.

●**Type ST-RP.** Stereo record/replay head. Price with screen can, without fixing stem, £6.

S. G. BROWN LTD., King George's Avenue, Watford, Herts. Tel.: Watford 23301. Cables: Radiolink, Watford.

A range of headphones suitable for recording and dictating equipment, e.g. lightweight miniature model. Price from £3 5s.

Super "K". Moving coil headphones. Available as monaural or binaural. Price: £6 17s.

Diplomat. Lightweight, high quality headset. Frequency response substantially flat from 30 c/s-12 Kc/s. Price: £6 6s.

Control Unit for use with headphones. Stereo or mono. Separate volume control for each channel, allows compensation for hearing deficiencies. Channel-blend device for stereo use. Isolation transformer. Impedance matching to 15 ohms or 600 ohms. Price to be announced.

★

A. BROWN & SONS LTD., 24-28 George Street, Hull.

Tape recorder covers to suit most makes from £1 15s. to £9 9s.

★

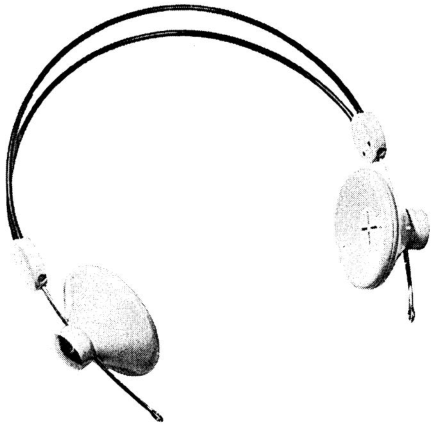
CINESMITH PRODUCTS, Britannic Works, Regent Street, Barnsley, Yorks. Tel.: Barnsley 4445.

Cinesmith Depolariser. A special tool for demagnetising the record/playback heads of any tape recorder. Comprises a plastic moulding with operative switch at one end and demagnetising polepiece at the other, so designed that recording heads can be demagnetised *in situ* without any dismantling. Price: £1 15s.

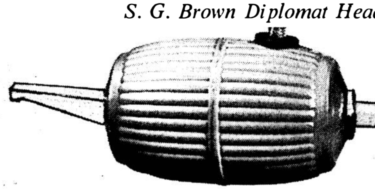
★

COLTON & CO. (LAPIDARIES) LTD., The Crescent, Wimbledon, London, S.W.19. Tel.: Wimbledon 9401.

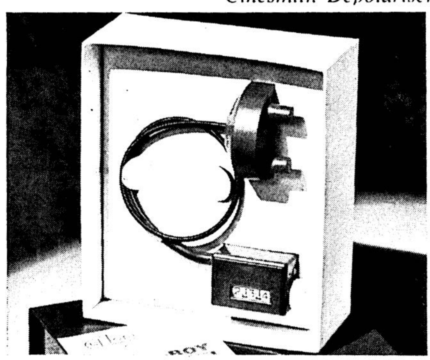
Call Boy. Counter-type position indicator, incorporating three-figure counter and reset wheel. Provides accurate cueing for tape recorders with no counter device. Fitted by means of a suction pad. Drive taken direct from spool, obviating slip and ensuring accuracy. Coupling device, used to connect the counter with the spool, can be placed into position, or removed, swiftly and without disturbing tape. Available in two spool fitting. Price: £2 2s.



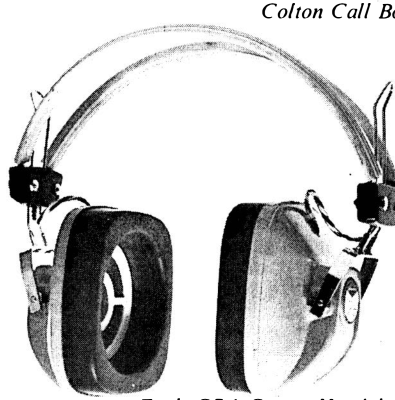
S. G. Brown Diplomat Headset



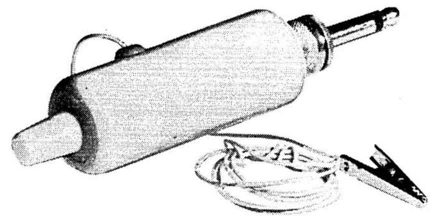
Cinesmith Depolariser



Colton Call Boy



Eagle SE.1 Stereo Headphone



Eagle GT.50 Plug-in Radio Jack

Precision level. Spirit level of circular bubble type in white plastic case $1\frac{3}{16}$ in. diameter, $\frac{1}{2}$ in. high. Three fixing holes provided or it may be secured with adhesive. Ensures accurate levelling in all directions. Price: 8s. 3d.

★

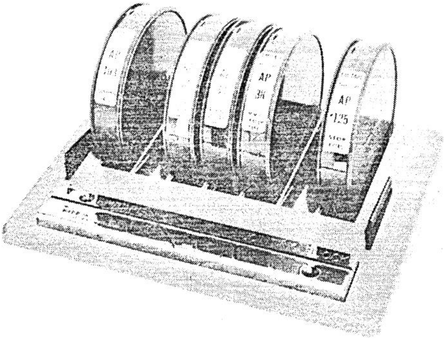
CONTRONICS LTD., Garth Works, Deepcut Bridge Road, Blackdown, Nr. Aldershot. Hants. Tel.: Deepcut 336.

Carol CS/1. Electronic synchronising unit for use with 8 mm cine projectors and stereo tape recorders. Price: £15.

★

COUSINO. Distributors: D. T. V. Group, 126 Hamilton Road, West Norwood, London, S.E.27. Tel.: Gipsy Hill 6166.

Audio Vendor. Single reel continuous loop tape magazine complete with friction-free tape. Versions for 3, 5, 8, 12, 15 or 30 mins. running. Model C for clockwise feed reel rotation, Model CC for counter-clockwise. Prices: 3 min. £3 7s. 6d., 5 min. £3 15s., 15 min. £4 16s., 30 min. £9.



Emitape Accessory Kit AP1.24

Various mounting accessories, spare magazines, anti-friction tape, etc. Details on request.

★

EAGLE PRODUCTS. Distributors: B. Adler & Sons (Radio) Ltd., 32a Coptic Street, London, W.C.1. Tel.: Museum 9606/7. Cables: Reldab, London.

TD.79 Tape Head Demagnetiser. 250V mains operation. Price: £1 9s. 6d.

GT.50 Plug-in Radio Jack. Receives MW 550 Kc/s-1600 Kc/s. For use with any amplifier, tape recorder, etc. Features high-gain aerial with adjustable coil, coupled to a micrometer tuning knob for station selection. Price: £1 5s. 4d. (U.K. purchase tax: 4s.)

T.635 Tape Splicer. Complete with cutting and trimming blades. Price: 15s.

S.E.1. Professional Stereo Headphones. F.R. 25 c/s-14 Kc/s. 3 in. dynamic speakers. Isolated right and left channels. "Flexifoam" seals. Dual adjustment. $\frac{1}{2}$W input. Complete with control box for remote operation and impedance matching network. Price: £6 16s. 6d.

★

ELIZABETHAN ELECTRONICS LTD., Crow Lane, Romford, Essex. Tel.: Romford 64101.

Elizabethan Stethoset Headphones. Lightweight, high impedance. Price: £1 1s.

★

ELSTONE ELECTRONICS LTD., 81 Kirkstall Road, Leeds, 3. Tel.: Leeds 35111.

WAL Tape Eraser. A mains operated tape demagnetiser, accommodates from 5 to 10 in. reels, push button operated. Erases both tracks in a few seconds. Available for 200-250V. 50 c/s or 111-125V, 60 c/s. Price: £6 18s. 6d.

WAL D-MAG. A mains operated head demagnetiser providing complete degaussing circuit. Suitable for erasing short passages from tape or striped film. Price: £2 10s.

E.M.I. TAPE LTD., Blythe Road, Hayes, Middx. Tel.: Hayes 3888. Cables: Emitape, London.

Emiguide AP128. Set of 6 instructional tapes, giving practical guidance in tape recording. Price: £2 11s. Available separately, 8s. 6d. each.

"Emitape Guide to Better Recording". All elements of tape recording described in straightforward terms by John Borwick. 56 pages fully illustrated. Price: 2s. 6d.

Emitape Jointing Compound. AP35 for C.A. base tape. AP77 for PVC base tape. A jointing fluid for making permanent welded joints in magnetic tape. Price: 7s. 6d. per bottle.

Emitape Jointing Tape. Adhesive jointing tape for simple and quick splicing and editing of magnetic tape. Price (AP102, $\frac{7}{32}$ in. wide): 4s. 9d. per reel; (AP103, $\frac{1}{2}$ in. wide): 7s. 6d. per reel.

Emitape P.V.C. Leader Tapes. A range of six coloured tapes to enable colour code references to be inserted in a reel of recorded tape for quick editing and indexing purposes. Packed in plastic dispensers. AP38/1 white; AP38/2 red; AP38/3 yellow; AP38/4 blue; AP38/5 orange; AP38/6 green. Price: 4s. 6d. per reel.

Emitape Jointing Block AP123. The under-cut channel holds the tape securely enabling a clean cut at 45° or 90°. Price: 10s. 6d.

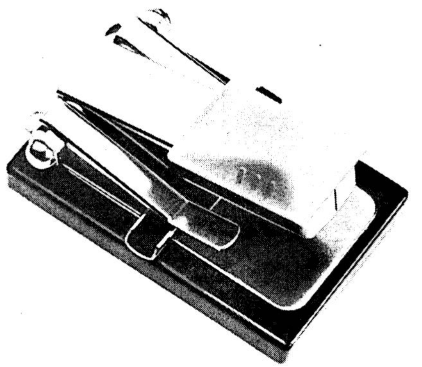
Emitape Non-magnetic Scissors. AP39. Made of non-ferrous metal, the scissors may be used for splicing magnetic tape without risk of magnetising, so ensuring a completely noiseless joint. Price: 16s.

Emitape Accessory Kit AP124. Holds three reels of coloured leader tape, 1 reel of jointing, 1 reel of stop foil, 1 Emitape jointing block, 2 cutters. Packed in plastic rack (to hold 7 spools), designed for the workbench. Price: £1 17s. 6d.

Emitape Metallic Stop Foil. AP125. Sufficient for 50 tapes. In plastic container. Price: 6s. 6d.

Emitape Plastic Spools in cartons. Price (AP93, 3 in.): 3s.; (AP93N, $3\frac{1}{4}$ in.): 3s.; (AP84, 4 in.): 3s. 6d.; (AP85, 5 in.): 4s.; (AP86, $5\frac{3}{4}$ in.): 4s. 6d.; (AP87, 7 in.): 5s.; (AP88, $8\frac{1}{4}$ in.): 8s. 6d.

Emicase. Polystyrene containers. Price (AP115, 5 in.): 3s. 6d.; (AP116, $5\frac{3}{4}$ in.): 3s. 6d.; (AP117, 7 in.): 4s.



Eagle T.635 Tape Splicer

A. C. FARNELL LTD., 81 Kirkstall Road, Leeds 3. Tel.: Leeds 35111.

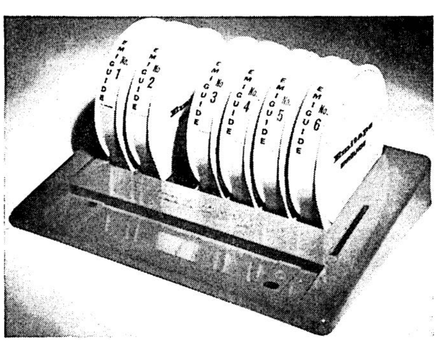
Irish S.P.3 Tape Splicer. Enables quick professional splices, without scissors or razor-blades. Uses $\frac{1}{4}$ in. of tape per splice, leaving edges free of adhesive. Removable base enables splicer to be mounted on recorder. Price: £3 7s. 6d. Spare cutter and fibre pad: 19s. 6d.

★

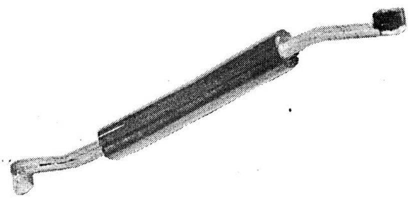
FI-CORD LTD., Charlwoods Road, East Grinstead, Sussex. Tel.: East Grinstead 21351.

Synchroslide. Compact transistorised unit for synchronising any automatic slide projector with tape recorder to give automatic slide programmes with sound. Press-button operated during recording adds subsonic pulse to the tape at each point where slides are to be changed. On replay this inaudible pulse triggers the slide projector. Supplied complete with all leads and instructions. Price: £14 14s.

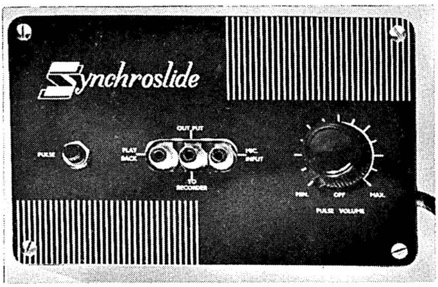
Synchrodek. Compact motorised unit for synchronising almost any 8 mm., 9·5 mm. or



Emiguide AP 128

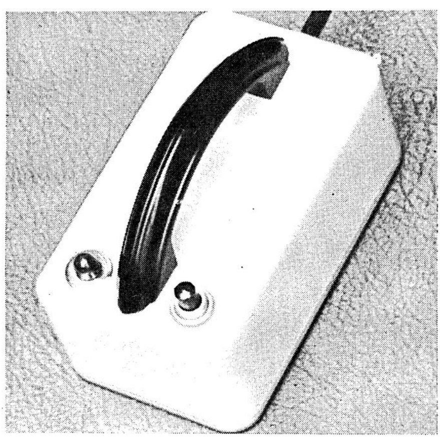


Global tape head cleaning tool



Fi-Cord Synchroslide

Fi-Cord Synchrodek



Global Mk 2 Bulk Eraser

16 mm. film projector to a tape recorder. Controls speed of projector in a locked system accurate to a $\frac{1}{16}$ second. Sprockets for various speeds of deck and projector also various accessories available. Price: £19 19s.

★

GEVAERT LTD., Great West Road, Brentford, Middx. Tel.: Isleworth 2131. Cables: Artoveg, Brentford-Hounslow.

Leader tapes. AmG/25 Green leader tape 82 ft. 2s. 6d.; AmR/25 Red leader tape 82 ft. 2s. 6d.

Empty spools. Supplied in boxes with tape clip and plastic bag. 3 in. 3s; 4 in. 3s. 9d.; 5 in. 4s. 3d.; $5\frac{3}{4}$ in. 4s. 6d.; 7 in. 4s. 9d.; $8\frac{1}{4}$ in. 7s.; 10 in. 12s. 3d.

★

GLOBAL PRODUCTS, 14 Underwood Road, Rothwell, Kettering, Northants. Tel.: Rothwell 540.

Bulk eraser Mk.2. Hand-operated bulk eraser housed in die-cast aluminium case $4\frac{1}{2} \times 3\frac{1}{2} \times 3\frac{1}{2}$ in. finished in hammer blue. Single push-button control with neon indicator to show when "on". Transformer double-insulated and instrument earthed via two yards three-core mains lead. Versions for 100-130V and 200-250V. AC only. Weight: 3 lb. 2 oz. Price: £5 14s. 6d.

Head assembly cleaning tool. Felt polisher and fibre scraper mounted on aluminium shaft with centre plastic grip enables heads, guides, pinch-wheels, etc., to be reached for cleaning. Special materials cannot harm tape head faces. Price: 5s.

★

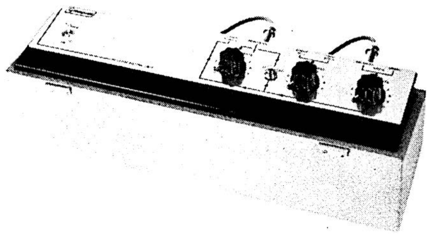
GRAMPIAN REPRODUCERS LTD., Hanworth Trading Estate, Feltham, Middx. Tel.: Feltham 2657. Cables: Reamp, Feltham.

Grampian G.7. Matching units, consisting of double wound transformer in a Mu-metal case with jack socket on the primary and a screened lead on the secondary. Dimensions: $3\frac{5}{8} \times 1\frac{1}{4}$ in. diameter. Versions available for matching 15/30 ohms, 600 ohms and 50,000 ohms or greater. Price: £3 10s.

Grampian Parabolic Reflector. Diameter 24 in., depth 5 in. Gain 14 dB over range of

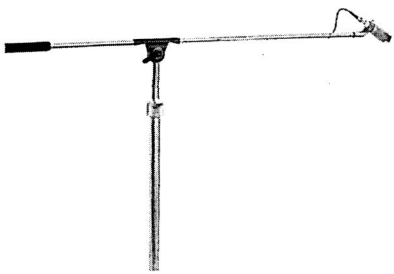
500 c/s to 5,000 c/s. To take Grampian DP4 Microphone. Weight: 4¾ lb. Price: £6 10s.

Grampian Reverberation Unit. Self-contained portable unit, transistorised and operated from internal dry batteries. Independent input channels, low level and high level. Output 1V, 600 ohms. Size (including detachable lid): 17½ × 5¼ × 6¼ in. Weight: 12 lb. Price: £52 (batteries extra). Mains unit available.



Grampian reverberation unit

Boom arm. Suitable for use with various types of microphones and stands. The clamp, locked by a single lever, allows the reach and angle to be readily adjusted as required. Length: 34 in. Weight: 1¾ lb. Thread termination for microphone $\frac{5}{16}$ in. BSF male, thread termination for stand ⅝ in. × 27 t.p.i. female. Supplied with adaptor to $\frac{5}{16}$ in. BSF female. Adaptors for other sizes available. Price: £5 15s. 6d.



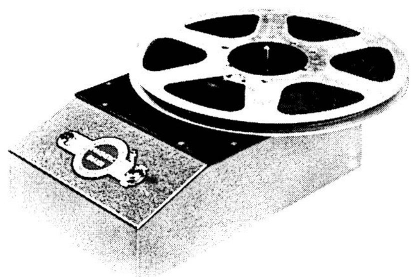
Grampian boom arm

Windshields. For use with DP4, DP6 and DP8 microphones. Pressure moulded cage with an inner lining and acoustic resistance network to reduce air turbulence to a low value. Size: 2¾ in. diameter. Weight: ¾ oz. Price: 17s. 6d.

★

GRUNDIG (G.B.) LTD., 40 Newlands Park, Sydenham, London, S.E.26. Tel.: Sydenham 2211.

Sona Dia. Designed to synchronise a tape recorder with automatic slide change projector. Recording sense: lower ¼-track. Power consumption 3W. Control Pulse Frequency 100 c/s. Price: £15 15s.



Harvey bulk eraser

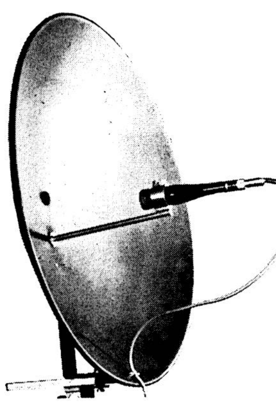
★

HARVEY ELECTRONICS LTD., 308 Farnborough Road, Farnborough, Hants. Tel.: Farnborough 41129. Cables: Harvelec, Farnborough, Hants.

A range of bulk erasers for 200-250V or 100-130V mains, 40-60 c/s. Smallest model will take 3¼ to 5 in. spools of ¼ in. tape, and the largest 3¼ to 12 in. spools of 1 in. tape. Prices, from £6 5s. to £15 10s.

★

ILFORD LTD., Ilford, Essex. Tel.: Ilford 3000. Zonal Films (Magnetic Coatings) Ltd., Zonal House, Westfields Road, Acton, London, W.3. Tel.: Acorn 6841. Cables: Zonagram, London, W.3.



Grampian Parabolic reflector

Coloured leader and timing tape. $7\frac{1}{2} \times 3\frac{3}{4}$ in. timing marks. 100 ft. Price: 4s. 6d.

Splicing tape. 108 ft. × $\frac{1}{4}$ in. Price: 3s. 6d.

Metallic Stop Foil. 100 ft. × $\frac{1}{4}$ in. Price: 4s. 6d.

★

KOSS. Distributors. Audioson Ltd., York House, Empire Way, Wembley, Middlesex. Tel.: Diligence 1886.

●**SP3X.** Stereo headphones. Response 10 c/s-15 Kc/s. Impedance 4-16 ohms. Moving coil. Sponge foam earpads. Distortion less than 1% at maximum audio output. 8 ft. 4-way lead. Weight: 15 oz. Supplied with adaptor

Koss T5 remote control

plate to facilitate use with mono and stereo systems. Colour: dark brown with beige ear and head cushions. Price: £9 18s.

●**PRO-4.** Professional quality stereo headphones. Response 30 c/s-20 Kc/s. Impedance 4-50 ohms. Moving coil. Fluid-filled ear cushions. Boom mic. attachment. Distortion less than 1% at maximum audio output. 8 ft. 4-way lead. Weight: 19 oz. Ear cushions removable for washing. Colour: grey-green cups with green ear cushions. Price: £17 10s.

●**T-5.** Remote control listening station. The T-5 box can be placed in the most convenient spot and separate gain controls for each channel enable balance and volume to be set precisely at the listening position. Switch to cut off speakers and jacks for stereophones. Size: $5\frac{7}{8} \times 3\frac{1}{8} \times 2\frac{7}{8}$ in. Weight: 14 oz. Price: £4.

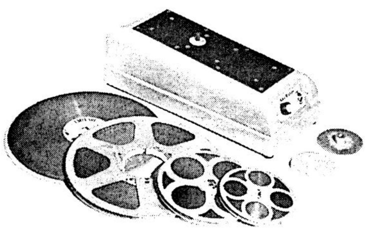
Koss PRO-4 stereo phones

LEEVERS-RICH EQUIPMENT LTD., 319b Trinity Road, Wandsworth, London, S.W.18. Tel.: Vandyke 9054/6. Cables: Leemag, London, S.W.18.

LeeRaser. Junior ER30A; Standard ER31B: Senior ER32B. Ultra rapid demagnetisers for spools of tape and accessories. Price: £7 10s.; £10; £20.

6 Band Audio Equaliser Model 46X. Wide range equaliser covering spectrum in 6 separately adjustable and overlapping bands, suitable for use in transcription to match widely differing recordings to a common quality standard. Price: £166.

Koss SP3X stereo phones



Leevers-Rich Leeraser ER32B

MASTERTAPE (MAGNETIC) LTD., Colnbrook, Slough, Bucks. Tel.: Colnbrook 2431.

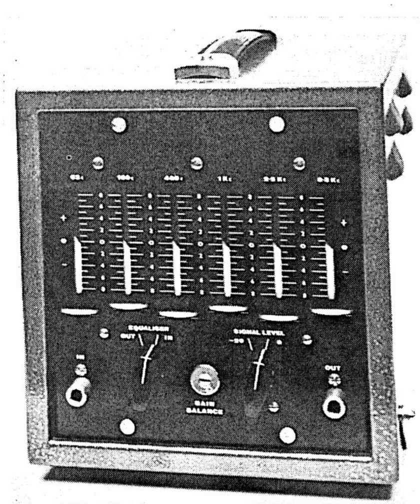
Splicing kit. Contains jointing tape, leader tape, jointing fluid with brush, Bib splicer and Mastertape calculator. Price: £1 5s.

Tape storage rack. Plastic-covered steel rack to hold any reel size from 3 in. to 7 in. Anti-slip rubber feet. Will also accommodate books. Price: 12s. 6d.

Empty spools in boxes. 3 in. 2s. 3d., 4 in. 3s., 5 in. 3s. 6d., $5\frac{3}{4}$ in. 3s. 9d., 7 in. 4s. 4d., $8\frac{1}{4}$ in. 5s. 6d.

★

MB ELECTRONIC. Distributors: Denham and Morley Ltd., Denmore House, 173/5 Cleveland Street, London, W.1. Tel.: Euston 3656. Cables: Denmorl, London, W.1.



Leevers-Rich six-band equaliser

●**K64.** Dynamic headphone for mono or stereo. F.R. 20 c/s-17 Kc/s. Impedance 200 ohms. Power requirements 60 mV/system. Weight: 5 oz. Round or oval earpads. Connection: two single screened leads 5 ft. 9 in. long.

●**K65.** Dynamic headphone for mono or stereo. Similar specification to K64 but with the addition of boom mounted moving coil microphone K84N.

●**K85.** Dynamic headphone for mono or stereo. Standard model 200 ohms. Other impedances available 50, 100, 700 and 1500 ohms. F.R. 20 c/s-17 Kc/s. Power requirements 60 mV/system. Weight: 5 oz. Round or oval earpads.

Various accessories available. Details and prices on request.

Grampian G.7 matching unit

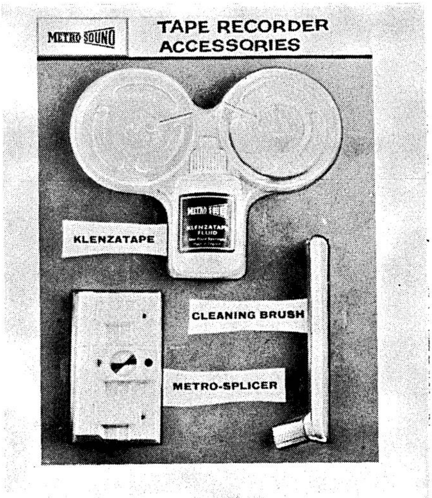
METRO-SOUND MANUFACTURING CO. LTD., Bridge Works, Wallace Road, Canonbury, London, N.1. Tel.: Canonbury 8641. Cables: Metrosound, London, N.1.

Metrostrobe. New design stroboscope for checking accuracy of tape recorder speeds at $3\frac{3}{4}$-$7\frac{1}{2}$ i/s and 15 i/s. Dials included for 50 c/s and 60 c/s. Price: 12s. 6d.

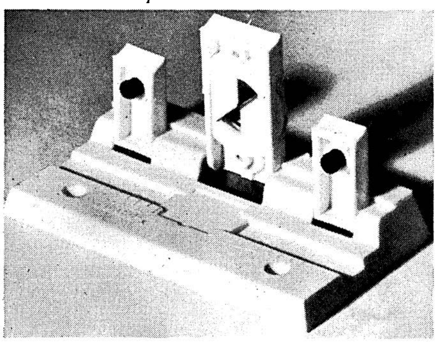
Klenzatape. Cleaning outfit for removing oxide deposits, dirt, etc., from tape heads *in situ.* Comprises a length of brushed velvet rubber-backed cleaning tape, two 3 in. spools and a bottle of cleaning fluid. Price: 13s. 6d. Replacement fluid 4s., replacement tape 6s.

Metro-Tabs. Set of coloured identifying tabs for affixing to recording tape. Visible on the wound spool and may be catalogued on the folder supplied. Price: 3s. 11d.

Metro-Brush. Made with specially angled Feathersoft Nylon for cleaning inaccessible places on tape decks, ciné cameras, projectors, etc. Price: 2s. 6d.



Metro-Sound tape accessories set


Metro-splicer

Metro-Sound tape strobe

Metro-Splicer. Suitable for splicing tape and 8 mm. ciné film. Cuts at any angle. Non-magnetic blade. Price: 15s.

Metro-Stop. Auto-stop actuator fluid. Should be applied to tape to actuate the auto-stop mechanism of the tape recorder. Special removing fluid is also supplied and the kit includes rod applicator for both Metro-Stop and remover. Price per set: 17s. 6d.

Tape Accessories Set. Contains Klenzatape, Metro-Splicer and Metro-Brush. Price: £1 10s.

★

MINNESOTA MINING AND MANUFACTURING COMPANY, 3M House, Wigmore Street, London, W.1. Tel.: Hunter 5522. Cables: Minnesota, London.

Tape Calculator. Giving playing times of standard, long play and double play tape. Free on request.

Scotch Accessory Kit. Contains Splicer, roll of No. 41 Splicing tape on dispenser, roll of No. 24 White Leader and Timing tape, cutter, 10 magnetic tape fastening clips. Price: £1 14s. 6d. Available separately: Tape clips. Price (per packet of 10): 2s. 6d. No. 24 Leader and Timing Tape. Price ($\frac{1}{4}$ in. × 100 ft.): 6s. No. 41 Splicing Tape ($\frac{1}{2}$ in. × 150 in.): 3s. 6d., ($\frac{7}{32}$ in. x 66 ft.): 4s. 6d., ($\frac{1}{2}$ in. x 66 ft.): 6s. 6d. No. 51 Sensing Tape. Price ($\frac{7}{32}$ in. × 150 in.): 14s.

★

MULTICORE SOLDERS LTD., Multicore Works, Hemel Hempstead, Herts. Tel.: Boxmoor 3636.

The "Bib" Tape Splicer. This splicer enables the tape to be joined easily and to be edited to the accuracy of a syllable. Supplied complete with razor cutter and mounted on flock-covered panel. Price: 18s. 6d.

The "Bib" Tape Accessory Kit contains "Bib" tape splicer. Tape reel labels, data card giving tape speeds. Splicing tape and spare cutters. Price: £1 8s. 6d.

"Bib" Tape Labels. Suitable for marking tape reels and boxes. Price: 2s. 6d.

★

OSMABET LTD., 46 Kenilworth Road, Edgware, Middlesex. Tel.: Stonegrove 9314.

"Instant" Bulk Tape Eraser and Recording Head Demagnetizer. Operates from AC mains to provide rapid and complete erase of tapes prior to making quality recordings. Weight: 18 oz. Price: £1 15s.

★

PHILIPS ELECTRICAL LTD., Electro-acoustics Division, Century House, Shaftesbury Avenue, London, W.C.2. Tel.: Gerrard 7777.

Empty spools. 3 in. 2s. 6d., 4 in. 3s., 5 in. 3s. 6d., 5¾ in. 3s. 9d., 7 in. 4s.

Leader tape. 210 ft. in green, red, blue or white. Price: 7s. 6d.

EL1901/50. Splicing kit. Contains white, green, red and blue leader tape, switching foil, adhesive tape, adhesive labels, cutting blade, splicing jig and instructions. Contained in plastic case. Price: £1 3s.

Stethoscope headphones. Various models. Mainly intended for use with Philips recorders. Price: (mono) £3 10s., (stereo) £5 10s.

EL3769/00 Slide synchroniser. Suitable for use with most Philips recorders. Price: £15 15s.

★

REVOX. Distributors: C. E. Hammond & Co. Ltd., 90 High Street, Eton, Windsor, Berks. Tel.: Windsor 63388. Telex.: 84316.

Slide-o-matic. Transistorised accessory for the Revox 736 stereophonic tape recorder which enables pulses to be recorded for the remote control of automatic transparency projectors. Price: £17 17s.

★

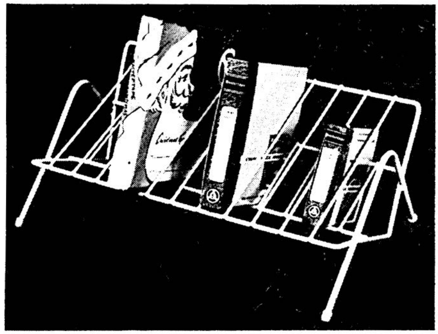
S.T.C. LTD., Electromechanical Division, West Road, Harlow, Essex. Tel.: Harlow 21341.

Stereo earphones. Moving-coil. F.R. 30 c/s-15 Kc/s ± 4 dB. Sensitivity 1 dyne/volt $+50$ dB. Imp. 200 ohms. Transformer fitted. Sponge pads fitted. Price: £6 6s.

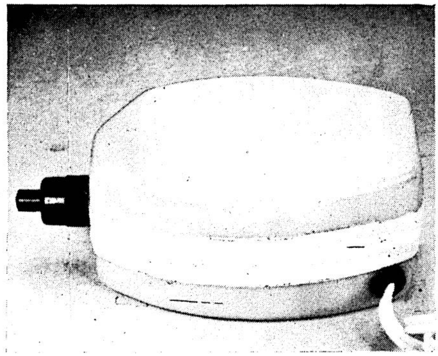
★

STUZZI. U.K. Distributors: Recording Devices Ltd., 197 Lower Richmond Road, Richmond, Surrey. Tel.: Prospect 4463.

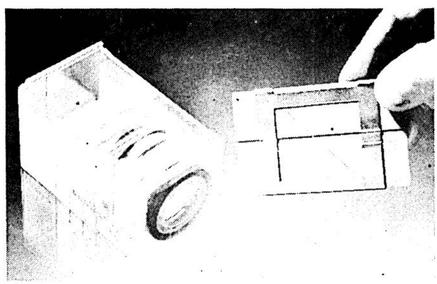
Stuzzi Tape Tuner. A.M. tuner variable tuning F.R. 190-550 m and 1,500 m preset.



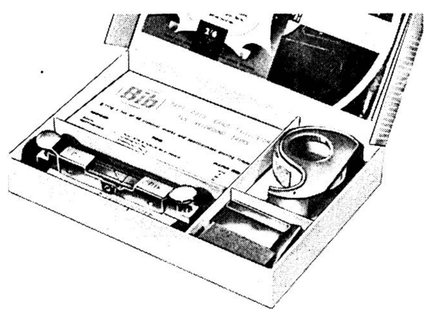
M.S.S. Tape-Rack



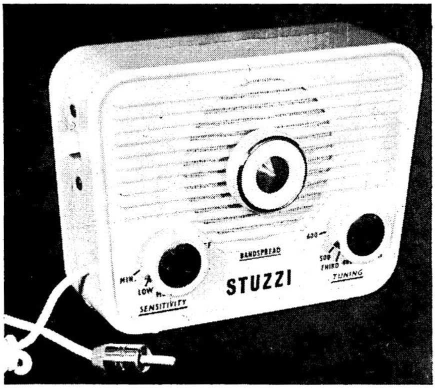
Instant Bulk Eraser



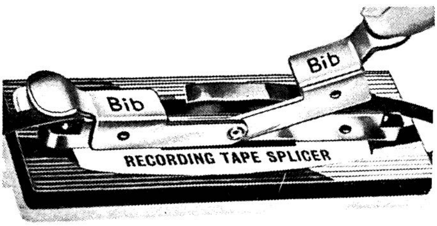
Philips EL 1901/50 Splicing Kit



Bib Tape Accessory Kit



Stuzzi Tape Tuner



Bib Tape Splicer

Wearite Defluxer

Scotch Accessory Kit

Powered by one PP3 battery. Printed circuit construction. Size: $5\frac{3}{4} \times 4\frac{1}{4} \times 1\frac{7}{8}$ in. Price: £4 1s. 10d. (U.K. purchase tax 13s. 2d.).

★

SYMPHONY AMPLIFIERS LTD., 16 King's College Road, London, N.W.3. Tel.: Primrose 3314/5.

Model A Tape Timer Unit. Contains special electric Time Unit with normal 12 hour dial. Neon Indicator. Fitted to take 13 amp or 15 amp socket for mains output on the back of the cabinet. Mains input is by flying lead. Price: £10 10s.

Model B. Similar to Model A, but in place of the neon indicator there is a special Process Timer with readings in one minute divisions up to 60 minutes. Price: £15 15s.

★

TAPE HEADS, LTD., High Street, Wollaston, Stourbridge, Worcs. Tel.: Stourbridge 6021. Cables: Electronics, Stourbridge. Registered office: Monarch Works, Powke Lane, Old Hill, Staffs.

Simplex Tape Record Sound Heads. Complete range of half-track, quarter-track and combined R/P-erase quarter-track tape record heads. Details and prices on application.

★

TAPE RECORDER MAINTENANCE LTD., 323 Kennington Road, London, S.E.11. Tel.: Reliance 5252.

Tape Head Cleaning Brush. Specially designed slim style brush with angled head for cleaning heads and guides, inside recorder sound channel, etc. Price: 4s. 3d.

★

TELEFUNKEN. Sole U.K. distributors: Welmec Corporation Ltd., Lonsdale Chambers, 27 Chancery Lane, London, W.C.2. Tel.: Chancery 9944. Cables: Welmcor, London.

Endless tape cassette. Price £2 10s.

★

TUTCHINGS ELECTRONICS LTD., 14 Rook Hill Road, Friars Cliff, Christchurch, Hants. Tel.: Highcliffe 2019.

Tapesponder's kit. Magnetic rubber for completely erasing tape and 40 ft. white noise azimuth alignment tape. Price: 5s. including postage.

UHER. Distributors: Bosch Ltd., 205 Great Portland Street, London, W.1. Tel.: Langham 1809.

631 Midget Magnetic Earphones. Price: £3 10s. 6d.

646 Stereo Midget Magnetic Earphones. Price: £7 10s.

★

VALRADIO LTD., Browells Lane, Feltham, Middlesex. Tel.: Feltham 4837/4242. Service department, 57 Fortess Road, Kentish Town, London, N.W.5. Tel.: Gulliver 5165.

D.C. Converters for operating tape recorders, etc., from car or boat battery, or ship's supply 110V DC and/or 220V DC. Prices from £14 14s. 6d.

Type 12/35T. Transistorised DC converter providing an output of 230V 50 c/s 25W from a 12V positive earth input (negative earth input available). Built-in switch-socket complete with input lead and fixing feet. Size: $9\frac{1}{2} \times 3\frac{1}{4} \times 2\frac{5}{8}$ in. Weight: 4 lb. Price: £9 16s. 6d.

★

WEIRCLIFFE. See Amos of Exeter Ltd.

★

WELLINGTON ACOUSTIC LABORATORIES LTD. (WAL). See Elstone Electronics Ltd.

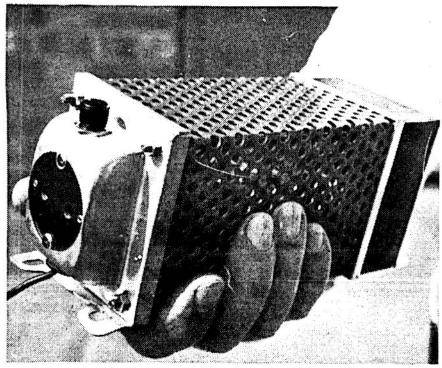
★

WRIGHT & WEAIRE LTD., 84 Blackfriars Road, London, S.E.1. Tel.: Waterloo 1981. Cables: Writewea, S.E.

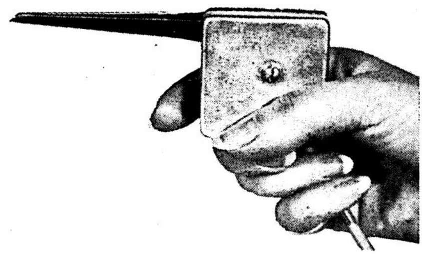
Wearite Defluxer. For depolarising heads of tape recorders and players. It ensures maximum signal/noise ratio from any tape recorder and protects recorded tapes from cumulative background noise and the gradual attenuation of the higher frequencies. Price: £2 10s.

★

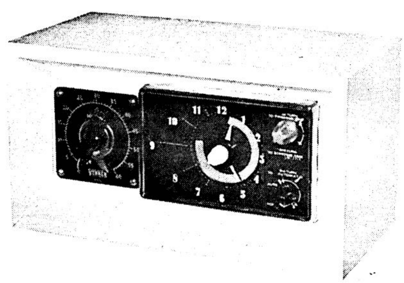
ZONATAPE. See Ilford.



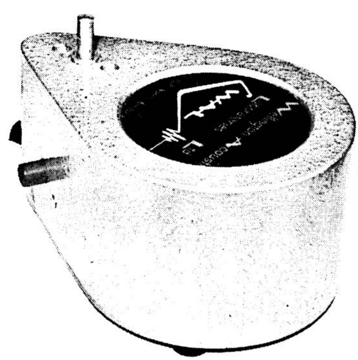
Valradio Type 12/35T D.C. converter



WAL D-MAG



Symphony model B tape timer



WAL Tape Eraser

Length of tape in feet	Type of spool	Maximum playing times in hours and minutes											
		1 Track				2 Tracks				4 Tracks			
		15 i/s	$7\frac{1}{2}$ i/s	$3\frac{3}{4}$ i/s	$1\frac{7}{8}$ i/s	15 i/s	$7\frac{1}{2}$ i/s	$3\frac{3}{4}$ i/s	$1\frac{7}{8}$ i/s	15 i/s	$7\frac{1}{2}$ i/s	$3\frac{3}{4}$ i/s	$1\frac{7}{8}$ i/s
3,600	$8\frac{1}{4}$″ DP	48	1 36	3 12	6 24	1 36	3 12	6 24	12 48	3 12	6 24	12 48	25 36
2,400	7″ DP $8\frac{1}{4}$″ LP	32	1 4	2 8	4 16	1 4	2 8	4 16	8 32	2 8	4 16	8 32	17 4
1,800	5″ TP 7″ LP $8\frac{1}{4}$″ S	24	48	1.36	3.12	48	1.36	3.12	6.24	1.36	3.12	6.24	12.48
1,700	$5\frac{3}{4}$″ DP	22	47	1 30	3 1	45	1 30	3 1	6 2	1 30	3. 1	6 2	12 5
1,200	5″ DP $5\frac{3}{4}$″ LP 7″ S	16	32	1 4	2 8	32	1 4	2 8	4 16	1 4	2 8	4 16	8 32
900	4″ TP 5″ LP	12	24	48	1 36	24	48	1 36	3 12	48	1 36	3 12	6 24
850	$5\frac{3}{4}$″ S	11	22	45	1 30	22	45	1 30	3 1	45	1 30	3 1	6 2
600	4″ DP 5″ S	8	16	32	1 4	16	32	1 4	2 8	32	1 4	2 8	4 16
450	3″ TP 4″ LP	6	12	24	48	12	24	48	1 36	24	48	1 36	3 12
400	$3\frac{1}{4}$″ DP	5	10	21	42	10	21	42	1 25	21	42	1 25	2 50
300	$3\frac{1}{4}$″ LP 4″ S	4	8	16	32	8	16	32	1 4	16	32	1 4	2 8
200	$3\frac{1}{4}$″ S	$2\frac{1}{2}$	5	10	21	5	10	21	42	10	21	42	1 25
150	3″ S	2	4	8	16	4	8	16	32	8	16	32	1 4

Note: *The 4 tape thicknesses are listed as S (Standard), LP (Long Play), DP (Double Play) and TP (Triple Play).*

DIRECTORY OF MAGNETIC TAPE

AGFA A. G., Leverkusen, W. Germany. Agfa Ltd., 27 Regent Street, London, S.W.1. Tel.: Regent 8581.

PE31. Long Play. 3 in. spool 210 ft. 9s.; 4 in. spool 450 ft. 14s. 6d.; 4¼ in. spool 600 ft. £1 1s.; 5 in. spool 900 ft. £1 8s.; 5¾ in. spool 1,200 ft. £1 15s.; 7 in. spool 1,800 ft. £2 10s.; 8¼ in. spool 2,400 ft. £3 12s. 6d.; 10 in. spool 3,280 ft. £4 8s. 6d.

PE41. Double Play. 3 in. spool 300 ft. 13s. 9d.; 4 in. spool 600 ft. £1 4s. 3d.; 4¼ in. spool 900 ft. £1 12s. 3d.; 5 in. spool 1,200 ft. £2 0s. 3d.; 5¾ in. spool 1,800 ft. £2 17s. 6d.; 7 in. spool 2,400 ft. £3 16s. 6d.; 8¼ in. spool 3,600 ft. £5 16s. 6d.; 10 in. spool 4,600 ft. £7 2s. 6d.

PE65. Triple Play. 3 in. spool 450 ft. £1 2s. 6d.; 4 in. spool 900 ft. £1 19s.; 4¼ in. spool 1,200 ft. £2 6s. 3d.; 5 in. spool 1,800 ft. £3 6s. 3d.; 5¾ in. spool 2,400 ft. £4 8s.; 7 in. spool 3,600 ft. £5 15s.

5, 5¾ and 7 in. spools also available in plastic library cassettes at additional cost of 2s. 6d.

★

BASF CHEMICALS LTD., 5a Gillespie Road, London, N.5. Tel.: Canonbury 2011.

LGS 52. Standard Play. PVC base. 5 in. spool 600 ft. £1 1s.; 5¾ in. spool 900 ft. £1 8s.; 7 in. spool 1,200 ft. £1 15s.; 8¼ in. spool 1,800 ft. £2 17s. 6d.

LGS 35. Long Play. PVC base. 3 in. spool 210 ft. 9s.; 4 in. spool 450 ft. 14s. 6d.; 4¼ in. spool 600 ft. £1 1s.; 5 in. spool 900 ft. £1 8s.; 5¾ in. spool 1,200 ft. £1 15s.; 7 in. spool 1,800 ft. £2 10s.; 8¼ in. spool 2,400 ft. £3 12s. 6d.; 10 in. spool 3,600 ft. £4 15s.

LGS 26. Double Play. PVC base. 3 in. spool 300 ft. 14s.; 4 in. spool 600 ft. £1 5s.; 4¼ in. spool 900 ft. £1 10s.; 5 in. spool 1,200 ft. £2 2s.; 5¾ in. spool 1,800 ft. £2 15s.; 7 in. spool 2,400 ft. £3 17s. 6d.

PES 18. Triple Play. Polyester base. 3 in. spool 450 ft. £1 2s.; 4 in. spool 900 ft. £1 19s.; 4¼ in. 1,200 ft. £2 9s.; 5 in. spool 1,800 ft. £3 6s.; 5¾ in. spool 2,400 ft. £4 10s.; 7 in. spool 3,600 ft. £5 15s.

Tape Library Box. Holds three tapes, in swivel-open cassettes to provide easy reference. Available with one or three LP or DP tapes.

With one LP 5 in. £1 11s.; 5¾ in. £1 18s. 6d.; 7 in. £2 15s.

With three LP 5 in. £4 4s.; 5¾ in. £5 5s.; 7 in. £7 10s.

With one DP 5 in. £2 5s.; 5¾ in. £2 18s. 6d.; 7 in. £4 2s. 6d.

With three DP 3 in. £2 2s.; 4 in. £3 15s.; 4¼ in. £4 10s.; 5 in. £6 6s.; 5¾ in. £8 5s.; 7in. £11 12s. 6d.

★

C.B.S. TAPES, 190 Palace Chambers, Bridge Street, London, S.W.1. Tel.: Whitehall 1851.

CIP. Standard Play. Acetate base. 3 in. spool, 150 ft. 5s. 6d.; 4 in. spool, 300 ft. 9s. 6d.; 5 in. spool, 600 ft. 17s. 6d.; 5¾ in. spool, 900 ft. £1 3s.

CIP-12PR. Professional. 7 in. spool, 1,200 ft. £1 7s. 6d.

L.P. Long Play. Acetate base. 5 in. spool, 900 ft. £1 1s.; 5¾ in. spool, 1,200 ft. £1 5s.; 7 in. spool, 1,800 ft. £1 15s.

CMXP. Double play. Mylar base. 3 in. spool, 300 ft. 10s.; 5 in. spool, 1,200 ft. £1 14s.; 5¾ in. spool, 1,800 ft. £2 5s.; 7 in. spool, 2,400 ft. £2 16s.

CIM. Standard play. Mylar base. 5 in. spool, 600 ft. £1 1s.; 7 in. spool, 1,200 ft. £1 15s.

CMLP. Long play. Mylar base. 5 in. spool, 900 ft. £1 5s.; 5¾ in. spool, 1,200 ft. £1 12s.; 7 in. spool, 1,800 ft. £2 7s.

CMXPX. Extra-Long play. Mylar base. 5 in. spool, 1,200 ft. £2 2s.; 5¾ in. spool, 1,800 ft. £2 15s.; 7 in. spool, 2,400 ft. £3 8s.

Triple play tape now available, prices and details on request.

★

DE VILLIERS (ELECTRONIC WORLD) LTD., 16-20 Strutton Ground, Westminster, London, S.W.1. Tel.: Abbey 5960.

Standard Play. PVC base. Spool sizes: 3 in., 150 ft. Price (four spools): 18s., (1 doz. spools): £2 8s.; 4 in., 300 ft. Price (four spools): £1 6s.; 5 in., 600 ft. Prices (two spools): £1 6s., 5¾ in., 900 ft. Price: 16s.; 7 in., 1,200 ft. Price: 19s.

Long Play. Pre-stressed polyester base. Spool sizes: 3 in., 225 ft. Price (four spools): £1 2s., (1 doz. spools): £3; 4 in., 450 ft. Price (two spools): £1 1s.; 5 in., 900 ft. Price (two spools): £1 15s., 5¾ in., 1,200 ft. Price: £1 4s.; 7 in., 1,800 ft. Price: £1 11s.; 8¼ in., 2,400 ft. Price: £2 5s.; 10 in. 3,600 ft. Price: £3 10s.

Double Play. Pre-stressed polyester base. Spool sizes: 3 in., 375 ft. Price (two spools): £1, (1 doz. spools): £5 8s.; 4 in., 600 ft. Price (two spools): £1 10s.; 5 in., 1,200 ft. Price: £1 7s.; 5¾ in., 1,800 ft. Price: £1 15s.; 7 in., 2,400 ft. Price: £2 5s.; 8¼ in., 3,200 ft. Price: £3 6s.; 10 in., 4,800 ft. Price: £5.

Triple Play. Pre-stressed polyester base. Spool sizes: 3 in., 475 ft. Price (two spools): £1 6s. 6d., (1 doz. spools): £7 10s.; 3¼ in., 650 ft. Price: 17s.; 4 in., 900 ft. Price: £1 3s. 6d.; 5 in., 1,700 ft. Price: £2; 5¾ in., 2,300 ft. Price: £2 12s. 6d.; 7 in., 3,300 ft. Price: £4.

All "Electronic World" tapes are sold by mail order direct from De Villiers Ltd., and the prices given are post free.

★

E.M.I. TAPE LTD., Blyth Road, Hayes, Middlesex. Tel.: Hayes 3888. Cables: Emitape, London.

"77" Standard Play. PVC. Professional 'pen-tested' grade. 5 in. spool 600 ft. £1 5s.; 5¾ in. spool 900 ft. £1 13s. 6d.; 7 in. spool 1,200 ft. £2 2s.; 8¼ in. spool 1,800 ft. £3 5s.; 10½ in. spool £4 11s. 6d.; 11½ in. spool £4 9s.

"88" Standard Play. PVC base. 3 in. spool 175 ft. 7s. 6d.; 3¼ in. spool 175 ft. 7s. 6d.; 4 in. spool 300 ft. 10s. 6d.; 5 in. spool 600 ft. £1 1s.; 5¾ in. spool 900 ft. £1 8s.; 7 in. spool 1,200 ft. £1 15s.; 8¼ in. spool 1,800 ft. £2 13s. 6d.; 10½ in. spool £3 16s.; 11½ in. spool £3 13s. 6d.

"99" Long Play. P.E. base. 3 in. spool 250 ft. 9s. 6d.; 3¼ in. spool 250 ft. 9s. 6d.; 4 in. spool 450 ft. 14s. 6d.; 5 in. spool 900 ft. £1 8s.; 5¾ in. spool 1,200 ft. £1 15s.; 7 in. spool 1,800 ft. £2 10s.; 8¼ in. spool 2,400 ft. £3 8s. 6d.; 10½ in. spool £5 6s.

"100" Double Play. Polyester base. 3 in. spool 400 ft. 17s.; 3¼ in. spool 400 ft. 17s.; 4 in. spool 600 ft. £1 5s.; 5 in. spool 1.200 ft. £2 5s.; 5¾ in. spool 1,800 ft. £2 17s. 6d.; 7 in. spool 2,400 ft. £4.

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GEVAERT LTD., Great West Road, Brentford, Middx. Tel.: Isleworth 2131. Cables: Artoveg, Brentford-Hounslow.

Gevasanor Type M. Standard Play. Triacetate base, 3 in. spool 150 ft. 5s. 3d.; 4 in. spool 300 ft. 10s. 6d.; 5 in. spool 600 ft. 18s.; 5¾ in. spool 900 ft. £1 3s. 6d.; 7 in. spool 1,200 ft. £1 10s.; 8¼ in. spool 1.800 ft. £2 3s. 6d.; 10 in. spool 2,400 ft. £2 15s.

Gevasonor Type LR. Long Play. Triacetate base. 3 in. spool 300 ft. 8s.; 4 in. spool 450 ft. 13s. 6d.; 5 in. spool 900 ft. £1 4s.; 5¾ in. spool 1,200 ft. £1 8s. 6d.; 7 in. spool 1,800 ft. £2 2s.; 8¼ in. spool 2,400 ft. £2 15s.; 10 in. spool 3,600 ft. £4.

Gevasonor Type LRP. Long Play. Tensilised polyester. 3 in. spool 300 ft. 9s. 6d.; 4 in. spool 450 ft. 16s.; 5 in. spool 900 ft. £1 8s.; 5¾ in. spool 1,200 ft. £1 15s.; 7 in. spool 1,800 ft. £2 10s.; 8¼ in. spool 2,400 ft. £3 5s.; 10 in. spool 3,600 ft. £4 15s.

Gevasonor Type DP. Double Play. Tensilised polyester. 3 in. spool 400 ft. 17s.; 4 in. spool 600 ft. £1 5s.; 5 in. spool 1,200 ft. £2 5s.; 5¾ in. spool 1,700 ft. £2 15s.; 7 in. spool 2,400 ft. £4.

Gevasonor Type TRP. Triple Play. Tensilised polyester. 3 in. spool 450 ft. £1 1s. 6d.; 3 in. spool 600 ft. £1 7s. 6d.; 4 in. spool 900 ft. £1 18s. 6d.; 5 in. spool 1.800 ft. £3 5s. 6d.

★

ILFORD LTD., Ilford, Essex. Tel.: Ilford 3000. Zonal Films (Magnetic Coatings) Ltd., Zonal House, Westfields Road, Acton, London, W.3. Tel.: Acorn 6841. Cables: Zonagram, London, W.3.

Zonatape. Standard Play. PVC base. 3 in. spool 150 ft. 5s. 9d.; 3¼ in. spool 175 ft. 7s. 6d.; 4 in. spool 300 ft. 10s. 6d.; 5 in. spool 600 ft. £1 1s.; 5¾ in. spool 900 ft. £1 8s.; 7 in. spool 1,200 ft. £1 15s.; 8¼ in. spool 1,800 ft. £2 17s. 6d.; 10½ in. spool 2,400 ft. £3 18s. 6d.

Zonatape. Extra Play. Polyester base. 3 in. spool 225 ft. 9s.; 3¼ in. spool 300 ft. 12s.; 4 in.

spool 450 ft. 14s. 6d.; 5 in. spool 900 ft. £1 8s.; 5¾ in. spool 1,200 ft. £1 15s.; 7 in. spool 1,800 ft. £2 10s.; 8¼ in. spool 2,400 ft. £3 12s. 6d.; 10½ in. spool 3,600 ft. £5 8s.

Zonatape. Double Play. Polyester base. 3 in. spool 300 ft. 13s. 6d.; 3¼ in. spool 400 ft. 17s.; 4 in. spool 600 ft. £1 5s.; 5 in. spool 1,200 ft. £2 5s.; 5¾ in. spool 1,800 ft. £2 17s. 6d.; 7 in. spool 2,400 ft. £3 17s. 6d.; 8¼ in. spool 3,600 ft. £6.

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KODAK LTD., Kodak House, Kingsway, London, W.C.2. Tel.: Holborn 7841.

T100. Standard play. Triacetate base. 5 in. spool 600 ft. 18s.; 5¾ in. spool 900 ft. £1 4s. 6d.; 7 in. spool 1,200 ft. £1 10s.

V150. Long play. PVC base. 3¼ in. spool 300 ft. 11s.; 5 in. spool 900 ft. £1 8s.; 5¾ in. spool 1,200 ft. £1 15s.; 7 in. spool 1,800 ft. £2 10s.

P200. Double play. Pre-stretched polyester base. 3¼ in. spool 400 ft. 17s.; 4 in. spool 600 ft. £1 4s. 6d.; 5 in. spool 1,200 ft. £2 5s.; 5¾ in. spool 1,650 ft. £2 15s.; 7 in. spool 2,400 ft. £4.

P300. Triple play. Pre-stretched polyester base. 3 in. spool 450 ft. £1 1s. 6d.; 3¼ in. spool 600 ft. £1 7s. 6d.; 4 in. spool 900 ft. £1 18s. 6d.; 5 in. spool 1,800 ft. £3 5s. 6d.; 5¾ in. spool 2,400 ft. £4 10s.; 7 in. spool 3,600 ft. £5 15s.

P400. Quadruple play. Pre-stretched polyester base. 3 in. spool 600 ft. £1 13s. 6d.; 3¼ in. spool 800 ft. £2 2s.; 4 in. spool 1,200 ft. £2 18s. 6d.

★

LEE PRODUCTS (GREAT BRITAIN) LTD. —(Concessionaires of Audio Devices Inc. (U.S.A.), 10-18 Clifton Street, London, E.C.2. Tel.: Bishopsgate 6711. Cables: Leprod, London.

Audiotape. A range of 8 grades and thicknesses for amateur and professional use. Spool sizes: 3, 3¼, 4, 5, 5¾, 7 in.

MASTERTAPE (MAGNETIC) LTD., Colnbrook, Slough, Bucks. Tel.: Colnbrook 2431.

Standard. 3 in. spool 150 ft. 4s. 6d.; 4 in. spool 300 ft. 8s.; 5 in. 600 ft. 15s.; 5¾ in. 900 ft. £1.; 7 in. 1,200 ft. £1 5s.

Long Play. 3 in. spool 225 ft. 6s.; 4 in. spool 450 ft. 11s.; 5 in. spool 900 ft. £1.; 5¾ in. spool 1,200 ft. £1 5s.; 7 in. 1,800 ft. £1 15s.; 8¼ in. spool 2,400 ft. £2 8s.

Double Play. 3 in. spool 300 ft. 9s.; 4 in. 600 ft. 17s.; 5 in. spool 1,200 ft. £1 13s.; 5¾ in. 1,800 ft. £2 4s.; 7 in. spool 2,400 ft. £2 15s.

Mini-voice letter. 10 minutes playing time. Complete with box and two envelopes. Price: 2s. 8d., 20-minute size 5s. 3d.

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MINNESOTA MINING AND MANUFACTURING COMPANY, 3M House, Wigmore Street, London, W.1. Tel.: Hunter 5522. Cables: Minnesota, London.

Scotch 111. Standard Play. Acetate base. 4 in. spool 300 ft. 9s.; 5 in. spool 600 ft. 18s.; 5¾ in. spool 850 ft. £1 4s. 6d.; 7 in. spool 1,200 ft. £1 10s.

Scotch 175. Standard Play. Polyester base. 5 in. spool 600 ft. £1 0s. 6d.; 5¾ in. spool 850 ft. £1 7s. 6d.; 7 in. spool 1,200 ft. £1 15s.

Scotch 150. Long Play. Polyester base. 3 in. spool 300 ft. 9s. 6d.; 4 in. spool 450 ft. 14s. 6d.; 5 in. spool 900 ft. £1 7s. 6d.; 5¾ in. spool 1,200 ft. £1 14s. 6d.; 7 in. spool 1,800 ft. £2 9s.; 8¼ in. spool 2,400 ft. £3 12s. 6d.

Scotch 200. Double Play. Tensilised polyester. 3 in. spool 400 ft. 16s. 6d.; 4 in. spool 600 ft. £1 4s. 6d.; 5 in. spool 1,200 ft. £2 1s. 9d.; 5¾ in. spool 1,800 ft. £2 15s.; 7 in. spool 2,400 ft. £3 16s. 6d.

Scotch 290. Triple Play. Tensilised polyester. 3 in. spool 600 ft. £1 4s. 9d.; 4 in. spool 900 ft. £1 18s. 6d.

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PHILIPS ELECTRICAL LTD., Electro-acoustics Division, Century House, Shaftesbury Avenue, London, W.C.2. Tel.: Gerrard 7777.

Standard Play (Green) 4 in. spool 300 ft. 10s. 6d.; 5 in. spool 600 ft. £1 1s.; 5¾ in. spool 900 ft. £1 8s.; 7 in. spool 1,200 ft. £1 15s.

Long Play (Red). 3 in. spool 210 ft. 9s.; 4 in. spool 450 ft. 14s. 6d.; 5 in. spool 900 ft. £1 8s.; 5¾ in. spool 1,200 ft. £1 15s.; 7 in. spool 1,800 ft. £2 10s.

Double Play (Blue). 3 in. spool 300 ft. 14s.; 4 in. spool 600 ft. £1 5s.; 5 in. spool 1,200 ft. £2 2s.; $5\frac{3}{4}$ in. spool 1,800 ft. £2 15s. 6d.; 7 in. spool 2,400 ft. £3 17s. 6d.

Triple Play (Grey). 3 in. spool 450 ft. £1 2s.; 4 in. spool 900 ft. £1 19s.; 5 in. spool 1,800 ft. £3 6s.

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R.C.A. GREAT BRITAIN LTD., Lincoln Way, Windmill Road, Sunbury-on-Thames, Middx. Tel.: Sunbury-on-Thames 5511.

Vibrant Sound tape. Standard play. Acetate base. 5 in. spool 600 ft. 18s.; 7 in. spool 1,200 ft. £1 10s.

Vibrant Sound tape. Long play. Mylar base. 5 in. spool 900 ft. £1 7s.; $5\frac{3}{4}$ in. spool 1,200 ft. £1 14s.; 7 in. spool 1,800 ft. £2 8s.

Vibrant Sound tape. Double play. Tensilised mylar base. 5 in. spool 1,200 ft. £2 2s.; $5\frac{3}{4}$ in. spool 1,800 ft. £2 15s.; 7 in. spool 2,400 ft. £3 16s.

Special low noise and low print tapes in $\frac{1}{4}$ in., $\frac{1}{2}$ in. and 1 in. widths available on plastic or metal reels. Also NAB metal hub spools.

★

SCOTCH. See Minnesota Mining & Manufacturing Co.

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SONY. U.K. Sales Division, Eastbrook Road, Eastern Avenue, Gloucester. Tel.: Gloucester 26841. Cables: DEBELEC, Gloucester.

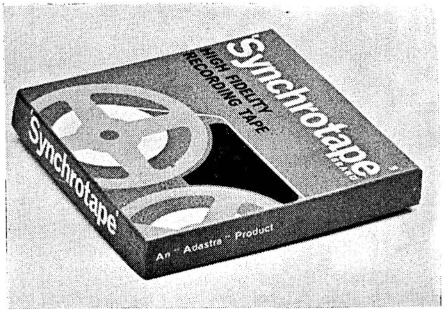
MY Long Play. Polyester base. Spool sizes: 3 in., 260 ft.; 5 in., 900 ft., 7 in., 1,800 ft. Prices on application.

★

SYNCHROTAPE. Sole distributors: Adastra Electronics Ltd., 167 Finchley Road, Swiss Cottage, London, N.W.3. Tel.: Maida Vale 8164.

Standard Play. PVC base. 3 in. spool 150 ft. 4s. 9d.; 5 in. spool 600 ft. 15s.; $5\frac{3}{4}$ in. spool 900 ft. 18s. 6d.; 7 in. spool 1,200 ft. £1 2s. 6d.

Long Play. PVC base. 3 in. spool 225 ft. 6s. 3d.; 4 in. spool 450 ft. 12s.; 5 in. spool 900 ft. 18s. 6d.; $5\frac{3}{4}$ in. spool 1,200 ft. £1 2s. 6d.; 7 in. spool 1,800 ft. £1 8s. 6d.



Synchrotape

Double Play. Tensilised polyester base. 3 in. spool 300 ft. 8s. 9d.; 4 in. spool 600 ft. 18s.; 5 in. spool 1,200 ft. £1 8s. 6d.; $5\frac{3}{4}$ in. spool 1,800 ft. £1 16s.; 7 in. spool 2,400 ft. £2 8s.

Triple Play. Tensilised polyester. 3 in. spool 450 ft. 13s. 9d.; 4 in. spool 900 ft. £1 7s.

Except for 3 in. spools, all Synchrotapes have Double Leader and Double Stop-Foils.

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TELEFUNKEN.—Sole U.K. Distributors: Welmec Corporation Ltd., Lonsdale Chambers, 27 Chancery Lane, London, W.C.2. Tel.: Chancery 9944. Cables: Welmcor, London.

Telefunken. Long Play. PVC base. 5 in. spool 900 ft. £1 8s.; $5\frac{3}{4}$ in. spool 1,200 ft. £1 15s.; 7 in. spool 1,800 ft. £2 10s.

Telefunken. Double Play. PVC base. 5 in. spool 1,200 ft. £2; $5\frac{3}{4}$ in. spool 1,800 ft. £2 10s.; 7 in. spool 2,400 ft. £3 15s.

Endless tape cassette. Price: £2 10s.

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UHER. Distributors: Bosch Ltd., 205 Great Portland Street, London, W.1. Tel.: Langham 1809-1800.

Long Play. 5 in. spool 900 ft. £1 8s.; $5\frac{3}{4}$ in. spool 1,200 ft. £1 15s.; 7 in. spool 1,800 ft. £2 10s.

★

ZONATAPE. See Ilford.

DIRECTORY OF TEST TAPES & DISCS

AMPEX (GREAT BRITAIN) LTD., Acre Road, Reading, Berkshire. Tel.: Reading 84411. Cables: Videotape, Reading.

31334-01. 3¾ i/s, 200 μSec. characteristic tape.

31331-01. 3¾ i/s. 120 μSec. characteristic tape.

31321-01. 7½ i/s. NAB characteristic tape.

31321-04. 7½ i/s. NAB characteristic tape, for four-track recorders.

31323-01. 7½ i/s. CCIR characteristic tape.

31336-01. 3¾ i/s. flutter test tape.

31326-01. 7½ i/s. flutter test tape.

All these tapes are priced at £8.

★

BASF CHEMICALS LTD., 5a Gillespie Road, London, N.5. Tel.: Canonbury 2011.

Calibration Tape 19. 7½ i/s, 100 μSec. characteristic. Azimuth alignment section included, also an unrecorded section for adjustment of bias, etc. Price: £11.

Calibration Tape 9. 3¾ i/s, 120 μSec. (high) and 3·180 μSec. (low) characteristics. Other details as for Tape 19. Price: £11.

Calibration Tape 38. 15 i/s. 35 μSec. characteristic. Other details as for Tape 19. Price: £11.

★

DECCA SPECIAL PRODUCTS, Decca Radio and Television Division of the Decca Record Co. Ltd., Ingate Place, Queenstown Road, London, S.W.8. Tel.: Macaulay 6677.

LXT 5346. 12 in. mono (lateral) frequency test disc covering the range 30 c/s to 18 Kc/s, with fixed bands on one side and gliding tone on the other. Follows RIAA curve, with level reduced by 6 dB above 10 Kc/s. Price: £1 12s. 3d. (U.K. purchase tax 5s. 3d.).

45-71123. 7 in. mono (lateral) frequency test disc covering the range 50 c/s to 10 Kc/s in fixed bands. Follows RIAA curve. Price: 5s. 9d. (U.K. purchase tax 11d.).

SXL 2057. 12 in. stereo (45/45) frequency test disc covering the range 40 c/s to 12 Kc/s in fixed bands, with left-hand channel only on side A and right hand on side B. Follows RIAA curve. Crosstalk at 1 Kc/s better than −20 dB. Price: £1 12s. 3d. (U.K. purchase tax 5s. 3d.).

★

DEUTSCHE GRAMMOPHON (G.B.) LTD., 12/13 Rathbone Place, Oxford Street, London, W.1. Tel.: Langham 8156/7/8/9. Cables: Gramdisc, London, W.1.

Polydor SNH 220497. 7 in. stereo test disc for setting-up purposes. Side A carries signals permitting adjustments for correct balance, response and speaker phasing. Side B carries demonstration recordings of a tramcar, train, aircraft and dance orchestra. Price: 6s. 8d.

★

EMI ELECTRONICS LTD., Hayes, Middx. Tel.: Hayes 3888. Cables: Emidata, London.

SRT12. Professional frequency test tape, 15 i/s, 35 μSec. CCIR characteristic. 15 Kc/s-40 c/s, with 15 Kc/s tone for azimuth alignment. 3 Kc/s band for wow and flutter checking has total wow and flutter contents better than 0·08% RMS. Length of tape with strobe markings for speed check included. Price: £10.

SRT13. Professional frequency test tape, 7½ i/s, 100 μSec. CCIR characteristic. 10 Kc/s-40 c/s, with 10 Kc/s tone for azimuth alignment. 3 Kc/s band for wow and flutter checking has total wow and flutter contents better than 0·08% RMS. Length of tape with strobe markings for speed check included. Price: £10.

SRT14. Professional frequency test tape, 3¾ i/s, 120 μSec. characteristic as proposed by I.E.C. (British 3¾ i/s pre-recorded tapes use this). Other details as for SRT13, but no strobe section. Price: £10.

SRT15. Professional frequency test tape, 3¾ i/s, 200 μSec. characteristic. 6 Kc/s-40 c/s, with 6 Kc/s tone for azimuth alignment and 4 Kc/s for equaliser setting. 3 Kc/s wow and flutter band. Price: £10.

EMI LTD., Tape Record Department, Hayes, Middx. Tel.: Hayes 3888. Cables: Emitron, London.

Type TBT 1. Full track tape, 7½ i/s, 100 µSec. CCIR characteristic. Range 40 c/s-10 Kc/s, with 8 Kc/s Aximuth alignment band. Price: £3.

★

EMI RECORDS (The Gramophone Co. Ltd.), EMI House, 20 Manchester Square, London, W.1. Tel.: Hunter 4488.

TCS 101. 12 in. stereo (45/45) frequency test disc covering the range 30 c/s to 20 Kc/s, with fixed bands on alternate left and right channels. Follows RIAA curve, with level reduced by 6 dB above 10 Kc/s. Both sides identical. Price: £1 17s. 6d.

TCS 102. 12 in. stereo (45/45) frequency test disc covering same range as TCS 101, but with gliding tone. Side A, left channel; side B, right channel. Price: £1 17s. 6d.

TCS 104. 12 in. mono (lateral) frequency test disc covering same range as TCS 101, with fixed bands on one side and gliding tone on the other. Price: £1 17s. 6d.

TCS 105. 12 in. vertical-cut frequency test disc covering same range as TCS 101, with fixed bands on one side and gliding tone on the other. Price: £1 17s. 6d.

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TUTCHINGS ELECTRONICS LTD., 14 Rook Hill Road, Friars Cliff, Christchurch, Hants. Tel.: Highcliffe 2019.

Test Tape No. 1. Pure tones 40 c/s-10 Kc/s with voice identification of each band. Recorded to new CCIR 70 µSec. characteristic at 7½ i/s. Track 2 carries continuous 7·5 Kc/s tone for azimuth alignment.

Test Tape No. 2. Pure tones 40 c/s-7·5 Kc/s with voice identification of each band. Recorded to new CCIR 140 µSec. characteristic at 3¾ i/s. Track 1 carries four identical frequency runs. Track 2 is recorded with continuous 5 Kc/s tone for azimuth alignment.

Test Tape No. 3. White noise, one third octave bands 40 c/s-10 Kc/s with voice identification of each band. Recorded to new CCIR 70 µSec. characteristic at 7½ i/s.

Test Tape No. 4. White noise, one octave bands 100 c/s-6·4 Kc/s centre frequencies with voice identification of each band. Track 2 carries full range unfiltered white noise. Recorded to new CCIR 70 µSec. characteristic at 7½ i/s.

Test Tape No. 5. Azimuth and vertical head alignment tape. Full track unfiltered white noise with track 3 blank. Can be used without test equipment at all tape speeds on two- or four-track recorders.

All tapes on 3 in. spools. Price £1 10s. each including postage.

Older CCIR characteristics of 100 and 200 µSecs. for 7½ i/s and 3¾ i/s respectively available. Full-track recordings of any single frequency can be supplied with low wow and flutter content at £1 5s. per 3 in. reel.

MICROPHONES FOR TAPE RECORDING

by John Earl

WHILE a good 'all-round' microphone often partners the average domestic tape recorder at the time of its purchase, its enthusiastic owner progressively has the urge to experiment with microphones of different types from that supplied, as his interest in tape recording grows. Questions then arise such as —'what type of microphone should I purchase?' . . .'how can I be sure that it will match my recorder properly?'. . .'could I use a low (or high) impedance microphone?'. . .'will it give sufficient output for full modulation?'. . .'what would be the best microphone for use outdoors (or indoors)?'. . .'what about polar response?' 'frequency response'. . . and so on and so forth!

Basic Principles

This article is written to answer questions like these; but to start we shall have to discover something about the basic principles of microphones. A microphone is a *transducer*. This simply means that it has the power to change one sort of energy to a different sort. With a microphone, the energy of the sound waves reaching it is changed to a corresponding electrical energy, called the microphone 'signal'. A loudspeaker is also a transducer, but with this the electrical energy, corresponding to the original sound, is changed to sound energy.

Microphone signal is usually of very small power. Nevertheless, to be *power*, of course, it must feature components of both signal *voltage* and signal *current*. We must remember this. A microphone, then, is really a rather specialised generator of electricity. Indeed, some microphones work on exactly the same principles as the electric generator. That is, a coil of wire is caused by the sound waves to move within a magnetic field. When this happens an electromotive force is produced in the winding. This is the force which drives the current through the winding, and is representative of the 'signal voltage'. Signal current flows when the coil is connected to a 'load', which is usually the input of the record amplifier.

The actual signal power (the product of the signal current and signal voltage) generated by this simple action is governed by the *rate* at which the turns of the coil 'cut' the magnetic field, by the strength of the field itself and by the number of turns of wire on the coil. The louder we shout into a microphone adopting this principle, the greater will be the available signal power (or signal voltage across the winding). This is simply because loud sounds increase the effective rate at which the turns of the coil cut the field. Increasing either the field strength or the number of turns increases the signal power potential of the microphone. The number of turns of wire on the coil also affects the 'impedance' of the microphone, as we shall see.

Signal Nature

The elementary construction of a *moving-coil* (or 'dynamic') microphone is depicted in **fig. 1.** It will be seen that this employs the electric generator principle discussed. The coil is caused to follow the vibrations of the diaphragm which, of course, is activated by the sound waves.

The signal produced, in common with that produced by other microphones, is of *alternating current* characteristic. This means that the polarity of the emf (or the direction of flow of current in the coil) changes from one direction when the coil is going into the field to the opposite direction when it is coming out of the field. The signal waveform so produced is endowed with all the characteristics of the sound.

The moving-coil microphone is one of the most versatile of microphones; and in view of this, coupled with its robust nature, it is very popular with amateur tape-recordists. It is, of course, the reciprocal of the moving-coil speaker. Other microphones employing the electric generator or, as it is more commonly called, the 'electromagnetic principle', are the *ribbon* (or 'velocity') microphone and the *variable-reluctance* microphone.

In both of these the signal voltage is generated by the vibrating diaphragm giving rise to changes in magnetic field across a coil of wire. The ribbon microphone uses a thin, metallic foil ribbon instead of a moving coil. This ribbon

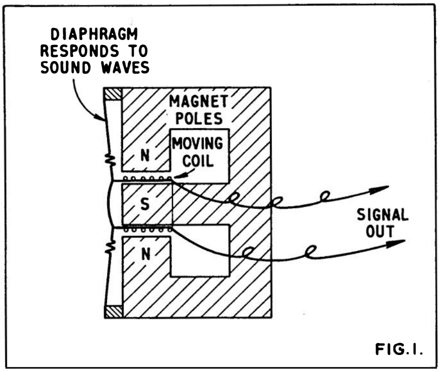

Fig. 1. *Elementary moving-coil microphone.*

is suspended in the magnetic field, and is itself caused to vibrate by the sound waves impinging upon it. It can, in fact, be considered as just a single turn of wire or conductor, and because of this, the signal voltage across its ends is generally much below that across the ends of a moving coil, which contains a number of turns all working within the field. The basic ribbon microphone is shown in **fig. 2.**

Variable-reluctance microphones have come over the years in many styles. In early versions the diaphragm was connected to an armature by a reed, rather like an old-style pickup, and the armature was thus caused to vibrate across the poles of a magnetic circuit, on the yoke of which was wound the coil of wire. Other versions feature a fixed coil and a moving magnet assembly, this being mechanically coupled to the diaphragm.

Piezo Microphone

We now come to the ype of microphone which uses the 'piezo-electric' principle of signal generation. This is called the *crystal, ceramic* or *piezo-electric* microphone. Certain crystals have the ability to generate a difference of electric potential across one of its axes when it is stressed across the opposing axis. The electricity so produced is called 'piezo-electricity'. When the crystal slab is bent, twisted, compressed or otherwise stressed, an electric charge is developed across the surfaces of the opposing axis. The magnitude of this charge is governed by the extent of the stress applied to the crystal. The greater the stress, the greater the charge. When the original stress is released, the charge collapses, and a new charge of opposite polarity is created when the stress is applied in a reverse sense.

Clearly, by arranging for a diaphragm, vibrating in sympathy with sound waves falling upon it, to subject the crystal element to varying stresses, it follows that the charge across the crystal will vary to the pattern of the sound waves, increasing in intensity with increase in sound levels. This, then, is the principle of the piezo microphone. It will be recalled that it has much in common with the piezo or crystal pickup.

While the electromagnetic microphone produces its signal voltage across a coil of wire (or a single conductor, in the case of a ribbon microphone), the piezo microphone produces its voltage across a crystal, the characteristics of which are virtually capacitive, as distinct from the inductive characteristics of the electromagnetic microphone.

Early crystal microphones were not all that good because the crystals used were of the water soluble variety, such as rochelle salt and like materials. The microphones were thus affected by humidity and temperature quite considerably. The frequency response was also somewhat limited. However, in recent years man-made ceramic crystals have been evolved. These have all the properties of piezo electricity, but are far more durable than the early crystals. The present-day ceramic microphone (still, sometimes called 'crystal microphone') is a far better device than its vintage counterpart.

The piezo microphone is commonly employed with the domestic tape recorder, and is often the first microphone ever used by the enthusiast. Its great advantage is its relatively high signal voltage, compared with the moving-coil and, particularly, the ribbon microphone. It does suffer the disadvantage of being a 'high impedance' device, as compared with the 'low impedance' characteristics of the electromagnetic microphone generally.

Impedance

It is now time that we looked at this impedance business in a bit more detail. Basically, impedance can be considered as the ac equivalent of dc resistance. Like ordinary resistance, impedance is measured in 'ohms'. However, if one were to measure the dc resistance of, say, a moving-coil microphone (that is, the coil resistance), this would differ somewhat from the *impedance* of the microphone. Actually, the impedance would be higher than the dc resistance. This is because the impedance is influenced by the frequency of the ac (signal) associated with the measurement. As the frequency is increased, so the impedance is also increased, since the 'reactive' component of a moving-coil (or electromagnetic) microphone is essentially inductive.

The coil of wire is little more than an inductance so far as the signal current is concerned. However, because it possesses components of pure resistance (the resistance of the wire) and capacitance (the distributed capacitance of the winding), it is more than 'inductive reactance' —the combined effect of these components creates the impedance. The term impedance implies that the ac is *impeded* during its travel through the combined resistance and reactive elements of the coil. In a like manner, dc is impeded by the pure resistive nature of a resistor.

The impedance of a microphone is usually specified at a particular frequency, 1,000 c/s being typical. Moving-coil and ribbon microphones are by their very nature low impedance devices. The ribbon, due to its single conductor, is lower than the moving-coil, which is composed of a number of turns of wire. Indeed, the ribbon microphone is generally of such a low basic impedance that a transformer is nearly always featured in its make-up to step up this low impedance to the amplifier. More is said about impedance transformation and microphone matching problems later.

Moving-coil microphones have basic impedance values ranging from a few tens of ohms to a few hundred of ohms, but even these sometimes utilise inbuilt impedance step-up transformers, taking the output impedance up to tens-of-thousands of ohms. Piezo microphones, as may be expected, are of high inherent impedance. This is because the output signal is derived from electric charges across the effective capacitance of the crystal element. These need to be 'loaded' to high values, in the order of millions of ohms.

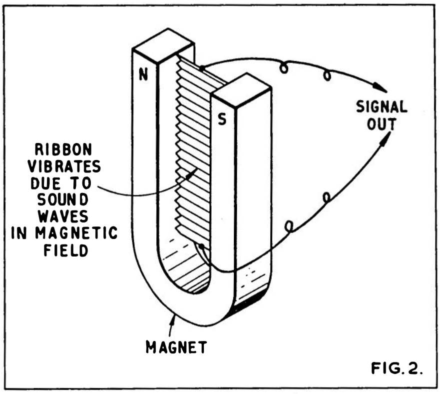

Fig. 2. *Basic ribbon microphone.*

Condenser Microphone

Another high impedance microphone is that which adopts the 'capacitor' principle, called the 'condenser microphone'. This works simply by the sound waves causing the vibration of a diaphragm to change the capacitance between it and a fixed electrode, as shown in **fig. 3.** The capacitance changes so created give rise to potential changes across a high value resistance which is placed in series with the microphone and a polarising potential. The high value resistance keeps the charge on the capacitor effectively constant, so the potential changes across the resistance represent the audio signal.

Although very rarely, if ever, used in tape recording, mention should be made of the carbon microphone, which was the start of all microphones many years back. This is also a low impedance device, and it consists in its basic form simply of a cylindrical container of loosely-packed carbon granules, on one side of which is a carbon electrode and on the other side a thin, carbon diaphragm. Vibration of the diaphragm varies the density of the granules, and hence the resistance through them, between the electrode and the diaphragm.

This changing resistance is translated to a changing current through the primary of a small transformer, a battery or dc supply being used to provide this current. Thus, across the transformer secondary is produced the output signal of relatively large magnitude. This microphone can be dismissed from our activities in view of its poor signal quality and restricted frequency range and because of its very high noise level.

So far, then, we have investigated the basic principles of microphones. We have discovered their relative impedances and have gleaned some idea of the nature of impedance. To recapitulate, we have on the low impedance side the ribbon, the moving-coil and the carbon; and on the high impedance side the piezo-electric (i.e. the crystal and ceramic) and the condenser. All these microphones, with the exception of the carbon, are used with tape recorders.

We must now see how high and low impedance microphones are 'matched' to the amplifier input. It is one of the basic laws of electricity that maximum energy transfer from the source to the load occurs when the source resistance is equal to the load resistance (or impedance in either case). So far as we are concerned, the *source* is the microphone and the *load* is the amplifier input impedance. Thus, we have ideal conditions from the matching aspect if the nominal impedance of the microphone is equal to the impedance of the microphone input circuit of the amplifier. Note, however, that the microphone still may not work the amplifier properly, as its output signal may be too small or too large for the microphone channel sensitivity of the amplifier or tape recorder. Too great an output would cause distortion, while too small an output would fail fully to modulate the tape. More is said about these important aspects later. For the time being let us concentrate on this matching business.

Matching

A low impedance microphone gives a current drive while a high impedance version gives a voltage drive. What does this mean? Let us suppose that we have two microphones of equal output power and that one is high impedance and the other low, each being correctly loaded. The signal voltage across the high impedance would be above that across the low impedance; conversely, the signal current from the low impedance would be above that from the high impedance.

This means that if we were to connect a low impedance microphone to a high impedance amplifier direct, the signal voltage fed to the high impedance amplifier would almost certainly be too small to work it. Shouting into the microphone may cause some small response, but this would be no good! This is because a high impedance amplifier is designed to accept more signal voltage than signal current. A low impedance amplifier, on the other hand, is designed to accept more signal current than signal voltage, so a high impedance microphone connected to this would not be much good. Another thing that would happen in this case is that the low impedance of the amplifier input would 'swamp' the high impedance of the microphone and reduce its output voltage, anyway.

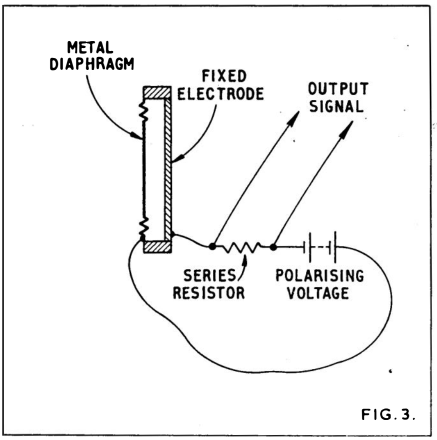

Fig. 3. *Showing the principles of the condenser microphone. The vibrating diaphragm relative to the fixed electrode causes a capacitance variation to the pattern of the sound waves. Owing to the polarising voltage, an audio signal is developed across the series resistor, and it is this that is fed to the amplifier.*

These are functions of mismatch. A further possibility is impaired frequency response due to the incorrect microphone and amplifier matching. The only way out of these problems is to ensure that the impedance of the microphone equals or matches that of the microphone input circuit of the amplifier or recorder. Some amplifiers and recorders provide for both low and high impedance matching, while others provide for just one, often the latter. This, then, means that some matching device must exist either at the microphone itself or in the microphone-to-amplifier connecting circuit to transform the low impedance of the microphone up to the impedance of the amplifier.

Microphone Transformer

The simplest matching device is the transformer and, as already mentioned, such may be incorporated in the case of a ribbon or moving-coil microphone. The transformer is a step-up one and is connected as shown in **fig. 4.** The turns ratio is easy to calculate; it is the square-root of the amplifier impedance divided by the microphone impedance. As an example, a transformer with a turns ratio of 200:1 would be required to step up the impedance of, say, a 10-ohm microphone to an amplifier impedance of 400,000 ohms. The calculation goes this way:

$$\sqrt{40{,}000/10} = \sqrt{40{,}000} = 200.$$

The transformer thus gives an increase in microphone *voltage* of 200 times (discounting losses, etc.), and a reduction in microphone current of the same value. Clearly, then, the microphone circuit is changed from a current drive to a voltage one which, as we have seen, is required for a high impedance input.

Microphone transformers have fairly high turns ratios, especially those designed for use with ribbon microphones, whose nominal impedance is very low to start with. Moving-coil microphones usually call for a smaller turns ratio because the nominal impedance of the moving coil is higher than that of the ribbon. This sort of transformer has to be very well designed to avoid hum troubles and, of course, has to share a wide frequency response—at least as wide as the microphone and amplifier.

Hum pickup is minimised by encasing the transformer in mu-metal and, in some cases, by centre-tapping the primary so that balanced twin microphone cable may be employed instead of ordinary screened single conductor. One may wonder why a suitable match could not be achieved by loading the microphone with a resistance of value equal to its impedance and then connecting a resistor in the lead between the microphone and the amplifier input, the value of this resistor corresponding to the amplifier impedance, as shown in **fig. 5.** Matching is perfectly sound by this means but, as already told, the voltage from a low impedance microphone is usually insufficient to drive a high impedance amplifier. If the amplifier is very sensitive and the microphone of high output, this idea may well work reasonably well. It should be noted, however, that a potential-divider is created by the series resistor and the amplifier load. Thus, the voltage presented to the amplifier by this means is even less than the voltage produced by the low impedance microphone!

Transistor Matching

Matching can be accomplished by the use of a transistor amplifier instead of a transformer. This has some merit in that the restrictions of a transformer are avoided. Gain can also be provided by the amplifier, and this can be built into a small self-contained, battery-operated unit, taking less than 1 mA of current. A typical amplifier of this kind is shown in **fig. 6.** This is arranged in the so-called common-base

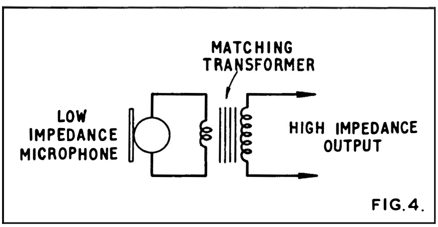

Fig. 4. *The most popular method of matching a low impedance microphone to a high impedance amplifier makes use of a matching transformer. This has a step-up ratio, and thus increases the signal voltage across the high impedance circuit or load.*

mode, with the input signal applied at the emitter and the output signal taken from the collector. A transistor lends itself admirably to current loading since it is a current-operated device. Signal current is required in the emitter/base junction to produce signal voltage across the collector load.

The input impedance of a common-base amplifier is low, thus offering a direct match to the low impedance microphone, while the output impedance is considerably higher, thereby allowing connection to a high impedance microphone input circuit. Piezo microphones are less easily matched by these means, but in most cases they represent a good match to a high impedance microphone circuit. One thing to remember is that such a microphone can be considered as a capacitance in series with the

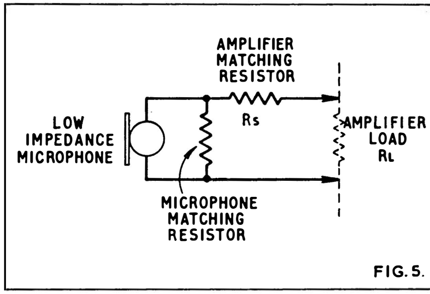

Fig. 5. *Resistive matching of this nature could be employed, but the low voltage across a low impedance microphone would give impaired sensitivity. There would also be a further reduction in signal voltage due to the potential-divider effect of Rs and Ri.*

'generator' voltage, and when connected to an amplifier it forms a potential-divider in conjunction with the load, as shown in **fig. 7.**

This is perfectly sound provided the load (that is, the amplifier input impedance) is of a substantially high value. At high signal frequencies the 'reactance' of the effective series capacitance is low, meaning that the full signal is developed across the load, but as the frequency is reduced the reactance of the effective capacitance increases. If the load resistance is not too large, the capacitive reactance may approach its value at low frequencies, and this would result in bass cut. Indeed, the circuit in **fig. 7** is representative of a bass-cut filter, but the effect is made negligible when the load is of high value. *It is most important, therefore, that piezo microphones be connected to amplifiers with very high impedance if bass cut is to be avoided.*

Usually, the capacitance of the microphone lead does not appreciably affect the piezo microphone's frequency response, but it can affect its output voltage. In any case, it is not a good thing to run long microphone cables at high impedance because they are very susceptible to hum pickup. For the use of long cables a low impedance circuit is essential. In this case, a low impedance microphone should be used and the amplifier should also be arranged to have a low impedance input (by the use of a transformer or transistor amplifier), the cable is then run at low impedance.

If it is required to run a long cable with a crystal or ceramic microphone, an impedance step-down device should be employed at the microphone, the cable run at low impedance and an impedance step-up arrangement used at the amplifier, if this happens to be of high impedance. Although it is not impossible to use transformers with piezo microphones, such are definitely not recommended. The best idea would be to use a transistor matching device with an impedance step-down characteristic. Giving this, is the common-collector mode (or emitter-follower circuit). Here the signal is applied in series with a suitable value resistor at the base and taken out at low impedance from the emitter, the collector being 'earthed' to signal. More satisfactory, however, is the use of a low impedance microphone of the electromagnetic variety.

Much of what has been said about piezo microphones applies also to condenser microphones, as these are also high impedance. However, the amplifier may be called upon to supply the polarising potential, in which case long cables are out of the question. High-quality condenser microphones, though, are arranged to work with a partnering polarising unit. This also contains matching arrangements, giving a low impedance output to line.

Microphone Sensitivity

The next thing to consider is microphone output voltage (or output signal), for although the matching may be, satisfied the signal from the microphone may not be strong enough to permit full drive or tape modulation. This is usually given in terms of microphone 'sensitivity', expressed in *decibels* relative to a fixed

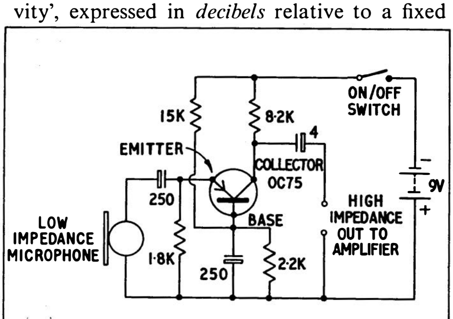

FIG.6.

Fig. 6. *A common-base transistor amplifier of this kind can be successfully employed to step up the impedance from a low impedance microphone to a high impedance microphone circuit.*

reference level. The reference level chosen is 1 volt (equals 0 dB) at a sound pressure of 1 dyne per square centimetre (that is, 1V/dyne/cm^2). Thus, a microphone quoted as having an output of 60 dB below 1V/dyne(cm^2 would generate about 1 mV when subjected to a sound pressure of 1 dyne/cm^2 (equal to 1 microbar). The microphone output voltage thus rises with increase in sound pressure (or intensity).

We have seen that the output *voltage* is somewhat governed by microphone impedance. The STC Model 4114 dynamic (moving-coil) micro-

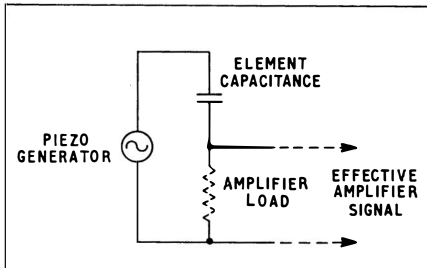

FIG. 7.

Fig. 7. *The capacitive nature of the piezo microphone in conjunction with the amplifier load gives a bass-cut filter effect (see the text).*

phone, for instance, is quoted as having an output of —80 dB/volt/dyne/cm^2 at its nominal impedance of 250 ohms and an output of —55 dB/volt/dyne/cm^2 when used with a step-up transformer which raises its impedance to 80,000 ohms. Incidentally, the minus sign in front of the decibel (dB) value implizs so many decibels *below* 1 volt.

—80 dB represents 10,000 times *below* 1 volt, while —55 dB represents 562 times *below* 1 volt. Thus, without the transformer, the microphone above produces 0·1 mV (100 V—microvolts), and with a transformer about 1·8 mV when the sound intensity is in the order of 1 dyne/cm^2 in each case. This ties in with what has already been discussed about impedances, etc.

Some microphones are more sensitive than others. Piezoelectric types can give outputs in the order of —50 dB (relative to the basis explained above) and moving-coil versions transformed to a high impedance follow close behind. Condenser microphones can give outputs as high as —60 dB, and ribbon microphones transformed to high impedance give similar outputs. The decibel ratios are found in tables, but they can also be worked out from the formula ndB=20 $\log_{10}$ (El/E2), where El in this case is the reference voltage (1 volt) and E2 is the microphone voltage, the answer being in minus ndB.

The voltage is generally given as an open-circuit voltage. With the correct load, the open circuit voltage falls by 6 dB (that is, by a half, since 6 dB is 2:1 voltage ratio). Thus, a microphone loaded by a value well below its own impedance will have an effective output voltage well below its open-circuit voltage. This is an important point to remember.

Microphone output is something expressed in voltage (mV) per microbar direct, instead of in decibels. A microphone with an output of, say, —80 dB/volt/dyne/cm^2 could also be said to have an output of 0·1 mV per microbar. It is interesting to note that a sound pressure in the order of one microbar may well be produced by speaking normally into a microphone, and the diaphragm may move only about one ten-thousandth of a centimetre due to this pressure! We can see, then, Why microphone output is so small.

Sound Pressure and Velocity

From the acoustic point of view, microphones are classified either as being *pressure-operated* or *velocity-operated.* A pressure operated microphone is the type in which the diaphragm moves in response to the pressure difference between its two faces. Microphones whose diaphragms are closed by the microphone case at the rear, and on which the sound falls only on one side are of the pressure-operated variety. These include moving-coil, piezoelectric, some condenser and carbon types. To avoid uneven frequency response characteristics, some acoustic correction is applied by virtue of resonant air chambers behind the diaphragm, and some of the STC models use equalising tubes, as shown in **fig. 8.**

Microphones whose diaphragms are open to sound waves on both sides are of the velocity-operated variety. Typical in this respect is the ribbon microphone, the ribbon in this case being considered as the diaphragm. Some moving coil types may also be modified to have this characteristic. The diaphragm is caused to move by the difference in the sound pressure between the front and the back, this difference in pressure being due to the extra distance the sound wave has to travel from the front to the back. This extra distance is proportional to the *velocity* of the wave. Hence the term, velocity-operated. Also, because the diaphragm responds to the pressure difference or *gradient* between the two faces, the term 'pressure gradient' is sometimes used to describe this kind of microphone.

Frequency Response

Frequency response is another important aspect of microphones. The inexpensive crystal microphone can suffer from bass attenuation

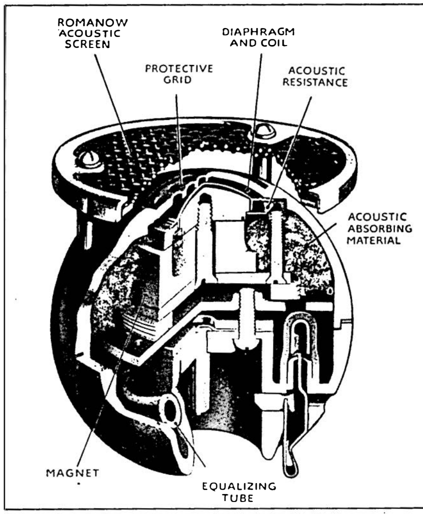

Fig. 8. *Sectional view of an STC moving-coil microphone, showing the internal construction. Note the equalising tube.*

due to poor loading and treble attenuation due to design problems. The treble response of average specimens is about 7/8 Kc/s. Better quality 'sound-cell' versions, however, can rise above this. This type, incidentally, does not employ an ordinary diaphragm coupled to the crystal; instead the crystal itself is arranged so that it is actuated by the sound waves impinging upon it direct. The output is below that of diaphragm versions, but the response is flatter.

Moving-coil units can response well up to 12 Kc/s or more with acoustic correction in the form of a baffle or similar arrangement. Ribbon microphones are characterised by their very flat frequency response, extending from 50 c/s up to 13 Kc/s or higher. Good-quality condenser microphones can go up into very high treble, but these, of course, are expensive instruments; not of the type which would be normally used by the tape enthusiast. There is not a great deal of merit in using a microphone with extended frequency characteristics when the response of the tape recorder or amplifier is itself limited. When choosing a microphone from the frequency response aspect, therefore, one should always take into account the equipment—present and future—with which it will be used.

Polar Diagram

The final factor of microphones which must be considered is the polar response or 'polar diagram'. This is nothing more than a graph which reveals the directivity characteristics of the microphone. For instance, a microphone with the label 'non-directional' or—more professional—*omnidirectional* has no favoured direction of acceptance and responds equally to sounds arriving from all directions. The *bi-directional* microphone is one which responds most to sounds arriving from the front and back and least to sounds from the sides, top and bottom. This type of microphone is said to have a *figure-of-eight* polar diagram. The *cardiod* (meaning heart-shaped) microphone responds mainly to sounds arriving from the front, rejecting sounds arriving from the rear. The term *undirectional* is often used to describe this type of microphone, which really consists of a combination of the responses of a omnidirectional and a bi-directional microphone. Indeed, two microphones (or microphone units) are often integrated to secure the cardioid polar diagram. Similar results are obtained with a ribbon microphone by clamping the ribbon at its centre and closing the rear of one half, so that one half of the ribbon is velocity-operated and the other half pressure-operated.

The three primary polar diagrams (a) omnidirectional, (b) bi-directional and (c) unidirectional are shown respectively in **fig. 9.** Most of the lower-priced microphones approximate omnidirectional characteristics, while the basic ribbon microphone has a bi-directional polar diagram. Some moving-coil microphones (and ribbons, as we have seen) are arranged to provide cardioid characteristics, but generally the moving-coil has an omnidirectional polar diagram.

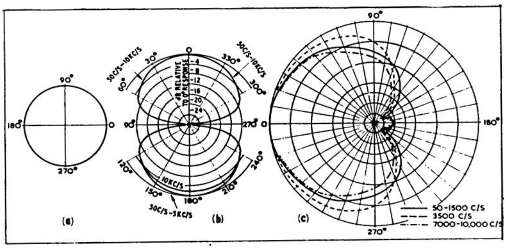

Fig. 9. *Polar responses: (a) omnidirectional, (b) bi-directional and (c) cardioid or unidirectional.*

Keep away from Wind

A good ribbon microphone can provide 'all-round' service, and it also has the attribute of directivity, thereby allowing orientation for the best signal/noise ratio. This kind of microphone, however, is best used away from a windy environment, and is ideal for music recording. For use out of doors, the ribbon should be fitted up with a windshield. Even a small breeze through an exposed ribbon microphone can produce a very high background noise, like the rumble of thunder. The ribbon microphone is also a good choice for use in a highly reverberant environment owing to its figure-of-eight polar diagram cutting down the reverberation response by a factor of about 3:1 relative to an omnidirectional microphone.

For recording in an acoustically dead room, however, the omnidirectional microphone has much to commend it. A good moving-coil microphone is ideal, since this gives maximum response to whatever little reverberation there happens to be in the room. Ribbon and moving-coil microphones are suitable for speech, but remember that an unnatural rise in bass response occurs by operating too close to the ribbon. Directional microphones of all types exhibit an apparent rise in sensitivity when the sound source is too close. Speaking less than about 2 ft away from any ordinary microphone should be avoided if possible, and this applies especially to the ribbon.

Piezo microphones are suitable for use reasonably close to the recorder, but cables in excess of about six feet should be avoided. For interviews, the piezo microphone can well be used, but becoming popular for this application is the slender type of hand microphone. These are often moving-coil and are remarkably sensitive, thanks to the new type of ceramic magnets exhibiting very strong fields from small dimensions.

The cardioid microphone is necessary when it is required to greatly attenuate sounds arriving from the rear. A classic application of this type of microphone is on a stage, arranged so that maximum response occurs from the stage and minimum from the orchestra pit and audience.

For stereo work, of course, a pair of matched microphones should be employed, and these are best spaced by about 6 ft. Multimicrophone networks demand the services of a mixer, and only experimentation will reveal the best placement and types to use for any particular application. It has been said that the skill necessary to handle more than one microphone successfully rises in greater proportion to the number of microphones used.

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★ In these abridged specifications, the following abbreviations are used: **Imp.**—microphone source impedance. **Rec. load imp.**—recommended load impedance, and sensitivity is given in dB with reference to 1 volt/dyne/cm², unless otherwise stated. ● Stereo.

AKG. (Akistische and Kino-Gerate GmbH. Distributors: Politechna (London) Ltd., 182-184 Campden Hill Road, Kensington, London, W.8. Tel.: Park 0711/3, 5008.

C12. Professional condenser. Sel. switch gives choice of 9 polar characteristics. Response 30-15,000 c/s ±3 dB. Sensitivity −60 dB. Imp. 50 and 250 ohms. Price: £170.

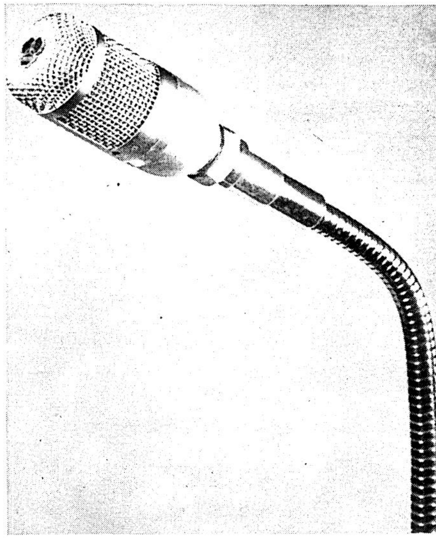
C12A. Professional condenser. Variable pattern. Remote selection (may be located up to 300 ft. from mic.); Control gives a choice of different directional characteristics. Selection can be made during programme pick-up. Response 20 c/s-20 Kc/s. Imp. 50 and 200 ohms. Price: £139.

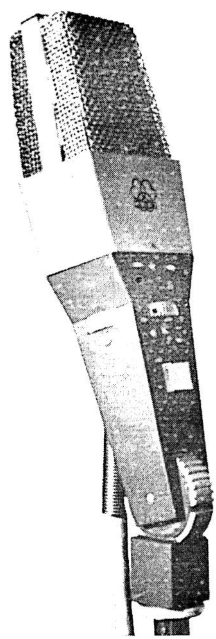
●**C24.** Stereo condenser. Sensitivity 1 mV/bar. Imp. 200 or 50 ohms. Response 30-20,000 c/s. Omni-directional cardioid; bi-directional, hyper-cardioid. Plus 5 intermediate patterns. Sensitivity approx. 1 mV per microbar (at 200 ohms output terminals) −33 dB re 1 milliwatt at a sound pressure of 10 dynes/cms. Crosstalk between channels <40 dB throughout entire range. Imp. <200 ohms when delivered. 50 ohms by changing solder connections. N.24 power supply unit. Remote control unit. Twin remote control cable. Price: £230.

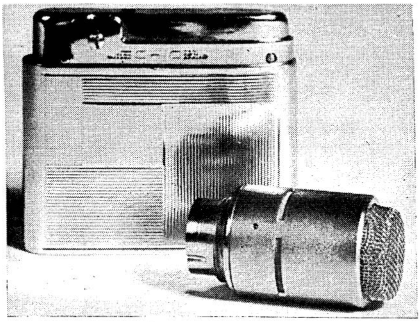
C28A. Condenser studio. Cardioid or omni-directional. Response 30 c/s-30 Kc/s. Sensitivity (with CK28 cardioid capsule) −58 dB, (with CK26 omni-capsule) −60 dB. Imp. 50 ohms or 200 ohms, from built-in transformer. Low noise, professional standards, variations C29A, C30A. Price (including N12 power unit, 20 m. cable and cable for the LF output) C28A: £110; C29A: £118; C30A: £125 10s.; C28/29/30A: £130 10s.

C60. Miniature professional condenser. Response 20-30,000 c/s. Imp. 50 or 200 ohms. Available with mains power unit or re-chargeable battery supply unit. Price (mains): £92 10s.; (battery): £79 10s.

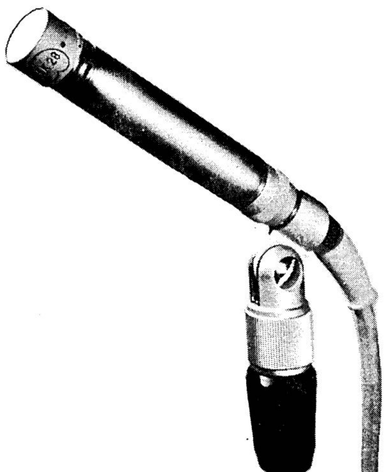
D7A. Moving coil. Omni-directional. Response 80 c/s-13 Kc/s ±5 dB. Sensitivity −74 dB (200 ohms), −52 dB (50K). Imp. 200 ohms or 50K available from built-in transformer. Price: £3 15s.

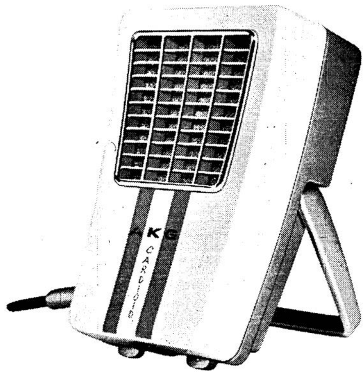

AKG D17 Moving Coil


AKG C12A Condenser


AKG D58 Moving Coil

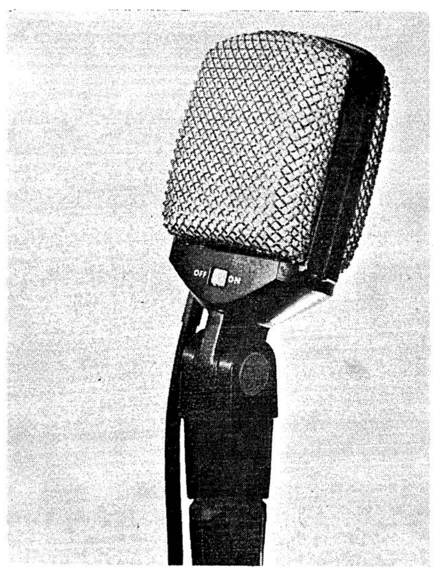

AKG D19E Moving Coil


AKG C60 miniature condenser



AKG D11N moving coil


AKG D12 moving coil



AKG D14 Cardioid

D11N. Moving coil with cardioid directional pattern. Response 80-12,000 c/s. Imp. 200 ohms or 50K ohms. Fitted with collapsible stands and 5 ft. screened cable. Price: £6 10s.

D12. Moving coil with cardioid directional pattern. Response 40-12,000 c/s ±4 dB. Front to back ratio 15 dB. Sensitivity −77 dB. Imp. 60 ohms, or to order. Price: £34.

D14. Dynamic cardioid microphone. Imp. 60-40,000 ohms. Response 50 c/s-15 Kc/s. On/off switch swivel joint fits all stand threads. Supplied with 5½ yards two-core screened lead. Weight: 8 oz. Price: £10.

D17. Moving coil with cardioid pattern. Response 50 c/s-15 Kc/s ±3 dB. Front to back ratio 18 dB. Imp. 200 ohms. Price (including flexible shaft adaptor): £24 10s.

D19C. Restyled version of the D19 finished in grey with silver grill. Moving coil with cardioid directional pattern and bass cut switch. Response 40-16,000 c/s, Imp. 60 or 200 ohms. Price: £17 10s.

D19E. Moving coil with cardioid directional pattern. Response 40 c/s-16 Kc/s. Built-in transformer provides 3 different impedances: 50, 200 ohms, 50K. Price: £21 10s.

D58. Moving coil, close-talk microphone. Response 50-12,000 c/s. Sensitivity 0·1 mV/bar. Imp. 200 ohms. Price: £11 10s.

●**D77A.** Stereo microphone. Moving coil with cardioid directional pattern. Response 80 c/s-13 Kc/s, flat between 200 c/s-10 Kc/s. Imp. 200 ohms. Upper and lower halves of microphone detachable for A-B use. Both halves with degree calibrations for altering the basic angle of the stereophonic pickup. Price: £15 10s.

D119CS. Dynamic cardioid microphone. "Sophisticated" version of D19C. Black finish with chrome stripes. Higher sensitivity. On/off switch. Imp. 200 ohms. Response 40 c/s-16 Kc/s. Front-to-back ratio better than 15 dB at 180 degrees sound incidence at 1 Kc/s. Price: £20 10s.

D119ES. Same specification as D119CS but with built-in transformer for 60-200 ohms and high impedance. Sand blast finish. Price: £24 10s.

DX11. Dynamic cardioid microphone with built-in reverberation unit (Echo microphone). Reverb effect can be controlled during pick up from 0 to 2½ seconds. Connects to low and high impedance amplifiers. 9V Ever Ready battery recommended for built-in amplifier. Supplied with 5½ yards three-core cable. Weight: 14 oz. Price: £30 10s.

ST200. Microphone floor stand. Telescopic. Height 42 to 77 in. Three collapsible feet with main support locking device. Anti-vibration characteristics. Microphone may be clamped to face any direction. Price: £12 10s.

K58. Microphone headset. Incorporates microphone D58 and headset K50 (see Tape Recorder Accessories). Price: £13 10s.

★

BANG & OLUFSEN. U.K. Sales Division, Eastbrook Road, Eastern Avenue, Gloucester. Tel.: Gloucester 26841. Cables: DEBELEC, Gloucester.

MD8. Moving-coil omni-directional. F.R. 50 c/s-17 Kc/s ±5 dB. Sensitivity: 80 dB below 1V/microbar. Imp. 200 ohms at 1 Kc/s. Supplied with desk stand and lavalier cord. Can be used as hand mic. Price: £8 8s.

●**BM5.** Stereo microphone. Response 30 c/s-13 Kc/s ±2·5 dB. Imp. 200 ohms per channel. Price: £23 2s.

BM6. Same specification as BM5 but mono. only. Price: £13 2s. 6d.

BM7. Same specification as BM5. This is an add-on unit to convert the BM6 (mono) into a BM5 (stereo). Price: £11 0s. 6d.

Desk stand for BM5. Price: £1 12s. 6d. Floor stand for BM5. Price: £7 7s.

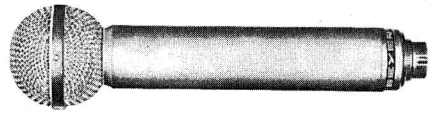
★

BEYER. Distributors: Fi-Cord International, Charlwoods Road, East Grinstead, Sussex. Tel.: East Grinstead 21351.

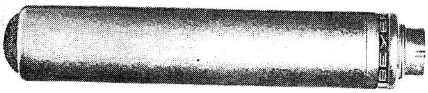
M41. Moving coil. Directional. Imp. 200 ohms. Supplied with 4½ ft. lead. Price: £16 15s.

M41S. Moving coil. Directional. Imp. 200 ohms. Built-in switch. Fitted 4½ ft. lead. Price: £18 6s.

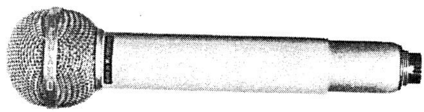
M51. Moving coil. Omni-directional. Response 100 c/s–8 Kc/s ±3 dB. Sensitivity 0·12 mV/microbar at 200 ohms. Imp. 200 ohms. Price: £6 10s.



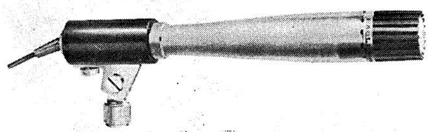
*Beyer M*160 *Double Ribbon*



*Beyer M*100 *Moving Coil*

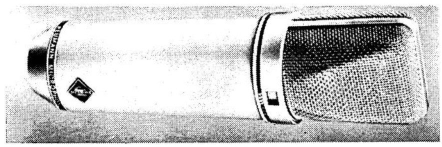


*Beyer M*260 *Ribbon*



Eagle UD 19*HL Moving Coil*

*AKG C*24 *stereo*



*Neumann U*67 *Condenser*

M57. Moving coil hand microphone. Imp. 200 ohms. Fitted $4\frac{1}{2}$ ft. lead. Price: £13 16s.

M64. Moving coil. Directional. Imp. 37·5 or 200 ohms. Supplied with 16 ft. or $4\frac{1}{2}$ ft. leads respectively. Prices: (37·5 ohms) £19 2s., (200 ohms) £18 3s.

M69. Moving coil. Directional. Imp. 37·5, 200 ohms, or 50K. Supplied with 16 ft., $4\frac{1}{2}$ ft., or 12 ft. leads respectively. Price: (37·5 ohms) £29 4s., (200 ohms) £28 5s., (50K) £32 17s.

M88. Moving coil. Directional. Imp. 200 ohms or 50K. Fitted $4\frac{1}{2}$ ft. lead or 12 ft. lead respectively. Prices: (200 ohms) £60 5s., (50K) £64 17s.

M100. Moving coil. Omni-directional. Response 40 c/s-18 Kc/s. ± 2 dB. Sensitivity 0·1 mV/microbar. Imp. 37·5 (16 ft. lead), 200 ohms ($4\frac{1}{2}$ ft. lead), 50K (12 ft. lead). Prices: (37·5 ohms) £61 4s., (200 ohms) £60 5s., (50K) £64 17s.

M110. Moving coil. Lavalier. Directional. F.R. 60 c/s-12 Kc/s. Imp. 200 ohms. Fitted $4\frac{1}{2}$ ft. lead. Price: £28 11s.

M119. Moving coil. Omni-directional. Response 50 c/s-16 Kc/s $\pm 2{\cdot}5$ dB. Sensitivity 0·22 mV/microbar. Imp. 200 ohms. Fitted $4\frac{1}{2}$ ft. lead. Price: £22 19s.

M130. Ribbon. Figure of eight. Imp. 200 ohms. Fitted $4\frac{1}{2}$ ft. lead. Price: £61 16s.

M160. Double ribbon. Cardioid. Response 40 c/s-18 Kc/s $\pm 2{\cdot}5$ dB. Sensitivity 0·08 mV/ microbar. Imp. 37·5, 200 ohms or 50K. Prices: (37·5 ohms) £60 18s., (200 ohms) £59 19s. (50K) £64 11s.

M260. Ribbon. Directional. Imp. 37·5, 200 or 50K ohms. Supplied with 16 ft., $4\frac{1}{2}$ ft. or 12 ft. leads respectively. Prices: (37·5 ohms) £24 11s., (200 ohms) £23 12s., (50K) £64 11s.

M610. Moving coil. Directional. Built-in switch. Imp. 37·5, 200 ohms or 50K. Prices: (37·5 ohms) £22 19s., (200 ohms) £23 12s., (50K) £26 12s.

M55. Moving coil. Omni-directional. Dual imp. 200 ohms and 50K. Supplied with stand and lead. Price: £6 17s.

M80. Moving coil. Cardioid. F.R. 50 c/s-16 Kc/s. Dual imp. 200 ohms and 50K. Supplied with table stand and cable. Price: £12 18s.

Microphone stands. ST260 table stand £3 12s. 6d. ST201/1 standard adjustable £8 4s. 6d. ST201A/1 heavy duty £10 15s. ST199 portable telescopic £6 7s. SCH211 boom arm £5 7s. 6d. SH126 gooseneck $8\frac{1}{4}$ in. lightweight with plug £3 11s. SH127 gooseneck 16 in. heavy duty with plug £6 15s. KV24 Adaptor clamp for all stands 9s. 6d.

Accessories. Windshields, plugs, sockets, cables, adaptors, etc.

Also see Fi-Cord microphones.

★

BOUYER. Distributors: Douglas A. Lyons and Associates Ltd., 32 Grenville Court, Dulwich, London, S.E.19. Tel.: Gipsy Hill 2833. Cables: Daliona, London, S.E.19.

76A. Moving coil microphone with marked cardioid response. Rear to front attenuation 20 dB. F.R. 150 c/s-15 Kc/s ± 3 dB. Sensitivity -63 dB reference 1 volt/dyne/cm^2. Imp. 20 ohms. Rec. load 30-150 ohms. Robust construction. Stand fitting with flexible stem. Hand grip available. Price: approximately £19 depending on fitting, etc.

★

S. G. BROWN LTD., King George's Avenue, Watford, Herts. Tel.: Watford 23301. Cables: Radiolink, Watford.

Dual Function. Stick type microphone which by operation of a shutter mechanism is changed from a conventional pressure operated configuration to differential operation rendering the microphone sensitive only to sounds originating close to it. Designed to deal with all types of programme situation. Price £6 6s.

★

CADENZA. See Simon Equipment Ltd.

★

COSMOCORD LIMITED, Eleanor Cross Road, Waltham Cross, Herts. Tel.: Waltham Cross 27331. Cables: Acos, Waltham Cross.

Acos Mic. 39-1. Crystal. Response 40 c/s-15 Kc/s ± 6 dB. Sensitivity -60 dB. Imp. equals 800 pF capacity. Rec. load imp. not less than 4·7 megohms. 8 ft. cable. Desk stand available. Price: £3 3s.

Acos Mic. 40. Available in three versions: Crystal, ceramic, magnetic. Crystal: Response 30 c/s-7 Kc/s. Sensitivity -52 dB. Rec. load 5 megohms. Ceramic: specification as for crystal but sensitivity -62 dB. Magnetic: Response 200 c/s-5 Kc/s. Sensitivity -75 dB. Rec. load 2K. Prices: Crystal £1 15s., ceramic £2, magnetic £2 5s.

Acos Mic. 55. Lapel microphone. Available in three versions: Crystal, ceramic, magnetic. Crystal: Response 30 c/s-10 Kc/s. Sensitivity -58 dB. Rec. load 4·7 megohms. Ceramic: Response 20 c/s-10 Kc/s. Sensitivity -58 dB. Rec. load 10 megohms. Magnetic: Sensitivity -75 dB. Rec. load 2K. Prices: Crystal £2 2s., ceramic £2 7s., magnetic £2 15s.

Acos. Mic. 60. Stick microphone. Available in three versions: Crystal, ceramic, magnetic. Specifications and prices as for Mic. 55.

Acos Mic. 39 Dynamic. Moving coil. Omnidirectional. Response 80 c/s-10 Kc/s $+3$ dB. Sensitivity -80 dB (200 ohms), -54 dB (50K). Transformer fitted, dual impedance. Price: £7 10s.

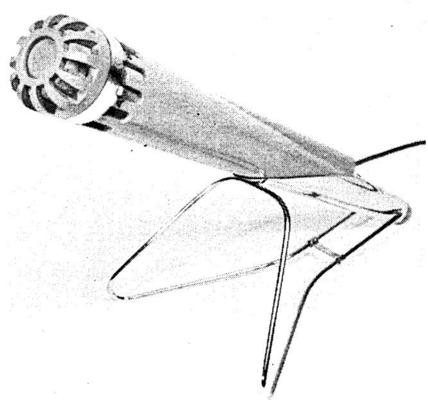
★

DERRITRON LTD. See Reslosound.

★

EAGLE PRODUCTS. Distributors: B. Adler & Sons (Radio) Ltd., 32a Coptic Street, London, W.C.1. Tel.: Museum 9606/7. Cables: Reldab, London.

Bouyer 76A moving coil

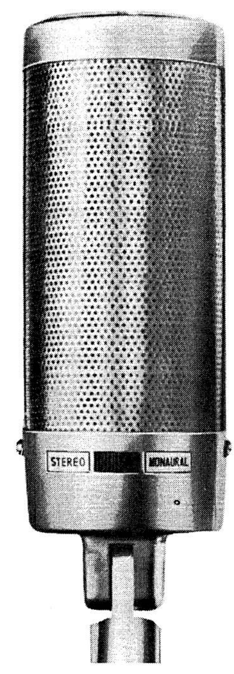


S. G. Brown dual-function

Grampian DP6

Film Industries M8S

Eagle DM 16HL Moving Coil



Eagle SM.D100 Stereo

DM. 15R. Moving-coil microphone for stand mounting. Response 60 c/s-12 Kc/s. Imp. 50K. Swivel-action mounting. Chrome finish. With stand adaptor and cable. Size: 5 in. long, $1\frac{1}{2}$ in. dia. Price: £3 9s. 6d.

DM.16HL. Moving-coil. Cardioid. Response 40 c/s-15 Kc/s. Sensitivity −62 dB. Imp. 500 ohm (low), 50K (high). Transformer fitted. Built-in high/low impedance switch. Price: £7 7s.

DM.18HL. Moving-coil microphone for hand, desk or floor stand use. Response 70 c/s-12 Kc/s. Dual imp., 600 ohms and 50K. Tapered body. Removable desk stand. Supplied with desk stand, adaptor for floor stand and cable. Price: £5 5s.

UD.19HL. Moving-coil. Undirectional cardioid. Range 100 c/s-14 Kc/s. Sensitivity −75 dB ±3 dB at 600 ohm; −55 dB ±3 dB at 50K. Imp. 600 ohm (low), 50K (high). Transformer fitted. Price: £14 14s.

●**S.M.D100 Stereo.** Moving-coil, with two units angled at 90°. Response 50 c/s-15 Kc/s. Sensitivity −60 dB. Imp. 50K. Built-in transformers. Stereo/mono switch. Price: £6 6s.

MC70. Crystal. Omni-directional. Response 50 c/s-12 Kc/s ±3 dB. Sensitivity −75 dB. Price: £2 19s. 6d.

★

ELECTROVOICE. See K.E.F. Electronics Ltd.

★

FI-CORD LTD., Charlswood Road, East Grinstead, Sussex. Tel.: East Grinstead 21351.

FC 801. Studio quality moving coil. Omnidirectional. F.R. 50 c/s-18 Kc/s. Shock proof and resistant to temperature changes. Especially suitable for outdoor work. Price: £16 5s.

FC 901. Studio quality moving coil. Cardioid. Damping at 180° 15-18 dB. F.R. 40 c/s-18 Kc/s. Suitable for use in unfavourable acoustic conditions. Shock proof. Finished in matt dark grey with matt chrome head. Price: £17 10s.

FC 1200. Condenser microphone with cardioid or omni-directional pattern. F.R. 30 c/s-20 Kc/s ±2·5 dB. Interchangeable head. Front to back response differential pattern 20 dB. Output imp. 300 ohms or 30 ohms balanced. Polarising voltage 60V DC. One Nuvistor type 7586 or 6CW4. Sizes: Capsule 1 in. diameter $1\frac{7}{8}$ in. long, pre-amplifier 1 in. diameter, $5\frac{3}{8}$ in. long, complete microphone 1 in. diameter $6\frac{7}{16}$ in. long. Weight: 10 oz. Finished in satin chrome or satin nickel. Supplied with windshield, microphone stand clamp, power unit and leads. Price: £98.

★

FILM INDUSTRIES LTD., 90 Belsize Lane, London, N.W.3. Tel.: Hampstead 9632/3. Cables: Troosound, London, N.W.3.

M7. Moving coil. Response 60-9,000 c/s. Imp. 20 ohms. 12 ft. twin screened cable standard, other lengths if required. Table desk and floor stands available. 4 in. flexible mounting. Internal leads. Price: £8 15s. With on/off switch: £10 7s. 6d.

M8. Ribbon. Response 50-13,000 c/s. Figure of eight polar diagram. Imp. 30 ohms. Can be fitted with transformer up to 60K. Plug and socket joint between microphone head and flexible, fitted with 12 ft. of twin-screened cable, other lengths if required. Table, desk and floor stands available. Price, all impedances: £9 9s. With on/off switch: £11 11s.

M8A. Ribbon. Unit as type M8 but without plug and socket connection between mic. head and flexible, this being one unit. A small desk stand is provided, which is removable, enabling other stands to be used. Available in all impedances up to 60K. Price: £9.

M8S. Embodies same internal components as the other ribbon microphones in the range. In place of the flexible support the base of the unit is machined to give a set degree of angle. Complete with desk stand. Price: £8 15s., with switch unit £10 7s. 6d.

Microphone Stands. Desk, table and floor stands. Grey Hammer finish with cast iron bases, stems in satin chrome. Price from £1 5s.

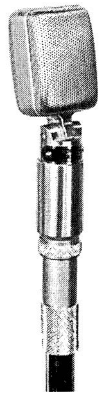
Matching Transformer. Enclosed in Mumetal screening case and moulded plastic outer case. Fitted with male and female jack connectors. Imp. ratio: 30 ohms to high impedance. Price: £3 10s.

Microphone Switch Assembly. To be used in conjunction with Type M7, M8 microphones. Price on application.

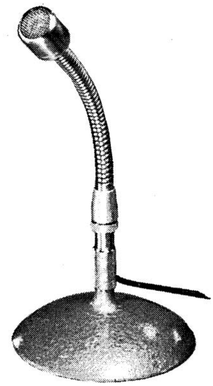
★

GRAMPIAN REPRODUCERS LTD., Hanworth Trading Estate, Feltham, Middx. Tel.: Feltham 2657/8. Cables: Reamp, Feltham.

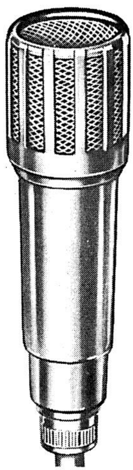
*Lustraphone VR*64



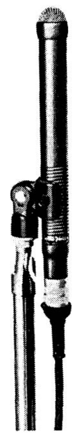
Reslo Type VRT



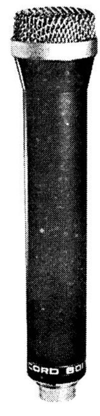
*Trix G*7852/*F*



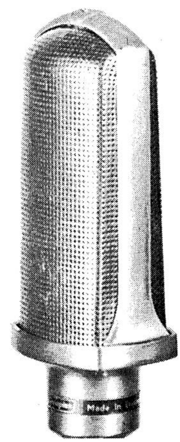
*Geloso M*69



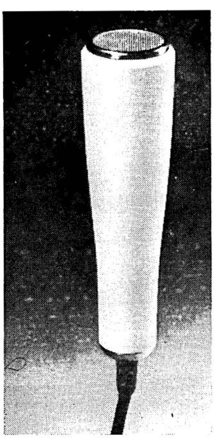
Electro-Voice 655*C*



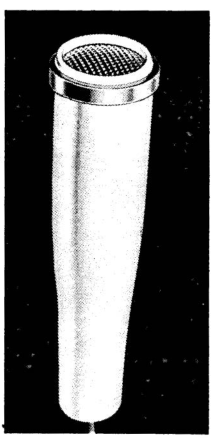
*Fi-cord FC*801



*Grampian GR*2 *ribbon*

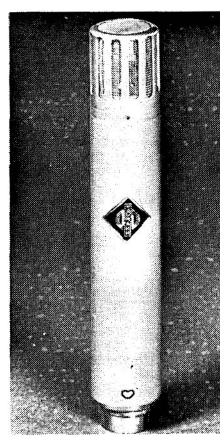


Acos Mic 39-1



Acos Mic 60

Film Industries 8*A*



Neumann Condenser

DP4/H. Moving coil. Response 50-15,000 c/s. Sensitivity −52 dB, −70 dB, −86 dB, for high, medium and low impedance. 50,000, 600 and 25 ohms. Tubular case. Price including lead: high or medium impedance: £9 5s.; low impedance: £8 5s.

DP6. Moving coil. Omni-directional. Response 200 c/s-15 Kc/s. Sensitivity −87 dB (25 ohms), −75 dB (200 ohms), −50 dB (600 ohms), −52 dB (50K). Built-in transformer fitted to all but low impedance model. Price (low impedance): £8 5s.; (other three models): £9 5s.

GR1. Ribbon. Unequal figure of eight. Response 40 c/s-15 Kc/s. Sensitivity −90 dB (25 ohms), −81 dB (200 ohms), −76 dB (600 ohms), −58 dB (50K). Imp. 25, 200, 600 ohms, 50K. Built-in transformer. Easily replaceable ribbon. Price (including lead, swivel holder, case): £11 15s.

GR2. Details as for GR1, but equal figure of eight response.

GCI series. Moving coil cardioid microphones. Response 40 c/s-12 Kc/s ±5 dB. Non-metallic diaphragms. Interchangeable leads. Various stands and accessories. Imp. GC1/L 25 ohms, rec. load 15-50 ohms· GC1/X 200 ohms, rec. load 150-300 ohms; GC1/M 600 ohms. rec. load 500-1,000 ohms; GC1/H 50K, rec. load 50K and upwards. Sensitivities: GC1/L −86 dB, GC1/X −75 dB, GC1/M −70 dB. GC1/H 52 dB. Prices: GC1/L £14; GC1/X, GC1/M, GC1/H £15.

DP8 series. Moving coil omni-directional microphones. Respon e 50 c/s-15 Kc/s ±5 dB. Built-in on/off switch. Interchangeable leads. Hand type with swivel holder for stand use. Sensitivities, impedances and rec. loads as for GC1 series. Prices: DP8/L £9 10s.; DP8/X, DP8/M, DP8/H £10 10s.

For microphone accessories see under tape recorder accessories section.

★

GRUNDIG (GREAT BRITAIN) LTD., Newlands Park, London, S.E.26. Tel.: Sydenham 2211. Cables: Grundig, London, S.E.26. Telex.: 22854.

GDM300. Moving coil omni-directional. Response 150 c/s-11 Kc/s ±5 dB. Sensitivity 0·35 mV/microbar. Imp. 4K. General purpose hand mic. Price: £4 4s.

GDM302. Moving coil omni-directional. Response 150 c/s-11 Kc/s ±5 dB. Sensitivity 0·35 mV/microbar. Imp. 400 ohms. General purpose hand mic. Price: £4 4s.

GDM311. Moving coil omni-directional. Response 100 c/s-11 Kc/s ±5 dB. Sensitivity 0·15 mV/microbar and 2·2 mV/microbar. Imp. 200 ohms and 55K (built-in transformer). General purpose hand mic. Price: £7 7s.

GDM121. Moving coil omni-directional. Response 50 c/s-16 Kc/s ±2 dB. Sensitivity 0·3 mV/microbar and 3 mV/microbar. Imp. 200 ohms and 40K. Table stand mic. Price: £22 1s.

GBM125. Ribbon cardioid. Response 50 c/s-15 Kc/s ±2 dB. Sensitivity 0·1 mV/microbar and 3 mV/microbar. Imp. 200 ohms and 200K. Table stand with standard thread. Price: £24 3s.

●**GDSM202.** Moving coil. Figure of eight. Response 80 c/s-13 Kc/s 5 dB. Sensitivity −54 dB. Imp. 50K. Transformers integral with plugs. Each unit may be detached and used independently. Price: £14 14s.

★

HAMMOND & CO. LTD., 90 High Street, Eton, Windsor, Berks. Tel.: Windsor 63388. Telex.: 84316.

Hammond Microkit. Mono condenser microphone with omni-directional response. Response 50 c/s-16 Kc/s ±3 dB. Imp. 200 ohms. Rec. Load 1,000 ohms. Replaceable capsules. Cannon connectors. Transistorised power supply. Stand fitting. Price: £29 18s.

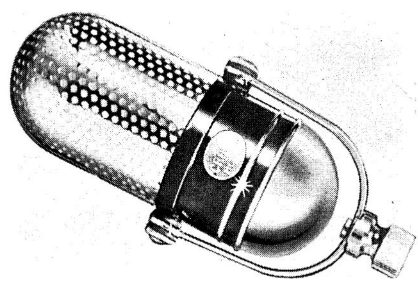
★

KEF ELECTRONICS LTD., Tovil, Maidstone, Kent. Tel.: Maidstone 55761. Cables: KEF.

Electro-Voice 642. Moving coil. Cardiline, uni-directional. Response 30 c/s-10 Kc/s. Sensitivity −68 dB. Imp. 50, 150 and 250 ohms. Transformer fitted. Cardioid up to 500 c/s, sharply directional above. Price: £102.

Electro-Voice 655C. Moving coil. Omni-directional. Response 40 c/s-20 Kc/s. Sensitivity −77 dB. Imp. 50, 150, 250 ohms. Transformer fitted. Very slim design with non-reflecting finish for TV work. Price: £52.

Electro-Voice 635. Moving coil. Omni-directional. Response 70 c/s-10 Kc/s. Sensitivity −57 dB. Imp. high or 150 ohms. Transformer fitted. Price: £21 10s.



Eagle MC70 Crystal

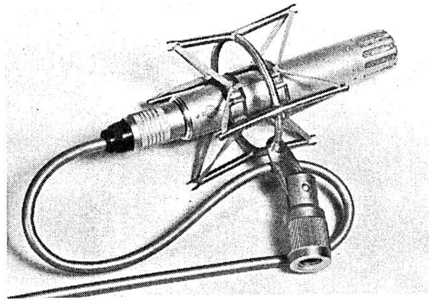
Electro-Voice 666. Moving coil. Cardioid. Response 40 c/s-15 Kc/s. Sensitivity −75 dB. Imp. 50, 150, 250 ohms. Transformer fitted. Slim cardioid with single moving element. Price: £67.

Electro-Voice 649B. Moving coil. Omni-directional. Response 100 c/s-9 Kc/s ±3 dB. Sensitivity −81 dB. Imp. 20-250 ohms. Transformer fitted. Only 1½ oz. less cable. Price: £26 10s.

Electro-Voice 668. Moving coil. Cardioid. Response 30 c/s-16 Kc/s. Sensitivity −78 dB. Imp. 50, 150, 250 ohms. Transformer fitted. Specially designed for boom operation. Price: £135.

Electro-Voice 652. Moving coil. Omni-directional. Response 100 c/s-7 Kc/s. Sensitivity −80 dB. Imp. 50, 150, 250 ohms. Transformer fitted. Semi-rigid tube microphone. Price: £32.

Grampian DP8



Neumann KM54a Condenser

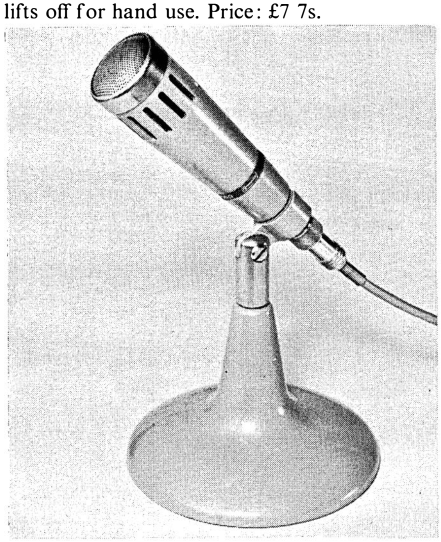
Electro-Voice 643. Moving coil. Super cardiline. Response 30 c/s-10 Kc/s. Sensitivity −67 dB. Imp. 50, 150, 250 ohms. Transformer fitted. Super directional with inbuilt 100 c/s high-pass filter. Long range pickup. Price: £450.

★

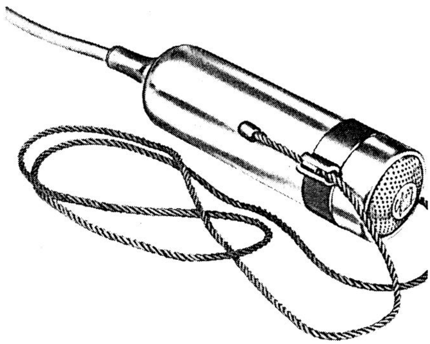
LEE PRODUCTS (G.B.) LTD., Elpico House, Longford Street, London, N.W.1. Tel.: Euston 5754. Cables: Leprod, London, N.W.1.

Geloso M51. Stick type crystal hand microphone. Omni-directional. F.R. 60 c/s-10 Kc/s. Sensitivity 1·1 mV/microbar. Imp. 500K. Price: £5 5s.

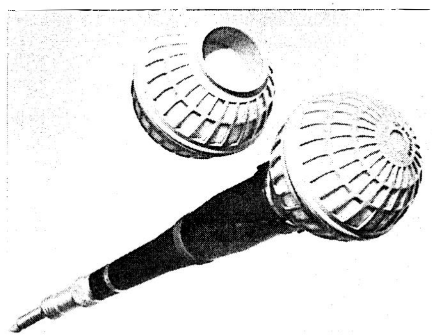
Geloso B72/1110. Crystal microphone for hand or stand use. Omni-directional. F.R. 60 c/s-10 Kc/s. Sensitivity 1·1 mV/microbar. Imp. 500K. Built-in switch. Table stand, head lifts off for hand use. Price: £7 7s.



Grampian cardioid



Geloso M19



Grampian DP4 and windshield

Geloso B92/1110. Similar to B72/1110 but with floor stand. Price: £11 11s.

Geloso M23. Moving coil wide angle microphone with gooseneck mounting. F.R. 60 c/s-14 Kc/s. Sensitivity 1·2 mV/microbar. Imp. 45K. Price: £9 9s.

Geloso M68. Hand type moving coil. Cardioid. F.R. 80 c/s-14 Kc/s. Sensitivity 1·7 mV/microbar. Imp. 250 ohms. Fitted special "sibilance" protector. Plug-in lead. Price: £10 10s.

Geloso M69. Similar to M68 but imp. 45K. Price: £10 10s.

Geloso M18. Lavalier moving coil. Cardioid. F.R. 60 c/s-14 Kc/s. Sensitivity 1·2 mV/microbar. Imp. 250 ohms. Price: £10 10s.

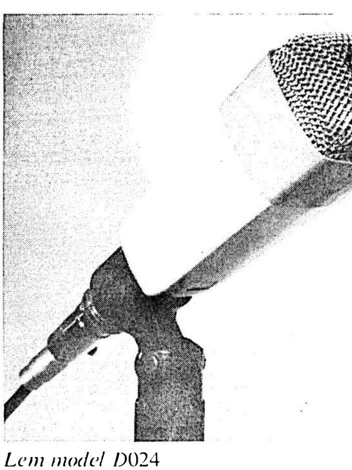
Geloso M19. Similar to M18 but imp. 45K. Price: £10 10s..

LEM. Distributors: Douglas A. Lyons and Associates Ltd., 32 Grenville Court, Dulwich, London, S.E.19. Tel.: Gipsy Hill 2833. Cables: Daliona, London, S.E.19.

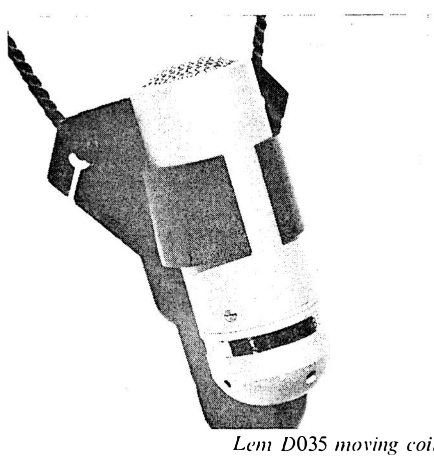
DH80. Miniature moving coil. Omnidirectional. F.R. 70 c/s-14 Kc/s. ± 4 dB. Imp. 50 ohms or 80K. Sensitivity (low imp.) -82 dB, (high imp) -52 dB. May be used as hand microphone, desk stand, or attached to floor stand. Prices: (low imp.) £6 15s., (high imp.) £8 10s. depending on fittings, etc.

DO35. Miniature Lavalier moving coil microphone. Omni-directional. F.R. 80 c/s-12 Kc/s ± 3 dB. Sensitivity -80 dB. Imp. 200 ohms. Can be used as hand or stand microphone. Size: $2\frac{1}{2}$ in. long, $\frac{7}{8}$ in. diameter. Weight: $1\frac{3}{4}$ oz. Price on application.

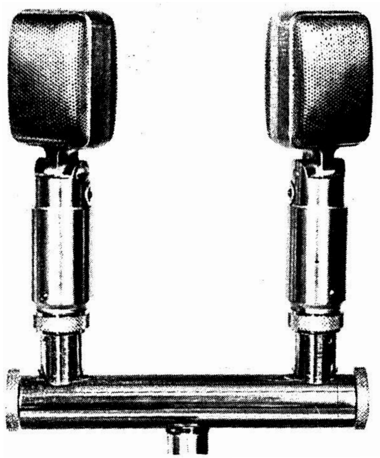
DO21B. Studio-quality omni-directional moving coil microphone. F.R. 30 c/s-16 Kc/s ± 3 dB. Imp. 50 ohms or 200 ohms. Sensitivity



Lem model D024

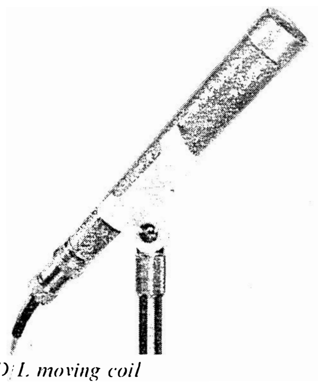


Lem D035 moving coil

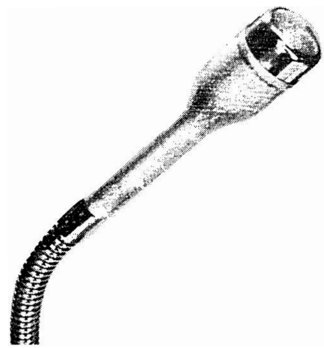


A pair of Reslo RBT/L

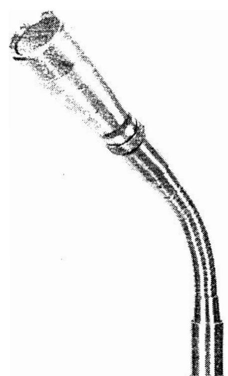
Lustraphone LD/66 moving coil



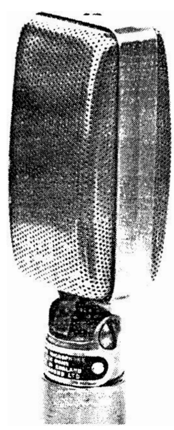
Reslo PD/L moving coil



Lustraphone LFV/59 moving coil



Reslosound Type MPD



Reslo Studios SR1 ribbon

(200 ohms) −77 dB. Individually calibrated response curves. Suitable for hand or stand use. Prices on application.

DO24. Hand or stand-type moving coil. Omni-directional F.R. 40 c/s-15 Kc/s Imp. 30-50 ohms. Sensitivity −82 dB. Internal element resiliently mounted to avoid mechanical shock Price. approximately £10 15s.

★

LUSTRAPHONE LTD., St Georges Works, Regents Park Road, N.W.1. Tel.. Primrose 8844. Cables: Lustraphon, London.

Lustrette LD/61 Series. Moving coil. Response 70-12,000 c/s. Source imp. low, line and high. Built-in trans, when required. 6 ft. cable. Price: £4 4s.

Master C51. Moving coil. Response 50-8,000 c/s. Source imp. low, line and high. Built-in trans. for line and high. 3-pin moulded mic. plug. Stand as required. Price, low: £6 6s.; line and high: £6 16s. 6d.

Master C48 and C48/S with Switch. Moving coil. Response 50-8,000 c/s. Source imp. 20 ohms. 3-pin moulded mic. plug. 6 ft. cable. Price C48. £6 6s.; C48/S: £7 17s. 6d.

Hand Pencil LFV/H59. Moving coil. Response 100-14.000 c/s. Source imp. low, line and high. Built-in trans. for line and high. 20 ft. cable for low and line. 9 ft. for high. Price: £8 18s. 6d.

Full-Vision LFV/59. Moving coil. Response 100-14,000 c/s. Source imp. low, line and high. Built-in trans. for line and high. 20 ft. cable with low and line. 9 ft. with high. Stand as required. Price: £9 19s. 6d.

Lavalier LV/59. Neck halter moving coil. Response 100-14,000 c/s. Low, line and high imp. Price· £9 19s. 6d.

LD/66. Moving coil. Response 70-12,000 c/s. Sensitivity −88, −75, and −52 dB, for low line and high imp. respectively. Price: £4 12s. 6d. low imp.; £5 5s. line and high imp. Stand fitting 15s. extra.

Tubular Hand TH59/SB. Moving coil with switch. Response 100-14,000 c/s. Sensitivity −88 dB at 25 ohms −75 dB at 600 ohms, and −54 dB at 50 000 ohms Transformer as required. Price: £10 10s.

Studio VR/53. Ribbon velocity. Response substantially flat to 14,000 c/s. Source imp. low, line and high. Built-in trans. 3-pin moulded mic. plug. 6 ft. cable. Stand as required. Price: £11 11s.

Ribbonette VR/64. Ribbon. Response substantially flat 50 to 13 000 c/s. Source imp low, line and high. Built-in transformer. 20 ft. cable for low and line. 9 ft. for high. Table base. Price: £8 18s. 6d.

●**Stereolus VR/65NS.** Dual head ribbon. Response 50-13,000 c/s. Sensitivity stereo −90 dB at 20 ohms. Price. £18 18s.

Lapel Mic. LP/62. Electro-Magnetic. Response, substantially maintained up to 6,000 c/s. Source imp. 30 and 1,000 ohms. 6 ft. cable. Price: £4 4s.

Chest Harness D59/BS. Moving coil. Response, substantially flat from 100-14,000 c/s. Source imp., low, line, high. 6 ft. cable. Price £12 12s.

Velodyne VC52/THSB. Noise cancelling moving coil with switch. Response rising to 1,700 c/s, flat to 3,500 c/s then falling. Source imp. 25 ohms or as required. Transformer as necessary. Price: £10 10s.

Contadyne Model CMC/68. Moving coil. Small contact microphone with noise cancelling feature. Imp. 20 ohms at 1 Kc/s. Price: £8 18s. 6d.

Microdyne Model CDA/72. Miniature electro-magnetic contact transducer. Price: £8 18s. 6d.

LT/59. Tubular hand model with P/1467 flexible tube support and table base. Price: £9 19s. 6d.

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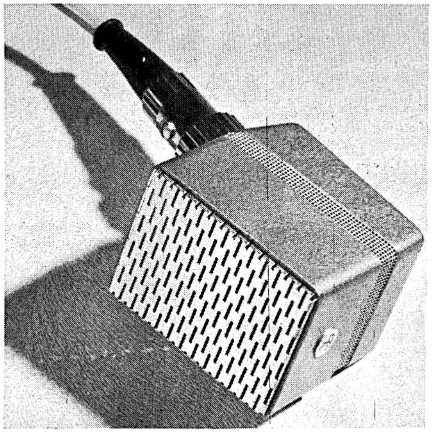
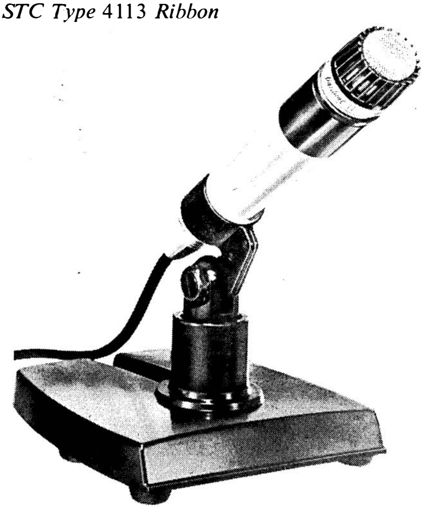
MB ELECTRONIC. Distributors: Denham and Morley Ltd., Denmore House, 173/5 Cleveland Street, London, W.1. Tel.: Euston 3656. Cables: Denmorl, London, W.1.

MB101. Moving coil. Omni-directional. Imp 200 ohms F.R. 40 c/s-18 Kc/s. Sensitivity −74 dB. Size: cap $1\frac{1}{8}$ in. dia., shaft $\frac{7}{8}$ in. dia., $5\frac{1}{2}$ in. long. Weight: 4 oz. Price: £14 14s.

MB201. Moving coil. Cardioid. Imp. 200 ohms. F.R. 50 c/s-18 Kc/s Front to back ratio 15-18 dB. Sensitivity −76 dB. Size and weight as for MB101. Price: £15 15s.



STC Type 4113 *Ribbon*



Shure 545 *Unidyne III*

Shure 55S *Small Unidyne*

MB211. Moving coil. Cardioid. Imp. 200 ohms. Response 50 c/s-18 Kc/s ±2·5 dB. Front to back ratio 15-18 dB. Sensitivity −76 dB. Size: head 1½ in. dia., shaft ⅞ in. dia., length 6 in. Weight: 5 oz. Price: £16 16s.

MB250. Moving coil. Cardioid. Imp. 200 ohms. F.R. 100 c/s-16 Kc/s. Front to back ratio 12-15 dB. Sensitivity −76 dB. Size: 1½ × 1½ × 5½ in. Weight: 3½ oz.

MB250TR. Similar size and specification as MB250 but with built-in transformer giving choice of 200 ohms or 50K imp. Price: £4 14s.
Prices and details of accessories on request.

★

NEUMANN G.m.b.H. Distributors: F. W. O. Bauch Ltd., Chaddlewood, Cockfosters Road, Cockfosters, Barnet, Herts. Tel.: Barnet 3170.

M49c. Condenser. Remote-controlled: omni-directional, cardioid, figure-of-eight (continuously variable). Response 35 c/s-15 Kc/s ±2 dB. Sensitivity across 1K: 0·7 mV/dyne/cm². Imp. 50 and 200 ohms. Built-in transformer. Remote-controlled pressure-gradient mic. Price (including power supply, mic., cable, output plug): £149 8s. 6d.

M50b. Condenser. Omni-directional. Response 40 c/s-16 Kc/s ±2 dB. Sensitivity across 1K: 1·5 mV/dyne/cm². Imp. 50 and 200 ohms. Built-in transformer. Pressure mic. Price (including power supply unit, mic. cable, output plug): £147 15s.

KM56c. Condenser. Switchable: omni-directional, cardioid, figure-of-eight. Response 40 c/s-15 Kc/s ±2 dB. Sensitivity across 1K: 0·8 mV/dyne/cm². Imp. 50 and 200 ohms. Built-in transformer. Miniature pressure-gradient type mic. Price (including power supply unit, mic. cable, output plug): £138 7s.

KM53c. Condenser. Omni-directional. Response 40 c/s-15 Kc/s ±2 dB. Sensitivity across 1K: 1·2 mV/dyne/cm². Impedance 50 and 200 ohms. Built-in transformer. Miniature pressure-type mic. Price (including power supply unit, mic. cable, output plug): £120 13s.

KM54c. Condenser. Cardioid. Response 40 c/s-15 Kc/s ±2 dB. Sensitivity across 1K: 0·8 mV/dyne/cm². Impedance 50 and 200 ohms. Built-in transformer. Miniature pressure-gradient type mic. Price (including power supply unit, mic. cable, output plug): £125 12s. 6d.

●**SM2c.** Stereo condenser. Both systems separately remote controlled: omni-directional, cardioid, figure-of-eight. Response 40 c/s-15 Kc/s ±2 dB. Sensitivity across 1K: 1 mV/dyne/cm². Imp. 50 and 200 ohms. Built-in transformer. Miniature mic. Price (including power supply unit, mic. cable, output plug): £238 8s.

M269c. Condenser. Remote-controlled: omni-directional, cardioid, figure-of-eight. Response 30 c/s-16 Kc/s ±2 dB. Sensitivity across 1K: 1·55 mV/dyne/cm² in cardioid; 1 mV/dyne/cm² in omni-directional and figure-of-eight, Imp. 50 and 200 ohms. Built-in transformer. Special sensitivity and bass cut switches. Price (including power supply unit, mic. cable, output plug): £150 10s. 6d.

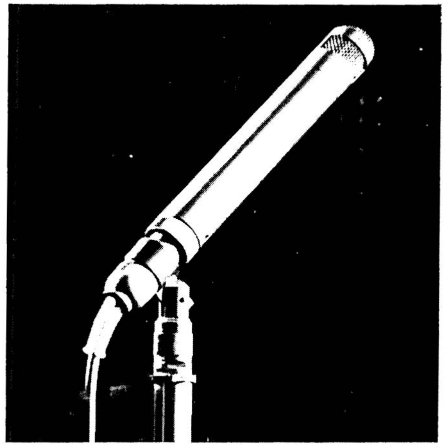
U67. Condenser. Switchable: Omni-directional, cardioid, figure-of-eight. Response 30 c/s-16 Kc/s ±2 dB. Sensitivity across 1K: 2 mV/dyne/cm² in cardioid, 1·2 mV/dyne/cm² in omni-directional and figure-of-eight. Imp. 50 and 200 ohms. Built-in transformer. Special sensitivity and bass cut switches; printed circuits. Price (including power supply unit, mic. cable, output plug): £129 10s.

KM64. Condenser. Cardioid. Response 40 c/s-18 Kc/s ±2 dB. Sensitivity across 1K: 0·9 mV/dyne/cm². Imp. 50 and 200 ohms. Built-in transformer. Special sensitivity switch (−14 dB). Miniature pressure-gradient type mic. Price (including power supply unit, mic. cable, output plug): £122 17s.

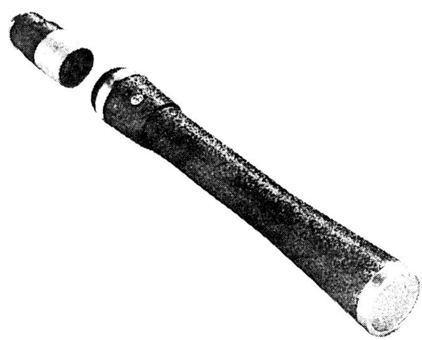
U64. Condenser. Cardioid. Response 40 c/s-18 Kc/s ±2 dB. Sensitivity across 1K: 1·1 mV/dyne/cm². Imp. 50 and 200 ohms. Built-in transformer. Special sensitivity switch (−14 dB). Miniature pressure-gradient type mic. Price (including power supply unit, mic. cable, output plug): £99 12s.

●**SM23c.** Double-stereo condenser. Both systems separately remote-controlled: omni-directional, cardioid, figure-of-eight. Response 40 c/s-15 Kc/s ±2 dB. Sensitivity across 1K: 1 mV/dyne/cm². Imp. 50 and 200 ohms. Built-in transformers. Miniature pressure-gradient type mics. Price (including power supply unit, mic cable, output plug): £247 15s.

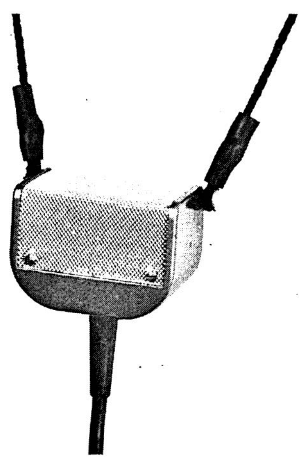
SRM64. Condenser. Cardioid. Response 40 c/s-18 Kc/s ±2 dB. Sensitivity across 1K: 0·8 mV/dyne/cm². 50 and 200 ohms. Built-in transformer. Special sensitivity switch (−14 dB). Miniature pressure-gradient type height-adjustable stand mic. Price (including mic. cable, power supply unit, output plug): £152 4s.



S.T.C. 4108 *condenser*

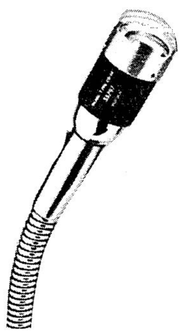


S.T.C. 4037-*A moving coil*

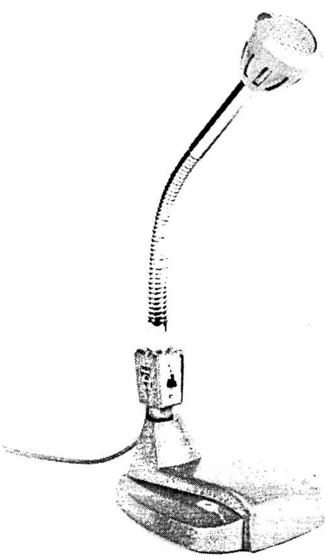


Reslo RL1/L

Simon Cadenza crystal



Pearl LD14 Moving coil



Philips EL6031 moving coil

●**SM69.** Double-stereo condenser. Both systems separately remote-controlled: omni-directional cardioid, figure-of-eight. Response 30 c/s-16 Kc/s +2 dB. Sensitivity across 1K: 1·5 mV/dyne/cm², Imp. 50 and 200 ohms. Built-in transformers. Pressure-gradient type mics. Price (including power supply unit, mic. cable, output plug): £252 14s. 6d.

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PEARL. Distributors: C. E. Hammond & Co. Ltd., 90 High Street, Eton, Windsor, Berks. Tel.: Windsor 63388. Telex.: 84316.

EC61. Condenser. Figure-of-eight. Response 30 c/s-18 Kc/s. Sensitivity −50 dB. Imp. 50, 200, 600 ohms. Fitted with transformer, self-contained amplifier. Price (incl. mains power supply unit or battery power supply unit): £42.

LD14. Moving coil. Omni-directional. Response 95 c/s-18 Kc/s. Sensitivity −54 dB. Output imp. 30-200 ohms. Transformer fitted. Price: £12 18s.

LD18. Moving coil. Omni-directional. Response 80 c/s-18 Kc/s. Sensitivity −54 dB. Output imp. 30-200 ohms. Transformer fitted. Price: £14 6s.

RD16. Moving coil. Cardioid. Response 50 c/s-18 Kc/s. Sensitivity −54 dB. Output imp. 30-200 ohms. Transformer fitted. Price: £14 14s.

RD34. Moving coil. Cardioid. Response 30 c/s-20 Kc/s. Sensitivity −54 dB. Output imp. 30-200 ohms. Transformer fitted. Price: £15 15s.

RD32. Moving coil. Cardioid. Response 60 c/s-18 Kc/s. Sensitivity −55 dB. Output imp. 30-200 ohms. Price: £29 5s.

C2. Condenser. Response 20 c/s-18 Kc/s. Sensitivity −55 dB. Output imp. 200 ohms. complete with power supply unit Type E. 3000. Price: £82 19s.

C12. Condenser. Response 100 c/s-16 Kc/s. Sensitivity −50 dB. Output imp. 200 ohms. complete with power supply unit Type E. 3000. Price: £77 14s.

CK. Condenser. Response 20 c/s-18 Kc/s. Sensitivity −55 dB (Cardioid) −60 dB; (Omni-directional) Output imp. 200 ohms Complete with power supply unit Type E. 3000. Price: £82 19s.

Flexible Swan-neck connectors. For dynamic microphones. Model 1903 less switch. 3 pole connector. Length 175 mm. Price: £3 17s. 4d.

★

PETO SCOTT ELECTRICAL INSTRUMENTS LTD., Addlestone Road, Weybridge, Surrey. Tel.: Weybridge 45511.

EL6014/00. Moving coil. Response 100-10,000 c/s. Sensitivity −74 dB or −57 dB. Source imp. 500 ohms or 25,000 ohms. Price: £8.

EL6021. Moving coil. Response 60-15,000 c/s. Source imp. 50, 500, 10,000 ohms. Price: £14.

EL6031. Hypercardioid moving coil. Response 70-15,000 c/s. Sensitivity −74 dB or −58 dB. Source imp. 500 ohms or 25,000 ohms. Price: £17.

EL6040. Moving coil. Response 60-20,000 c/s. Source imp. 50, 500 and 25,000 ohms. Price: £25.

ET1045. Miniature moving coil. Halter. Omni-directional. Response 150 c/s-10 Kc/s ±3 dB. Sensitivity −88 dB. Imp. 50 ohms. 15, 30, 60 feet extension cables available. Quick release attachment of cable. Price: £13; cable extra.

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PHILIPS ELECTRICAL LTD., Century House, Shaftesbury Avenue, London, W.C.2. Tel.: Gerrard 7777. Cables: Phillamps, London.

EL3755/00. Moving coil. Cardioid. Response 150 c/s-10 Kc/s. Output 0·34 mV/microbar at 1 Kc/s. Imp. 500 ohms. Price: £3 10s.

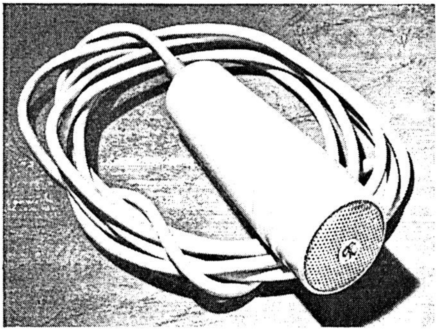
●**EL3757/00.** Stereo moving coil. Cardioid. Output 0·2 mV/microbar at 1 Kc/s. Imp. 500 ohms per insert. Two inserts at 90° for stereo recording. Price: £10 10s.

EL3781/00. Moving coil. Omni-directional. Response 150 c/s-10 Kc/s. Output 0·36 mV/microbar at 1 Kc/s. Imp. 500 ohms. Price: £3 10s.

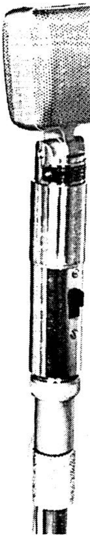
EL3782/00. Moving coil. Cardioid. Response 150 c/s-10 Kc/s. Output 0·22 mV/microbar at 1 Kc/s. Imp. 500 ohms. Speech/music switch, bass cut in speech position. Price: £5.

EL3790/00. Moving coil. Omni-directional. Response 150 c/s-10 Kc/s. Output 0·26 mV

S.T.C. 4033 *moving coil and ribbon*



STC Type 4118 *Moving Coil*



Reslo RBTS/L

microbar at 1 Kc/s. Imp. 500 ohms. Price: £3 10s.

EL3797/00. Moving coil. Omni-directional. Specially designed for use with Philips EL3300 recorder. Includes EL3796 remote control (detachable). Response 150 c/s-10 Kc/s. Output 0·23 mV/microbar at 1 Kc/s. Imp. 500 ohms. Price: £4 5s.

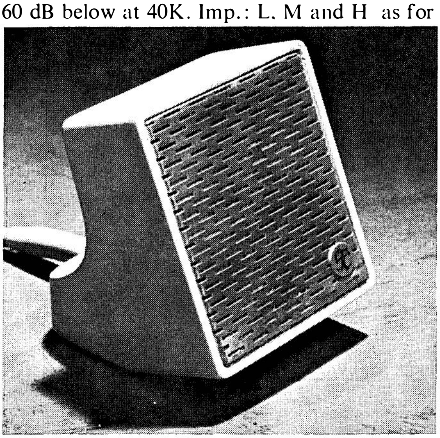
★

RESLOSOUND LTD., 24 Upper Brook Street, London, W.1. Tel.: Hyde Park 2291. Cables: Derritron, London.

RBT Series. High quality miniature ribbon. F.R. 50 c/s-14 Kc/s ±3 dB. Figure of eight, modified as required by filter pads. Sensitivity 58 dB below at 40K. Imp. RBT/L 30-50 ohms; RBT/M 250 or 600 ohms; RBT/H 30-50 ohms or 40K. A switched model also available with the switch included in a slightly longer body (RBTS/L, RBTS/M, RBTS/H). Finish: Satin chrome or silver hammertone enamel. Acoustic filter pad for close-talking use. Prices: RBT/L £11 0s., RBT/M, RBT/H £11 10s. For switched models add £2 10s.

CR2 Series. High quality miniature ribbon. F.R. 40 c/s-16 Kc/s (−2 dB at 60 c/s, +10 dB at 16 Kc/s.). Cardioid, figure of eight partially suppressed at the rear. Sensitivity 58 dB below for high-Z model. Imp.: L, M and H as for RBT Series. Flexible swan neck stem. Finish: Satin chrome perforated front, diecast case, silver grey hammer enamel. Prices: CR2/L £11 10s., CR2/M, CR2/H £12.

PR Series. Pencil type ribbon. F.R. 50 c/s-16 Kc/s. (±5 dB 100 c/s-10 Kc/s). Modified figure of eight with pads fitted. Sensitivity 60 dB below at 40K. Imp.: L, M and H as for



STC Type 4114 *Moving Coil*

RBT Series. Removable fibre-glass damping pads. Finish: Satin chrome and silver grey hammer. Other finishes to order. Prices: PRL £9. PRM, PRH £9 10s.

RL1 Series. Lightweight ribbon Lavalier type. F.R. 100 c/s-16 Kc/s (−10 dB at 100 c/s, +6 dB at 16 Kc/s). Cardioid above 200 c/s, minimum underneath and side pick up at 5 Kc/s. Sensitivity 89 dB below at 30-50 ohms. Imp.: RL1/L 30-50 ohms, RL1/M 300 or 600 ohms. Other impedances to quantity order. Direct contact noise reduced to minimum. Lower bass frequencies attenuated to control chest tones. Black nylon neck cord with quick release loops. Mazak diecast case finished polychromatic grey with aluminium mesh. Prices: RL1/L £15, RL1/M £15.

SR1 Series. Professional studio ribbon. F.R. 30 c/s-20 Kc/s ±2 dB. Nominal figure of eight. Damping pads available. Sensitivity 73 dB at 300 ohms. Imp.: SR1/L 30-50 ohms, SR1/M 250 or 300 ohms. Developed for use by broadcasting authorities and recording studios. Finish: satin Florentine bronze. Other finishes to quantity order. Price: (both models) £27.

VRT Series. Special miniature ribbon. F.R. 30 c/s-16 Kc/s, −2 dB at 40 c/s, +2 dB at 16 Kc/s. Nominal figure of eight. Damping pads available. Sensitivity 81 dB below at 300 ohms. Developed for broadcast and recording studios. Satin chrome finish. Price: £17.

PD Series. Pencil moving coil with lightweight tapered housing. F.R. 50 c/s-15 Kc/s, −4 dB at 100 c/s, +4 dB at 14 Kc/s. Omni-directional with microphone vertical. With microphone horizontal rear response −18 dB at 11 Kc/s. Sensitivity 88 dB below at 30–50 ohms. Imp.: PDL 30-50 ohms, PDM Dual 250 or 600 ohms, PDH Dual 30-50 ohms or 40K. Switched version available; PDS/L, PDS/M, PDS/H. Finish: Silver grey hammer or black crackle. Prices: PDL £11 10s., PDM, PDH £12 10s. For switched versions add £1 10s.

MPD Series. Miniature pencil moving coil. F.R. 50 c/s-15 Kc/s, −12 dB at 100 c/s, +4 dB at 14 Kc/s. Omni-directional with microphone vertical, rear response − 18 dB at 11 Kc/s with microphone horizontal. Sensitivity 88 dB below at 30-50 ohms. Imp.: MPD/L 30-50 ohms, MPD/H high impedance (comprises MPD head, LTU1 line transformer, A922 flexible stem and C930 cable set). Suitable close-talking applications without additional filters. MPD/L supplied with

Lavalier cord and quick-release clips. Finish: Satin tint laquer. Other finishes to quantity order. Prices: MPD/L £10 10s., MPD/H £14.

VMC2. High-output moving coil. Rugged construction. F.R. 50 c/s-16 Kc/s ± 5 dB. Imp. 15 ohms. On/off switch. Price: £9 5s.

HM Series. THM1/L moving coil insert in high-impact off-white plastic case for hand use. Input load 30-50 ohms. CHM1 crystal insert in similar case to THM1/L. Incorporates switch and low capacity coaxial cable. Suitable domestic tape recording. Prices: THM1/L £7, CHM1 £3 5s.

Coupler unit GE1. Suitable for use with any impedance microphone. Designed for external use adjacent to the tape recorder or amplifier. Gain 35-40 dB. Response 50 c/s–20 Kc/s ± 1 dB. Fitted 36 in. screened lead and jack plug. Self-contained PP4 battery with average life of 1,500 hours. Price: £8.

Coupler unit GE2. Similar to GE1 but with addition of a 30-50 ohm input transformer for balanced-to-earth input. Permits use of long microphone lines with low noise and hum. Price: £12.

Coupler transformer LTU1. Designed for use between a low impedance microphone (15-50 ohms) and a high impedance microphone-input socket. Nominal input 40 ohms, nominal output 100K for valve grid circuit. Response 50 c/s-15 Kc/s. 1 dB. Price: £4 7s. 6d.

Microphone transformers MT101, MT102. Designed for internal mounting in equipment having only high impedance inputs. Input imp.: MT101 15-50 ohms, MT102 300-600 ohms. Nominal output imp. 100K. Response 50 c/s-15 Kc/s ± 2 dB. Prices: MT101 £2 15s., MT102 £3.

Microphone stands.

MS. 100A. Adjustable floor stand. Minimum height 3 ft. 4 in., maximum height 5 ft. 2 in. Grey hammertone base and outer stem, chrome inner extension piece. Price: £7 10s.

MS. 110A. Similar to the MS. 100A but with chrome stem. Price: £7 10s.

A boom fitting (MS.175) is available for use with Reslo floor stands. Details on application.

MS. 200. Adjustable table stand. Minimum height 1 ft. 4 in., maximum height 2 ft. 2 in. Grey hammertone base with chrome stem and extension piece. Price: £4 5s.

MS. 300. Circular desk stand. Grey hammertone base fitted with 3 in. chrome stem. Price: £2 5s.

MS 400. Rectangular desk base. Fitted foam pads. Finished in silver grey hammertone. Muting switch optional extra. Price: £2, with switch £2 13s.

MS. 500. Rectangular desk base. Similar to MS. 400 but fitted with rubber feet. Price: £1 15s., with switch £2 8s. 6d.

Other accessories available include mounting units, cables, reducers, adaptors, etc. All prices include packing and postage.

★

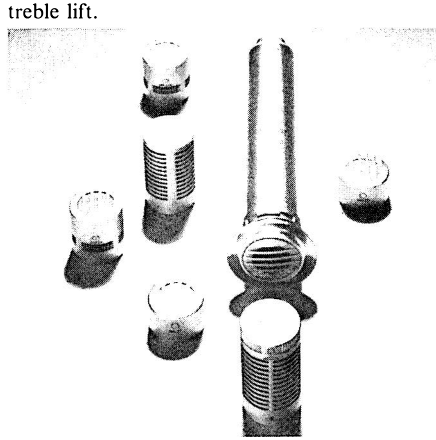
RONETTE. Distributors: H. K. Harrison & Co. Ltd., 1-3 Jacobs Well Mews, George Street, London, W.1. Tel.: Welbeck 9453/9606. Cables: Empirian, Audley.

Ronette MM-65. Crystal. Omni-directional. Response 30 c/s-10 Kc/s. Imp. 5 megohms. 300 pF. Small and rugged. Price: £2 5s.

SCHOEPS. Distributors: C. E. Hammond & Co. Ltd., 90 High Street, Eton, Windsor, Berks. Tel.: Windsor 63388. Telex.: 84316.

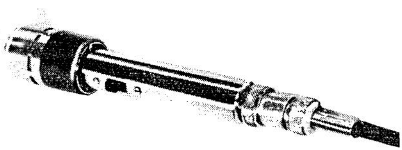
Miniature condenser microphone system, consisting of power supply, body and various screw-in capsules.

M221B. Microphone body.
N20B. Power supply unit.
MK24. Capsule. Cardioid.
MK22. Capsule. Omni-directional.
MK23. Capsule. Omni-directional with slight treble lift.

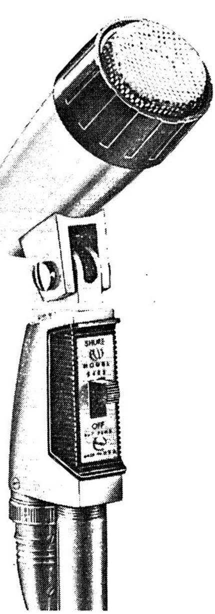


Schoeps Condenser Microphone System

Shure model 535



Reslo CD dynamic



Shure model 540*S*

MK240. Capsule. Cardioid. Has slight bass cut. Front-to-back ratio at 1 Kc/s better than 31 dB.

MK26. Cardioid / bi-directional / omni-directional.

MK28. Capsule. Bi-directional.

M934B. Cardioid/omni-directional.

Full range of accessories available, including elastic suspension cradle and breath shield. Prices on application.

★

SENNHEISER ELECTRONICS. Distributors: Impectron Ltd., Impectron House, 125 Gunnersbury Lane, Acton, London, W.3. Tel.: Acorn 8762.

MD21. Desk stand moving coil microphone. Near omni-directional. F.R. 50 c/s-15 Kc/s. Imp. 200 ohms or 30K. Sensitivity −53 dB. Size: 4 × $1\frac{7}{8}$ × $1\frac{7}{8}$ in. Weight: $6\frac{1}{2}$ oz. Windshield and various accessories available. Price on request.

MD201. Moving coil. Desk stand. Shock resistant mounting in light metal case. Fully weatherproofed and suitable for outside work. Approximately omni-directional. F.R. 50 c/s-13 Kc/s. Imp. 200 ohms. Sensitivity −53 dB. Size: $2\frac{1}{8}$ × $4\frac{5}{8}$ in. Weight: 14 oz. Various stand and accessories. Price on request.

MD403. Moving coil. Directional super cardioid response. F.R. up to 12 Kc/s. Imp. 200 ohms or 45K. Sensitivity −56 dB. Discrimination at 135° >12 dB over whole frequency range. Size: $3\frac{1}{2}$ × $2\frac{1}{4}$ × $1\frac{1}{2}$ in. Price on request.

MD421. Moving coil studio microphone. Cardioid. F.R. 30 c/s-17 Kc/s. Sensitivity −53 dB. Imp. 200 ohms or 30K. Built-in spee h/music control Individual response curve supplied with every unit. Full range of stands, adaptors, etc. Price on request.

●**MDS1.** Stereo microphone incorporating two dynamic units. F.R. up to 15 Kc/s (response of one unit is within ± 1·5 dB of the other). Imp. 200 ohms. Discrimination at 120° > 12 dB. Various mounting arrangements to provide intensity stereo, A/B stereo and artificial head.

MD31. Miniature moving coil floor stand microphone. Near omni-directional. F.R. 50 c/s-12 Kc/s Imp. 200 ohms. Stand base $6\frac{3}{4}$ in. diameter, $2\frac{3}{8}$ in. thick. Telescopic stand 35-60 in. Total weight $3\frac{1}{4}$ lb. Accessories include tube exte sion and sound guide to convert to directional response. Price on request.

★

SHURE ELECTRONICS LTD., 84 Blackfriars Road, London, S.E.1. Tel.: Waterloo 6361.

55S Small Unidyne. Cardioid moving coil. Response 50-15.000 c/s. Sensitivity −57 dB at high impedance. Source imps. 35-50, 150-250 ohms, and high. Switched transformer built-in. Price: £27 13s. 4d.

535 Slendyne. Moving coil. Response 60-13,500 c/s. Sensitivity −61 dB. Source imps. 50-250 ohms and high. Switched built-in transformer. Price: £24 6s. 8d.

545 Unidyne III. Cardioid moving coil. Response 50-15,000 c/s. Sensitivity −55 dB. Source impedance 25-250 ohms and high. Built-in transformer. Price: £28 6s. 8d.

Sonodyne II Model 540S. Moving coil microphone. Response 60-15,000 c/s variable. High output. High and low impedance. Price: £16 13s. 4d.

★

SIMON EQUIPMENT LTD., 48 George Street, Portman Square, W.1. Tel.: Welbeck 2371. Cables. Simsale, London.

Cadenza Ribbon. Response 50-12,000 c/s. Sensitivity, high impedance −58 dB, low impedance −93 dB, or with suitable line transformer −58 dB. Source imp. 30 ohms and 80K ohms. Price: £8 18s. 6d.; with tripod desk stand and 11 ft. cable: £10 10s.

Cadenza Crystal. Response 30-8,000 c/s. Sensitivity −47 dB. Optimum load 10 megohms. Minimum load 1 megohm. Price: £3 13s. 6d.

★

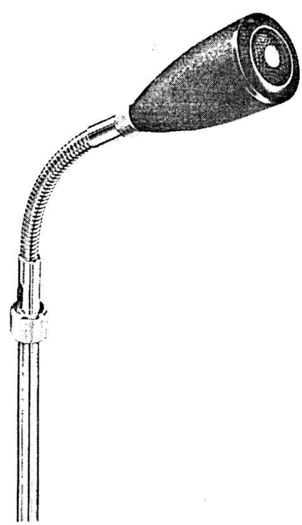
S.T.C. LTD., Electromechanical Division, West Road, Harlow, Essex. Tel.: Harlow 21341.

4021-J. Spherical omni-directional moving coil. Flat response 30-15,000 c/s. Impedance 30 ohms. Sensitivity −80 dB. Price: £16 10s.

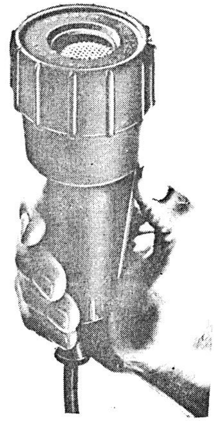
4032-G. Moving coil hand microphone. Flat response 40-10,000 c/s. Imp. 30 ohms. Sensitivity −78 dB. Windshield available. Price: £16 10s.

S.T.C. 4038 *A ribbon*

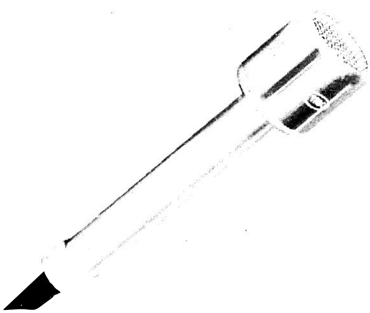
Neumann SM2 Stereo Condenser



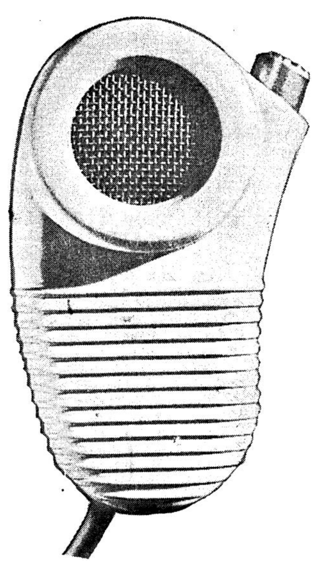
*Vitavox M*100



Vitavox B64 moving coil



Trix G7854 moving coil



Vitavox B50 moving coil

4033-A. Cardioid microphone. Moving coil and ribbon elements which can be used individually or in combination. Flat response 30-10,000 c/s. Imp. 50 ohms. Sensitivity 80 dB. Front to back ratio 15 to 20 dB. Price: £54.

4037-A. Moving coil unobtrusive "Pencil" microphone. Flat response 30-15,000 c/s. Imp. 30 ohms. Sensitivity −84 dB. Price: £22 (long model).

4038-A. Studio ribbon microphone. Accurate figure-of-eight polar response. Flat response 30-15,000 c/s. Imp. 30 ohms. Sensitivity −85 dB. Non-linear distortion 0·1%. Controlled transient response. Price: £43 10s.

4104-B *X* C. Commentator's lip microphone. High degree of noise cancellation. Flat response 70-10,000 c/s. Imp. 30 ohms. Output −82 dB ref. 1V for 10 dyne/cm. Price: £70.

4105-A. Cardioid moving coil. Flat response 60-10,000 c/s. Imp. 30 ohms. Sensitivity −82 dB. Front to back ratio 15 to 20 dB. Price: £22 10s.

4108. Condenser. Cardioid. Response 30 c/s-20 Kc/s. Sensitivity −60 dB. Imp. 30 or 300 ohms. Transformer fitted. Small directional studio microphone. Price: £96.

4118. Moving coil. Omni-directional. F.R. 100 c/s-15 Kc/s ±4 dB. Sensitivity −80 dB (200 ohms), −60 dB (50K with transformer). Neck halter and desk stand available. Price: £4 19s. 6d.

4113. Ribbon. Cardioid. F.R. 60 c/s-15 Kc/s ±3 dB. Sensitivity −87 dB. Imp. 30 ohms. Desk stand available. Price: £11 11s.

4114. Moving-coil. Omni-directional. F.R. 100 c/s-8 Kc/s ±4 dB. Sensitivity −80 dB. Imp. 200 ohms. Transformer available to order. Price on application.

4119. High quality ribbon. Narrow cardioid response. Tubular-shape case with spherical woven wire wind shield. The tubular bass chamber forms convenient handle. Especially suitable for close-talking applications, pop singers, etc. Price about £25.

4126. Capacitor type with built-in field effect transistor head amplifier. Cardioid or omni-directional to order. Maximum pick up forward in line with axis. Suitable for in-shot TV work and for use by individual artists.

Tubular and just over 2 in. long. Price: (with power unit and accessories) about £120.

★

TRIX. Ultra Electronics Ltd., Telecommunications Division, Long Drive, Greenford, Middlesex. Tel.: Waxlow 5721. Cables: Seltric, Greenford.

G7823. Ribbon. Response 50-12,000 c/s. Source imp. 30 ohms. 18 ft. cable, 3 pin locking type plug. Stands as required. Price: £10 7s., (high impedance G7823/H) £11.

G7852. Moving coil. Response 50-9,000 c/s. Source imp. 30 ohms. Cable and connector. Price: £10 10s.

G7852/F. Moving coil. Similar to G7852 but incorporating flexible stem. Cable and connection. Price: £11 2s.

G7852/FP. Moving coil. Similar to G7852 but priority microphone on base with switch. Price: £16 10s.

G7854. Moving coil. Response 100 c/s-11 Kc/s. Imp. 30 ohms. Hand-type, complete with cable. Price: £8 2s. Can be used with neck sling attachment G7977/N, also with stand fitting with swivel clip attachment G7979/C: £1.

M76A. Moving coil. Cardioid. Response 100 c/s-15 Kc/s. Sensitivity −63 dB. Imp. 30 ohms. Attenuation—rear to front,—20 dB. Price: £21 15s.

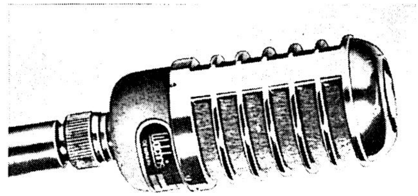
G7871/D. Moving coil. Response 50 c/s-8 Kc/s. Source imp. 30 ohms. 18 ft. cable, with switch. Stands as required. Price: £8 7s.

★

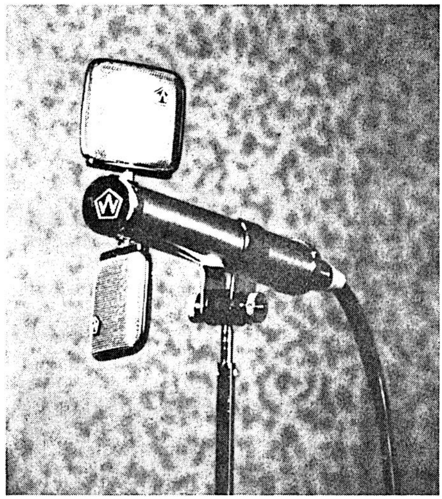
TURNER. Distributors: Ad Auriema Ltd., 125 Gunnersbury Lane, Acton, London, W.3. Tel.: Acorn 8762.

SR90D. Robust hand type pressure-operated dynamic unit. Response 200 c/s-10 Kc/s. Imp. 200 ohms or 25K. Built-in switch with spare contacts. Die-cast case finished brushed chrome. Weight: 1 lb. 6 oz. including self-coiling lead. Price: £14 8s. 10d.

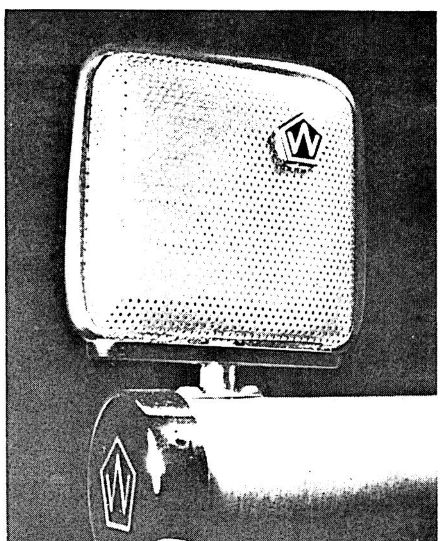
58. Miniature dynamic designed for lavalier use. Omni-directional. Response 60 c/s-13 Kc/s. Imp. interchangeable 150 ohms and 30K. Size: 4 in. long, 1 in. diameter. Weight: 3½ oz. Desk stand optional extra. Price: £19 7s. 4d.



Walchris 63M



Woollett stereo condenser



Woollett condenser

500. Hand or stand dynamic unit with cardioid response. Frequency response 40 c/s-15 Kc/s. Imp. 150 ohms and 40K. Die-cast alloy case finished satin chrome. Size: $6\frac{3}{4}$ in. long, $1\frac{1}{2}$ in. diameter. Weight: 12 oz. (excluding cable). Price: £29 14s. 4d.

510. Hand or stand dynamic unit with cardioid response. Frequency response 40 c/s-15 Kc/s. Imp. 50 ohms and 200 ohms. Designed for broadcast use. Shock mounted. Die-cast alloy case finished matt blue-grey. Size: $6\frac{3}{4}$ in. long, $1\frac{1}{2}$ in. diameter. Weight: 12 oz. (excluding cable). Price: £50 19s. 4d.

★

UHER. Distributors: Bosch Ltd., 205 Great Portland Street, London, W.1. Tel.: Langham 1809.

M152. Moving coil. Omni-directional. F.R. 50 c/s-10 Kc/s. Imp. 200 ohms. Record/Stop/ Start/ Rewind control. Price: £11 15s.

★

VITAVOX LTD., Westmoreland Road, London, N.W.9. Tel.: Colindale 8671. Cables: Vitavox, London, N.W.9.

B50. Moving coil. Response 60 c/s-8 Kc/s. Sensitivity −85 dB. Source imp. 25 ohms. 6 ft. cable. Built-in control switch. Price: £6 17s.

B54. Moving coil incorporating built-in transformer. Response 60 c/s-8 Kc/s. Sensitivity −85 dB (excluding transformer). Source imp. 200, 500, 10K, 100K ohms according to transformer. Built-in control switch. Price: £8 5s.

B60. Similar specification to B50 but weatherproof version. Price: £8 17s.

B64. Similar specification to B54 but weatherproof version. Price: £10 5s.

M100. Moving coil incorporating tapped transformer giving choice of 25, 200, 10K ohms and high impedance. Response 50 c/s-15 Kc/s ±3 dB. Sensitivity -80 dB, −71 dB, −54 dB, −44 dB according to impedance. 9 ft. cable and flexible support. Price: £18.

★

WALCHRIS. Distributors: Britimpex Ltd., 16/22 Great Russell Street, London, W.C.1. Tel.: Museum 7600. Cables: Brytron, London, W.C.1.

63M. Velocity type studio microphone available in high or low impedance versions. Figure of eight. Response 30 c/s-18 Kc/s ±2·5 dB. Sensitivity (high Z) 1 mV/microbar. Imp.: 50 ohms, 200 ohms, or 80K. Special impedances to order. Weight: 7 oz. Resilient mounting isolates unit from shocks or vibration through the support Price: £16 16s.

Base: semi-flexible stand, 10 ft. cable and connector. Available in chrome and grey or black crackle finish. £4 4s. Shielded transformers, connectors, extension leads, switch units, etc.

★

L. G. WOOLLETT & COMPANY LTD., 21 Anerley Station Road, London, S.E.20. Tel.: Sydenham 9003.

●**Stereo/condenser.** Separate plug-in cells. Stereo or mono. Figure of eight, velocity. Stand type unit fits international photographic thread ($\frac{1}{4}$ in. Whitworth). Specification not available at time of going to press. Price: Velocity head £14 14s. (two required for stereo), Head amplifier £18 18s., isolated power supply £23 2s.

DIRECTORY OF CONSTRUCTIONAL KITS

DYNACO. See amplifier and tuner sections.

★

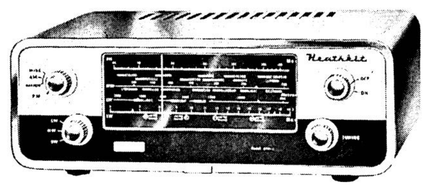
HEATHKIT. Manufactured by Daystrom Ltd., Bristol Road, Gloucester.

●**AA-22U.** Transistorised stereo integrated amplifier. Inputs: PU 6 mV, radio 250 mV, tape 250 mV, aux. 1. 250 mV, aux. 2. 250 mV. Controls: Balance, selector switch, mode switch, volume, bass, treble, filter (3-position; flat, 4 Kc/s, 8 Kc/s 12 dB/octave). Noise -50 dB on PU, -65 dB all other inputs. Output: 20W per channel RMS. Distortion 0·3% at 20W. F.R. 15 c/s–30 Kc/s ± 1 dB. Feedback 35 dB. Output imp. 4, 8 or 16 ohms. Pre-set gain controls accessible from the front. Mains 110, 200-250V 50-60 c/s. Size: $15\frac{1}{2} \times 3\frac{7}{8} \times 12\frac{1}{8}$ in. Price (kit): £43 18s.; (assembled): £68 16s.

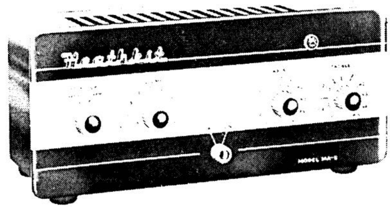
●**S-99.** Stereo amplifier kit. Output 9W, 3 or 15 ohms, per channel. Distortion 0·2% at 1 Kc/s, 0·35% at 4 Kc/s, 0·42% at 40 c/s. F.R. 30 c/s-20 Kc/s $\pm 0{\cdot}5$ dB. Feedback 26 dB. H. and N. pickup 1 (magnetic) -55 dB; pickup 2 (crystal -55 dB; Aux. (microphone, etc.) -60 dB; radio, tape -65 dB. Inputs: pickup 1, 4 mV, 100K continuously variable; pickup 2, 180 mV, 47K continuously variable; Aux. 20 mV, 500K linear; radio, tape 100 mV. 350K linear. P.s.n. 100-125, 200-210, 220-230, 240-250V, 50-60 c/s. 100W. Printed circuit boards for easy assembly. High sensitivity to suit all types of pickups. Variable filter. Price (kit): £28 9s. 6d.; (assembled): £38 9s. 6d.

●**S-33.** Stereo amplifier kit. 3W per channel. Distortion 0·3%. Input 100 mV at 1 megohm. Bass, treble, balance, volume. Price (kit): £13 7s. 6d.; (assembled): £18 18s.

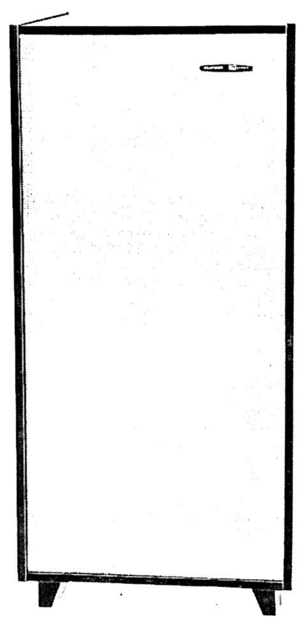
●**S-33H.** Stereo/mono amplifier. Output 3·5W. Distortion, less than 0·6% at 1,000 c/s for 3W. H. and N. gram -55 dB, radio -60 dB (referred to 3W). Sensitivity: gram 50 mV (high imp.), aux. 150 mV, radio 100 mV. P.s.n. 100-125, 200-210, 220-230, 240-250V AC 40-60 c/s. Size: $11\frac{3}{4} \times 5\frac{1}{4} \times 10$ in. Based on Model S-33, but an extra stage is incorporated to increase the sensitivity required for the new high quality Ceramic pickups. Choice of three inputs provided, and close matched twin ganged potentiometers used for volume and tone controls. Price (kit): £15 17s. 6d.; (assembled): £21 7s. 6d.



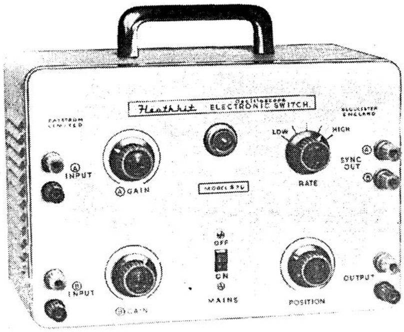
Heathkit AFM/1 AM/FM tuner



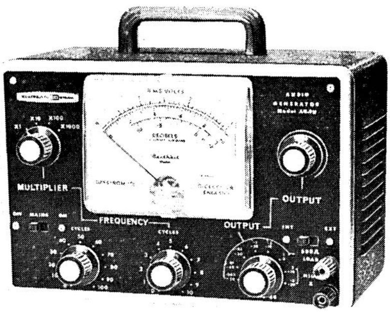
Heathkit MA-5 monaural amplifier



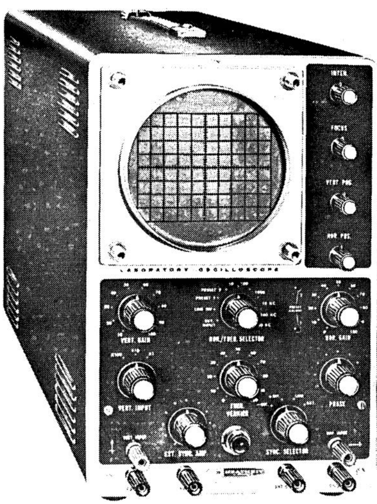
Heathkit Cotswold MFS



Heathkit S-3U electronic switch



Heathkit AG-9U audio signal generator



Heathkit 10-12U oscilloscope

MA-5. Monaural amplifier. Output 5W. Distortion less than 0·5% at 1,000 c/s; less than 1% at 5 Kc/s. Sensitivity: radio 200 mV, 0·5 megohms; gram 200 mV, 0·5 megohms. Rec. imp. 2-4 and 14-16 ohms. H. and N. less than −60 dB referred to 5W. Output stages: ECC83, EZ81, 2 × EL84. P.s n. 100-110, 200-210, 220-230, 240-250V AC 40-60 c/s. Size: 11 × $6\frac{5}{8}$ × $4\frac{3}{4}$ in. Panel $11\frac{3}{4}$ × $5\frac{1}{4}$ in. Suitable for most crystal pickups. Provision for connection of radio tuner or tape recorder. Price (kit): £10 19s. 6d.; (assembled): £15 10s.

MA-12. Mono amplifier. Output 10W rms (12W max) between 30 c/s and 10 Kc/s. Distortion: less than 0·1% at 10W, 1 Kc/s; less than 0·2% at 10W, 5 Kc/s; less than 0·4% at 10W, 40 c/s. F.R. 20 c/s-30 Kc/s ±1 dB. Feedback main loop 26 dB, subsidiary loop 6 dB. H. and N. −85 dB at 10W. Input 120 mV for 10W output. Output imp. 2-4, 8-11, 14-16 ohms. Valves, EF86, ECC83, EL84 (2), GZ34. P.s.n. 100-117V, 200-250V AC, 40-60 c/s, 100W. Size: $11\frac{1}{8}$ × $6\frac{3}{4}$ × $5\frac{3}{4}$ in. Weight: $12\frac{1}{2}$ lb. Price (kit): £11 18s.; (assembled): £15 18s.

●**USC-1.** Stereo pre-amplifier. Inputs: pickup 1, 3-4 mV 50K; pickup 2, 150 mV 1 megohm; tape 1, 2·5 mV 80K CCIR, tape 2, 150 mV 100K; radio 150 mV; mic. 3 mV, 1 megohm; aux., 4-150 mV, 1 megohm. Controls: bass, treble, rumble filter, variable low pass filter, balance, volume, function, channel reverse. Power required, 250V 10 mA, 6·3V 1·5 amps. Output voltage 1·3V R.M.S. Price (kit): £19 10s.; (assembled): £26 10s.

UMC-1. Mono control unit. Inputs: mag. pu. 9 mV, 100K, RIAA; crystal pu. 50 mV variable, 1 megohm linear: Aux. 120 mV, 500 K linear; mic. 4 mV, 130K linear; radio 100 mV variable, 330K linear. Output up to 0·25V. Controls: sel., bass, treble, filter, volume on/off. Low pass filter. H. and N. −65 dB P.s.n. 180-300V, 3 mA DC, 6·3V, 0·6 amps AC. Suitable for free standing or cabinet installation. Price (kit): £8 12s. 6d.; (assembled): £13 12s. 6d.

USP-1. Booster amplifier. Suitable for stereo and monaural sources of low sensitivity, e.g. pickups, tape heads or microphones. Input sensitivity 2-20 mV. Output adjustable from 20 mV to 2V. Maximum gain 100. Power requirements 180-250V, 3-5 mA; 6·3V 0·5 amps. Price (kit): £7 7s. 6d.; (assembled): £10 9s. 6d.

TM-1. Four-channel mixer. Two high imp. inputs with sensitivity 1 5 mV and two aux. inputs with sensitivity 180 mV. Output 200 mV at approximately 600 ohms. Individual and master volume controls. Walnut veneered cabinet. Size: $11\frac{3}{4} \times 3\frac{3}{4} \times 7\frac{1}{2}$ in. Price (kit): £11 16s.

TA-1M. Pre-amplifier. Inputs. Mic. 0·5 mV. Radio 250 mV. Switched controls, record/ replay, bias, level, mic., radio. H.D. $<0{\cdot}1\%$ for 500 mV H. and N. -60 dB for 500 mV. Power supply required 290V 20 mA DC 6·3V 1 amp per channel. Size: $4\frac{1}{2} \times 13\frac{1}{2} \times 12$ in. Price (kit): £19 18s.; (assembled): £28 18s.

●**TA-1S.** Stereo version of TZ-1M. Price (kit): £25 10s.; (assembled): £35 18s.

TA-1C. Conversion Unit for TA-1M to convert to TA-1S. Price: £6 15s.

V-7A. Valve voltmeter kit. Printed circuit. Measures AC volts (0-1·5, 5, 15, 50, 150, 500, 1,500) R.M.S., AC volts (0-4, 14, 40, 140, 400, 1,400, 4,000). Peak-to-peak, DC volts (0-1·5, 5, 15, 50, 150, 500, 1,500). Ohms (with 10 ohms centre) × 1, 10, 100, 1,000, 10K, 100K, 1 megohm 0·1 ohms to 1,000 megohms with internal battery. Input resistance 11 megohms. Meter 200 micro-amps. Full scale deflection. Accuracy $\pm 3\%$ full scale. Price (kit): £13 18s. 6d.; (assembled): £19 18s. 6d.

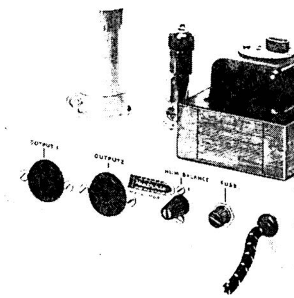
IM-13U. Laboratory valve-voltmeter kit. Printed circuit. Gimbal mounting, for viewing from any angle. Measures AC volts (0-1·5, 5, 15, 50, 150, 500, 1,500 R.M.S.; AC volts (0·4, 14, 40, 140, 400, 1,400, 4,000) peak-to-peak). DC volts (0-1·5, 5, 15, 50, 150, 500, 1,500). Ohms (with 10 ohms centre) X1, X10, X100, X1000, 10K, 100K, 1 megohm. 0·1 ohms to 1,000 megohms with internal battery. Input resistance 11 megohms. 200 μA meter movement. Deflection accuracy $\pm 3\%$, full-scale. Price (kit): £18 18s.; (assembled): £26 18s.

MGP-1. Power supply unit. 200, 250, 270V, 120 mA; 6·3V, 2·5 amps. Price (kit): £5 2s. 6d.; (assembled): £6 12s. 6d.

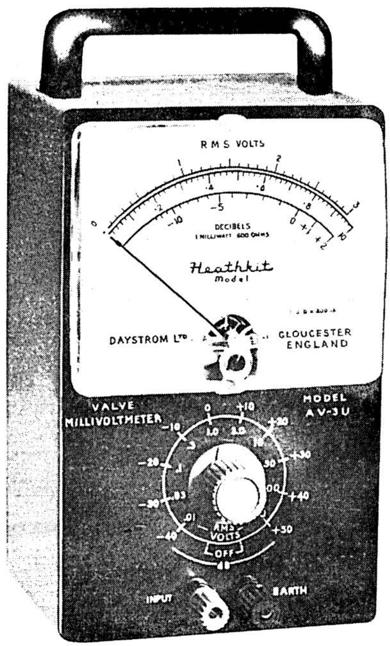
OS-1. Service oscilloscope kit. $2\frac{3}{4}$ in. C.R. tube. Printed circuit. Vertical bandwidth 10 c/s to 2·5 Mc/s. Built-in calibrator. "Y" sensitivity 10 mV R.M.S. per cm. "X" sensitivity 1V R.M.S. per cm. Price (kit): £22 18s.; (assembled): £30 8s.

IO-12U. General purpose oscilloscope kit. 5 in. flat face C.R. tube. Printed circuits. Vertical band-width 3 c/s to 4·5 Mc/s. Built-in 1V calibrator. Y-sensitivity 10 mV R.M.S. per cm at 1 Kc/s, X-sensitivity 50 mV R.M.S. per cm at 1 Kc/s. Price (kit): £35 17s. 6d.; (assembled): £45 15s.

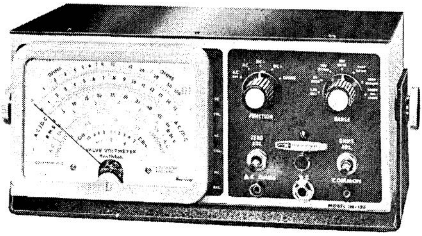
Heathkit USP-1 booster amplifier



Heathkit MGP-1 power unit

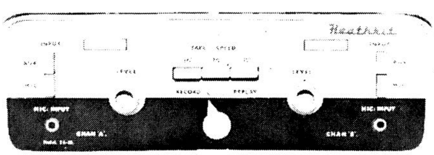


Heathkit AV-3U audio wave millivoltmeter

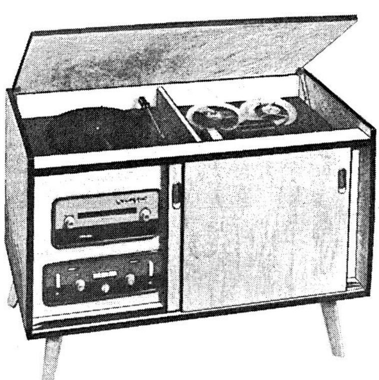


Heathkit IM-12U audio distortion meter

Heathkit S-99 stereo amplifier



Heathkit TA-1M tape amplifier



Heathkit Malvern

S-3U. Electronic Switch (oscilloscope trace doubler). Converts a single beam oscilloscope to double beam. Switching rates 150, 500, 1,500, 5,000 and 15,000 c/s. Signal frequency response 0-100 Kc/s ± 1 dB. Signal input range 0·1 to 1·8V R.M.S. Price (kit): £12 18s. (assembled): £18 10s.

C-3U. Resistance-capacitance bridge. Self-contained and powered. Capacitance range 0·00001 to 1,000 microfarads. Resistance range 100 ohms to 5 megohms. Power factor and leakage also indicated. Polarising voltages available from 5 to 450V. Price (kit): £10 10s.; (assembled): £16.

AV-3U. Audio valve millivoltmeter. Measure voltages as low as 1 mV to a maximum of 300V at high impedances in 10 ranges. Frequency range 10-400,000 c/s. Uses a 4½ in. meter. Cathode follower output. Price (kit): £16 10s.; (assembled): £22 18s.

309-CU. RE probe. Extends the range of a valve voltmeter to 100 Mc/s. Uses a printed circuit board. Price (kit): £1 13s. 6d.

AW-1U. Audio wattmeter. Uses external loads or the following internal loads: 3, 8, 15 and 600 ohms. 5 power ranges from 0-5 mW to 50 watts. 4½ in. meter calibrated in watts and dB. Price (kit): £17 5s.; (assembled): £23 18s.

AO-1U. Inexpensive audio generator covering 20 c/s-150 Kc/s sine wave, 20 c/s-25 Kc/s square wave. Output up to 10V RMS sine wave or 80V peak-to-peak square wave. Size: 9½ × 6½ × 5 in. Price (kit): £14 15s.; (assembled): £21 5s.

IM-12U. Low-priced audio distortion meter. Simple to use. Measures distortion at frequencies between 20 c/s and 20 Kc/s. Size: 13 × 7 × 8½ in. Price (kit): £24 15s.; (assembled): £34.

IG-82U. Audio generator covering 20 c/s-1 Mc/s. Sine and square wave available simultaneously. Sine wave output up to 10V RMS, square wave output up to 10V peak-to-peak. Rise time 0·15 μSec. Size: 13 × 8½ × 7 in. Price (kit): £24 10s.; (assembled): £36 10s.

AG-9U. Audio signal generator. Range 10 c/s to 100 Kc/s. Distortion less than 0·1% from 20 c/s to 20 Kc/s. Decade switching over 8 voltage ranges from 3 mV to 10V monitored. Uses 4½ in. meter. Price (kit): £22 10s.; (assembled): £30 10s.

AFM/1. AM/FM tuner. Variable tuning. FM frequency range 88-108 Mc/s. AM frequency range 16-50, 200-550, 900-2,000 metres. Wide band ratio discriminator plus two limiters. Magic eye tuning indicator. Self-powered. Size: $10\frac{3}{4} \times 11\frac{1}{8} \times 4\frac{1}{2}$ in. Price (kit): £27 5s. (for both units).

FM tuner. Comprises model FMT-4U tuner unit and FMA-4U IF strip and power supply. Flywheel tuning, thermometer tuning indicator, three IF stages with two limiters, printed circuit board and prealigned coils. Tuning range 88-108 Mc/s. Sensitivity 2·5 μV for 20 dB quieting. Price (Kit): £16 8s. (for both units).

SSU-1. Speaker system kit. Comprises 8 in. and 4 in. matched drive units, and ducted-port bass reflex cabinet. Response 40-16,000 c/s ± 5 dB, crossover frequency 3,000 c/s. Imp. 15 ohms. Size: $23 \times 11\frac{1}{2} \times 11\frac{3}{4}$ in. Available for horizontal or vertical mounting. Price complete (kit): £12 12s.; without legs (kit): £11 17s. 6d.

Cotswold. High fidelity three speaker system. Drive units are 12 in. bass, 8×5 in. elliptical, and pressure tweeter. Range 30-20,000 c/s. Two volume controls. Celotex lined enclosure. In white wood ready cut and drilled. Dimensions: $26 \times 23 \times 14\frac{1}{2}$ in. Price complete with crossover unit, etc. (kit): £25 12s.; assembled in the white: £33 17s.

Cotswold MFS. Almost identical to the Cotswold, but specially designed to occupy minimum floor space. Slight reduction in output below 40 c/s with smaller source area. Recommended for small rooms Dimensions: $36 \times 16\frac{1}{2} \times 14$ in. plus two legs. Price (kit): £25 12s.; assembled in the white: £33 17s.

Gloucester. Cabinet for hi-fi equipment. Space available to house records, tapes, etc. Mk. 1 accommodates tape deck or record player, F.M. tuner, and stereo amplifier. Mk. II accommodates both tape deck and record player, F.M. tuner and stereo amplifier. Dimensions: $46\frac{1}{8} \times 30 \times 21$ in. Price Mk 1: Kit £17 3s. 6d. Mk. II: Kit £18 10s.

Malvern. Cabinet for hi-fi equipment. Space available for transcription record player, tape deck, radio tuner, audio amplifier (or control unit and separate power amplifiers) and tape record/replay amplifier. Price (kit): £18 1s.

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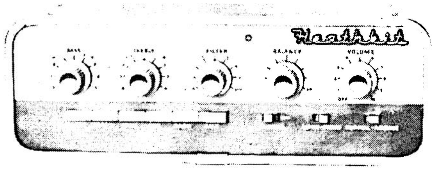
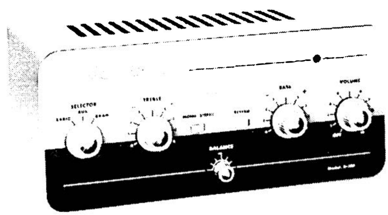
HENRY'S RADIO LTD., 303 Edgware Road, London, W.2. Tel.: Paddington 1008/9.

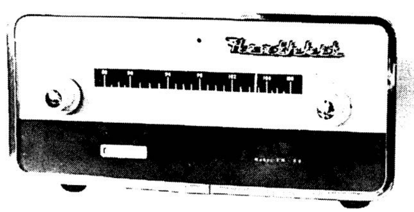
Hi-Fi 10. Transistorised amplifier kits. Four models: TPA3, TPA15, MP2, SP4.



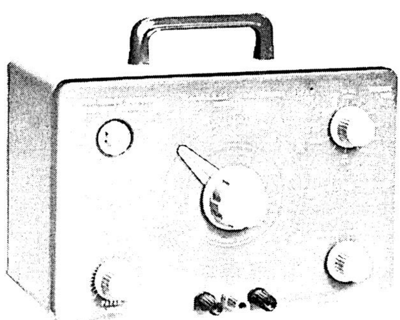
Heathkit USC-1 stereo control unit,



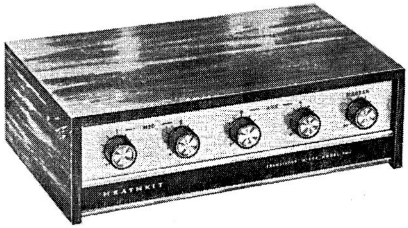
Heathkit S-33H stereo amplifier



Heathkit FM tuner



Heathkit C-3U resistance capacitance bridge

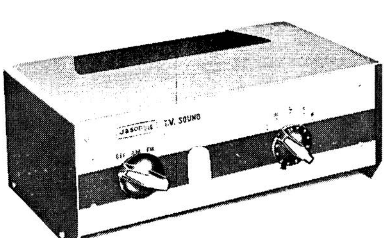


Heathkit TM-1 four-channel mixer

TPA3. Output 10W at 400 c/s. Distortion 0·25% at 10W. Response 30 c/s-20 Kc/s. Feedback 60 dB. N.L. −70 dB. Input 100 mV into 33K from 10K (or less) source. L.S. matching 3-4 ohms. Output stages: matched OC35s, Class B. P.s.n. 24V DC, 15 mA (static), 300 mA (average for 10W). To operate with pre-amp. Model MP2 (mono) or SP4 (stereo). Size: 4 × 2½ × 1⅛ in. Printed circuit and 4 × 4 × 1 in. radiator for output pair. Price (assembled): £5 10s., mono mains unit £2 9s. 6d., stereo mains unit £3 9s. 6d.

TPA15. L.S. matching 15-16 ohms. P.s.n. 40V DC, 12 mA (quiescent), 150 mA average for 10W. Price (assembled): £5 19s. 6d. Other details as for TPA3.

Model MP2. Transistor mono pre-amplifier. Inputs: (pickups) 5 mV, 6K; 100 mV, 100K; 250 mV, 400K; correction for microgroove and 78 rpm; (tuners) 150 mV, 100K; 5 mV, 1K; 50 mV, 50K; (tape) 2·5 mV, 1K corrected for 7½ i/s; (mic.) mag. and crystal 1·5 mV, 1K. Controls: bass, treble, switched low-pass filter, volume, input selector. Filters: low-pass 4 Kc/s, 6 Kc/s, 10 Kc/s, 20 Kc/s; high-pass, roll-off below 40 c/s. Response: flat, but with standard correction for records and tape. Noise −70 dB with controls level; no hum. P.s.n. 9/12, 18/24, 35/45V DC at 2½ mA nominal. Printed circuit. For use with TPA3 or TPA15 amplifiers. Dimensions: 9 × 2½ × 1¼ in. Price (assembled): £5 10s.; (front panel 8s. 6d. extra).



Jason JTV2

●**Model SP4.** Two-channel stereo version of Model MP2. For use with two TPA3 or TPA15 power amplifiers. Size: 9 × 3¼ × 1⅞ in. Price (assembled): £10 19s. 6d.; (front panel 12s. 6d. extra).

Transistorised FM Tuner. Geared slow motion full tuning. Range 87-105 Mc/s. A.G.C., A.F.C. Ratio detector. Multiplex adaptor. Aerial imp. 75 ohms. Output max. 80 mV for 100 μV aerial; min. 2½ mV for 1 μV aerial. P.s.n. 9V, 9 mA. Size: 3½ × 2¼ × 4 in. Price (kit): £7 19s. 6d.

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JASON ELECTRONIC DESIGNS LTD., 18 Tudor Place, Tottenham Court Road, London, W.1. Tel.: Museum 4666.

F.M.T.I. Standard F.M. tuner kit. 4 valves only are used, giving an aerial sensitivity of better than 100 μV. A ratio detector is combined with a limiter for low distortion and good noise rejection. Price without valves and power supply: £5 19s. Power Pack kit: £2 14s.

F.M.T.2. This is the same unit as the F.M.T.1., but built into a shelf mounting case. Price, less valves, but with power supply: £9 9s.

F.M.T.3. A fringe F.M. tuner with automatic frequency control. Two limiters combat the effects of aeroplane flutter and car interference. Price with case but less seven valves required: £10 9s.

AG10. Audio Generator. A capacity tuned Wien bridge covers from 10 c/s to 100 Kc/s with excellent stability and low distortion while the output is held constant within 1 dB. Output impedance is 600 ohm from a cathode follower and the Attenuator uses resistors of 1% accuracy. The rise time on square waves is better than 2 microseconds. Price (kit): £15 19s.

OG10. 2¾ in. oscilloscope has a sensitivity of 10 mV/cm with a bandwave of 2 c/s-2 Mc/s. Sweep linearity is good and push-pull amplifiers are used on both X and Y. Price (kit): (less tube) £18 10s.

JTL. Stereo amplifier kit (see Tape Amplifier section). Price: £21.

JTV2. Tuner kit. See details of built model. May be built for £14 0s. 4d. Inc. purchase tax 18s. 1d. Four extra valves required.

Mercury 2. Tuner kit. See details of Monitor. May be built for £9 15s. 4d. Inc. purchase tax 18s. 1d. Three extra valves required.

★

MARTIN ELECTRONICS LTD., 154-155 High Street, Brentford, Middx. Tel.: Isleworth 1161/2.

Models C and D are tape recorder kits, using ready-wired amplifiers. Prices include case, speaker, deck, amplifier, etc.

Model C. ½-track. Magnavox Studio deck. Speeds: 7½, 3¾, 1⅞ i/s. M.E.; Tape position indicator. F.R. 7½ i/s, 80 c/s-12 Kc/s ±3 dB. Inputs for mic., radio, pu. Extension speaker outlet. Price: £29 18s. 6d.

Model D. ¼-track. Other details as for Model C. Price: £35 14s.

Model E. Add-on unit, containing Pre-amp. 8319-CP, Magnavox Studio deck ½-track, polished wood cabinet. Price: £27 16s. 6d.

Model F. Add-on unit, containing Pre-amp. 8319-CP. Magnavox Studio deck ¼-track, polished wood cabinet. Price: £33 12s.

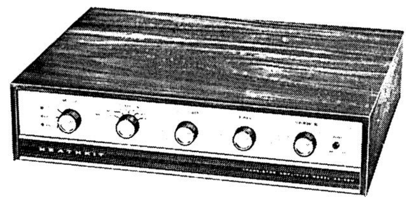
Model G. Drop-in assembly kit, containing Pre-amp. 8319-CP. Magnavox Studio deck ½-track, accessory kit 8319-CKD. Price: £23 2s.

Model H. Drop-in assembly kit, containing Pre-amp 8319-CP, Magnavox Studio deck ¼-track, accessory kit 8319-CKD. Price: £28 17s. 6d.

8311-V. Tape record/replay amplifier. ½-track mono Inputs: mic. 3 mV, ½ megohm; radio/gram 400 mV. 1 megohm. Output 3 ohms, 3W. F.R. 80 c/s-12 Kc/s. Bias oscillator 52 Kc/s. Equalisation for CCIR, 7½, 3¾, 1⅞ i/s. M.E. Controls: vol., tone, monitor. Self-powered. Designed for building into existing cabinets. Suitable for Magnavox deck, Bradmatic ½-track or Michigan or Marriott ¼-track heads. Size: 7½ × 3½ × 2¾ in. Price: £11 11s.

8311-4-V. Tape record-replay amplifier. ¼-track mono. Details as for 8311-V. Price: £12 12s.

8319-4-CP. Mono Tape Record/replay amplifier. Inputs: mic. 3 mV, 470K; radio/gram 400 mV, 1 megohm. Output 250 mV, 10K. F.R. 30 c/s-12 Kc/s. Bias oscillator 52 Kc/s. Equalisation for CCIR, 7½, 3¾, 1⅞ i/s. M.E. Volume control. Self-powered. Designed for building into existing cabinet. Suitable for ¼-track Magnavox, Marriott or Michigan heads. Size: 6⅝ × 2¾ × 2⅝ in. Price: £9 9s.



Heathkit AA-22U stereo amplifier

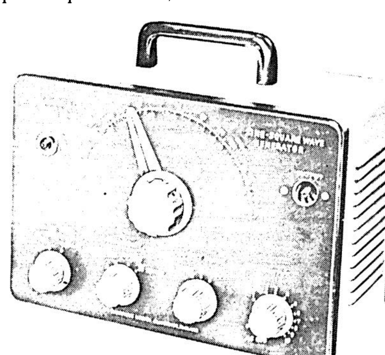
8319-CP. Details as for 8319-4-CP, but suitable for ½-track Magnavox, Bradmatic heads. Price: £8 8s.

8319-CKD. Drop-in accessory kit for use with Magnavox deck, when building deck and pre-amp into existing cabinet. Price: £1 11s. 6d.

Audiokit 1/4. Transistorised mono control unit. Inputs: from 3 mV according to signal input requirements; RIAA correction on pu input. Output 200 mV. Controls: sel. switch (tape head, mag. pu, crystal pu, radio, aux. mic.). Filters: bass cut and lift, treble cut and lift, low pass 20 Kc/s. Response 45 c/s-20 Kc/s. H. and N. −70 dB. P.s.n. 9-15V DC. Easily adapted to stereo. To operate with Audiokit 5 Size: 8 × 3¼ × 1¾ in. Price: £5 10s.

●**Audiokit 1/4/S.** Transistorised stereo control unit. Details as for 1/4. Size: 8 × 3¼ × 3¾ in. Price: £11.

Audiokit 1/2. Transistorised mono control unit. Inputs: from 3 mV according to signal input requirements; RIAA correction on pu



Heathkit AO-1U audio generator

input. Output 200 mV. Controls: sel. switch (tape head, mag. pu, crystal pu, radio, aux, mic.). Response 40 c/s-20 Kc/s. H. and N. −70 dB. P.s.n. 9-15V DC. Easily adapted to stereo. To operate with Audiokit 5. Size: $5\frac{3}{4} \times 3\frac{1}{4} \times 1\frac{3}{4}$ in. Price: £4 5s.

●**Audiokit 1/2/S.** Transistorised stereo control unit. Details as for 1/2. Size: $5\frac{3}{4} \times 3\frac{1}{4} \times 3\frac{3}{4}$ in. Price: £9 10s.

Audiokit 5. Transistorised mono amplifier. 10W. H.D. 0·25%. Response 40 c/s-20 Kc/s. Feedback 60 dB. N.L. −85 dB. Input 100 mV. L.S. matching 3 ohms. P.s.n. 24V DC, 0·8 amps. To operate with Audiokits 1/2, 1/4, 2/3, 3/4. Size: $4\frac{1}{2} \times 4 \times 3\frac{1}{2}$ in. Price: £5 12s. 6d.

Audiokit 7. Similar to Audiokit 5 but for 15 ohms speaker. Operates from 40V.

Audiokit 3/4. Transistorised mono 3-channel pre-amplifier/mixer. Plug-in adaptors available to match almost any input. Output 200 mV, 8K. F.R. 45 c/s-20 Kc/s. Controls: one per channel plus bass, treble, vol. P.s.n. 9-15V DC. Size: $11\frac{3}{8} \times 2\frac{1}{8} \times 3\frac{1}{2}$ in. Price: £8 7s. 6d.

●**Audiokit 3/4/S.** Transistorised stereo 3-channel pre-amplifier/mixer. Details as for 3/4. Price: £16 15s.

Audiokit 2/3. Transistorised mono 3-channel pre-amplifier/mixer. Plug-in adaptors to match almost any input. Output 200 mV, 8K. F.R. 45 c/s-20 Kc/s. Controls: one per channel plus volume. P.s.n. 9-15V. Size: $11\frac{3}{8} \times 2\frac{1}{8} \times 2$ in. Price: £7 2s. 6d.

●**Audiokit 2/3/S.** Transistorised stereo 3-channel pre-amplifier/mixer. Details as for 2/3. Price: £14 5s.

Audiokit 15, 16 and 17. FM/VHF tuner. Variable tuning 88-108 Mc/s. Ratio detector. Sensitivity 2 µV for 20 dB quieting. Aerial input 75 ohms balanced or coaxial. Output 100 mV 100K. Multiplex decoder will be available when service starts. A.F.C. Power supply 9V battery. Consumption 12 mA. Size: $9\frac{1}{2} \times 3\frac{1}{2} \times 4$ in. behind panel. Supplied as three units for home assembly into cabinet. Price: £12 0s. 3d. (U.K. purchase tax 17s. 3d.).

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SINCLAIR RADIONICS LTD., Comberton, Cambridge. Tel.: Comberton 682.

Sinclair X-20. Transistorised mono amplifier. Pulse-width modulated amplifier with built-in pre-amplifier stage for use with external control unit. Output 15W RMS into 7·5 ohms, 12W RMS into 15 ohms. Distortion $<0{\cdot}1\%$ at 10W. F.R. 20 c/s–20 Kc/s ± 1 dB. Input voltage for stated output, 1 mV. Noise better than 70 dB below 15W. Output imp. 7·5 or 15 ohms. Chassis size: $8\frac{1}{4} \times 3\frac{1}{4} \times 1$ in. Price (assembled): £9 19s. 6d.; (kit): £7 19s. 6d.

Power unit. Mains power supply to drive one or two X-20 amplifiers. Price: £4 19s. 6d.

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H. L. SMITH & CO. LTD., 287/289 Edgware Road, London, W.2. Tel.: Paddington 5891/7595.

See Amplifier section for details of the following kits:

Cooper-Smith Bantam Combined Amplifier and Control Unit.

★

STERN-CLYNE LTD., Head office and mail order, 3-5 Eden Grove, Holloway, London, N.7. Tel.: North 8161. Branches throughout: London, Liverpool, Manchester, Sheffield and Bristol.

Type C Mk. II Tape pre-amplifier. To Mullard design (see Tape Amplifier Section). Price: £11; power supply unit £3 extra.

HF/TR3 Mk. II Tape Amplifier. To Mullard design (see Tape Amplifier Section). Price, including power supply unit: £13 13s.

Mullard 2 Valve Pre-amplifier Tone Control Unit. (See Amplifier Section). Price: £6 6s.

Mullard 3-Valve Pre-amplifier. (See Amplifier Section). Price: £10.

Mullard "5-10" Power Amplifier. (See Amplifier Section). Price: £10.

Mullard "10-10" Power Amplifier. (See Amplifier Section). Price: £16; with passive control unit £4 extra.

Mullard Dual Channel Pre-Amplifier. (See Amplifier Section). Price: £12 10s.

STP-1 Stereo Pre-amplifier. (See Tape Amplifier Section). Price: £22.

Mullard 3-Valve 3W Power Amplifier Series II. (See Amplifier Section). Price: £8 8s.

HI-FI FURNITURE

A. DAVIES & COMPANY, 3/11 Parkhill Place, off Parkhill Road, Hampstead, London, N.W.3. Tel.: Gulliver 5775.

Contemporary horizontal. Horizontal style cabinet with full-width lift-up lid in choice of sapele, oak, walnut, or teak. Rosewood front if desired. Pneumatic lid stay. Overall size: 29 in. high (including 12 in. legs), 20 in. deep, and in widths of 25½ in., 36 in., 48 in., 60 in., and 72 in. Prices: (25½) £17 10s., (36) £21., (48) £26 5s., (60) £33 10s., (72) £42. Extra for rosewood front.

Will quote for special cabinets to customers requirements.

★

DECCA SPECIAL PRODUCTS, Decca Radio and Television Division of The Decca Record Co. Ltd., Ingate Place, Queenstown Road, London, S.W.8. Tel.: Macaulay 6677.

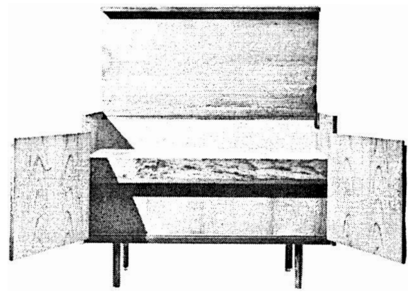
Decola Separates Third Cabinet. Soundly constructed cabinet finished to match other Decola Separates. Takes turntable on top with control unit and radio tuner side by side in shelf beneath. Beneath shelf there is record storage space and the bottom compartment (open at the back only) houses a power amplifier. Price: £19 19s.

★

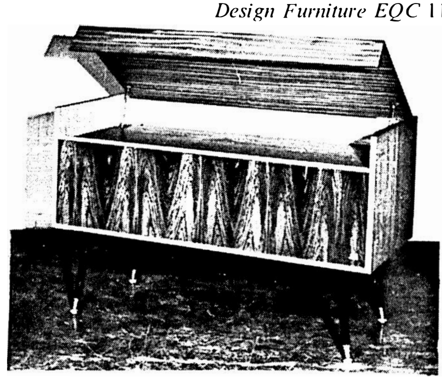
DESIGN FURNITURE LTD., Calthorpe Manor, Banbury, Oxfordshire. Tel.: Banbury 4341.

EQC 4. Upright cabinet with glide-away doors, in rosewood. The well and control panel finished in grey Suwide. Takes gram unit, tape deck, tuner, amplifiers, etc. Two lift-up lids covered in black Lanide. Overall size: 43 × 21 × 31 in. (inc. 10½ in. legs). The control panel is removable and the inner top shelf adjustable down to 6¼ in. deep. Price: £38 11s. 6d.

EQC 7. Upright cabinet with tambour doors, in walnut, sapele, mahogany or teak. Takes gram unit, tape deck, tuner, amplifiers, etc. Lift-up lid. Overall size: 43 × 21 × 28½ in. (inc. 6 in. legs). The control panel is removable and the inner top shelf adjustable down to 6 in. deep. Price: £37 10s. 6d.

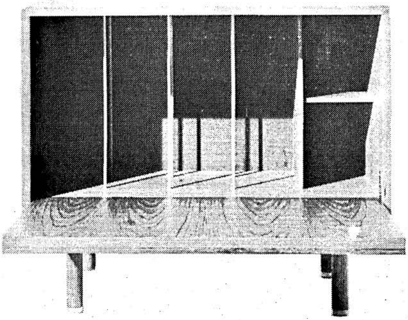


Design Furniture EQC 11



A. Davies contemporary horizontal

G.K.D. Duette



Design Furniture RC 77

Hampstead

Lowther 3 cabinet

EQC 8. Upright cabinet with tambour doors, in walnut, sapele, mahogany or teak. Takes gram unit, tape deck, tuner, amplifiers and record storage space (approx. 130 records). Lift-up lid. Overall size: 43 × 21 × 28½ in. (inc. 6 in. legs). Price: £39 7s.

EQC 9. Upright cabinet in walnut, sapele, mahogany or teak. The well and inner top shelf finished in grey Suwide. Takes gram unit or tape deck. Lift-up lid. Overall size: 20⅞ × 17 × 28¾ in. (inc. 6¾ in. legs). Price: £15 5s.

EQC 11. Upright cabinet with two doors, in walnut, mahogany or teak. Takes gram unit, tape deck, tuner, amplifiers, etc. Lift-up lid. Overall size: 41½ × 21 × 29 in. (inc. 8½ in. legs). Free access to inner top shelf. The control panel is removable and the inner top shelf adjustable down to 6 in. Price: £37 14s.

EQC 14. Lowline cabinet in walnut, sapele, mahogany or teak. Takes gram unit, tape deck, tuner, amplifiers, etc. Lift-up lid. Overall size: 59 × 21 × 24¼ in. (inc. 9¼ in. legs). The motor board can be divided and "stepped" in height using the loose division supplied. Price: £34.

EQC 15. Lowline cabinet in walnut, sapele, mahogany or teak. Takes gram unit or tape deck. Lift-up lid. Overall size: 41⅞ × 21 × 22½ in. (inc. 7½ in. legs). The motor board can be divided and "stepped" in height using the loose division supplied. Price: £26 17s. 6d.

RC 522. Upright record cabinet in walnut, sapele, mahogany or teak. Takes 144 10- or 12-in. and 96 7-in. records. A further 46 12-in. can be housed by removing shelf. Fall front with combined hinge and stay. Overall size: 26 × 14½ × 27¼ in. Price: £11 2s. 6d.

RC 77. Upright record cabinet in walnut, mahogany or teak. Takes 170 10- or 12-in. and 100 7-in. records. Fall front with combined hinge and stay. Overall size: 30 × 16 × 25 in. Specially designed to match model EQC 11. Price: £16 10s.

RC 307. Upright record cabinet with bow front, in walnut, mahogany or teak. Takes 125 12-in. and 250 7-in. records. Tambour doors. Overall size: 30½ × 15 × 27 in. Interior lined with Storoflex. Brass-ferruled slim tapered legs. Price: £20 15s.

RC300. Upright record cabinet with bow front, in walnut or teak. Takes 280 records of all sizes. Tambour doors. Overall size: 30½ × 15 × 27 in. Interior lined with Storoflex. Brass-ferruled slim tapered legs. Price: £20 15s

RC144. Upright record cabinet in walnut, mahogany or teak. Takes approx. 144 records. Two doors. Overall size: $19\frac{3}{4} \times 14\frac{7}{8} \times 24\frac{3}{4}$ in. Prices: Walnut and mahogany £7 15s. Teak £8 5s.

★

A. R. FRANKLIN & COMPANY LTD., 6 Kings College Mews, London, N.W.3. Tel.: Juniper 0480.

Lowline. Finish in wood-grained material. Accommodation for turntable tuner, main amplifier, control unit. Table top for tape. Hinged perspex lid which can be lifted off. Based on coffee table principle on castors with shelf to carry large main amplifier. Overall dimensions 42 in. long, 18 in. wide. Lid section 20 × 16 in. Legs 12 in. with castors. Price: £25 4s.

Special cabinets. Individually styled cabinets to customers' requirements. Equipment built-in to existing furniture.

★

G.K.D. LTD., 74 Langley Street, Luton, Beds. Tel.: Luton 30321.

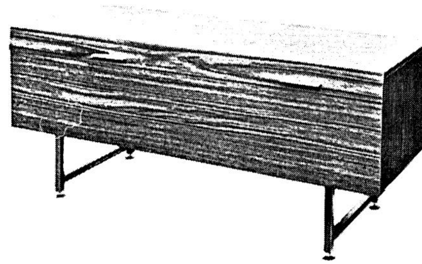
Leak shelf cabinet. Shelf-mounting cabinet to take Leak pre-amplifier or tuner. Finish: Formica, natural teak or dark Australian walnut. Size: $12\frac{1}{8} \times 9\frac{1}{2} \times 5$ in. Price: £4 7s. 6d.

Leak Stereo 30 shelf cabinet. Shelf-mounting cabinet to take Leak Stereo 30 integrated amplifier. Finish: Formica, natural teak or dark Australian walnut. Size: $13\frac{5}{8} \times 9\frac{1}{2} \times 5$ in. Price: £4 15s.

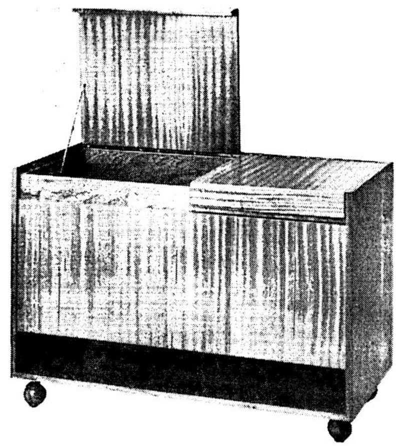
Southdown Mk. II. Lowline style accessory cabinet to house most tape recorders, tape, records, accessories, etc. Finish: Formica, natural teak or dark Australian walnut. Lift-up lid. Matches Southdown and Chiltern equipment cabinets. Size: $20\frac{5}{8} \times 19\frac{1}{4} \times 13\frac{3}{4}$ in. Price: £15 15s.

Huntingdon Mk. II. Lowline accessory cabinet to house most tape recorders, tape, records, accessories, etc. Finish: Formica, natural teak or dark Australian walnut. Lift-up lid. Matches Huntingdon and Anglian equipment cabinets. Size: $20\frac{5}{8} \times 21\frac{1}{8} \times 13\frac{3}{4}$ in. Price: £15 15s.

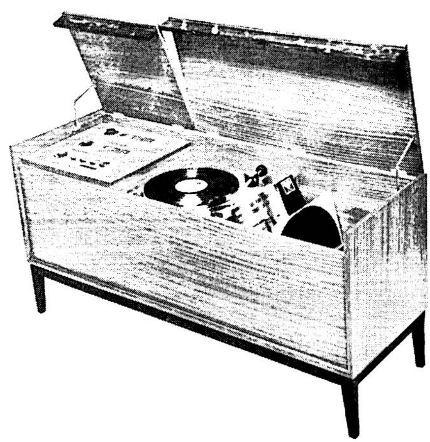
Southdown Mk. II. Lowline cabinet designed exclusively for all current Leak equipment (including Stereo 30), gram unit or tape deck.



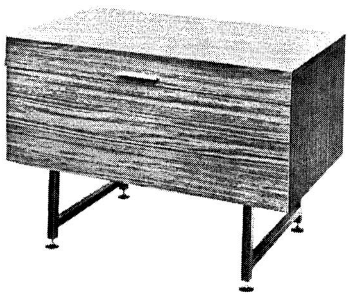
G.K.D. Anglian Mk II



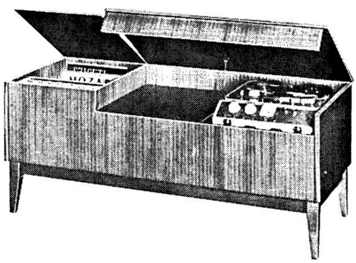
Imhof Trolley type L



P.W.B. model A2

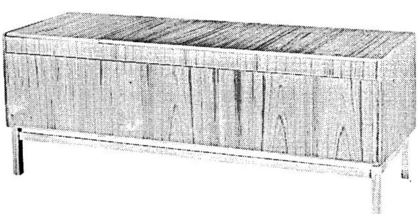


G.K.D. Huntingdon Mk II



Record Housing Lowflex

Howland-West Karelia De Luxe



Howland-West Trondheim II

Finish: Formica, natural teak or dark Australian walnut. Lift-up lid. Sprung motor board. Concealed spring-loaded drawer houses equipment and control knobs. Amplifier section free for storage when Stereo 30 used. Size: 34 × 21 × 25 in. (including legs). Motor board $18\frac{1}{4}$ in. wide, $19\frac{1}{4}$ in. deep, 4 in. above, $8\frac{1}{4}$ in. below. Price: £30 9s.

Huntingdon Mk. II. Lowline cabinet suitable for most equipment including Quad, Leak, Rogers, Armstrong, Truvox, Chapman, etc. Finish: Formica, natural teak or dark Australian walnut. Lift-up lid giving easy access to controls, gram unit and tape deck. Size: $35\frac{3}{4}$ × $21\frac{1}{8}$ × $25\frac{1}{4}$ in. (including legs). Motor board $17\frac{3}{4}$ in. wide, $19\frac{3}{4}$ in. deep, 4 in. above, $8\frac{1}{4}$ in. below. Price: £30 9s.

Chiltern Mk. II. Lowline cabinet designed exclusively for all current Leak equipment including Stereo 30. Finish: Formica, natural teak or dark Australian walnut. Lift-up lid. Spring-loaded drawer houses equipment and controls. Top compartment takes gram unit, tape deck, or complete recorder in its case. Size: 54 × 21 × 25 in. (including legs). Motor board $18\frac{1}{4}$ in. wide, $19\frac{1}{4}$ in. deep, 4 in. above, $8\frac{1}{4}$ in. below. Price: £40 19s.

Anglian Mk. II. Lowline cabinet suitable for most equipment including Quad, Leak, Rogers, Armstrong, Truvox, Chapman, etc. Finish: Formica, natural teak or dark Australian walnut. Lift-up lid giving easy access to controls, gram unit and tape deck. Size: $55\frac{1}{8}$ × $21\frac{1}{8}$ × $25\frac{1}{4}$ in. (including legs). Combined motor board and tape section 37 in. wide, $19\frac{3}{4}$ in. deep, 4 in. above, $8\frac{3}{4}$ in. below. Price: £40 19s.

Duette. Wall or free-standing cabinet assembly. Can be used as room divider. Comprises two units: upper cabinet for control units, tuner or integrated amplifier; lower cabinet for gram unit, tape deck and main amplifiers. Suitable for Leak Stereo 30 or other similar integrated amplifiers. Top cabinet has drop-down lid, lower cabinet has lift-up lid. Finish: Formica, natural teak or dark Australian walnut. Size: 38 × 21 × 58 in. Lower cabinet 34 in. wide, 19 in. deep, 11 in. high (motor board height adjustable). Upper cabinet (internal) $33\frac{7}{8}$ in. wide, $13\frac{1}{4}$ in. deep, $7\frac{1}{4}$ in. high. Fascia panel 34 × $7\frac{1}{4}$ in. Price: £47 5s. Extension frame and two shelves to extend up to ceiling £4 4s. extra.

★

HAMPSTEAD HIGH FIDELITY, 91a/91b Heath Street, Hampstead, London, N.W.3. Tel.: Hampstead 6377.

Hampstead. Low upright cabinet with separate lift-up lids for gram unit and tape deck compartments. Pull-out front hopper for tuner and control unit or integrated amplifier. Will accommodate gram unit, tape deck, tuner, control unit and amplifier. Takes any pre-amplifier or integrated amplifier not exceeding 14 in. in depth. Available with tape section made into well to hold complete recorder up to 9 in. in height. Special version for Ferrograph and Revox with professional size spools 2 in. longer. Size (standard model): 36 × 26 × 20 in. Prices: Mahogany and walnut £37, teak £38, special model for Revox and Ferrograph £44 in all finishes.

Special cabinets and fitments made to order. Designs and drawings prepared for complete room or house hi-fi schemes.

★

HEAL AND SONS LTD., 196 Tottenham Court Road, London, W.1. Tel.: Museum 1666.

Comprehensive range of free-standing and wall mounting cabinets. A number of units designed specially for Quad and Leak equipment. Full details on request.

★

HEATHKIT. Manufactured by Daystrom Ltd., Bristol Road, Gloucester. Tel.: Gloucester 20217.

Malvern. Horizontal cabinet. Available in kit form or assembled "in the white". Takes gram unit, tape deck, tuner and amplifier. Lift-up lid, sliding doors. Overall size: $39\frac{1}{8}$ × $21\frac{3}{4}$ × 32 in. Price: £18 1s. kit form.

Gloucester. Horizontal cabinet. Available in kit form or assembled "in the white". Takes gram unit or tapedeck, tuner and amplifier. Lift-up lid. Overall size: $46\frac{1}{8}$ × 21 × 30 in. Price: £17 3s. 6d. kit form.

Chepstow. Upright cabinet. Available in kit form or assembled "in the white". Takes gram unit, tuner and amplifier. Lift-up lid. Overall size: 18 × 34 × $32\frac{3}{4}$ in. Price: £11 12s. 6d. kit form.

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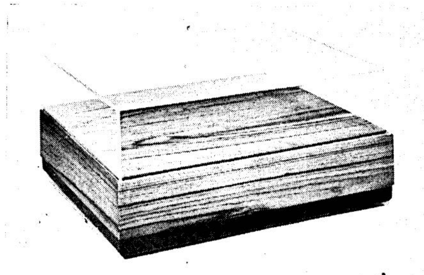
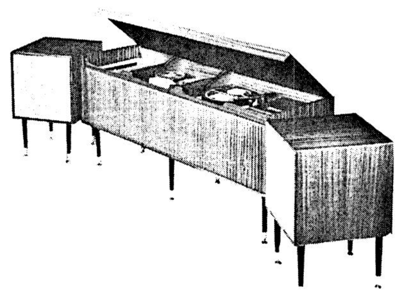
HOWLAND-WEST LTD., 11 Howland Mews, Howland Street, London, W.1. Tel.: Langham 1381.

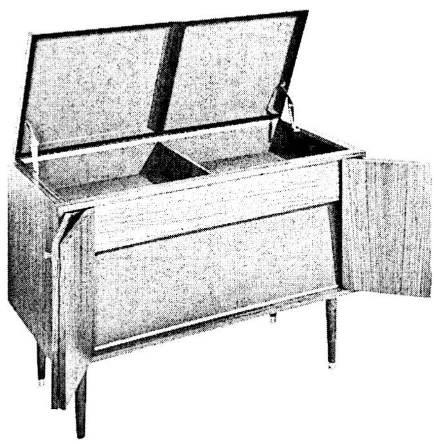
Oslo II. Upright cabinet in teak, walnut or teak with rosewood front panel. Takes



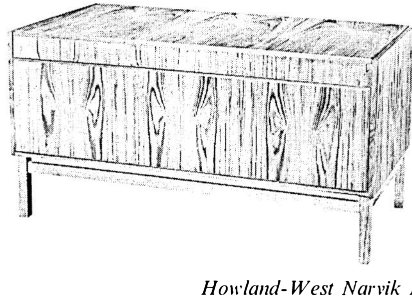
Howland-West Clearview HW12



Largs Quartette



Design Furniture EQC4



Howland-West Narvik II

gram unit or tape deck and amplifier. Single lift-up lid. Plinth can be stowed inside for transport. Overall size: 21 × 22 × 25¾ in. Prices: Teak or walnut £14 14s.; Teak/Rosewood front panel £15 4s. 6d.

Karelia de Luxe. Lowline cabinet in rosewood with beech interior or teak with beech interior. With anodised aluminium skids. Takes all combinations of equipment. Lift-up lid and front opening door. Overall size: 60 × 20¼ × 16 in. plus legs 8 in. Small compartment 16¼ in. wide. Price: £51 9s.

Bergen II. Horizontal cabinet in teak, walnut, or teak with rosewood front panel. Takes all combinations of equipment. Single lift-up lid. Overall size: 36 × 22 × 25¾ in. Prices: Teak or walnut £23 2s.; Teak/Rosewood front panel £24 3s.

Narvik II. Horizontal cabinet in teak, walnut or teak with rosewood front panel. Takes all combinations of equipment. Single lift-up lid. Overall size: 48 × 22 × 25¾ in. Prices: Teak or walnut £31 10s.; Teak/Rosewood front panel £33 1s. 6d.

Trondheim II. Horizontal cabinet in teak, walnut or teak with rosewood front panel. Takes any combination of equipment. Two lift-up lids. Overall size: 66 × 22 × 25¾ in. Prices: Teak or walnut £43 1s.; Teak/Rosewood front panel £45 3s.

Tromso II. Lowline cabinet in teak, walnut, or teak with rosewood front panel. Takes gram unit or tape deck, tuner and amplifier. Two lift-up lids. Overall size: 48 × 20 × 14 in. less plinth. Prices: Teak or walnut £30 9s.; Teak/Rosewood front panel £31 10s.

Largs Fidelia

Clearview H.W.1. Cabinet in teak, walnut or rosewood. Takes gram unit or tape deck. Lift-off perspex lid. Overall size: 18¼ × 16½ × 8½ in. Clearance above board 3¾ in., below board 4½ in. Price: £8 19s. 6d. (all finishes).

Clearview H.W.12. Cabinet in teak. Takes gram unit or tape deck. Lift-off perspex lid. Overall size: 23½ in × 19 × 8½ in. Clearance above board 3¾ in., below board 4½ in. Price: £11 19s. 6d.

Clearview de Luxe H.W.2. Cabinet in teak, walnut and rosewood. Takes gram unit or tape deck. Hinged lift-up lid in wood and perspex. Overall size: 19 × 17 × 9 in. Clearance above board 3¾ in., below board 4¼ in. Price: £10 19s. 6d. (all finishes).

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IMHOFS. 112-116 New Oxford Street, London, W.C.1. Tel.: Museum 7878. Cables: Imcase, London, W.C.1.

HFU/10. Control cabinet with three compartments. Will house the largest of control equipment including tape decks. Finish: Light or dark sapele mahogany, walnut, bleached pine or teak. Separate lift-up lid to each of the three compartments. Size: 52 × 27 × 21 in. (including legs). Compartments 15 in., 18 in., and 16½ in. wide, all 19⅛ in. deep. Prices: £39 18s.; Teak £42. (A two-compartment version is available at £30 10s. or £32 in teak.)

HFU/16M. Two compartment cabinet with drawer for tape recorder. Either side will accommodate any transcription motor (or auto-changer) and is large enough for the SME3012 arm. Finish: Teak and rosewood; two-tone sapele mahogany; walnut. Single lift-up lid at top with hydraulic stay. Righthand side has drop-down panel with withdrawable deck. Size: 41¼ × 29¾ × 22 in. (including 7½ in. legs). Compartments all 19 in. wide, 20 in. deep. Height above tape recorder deck is 10 in. Price: £38 17s.

HFU/1L. Control cabinet. Designed to allow a tuner to be fitted alongside a transcription motor. Finish: Walnut, mahogany, bleached pine, teak. Lift-up lid. Size: 28 × 19 × 26 in. (including 9 in. legs). Price: £23 2s.

IMIII/AT6. Designed to house the Garrard AT6 motor. Finish: walnut or mahogany. Lift-up lid. Size: 17 × 9½ × 15½ in. Price: £8 8s.

IMIIIB. Similar to above but measuring 19 × 8 × 18¾ in. Price: £8 8s.

Type L. Trolley cabinet with two compartments. Easy-running finger-tip movement. Finish: Light or dark sapele mahogany, two-tone mahogany, walnut, teak. Two lift-up lids. Size: 35¾ × 24 × 18½ in. (including castors). Compartments 17⅞ in. and 15½ in. wide, both 16 in. deep. Price. £30 10s.; teak £32.

★

LARGS OF HOLBORN, 76-77 High Holborn, London, W.C.1. Tel.: Chancery 2626.

Continental. Wall mounted cabinet in sapele, mahogany or walnut veneer. Takes gram unit, amplifier, record storage, tuner and loudspeaker enclosure. Choice of "drop-down" or sliding doors. Overall size: 69 × 18 × 22 in. Four compartments. Price: £51 9s.

Fidelia. Upright cabinet in sapele mahogany or walnut veneer (other finishes by arrangement) Takes gram unit, amplifiers and tuner. Lift-up lid. Overall size: 30 × 18 × 14 in. (plus 15 in. for legs). Price: £16 16s.

Libretto. Upright cabinet complete with room divider, in teak veneer. Takes gram unit, tuner, amplifiers, tape deck. Lift-up lid with brass/nylon lid stays. Overall size: 37½ × 18 × 26½ in. Control panel (lower section) covered by sliding doors. Super-structure 6 ft. 2 in. high, two shelves 36 in. wide by 8¼ in. deep, one shelf 18 in. wide by 8¼ in. deep. Price: £44 2s.

Olympic. Upright cabinet with pull-out control panel in sapele, mahogany or walnut veneer (other finishes by arrangement). Takes gram unit, tape deck, tuner and amplifiers. Lift-up lid with tensioned lid stays. Fitted with Shepherd castors. Overall size: 40 × 22 × 29 in. Particularly suitable for Quad, Leak, and Ferrograph equipment. Price: £50 8s.

Quartette. Lowline cabinet in sapele, walnut or mahogany veneer (other finishes by arrangement). Takes gram unit, amplifiers, tuner, tape deck, record storage. Lift-up lid. Overall size: 66 × 18 × 17 in. on 9 in. legs. Matching loudspeaker enclosures by arrangement. Price: £38 17s.

The high fidelity equipment cabinets listed and illustrated represent only a small selection of Largs' tailor-made products. Largs operates its own cabinet factory and invites enquiries to manufacture cabinets to customers own specifications.

Prices quoted include delivery in Great Britain. Largs cabinets cost from £16 16s. In many instances delivery is ex-stock.

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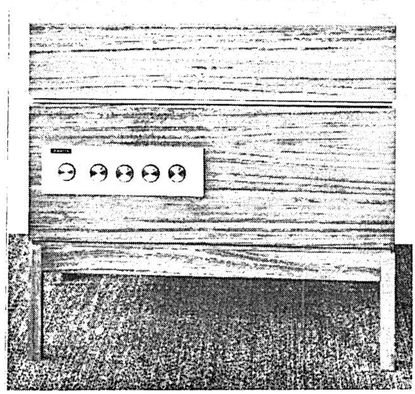
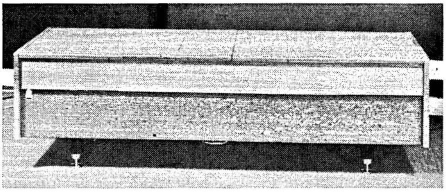
LEWIS RADIO COMPANY, 100 Chase Side, Southgate, London, N.14. Tel.: Palmers Green 3733/9666.

Stereo De Luxe. Modern contemporary cabinet rigidly constructed from ¾ in. material. Finished in choice of walnut, sapele or teak. Speaker enclosures built into each end are fully lined with sound absorbent material. Two sliding doors open to reveal central control panel and motor board. Takes most makes of tuner, amplifier and motor unit. Size: 48 × 16½ × 24 in. Motor board 16 in. wide 14½ in. deep. Control panel 20 in. wide, 8½ in. high, 13 in. depth behind. Speaker enclosures 22½ × 12½ × 14¾ in. Price (walnut or mahogany): £34 13s., (teak) £37 16s.

Forum. Lowline style equipment and record storage cabinet. Lift up lid with hydraulic stay for equipment compartment. Drop front for record storage. Finished in walnut, mahogany or teak. Size: 51 × 17½ × 15 in. (plus 12 in. for legs). Radio panel 16¾ in. wide, 14¾ in. deep. Price (walnut or mahogany): £30 9s., (teak) £33 12s.



Musicraft Richmond


Musicraft Dorking

Long John. Lowline cabinet with four compartments covered by two lift-up lids. Designed to take almost any combination of hi-fi equipment. Finished in walnut, mahogany or teak. Size: 70 × 18 × 13¾ in. (plus 12 in. for legs). Mounting boards from left to right: 14 × 15 in., 18 × 15 in., 19½ × 15 in., 13 × 15 in. Price: (walnut or mahogany) £34 13s.; (teak) £37 16s.

Avon. Twin compartment cabinet built on similar lines to the Long John. Single lift-up lid. Takes most makes of hi-fi equipment plus gram unit or tape deck. Size: 36½ × 18 × 13¾ in. (plus 12 in. for legs). Mounting boards 16½ in. wide, 15 in. deep. Price: (walnut or mahogany) £21; (teak) £23 2s.

Lowboy. Lowline cabinet with one large and one small lift-up lids. Constructed throughout from ¾ in. material. Accommodates all makes of equipment. Motor boards adjustable for height. Supplied in walnut, sapele or teak with black turned legs. Size: 53 × 18 × 13¾ in. (plus 12 in. for legs). Three interior motor boards 16 × 15 in. deep. Price: (walnut or sapele) £28 7s.; (teak) £30 9s.

Concerto. Stereo equipment cabinet with speaker enclosures at each end. Folding doors with magnetic catches. Lefthand compartment for gram unit provides 11¼ in. clearance above motor board and 3½ in. below. Upper right-hand compartment has recessed vertical control panel to accommodate tuner and control unit. Lower righthand compartment will house a complete tape recorder. Size: 51½ × 15½ × 16 in. (plus 12 in. for legs). Speaker enclosures 7½ × 14¾ × 14¾ in. Price: (walnut or mahogany) £28 7s.; (teak) £30 9s.).


Imhof HFU/IL

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LOWTHER MANUFACTURING CO., Lowther House, St. Mark's Road, Bromley, Kent. Tel.: Ravensbourne 5225. Cables: Lowther, Bromley.

Model 1. Lowline compact cabinet. Block-board construction. Finished in walnut, sapele, oak, tola. Lift-up lid. Detachable unit mounting board, rear panel and legs. Size: 36 × 19 × 29 in. Mounting board 34½ × 17½ in. On short legs with adjustable brass feet. Price: £30 ex works.

Model 2. Lowline cabinet with similar specification to Model 1 but larger. Size: 50 × 19 × 29 in. (including 11½ in. for legs). Mounting board 48 × 17½ in. Depth inside lid 3⅜ in. Single lid with two pneumatic stays. Price: £50 ex works.

Special model 56 in. wide made to order. Price on request.

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MUSICRAFT HI FI CENTRE, 63 High Street, Hounslow, Middlesex. Tel.: Hounslow 4640.

Richmond. Medium line modern cabinet in oiled teak. Takes gram unit, amplifier and tuner. Lift-up lid. Overall size: 26 × 17½ × 25 in. Price: £17 17s.

Sutton. Lowline cabinet in teak with lid and supporting frame in white or black. Takes gram unit, amplifier and tuner. Lift-up box lid for player. Lift-up slab lid for controls. Overall size: 42 × 20 × 24 in. (inc. 13½ in. frame). Price: £30 9s.

Dorking. Lowline cabinet in oiled teak. Takes gram unit, tuner, amplifier and tape deck. Two lids which fold away from centre section then lift up. Overall size: 60 × 20¾ × 19¼ in. (inc. 8½ in. legs). Can be used in centre of room. Price: £34 13s. with black vynair front panel, £36 15s. with teak front panel.

Modular Tape Unit. One of five 20 in. cube module cabinets. Finished in rosewood/sapele, mahogany or teak. Top and upper half of front open to provide easy access for a portable tape recorder. Lower drawer. Cutaway back to take leads. Matching speaker and amplifier cabinets available. Size: 20 × 20 × 20 in. with 7 in. base frame with adjustable feet. Price: £18 18s. (cabinet), single base unit £3, double base unit £3 10s.

Modular Amplifier Unit. 20 in. cube module cabinet in rosewood/sapele, mahogany or teak. Satin black handles. Lift-up lid, drop down half front. Matching cabinets can be added as equipment grows. Size: 20 × 20 × 20 in. with 7 in. base frame with adjustable feet. Price: £18 18s. (cabinet), single base unit £3, double base unit £3 10s.

PERIOD HIGH FIDELITY LTD., 41 Beauchamp Place, London, S.W.3. Tel.: Knightsbridge 9258.

Authentic Period-styled hand-made cabinets fitted with equipment to customers requirements. Speaker enclosures in matching style. Prices and quotations on request.

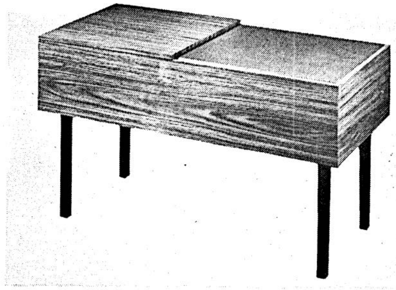
P.W.B. AUDIO LTD., 33 Call Lane, Leeds 1, Yorkshire. Tel.: Leeds 28559.

Model A1. Lowline style with single lift-up lid. Takes gram unit, tuner and amplifier. Finish: Teak, walnut, mahogany or oak. Matching or black legs. Rosewood drop on front of lid optional extra. Size: 36 × 16½ × 27 in. Motor board 17½ × 15 in. deep. Amplifier section 17½ × 15 in. deep. Price: £25.

Model A2. Lowline style with twin lift-up lids, smaller lefthand lid over amplifier and tuner section, larger righthand lid over gram unit and record storage section. Finish: Teak, walnut, mahogany, oak. Matching or black legs. Rosewood drop on front of lids optional extra. Takes gram unit, tuner, amplifier, and has provision for record storage. Record storage section lifts out to permit tape deck to be fitted. Size: 52 × 16 × 27 in. Internal sections dimensioned as required. Price: £35.

RECORD HOUSING, Brook Road, Wood Green, London, N.22. Tel.: Bowes Park 7487.

Longfellow. Lowline cabinet in walnut, mahogany or teak. Takes gram unit, tapedeck,



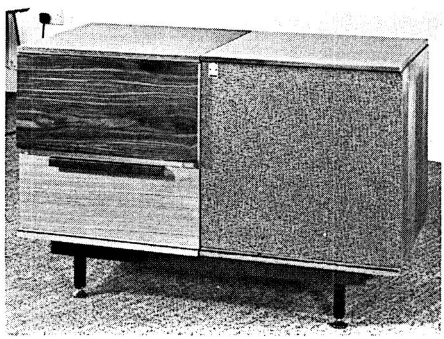
Rogers lowline with legs

tuner, amplifier. Record storage (150). Two lift-up lids. Overall size: 76½ × 21 × 14 in. (plus 9 in. for legs). Will take complete tape-recorder and largest players, transcription or autochange. Price: (walnut and mahogany) £40 19s.; (teak) £44 2s.

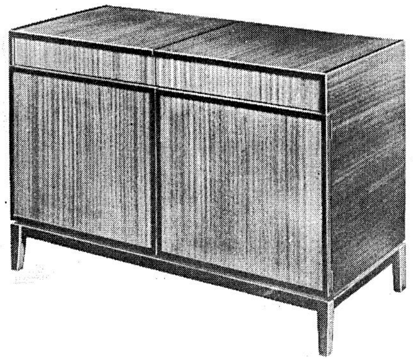
Nielsen. Upright cabinet in walnut, mahogany or teak. Takes gram unit, tuner, amplifier, etc. Lift-up lid. Overall size: 19¾ × 18½ × 29 in. Motor board size: 18½ × 16½ in. Moves on castors. Prices: (walnut and mahogany) £17 17s.; (teak) £18 18s.

Lowflex. Lowline cabinet in walnut, mahogany or teak. Takes gram unit, tape deck, tuner, amplifier, etc. Lift-up lids, one with pneumatic stay. Overall size: 59 × 21 × 14 in. (plus 9 in. for legs). Record storage on left. Partition removable if not required. Prices: (walnut and mahogany) £30 9s.; (teak) £32 11s.

Schubert. Upright cabinet in walnut, mahogany or teak. Takes gram unit, tape deck or complete recorder, tuner, amplifier and record storage. Lift-up lids, front opening doors, right-hand compartment for storage. Overall size: 42 × 21 × 25 in. (plus 6 in. for legs). Prices: (walnut and mahogany) £36 15s.; (teak) £38 17s.



Musicraft modular tape and speaker cabinets



Record Housing Schubert

Available in walnut, mahogany or teak Designed to accommodate most amplifiers, preamplifiers, tuners and gram units in smallest space consistent with adequate ventilation. Single, double and triple models available having same depth and height but with different widths. Size: 20 × 17 in. (with legs 26 in. high). Motor board 17 × 18 in. Single model 18 in. wide, double 36 in. wide, triple 54 in. wide. Prices: (single) £11 6s.; (double) £20 6s. 10d.; (triple) £26 13s.

ROGERS DEVELOPMENTS (ELECTRONICS) LTD., 4/14 Barmeston Road, Catford, London, S.E.6. Tel.: Hither Green 7424/4340. Cables: Rodevco, London, S.E.6.

Lowline. Lowline cabinet in teak or dark Australian walnut. Takes gram unit, tuner, control unit and main amplifier. Lift-up lid. Designed especially for Rogers Cadet III or HG88 III. Square section black steel legs optional extra. Overall size: 36¼ × 17¼ × 8¾ in. Price: (cabine)) £14 6s.; (legs) £1 10s.

SYMPHONY AMPLIFIERS LTD., 16 King's College Road, London, N.W.3. Tel.: Primrose 3314/5.

Equipment cabinet. Modern style cabinet for table use or, with legs, for use as floor unit.

TYSONS, 41 Russell Street, Leamington Spa. Tel.: Leamington Spa 24935.

Tysonic Dower Chest. Lowline style in oak. Suitable for gram unit, tape deck, tuner, amplifier. Lift-up lid. Generally 36 in. to 48 in. long. Prices: £35 to £50.

Equipment installed in antique or reproduction furniture to customers' requirements. Dower chests a speciality.

WHITELEY ELECTRICAL RADIO CO. LTD., Victoria Street, Mansfield, Nottinghamshire. Tel.: Mansfield 1762-5. Cables: Whitebon, Mansfield.

C16 Thoresby Equipment Console. Upright style equipment cabinet with lift-up lid. Takes most makes of gram unit or tape deck, amplifier, control unit and tuner. Available in mahogany or walnut. Supplied packed flat and easily assembled in a few minutes with a screwdriver only. Size: 19⅜ × 18 × 31 in. Price: (mahogany) £15; (walnut) £15 10s.

DIRECTORY OF HI-FI DEALERS

IMPORTANT NOTE: The following list is of shops where stocks of equipment are kept, and where facilities for demonstration exist. It is not necessarily a complete list, and we invite new dealers to submit details for future publications.

LONDON AREA

BERRY'S RADIO LTD, 25 High Holborn, W.C.1
CHELSEA RECORD CENTRE, 203 King's Road, S.W.3
CUSTOM HIGH FIDELITY, 371 Green Lanes, Palmers Green, N.13
DAVENSET RADIO, 2 Burnt Ash Parade, Lee Green, S.E.12
H. NORMAN DAVIS LTD, 91 The Broadway, Mill Hill, N.W.7
FRANCIS OF STREATHAM, 169-173 Streatham High Road, S.W.16
C. C. GOODWIN (SALES) LTD, 7 The Broadway, Wood Green, N.22
HAMPSTEAD HIGH FIDELITY, 91 Heath Street, Hampstead, N.W.3
HAMPTONS OF KENSINGTON, 7 Kensington High Street, W.8
THOMAS HEINITZ, 100 Queensway, W.2
ALFRED IMHOF, 112-116 New Oxford Street, W.C.1
LARGS OF HOLBORN, 76-77 High Holborn, W.C.1
LASKY'S RADIO, 207 Edgware Road, W.2; 152-153 Fleet Street, E.C.4; 33 Tottenham Court Road, W.1
LEE ELECTRONICS, 400 Edgware Road, W.2
LEWIS RADIO, 100 Chaseside, Southgate, N.14
MAC'S CAMERA SHOPS LTD, 250-252 King Street, Hammersmith, W.6
MASSEYS CENTRE OF SOUND, 121-123 High Road, W.4
MODERN ELECTRICS LTD, 120 Shaftesbury Avenue, W.1
V. J. MONK LTD, 140-141 Plumstead Road, S.E.18
NEWBURY RADIO (FOREST GATE) LTD, 272 and 305 Romford Road, Forest Gate, E.7
NORTHERN RADIO SERVICES, 16 Kings College Road, N.W.3
NUSOUND, 93 Mortimer Street, W.1; 242-244 Pentonville Road, N.1; 228 Bishopsgate, E.C.2; 36 Lewisham High Street, S.E.13; 2 Maryland Station, E.15; 205 High Street North, E.6
THE RECORDER CO, 188 West End Lane, West Hampstead, N.W.6
R. E. W. EARLSFIELD, 266 Upper Tooting Road, S.W.17
R. S. C. (MANCHESTER) LTD, 238 Edgware Road, W.2
R.T.M. (RADIO & TELEVISION) SERVICE LTD, 387b Mare Street, E.8
SHEEN TAPE RECORDER CENTRE, 3 and 4 Station Parade, Sheen Lane, S.W.14
H. L. SMITH & CO LTD, 287-289 Edgware Road, W.2
STERNE-CLYNE LTD, 9 Camberwell Church Street, S.E.5; 309 Edgware Road, W.2; 109 Fleet Street, E.C.4; 18 and 23 Tottenham Court Road, W.1
STUDIO 99, 57 Fairfax Road, Swiss Cottage, N.W.6
TELERADIO, 189 Edgware Road, W.2
TELESONIC LTD, 92 Tottenham Court Road, W.1
TELETAPE LTD, 33 and 59a Edgware Road, W.2; 84-88 Shaftesbury Avenue, W.1
TEL-LEE-RADIO, 220 The Broadway, Wimbledon, S.W.19

BATH (SOMERSET)

C. MILSOM & SON, North Gate

BEXLEY HEATH

HI-FI CENTRE, BROADWAY RADIO, 228 Broadway

BIRMINGHAM

NORMAN H. FIELD ELECTRONICS, 68 Hurst Street, 5
GRIFFIN RADIO LTD, 94 Bristol Street, 5
REEVES SOUND SERVICE LTD, Audio and Photographic Centre, 31 Smallbrook Ringway, 5
R.S.C. (MANCHESTER) LTD, 30-31 Great Western Arcade
COLIN G. TURNER, 39 York Road, King's Heath, 14

BISHOP AUCKLAND (DURHAM)

McKENNA & BROWN (PHOTOGRAPHIC) LTD, 134 Newgate Street

BLACKBURN (LANCS)

HOLDINGS AUDIO CENTRE, 39-41 Mincing Lane, Darwen Street

BLACKPOOL

F. BENFELL LTD, 17 Cheapside
THE TAPE RECORDER CENTRE (BLACKPOOL)—C. BRADDOCK LTD, 226 Waterloo Road

BOGNOR REGIS

TANSLEY & COOKE LTD, Television House, Sandymount Avenue; 3-4 Odeon Buildings; 46 Aldwich Road

BOLTON (LANCS)

HARKER & HOWARTH (MUSIC) LTD, 7 The Arcade, Bradshawgate
STEREO LECTRICS LTD, 150 Higher Bridge Street

BOURNEMOUTH

NATIONAL RADIO SUPPLIES, 70-72 Holdenhurst Road

BRADFORD

CHRISTOPHER PRATT & SON S LTD, 33 North Parade, 1
R.S.C. (MANCHESTER) LTD, 54-56 Morley Street, 7

BRIGHTON

LANES (RADIO) LTD, 11 Gardner Street

BRISTOL

BRISTOL & WEST RECORDING SERVICE LTD, 6 Park Row
R.S.C. (MANCHESTER) LTD, 14 Lower Castle Street
STERNE-CLYNE LTD, 28 Merchant Street

BROMLEY (KENT)

HOWARD TAPE RECORDERS, 218 High Street

CAMBRIDGE

ADAM & DELLAR LTD, 61 Regent Street
H. GEE, 94a Mill Road
REECE OF CAMBRIDGE, 1 and 2 Peas Hill
UNIVERSITY AUDIO, 1 and 2 Peas Hill
UNIVERSITY RECORDING COMPANY, 38 Gold Street

CANTERBURY

HAMPTONS OF KENSINGTON, 36 High Street

CARLISLE

MISONS, Citadel Row

CARDIFF

J. GOUGH & CO LTD, 148-154 North Road

CHELTENHAM
MODERN RADIO (CHELTENHAM) LTD, 40-42 St. James Street
RAY ELECTRICAL (CHELTENHAM) LTD, 287 High Street
UNIVERSITY AUDIO, 87 Winchcombe Street

CHICHESTER
STORRYS, 83 North Street

COVENTRY
COVENTRY & DISTRICT CO-OPERATIVE SOCIETY LTD, Central Premises, Corporation Street
R.E.S. (COVENTRY) LTD, 13 City Arcade; 128 Far Gosford Street

CRAWLEY (SUSSEX)
KIRKMAN, 40 The Broadway

CREWE
CHARLESWORTH'S OF CREWE LTD, 14 Hightown

CROYDON
LIVING SOUND, 11 Essex House, George Street
SOUTHERN AUDIO SERVICES OF CROYDON, 3 Lower Church Street
SPALDING ELECTRICAL LTD, 352-354 Lower Addiscombe Road
STERNE-CLYNE LTD, 12 Suffolk House, George Street

DARLINGTON
R.S.C. (MANCHESTER) LTD, 13 Post House Wynd

DERBY
BUCKLAND'S OF DERBY, 41-49 London Road
R.S.C. (MANCHESTER) LTD, 26 Osmaston Road

DORKING (SURREY)
THE HIGH FIDELITY CENTRE, 61 West Street

DUNDEE
LARG & SONS (DUNDEE) LTD, 16-24 Whitehall Street

EDINBURGH
HI-FI CORNER, 1 Haddington Place, 7
R.S.C. (MANCHESTER) LTD, 133 Leith Street

EXETER
JIM GAPPER (IN ASSOCIATION WITH) ALFRED HEXT, 18 Clinton Avenue, off Monks Road

FARNHAM (SURREY)
LLOYD & KEYWORTH LTD, The Record Shop, 26-27 Downing Street

GLASGOW
JAMES KERR & CO LTD, 435 Sauchiehall Street, C.2
M. & M. ELECTRONICS LTD, 91 N. Hanover Street, C.1
R.S.C. (MANCHESTER) LTD, 326 Argyle Street

GOODMAYES (ESSEX)
UNIQUE RADIO, 6 The Facade, High Road

GRIMSBY
JOHN ANGLIN, 385 Cleethorpe Road
LINCOLNSHIRE INSTRUMENT CO, HI-FI HOUSE, 69-73 Cartergate

GUILDFORD
PORTER'S RADIO SUPPLIES, 15 Chapel Street

HALIFAX
TAPERECORDER CENTRE (HALIFAX), 30 King Cross Street

HAMPTON HILL (MIDDLESEX)
MELFORD RADIO SERVICE, 58 Windmill Road

NORTH HARROW (MIDDLESEX)
CITY ELECTRONICS LTD, Broadwalk, Pinner Road

HASSOCKS
TANSLEY & COOKE LTD, 11 Keymer Road

HAYWARDS HEATH
TANSLEY & COOKE LTD, 26 South Road

HENLEY ON THAMES
G. O. MOORHEN, 190 Reading Road

HIGH WYCOMBE
M. W. KEEN LTD, Pauls Row

HITCHIN (HERTS)
RECORD SHOP, 31 Hermitage Road

HORSHAM (SUSSEX)
TANSLEY & COOKE, 37 West Street

HOUNSLOW (MIDDLESEX)
MUSICRAFT HI-FI CENTRE, 63 High Street

HUDDERSFIELD
RADIO CRAFT (HUDDERSFIELD) LTD, 38 King Street
J. WOOD & SONS LTD, 67 New Street

HULL
R.S.C. (MANCHESTER) LTD, 51 Savile Street

IPSWICH
R.C.S., 61 Fore Street

KEIGHLEY (YORKS)
J. S. RAMSBOTTOM & CO LTD, Cook Lane

KIDDERMINSTER (WORCS)
F. W. LONG, 14 Mill Street

LEAMINGTON SPA
REGENCY ELECTRONICS LTD, 29 Regent Street
TYSONS SOUND ENGINEERS, 41 Russell Street

LEATHERHEAD (SURREY)
MAURICE RICHARDS LTD, Radio House, The Crescent

LEEDS
ELECTRONIC SERVICE (LEEDS) LTD, 59 Street Lane
R.S.C. (MANCHESTER) LTD, 5-7 County (Mecca) Arcade, Briggate, 1
VALLANCES, Headrow House, 1

LEICESTER
DALTON & SONS LTD, 76 Granby Street
HI-FI RECORD BAR, 9-13 Applegate Street
LEICESTER CO-OPERATIVE SOCIETY LTD, High Street
R.S.C. (MANCHESTER) LTD, 32 High Street

LITTLEHAMPTON
TANSLEY & COOKE LTD, 61 High Street

LIVERPOOL
BEAVER RADIO OF WHITECHAPEL
LAMBDA RECORD CO, 95 Liverpool Road, 23
R.S.C. (MANCHESTER) LTD, 73 Dale Street, 2

LOUGHTON (ESSEX)
SOUND SUPPLIES (LOUGHTON) CO LTD, Smart's Lane

LUTON (BEDS)
COVENTRY RADIO, 189-191 Dunstable Road

MACCLESFIELD
HI-FI HOUSE, 123 Chestergate

MAIDSTONE
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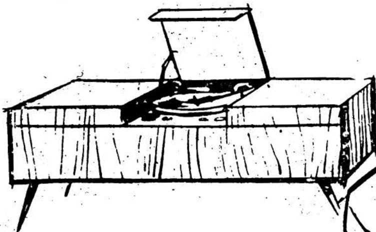

If you're on the track of any piece of hi-fi equipment you must visit University Audio, where you'll find it sooner and hear it better. Find it sooner because everyone at University Audio is a specialist, enthusiastic about hi-fi and able to find quickly the right item at the right price. Hear it better because there's a mono-stereo comparator which enables you to hear and see how any piece of equipment works.

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GODLEYS, 2-10 Shudehill, 4
LANCASHIRE HI-FI LTD, 8 Deansgate, 3
RARE RECORDS LTD, 5-7 Barton Square, off St. Ann's Square, 2
R.S.C. (MANCHESTER) LTD, 60a-60b Oldham Street
STERNE-CLYNE LTD, 10 Withy Grove, 4

MIDDLESBROUGH (YORKS)
McKENNA & BROWN (PHOTOGRAPHIC) LTD, 122 Linthorpe Road
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SPARKSOUND LTD, 41 Borough Road

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HOME RADIO (MITCHAM) LTD, 187 London Road

NEW BARNET (HERTS)
AUDIO SERVICES, 82 East Barnet Road

NEWCASTLE UPON TYNE
FENHAM RADIO, 158 New Bridge Street, 1

NORTHAMPTON
CRYERS. RADIO AND SOUND EQUIPMENT LTD, 220-224 Wellingborough Road

NOTTINGHAM
NOTTINGHAM TAPE RECORDERS LTD, Burton Street
THE PHOTO CENTRE, 28-30 Pelham Street

OXFORD
HORNS, 6 South Parade
WESTWOOD'S OF OXFORD, 46 George Street

PAIGNTON
PAUL PINCH LTD, Foales Corner

PERTH
GEORGE D. BROWN, 61 Kinnoull Street

PETERBOROUGH
CAMPKINS RECORD SHOP, 15 Long Causeway

PLYMOUTH
TOM MOLLAND LTD, 102 Cornwall Street
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P. A. BAKER, 111 Above Bar
HAMILTON ELECTRONICS, 35 London Road
LEECH & HAING LTD, 57-61 London Road
J. F. SUTTON, 421 Shirley Road
UNIVERSITY AUDIO OF SOUTHAMPTON, 12 Bargate Street

SOUTHSEA
TANSLEY & COOKE LTD, 161 Albert Road

SOUTHWICK (SUSSEX)
TANSLEY & COOKE LTD, 14 Southwick Square

STOCKPORT (CHESHIRE)
FAIRBOTHAM & CO LTD, 58-62 Lower Hillgate

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HIGH FIDELITY SOUND EQUIPMENT, 116 Birches Head Road, Hanley

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TUNBRIDGE WELLS
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WINDSOR
AUDIOCRAFT LTD, 89-90 High Street, Eton

WOKING
E. H. MAXWELL & SONS LTD, 87 Walton Road; Guildford Road; Chertsey Road

WOLVERHAMPTON
FENWICKS (RADIO AND TELEVISION), Fenwick Buildings, Great Brickkiln Street
M. R. WARNER & SON LTD, 26 Chapel Ash

WORCESTER
JOHNSONS SOUND SERVICE, 9 Sidbury

WORTHING
BOWERS & WILKINS LTD, 1 Becket Buildings, Littlehampton Road
CRAY OF WORTHING LTD, 132 Montague Street
J. W. MANSFIELD LTD, 8-12 Liverpool Road
TANSLEY & COOKE LTD, 11 Chapel Road; 187 Montague Street

YEOVIL
YEOVIL'S OWN RADIO HOUSE, 19 Princes Street

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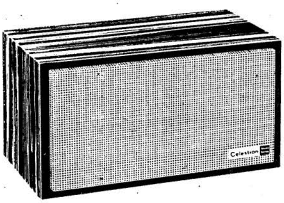
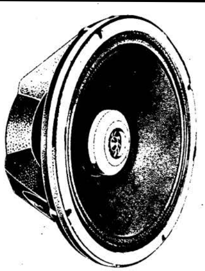
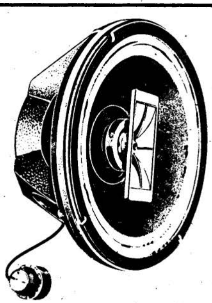
CUSSINS & LIGHT LTD, King's Square; 34 Walmgate

over 40 Sound Years and many Millions of Loudspeakers...

. . . is the background to the Celestion STUDIO SERIES range of high fidelity loudspeakers, a firm foundation, you will agree.







Considering first the latest addition to the range, the Ditton 10 is a compact 10 watt full range, high fidelity loudspeaker which was introduced at the 1965 Audio Fair.

Certainly not the smallest and far from being the largest **COMPACT**, the Ditton 10 has been acclaimed by the technical reveiwers, leading stockists and the general public. We realise that there are many **COMPACTS** available but none, as far as we know, superior to the Ditton 10 in appearance or performance.

The STUDIO SERIES range was launched early in 1964 with two 12″ co-axial units. These, the CX1512 and the CX2012 are capable of handling 15 and 20 watts respectively. The chassis, used on both models, is a heavy duty die-casting which ensures precision alignment and a new, high efficiency, Feroba magnet assembly controls the main voice coil and cone. Add to these the axially mounted pressure driven treble unit (similar to those we supply to the B.B.C.) and you have precision loudspeakers that look and sound superb.

More loudspeakers are to be added to the STUDIO SERIES range and these too will reflect the know-how and craftsmanship to be found at Thames Ditton, the home of loudspeaker research and development.

Celestion Studio Series

CELESTION LTD.
Ferry Works,
Thames Ditton, Surrey

Telephone: EMBerbrook 3402/6

A SHURE BREAKTHROUGH IN SOUND PURITY-THE FIRST TRUE 15° CARTRIDGES

There is a Shure 15° Dynetic Cartridge for every true high-fidelity application.

The M44 Series track at an effective vertical angle of 15°, affording an increase in the richness, clarity and vitality of sound that is quite amazing.

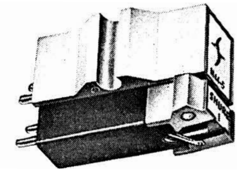
Based on the Shure moving-magnet principle, the M44 Series feature high compliance, low needle-talk and wide range frequency response.

Each model has a no-scratch, retractile stylus that momentarily retracts whenever excessive forces are applied to the tone arm.

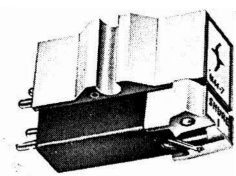
The M44-7 and M44-C are suitable for fitting to certain high-grade automatic turntables, playing units and changers.

SHURE

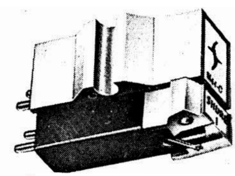
setting the world's standard in sound



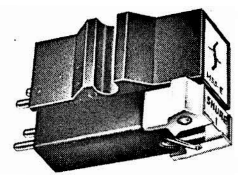
Model M44-5
Designed for use with precision transcription arms capable of tracking at between $\frac{3}{4}$ and $1\frac{1}{2}$ grammes



Model M44-7
Intended for use at a tracking pressure between $1\frac{1}{2}$ and 3 grammes

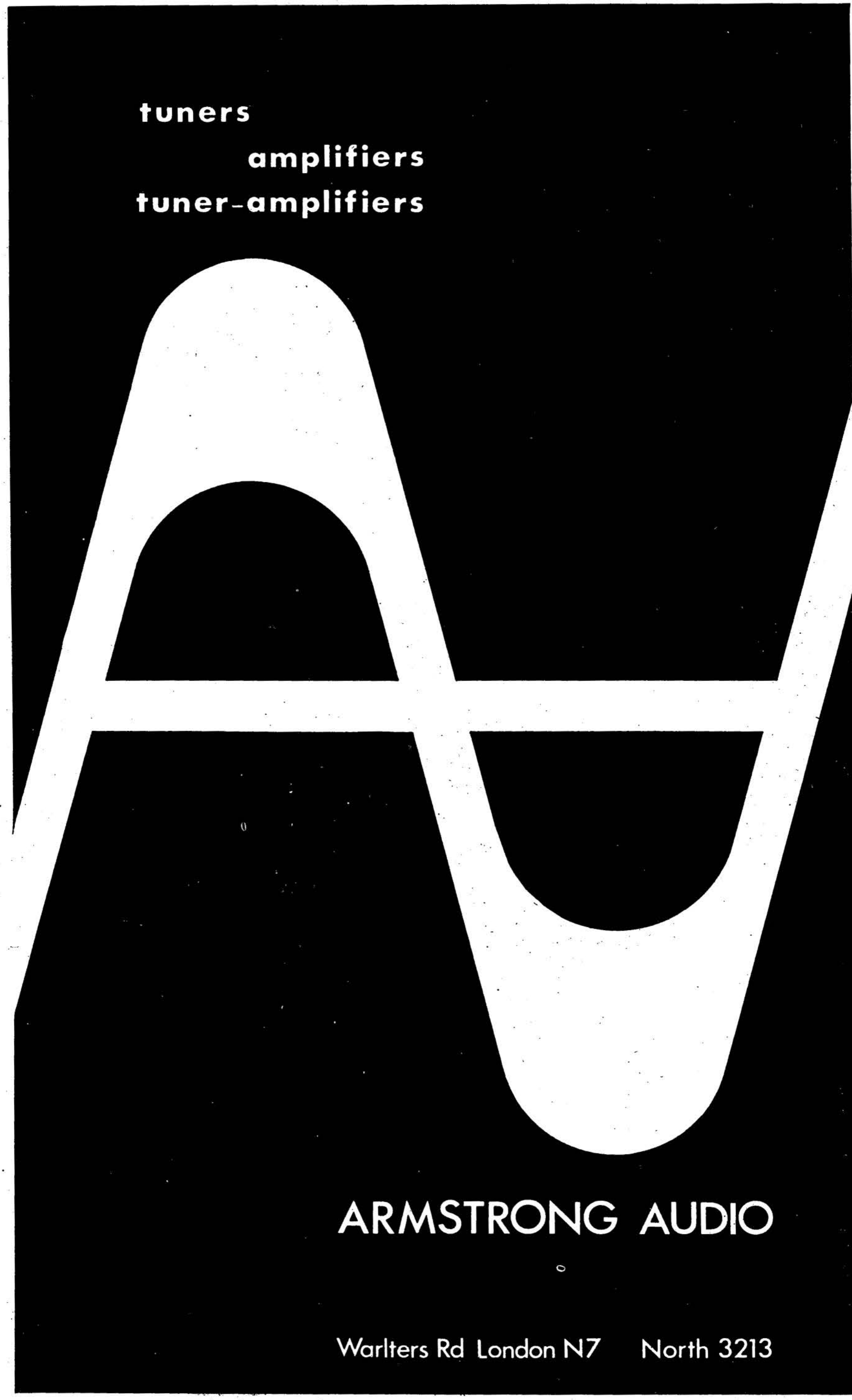


Model M44-C
Intended for use at a tracking pressure between 3 and 5 grammes



Model M55-E
Incorporates an elliptical stylus (for stereo and mono LP records). This is a cartridge for the connoisseur whose audio equipment is of the very highest standard. $1\frac{1}{2}$ grammes tracking with a transcription arm ensures virtual absence of wear of record and stylus

Shure Electronics Limited
84 BLACKFRIARS ROAD · LONDON · SE1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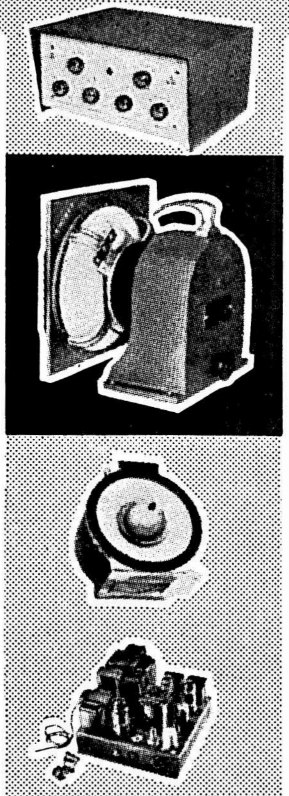
ARMSTRONG AUDIO
Warlters Rd London N7
North 3213



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ONLY ONE IS RIGHT FOR YOU

RIDICULOUS to buy your tape recorder or Hi-Fi without first checking on the full choice that's open to you. With so many different models on the market, designed for so many different jobs, you risk buying the wrong type unless you see a full range and discuss your choice with experts. At the Tape Recorder Centre—amongst the first and foremost specialists in the field—you will find the fullest range and the most expert experts.

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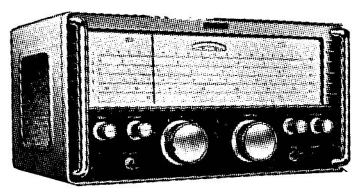

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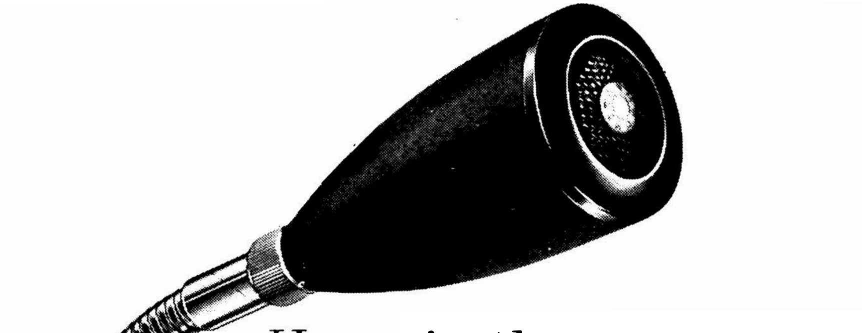

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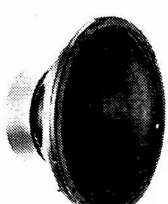

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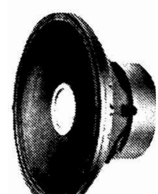

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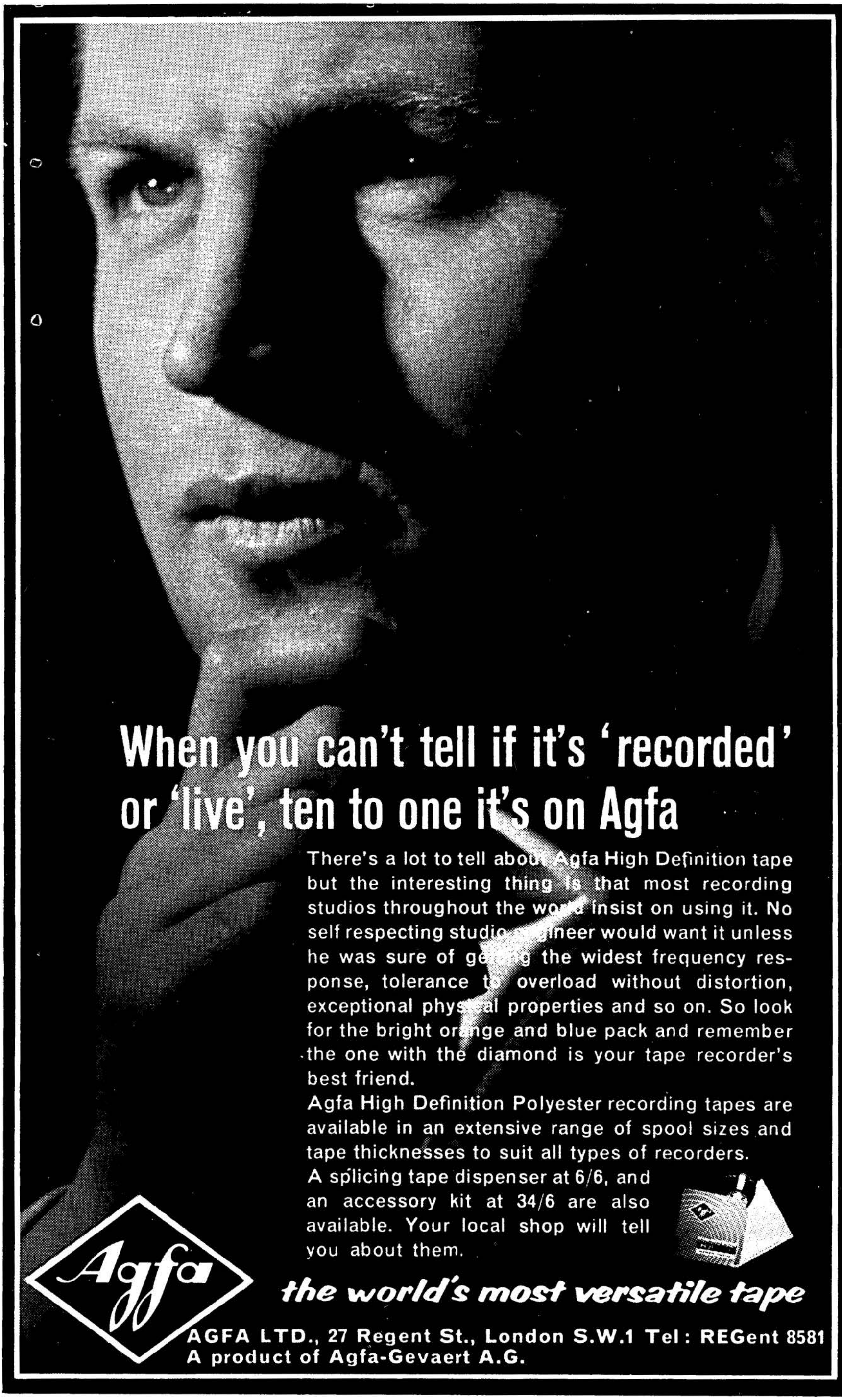
When you can't tell if it's 'recorded' or 'live', ten to one it's on Agfa
There's a lot to tell about Agfa High Definition tape but the interesting thing is that most recording studios throughout the world insist on using it. No self respecting studio engineer would want it unless he was sure of getting the widest frequency response, tolerance to overload without distortion, exceptional physical properties and so on. So look for the bright orange and blue pack and remember the one with the diamond is your tape recorder's best friend.
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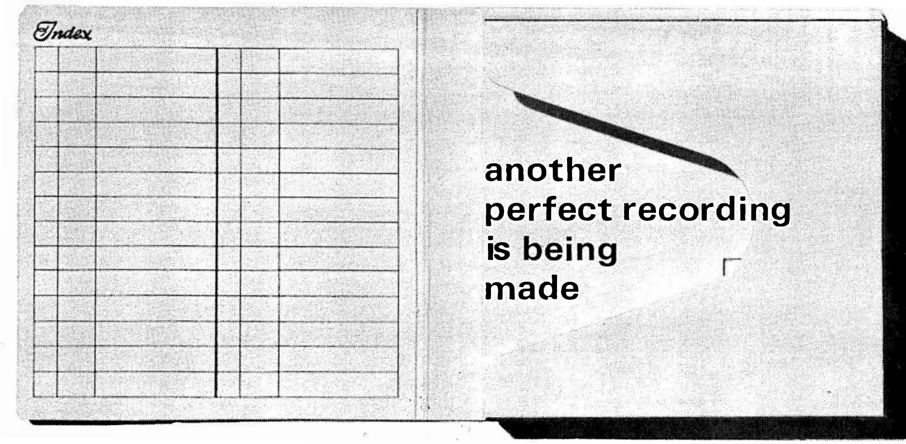
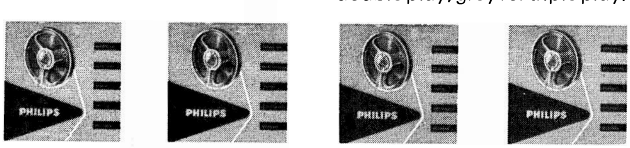


on Philips tape, naturally. Soon the tape will be filled with melodies, happy memories. Pleasure for years to come—perfectly stored on the perfect tape. It has high resistance to stretching, snapping, tearing. It has powerful magnetic coat adhesion for durability. It has polished magnetic coating for minimum head wear, maximum tape-head contact. It has high remanence, high sensitivity, low noise level. It gives lasting high quality performance. Even the box it comes in is built to last. Designed like a book for easy storage, it has a title space on the spine, and is colour coded to indicate type. It pays to get the best. Ask for Philips tape by name, whatever your recorder.

Choose green for standard play, red for long play, blue for double play, grey for triple play.



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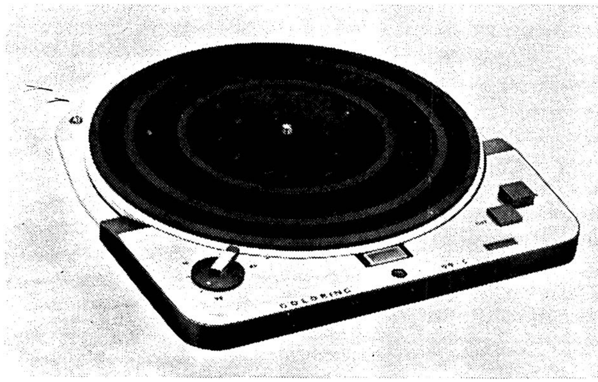
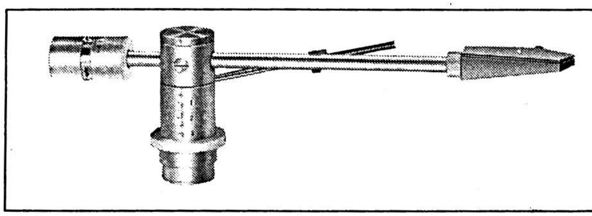
This is the transcription unit for the enthusiast who wants the proven features of Goldring-Lenco turntable units but prefers to mount an arm of his choice. Beautifully styled and proportioned, the G.99 has the unique continuously variable speed and vertical drive features, an 8 lb. non-magnetic turntable and push-button on/off control which also disengages the idler. A neon-lit stroboscope is built into the unit to facilitate speed settings and the speed variation is less than 1% for up to 13% mains voltage change. A pilot light gives the sophisticated G.99 an added touch of refinement.
£18.18.0d. + £3.1.5d. P.T.



*Recommended transcription arms: Goldring-Lenco P77 and G65. †Recommended cartridges: Pickering V15AM1, V15AME1, 380A, Goldring CS90 and CS91E.



*** Goldring-Lenco P77 Transcription Arm**
A magnificently engineered precision arm with provisions for balancing in every plane. Calibrated stylus pressure adjustment. Hydraulically damped positioning and lowering device. Removable plug-in head shell.
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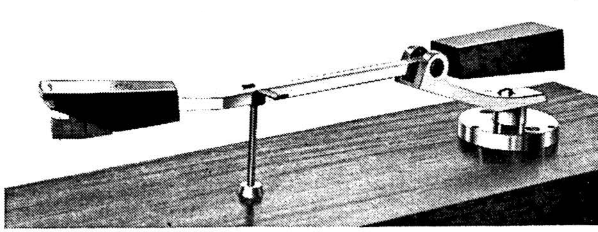

† Pickering V15 AM1 and AME1 Micro Magnetic Cartridge
Weighing only 5 gm., these high output, high compliance stereo/mono cartridges are perfect for low mass arms. 15° tracking angle gives minimum distortion. Hermetically sealed. Replaceable push-in diamond stylus assembly, with retracting stylus arm for added protection to records. (0.0007" tip radius for V15/AM1 and elliptical, with even high compliance, for V15/AME1).
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† Pickering 380A Cartridges
Moving-magnet for exceptional mono or stereo reproduction. Features the exclusive V-guard push-in diamond stylus unit which prevents damage through accidental dropping of arm on record. The Pickering 380A ensures high channel separation and virtually eliminates needle talk, hiss or distortion. Hermetically sealed, it tracks at 2 gm., faultlessly reproduces the most exacting records
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† Goldring CS 90 & CS 91E Cartridges
These are stereo ceramic cartridges with excellent frequency response and cross-talk separation. Low tip mass, replaceable diamond stylus (CS 90—0.0005" or 0.0007" tip radius; CS 91E—elliptical) Coupled with high compliance enables these cartridges to be played at light tracking weights.
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4000 REPORT-L

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Technical Specifications. *Recording Sense.* two tracks to international standard. *Tape Speeds:* 15/16 ips, 17/8 ips, 33/4 ips, 71/2 ips. *Maximum Reel Diameter:* 5" *Frequency Response:* 40 — 4,500 cps at 15/16 ips 40 — 10,000 cps at 17/8 ips 40 — 17,000 cps at 33/4 ips 40 — 20,000 cps at 71/2 ips. *Signal-to-Noise Ratio:* 55 db. *Wow and Flutter:* ± 0.15% at 71/2 ips (audible frequencies only). *Output Power:* 1 watt (push-pull output stage). *Power Supply:* 5 flashlight cells (1.5 volt), Z 211 'dryfit' storage battery or Z 114 Mains-Operated Power Unit and Battery Charger.

Price: 103 gns. (Including Microphone and Tape)

NEW
3 digit footage counter.

NEW
Transistor controlled motor (almost noiseless) for greater speed stability.

NEW
redesigned lid for extra visibility of tapes.

NEW
meter calibrated in db's for really precise control.

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plug-in printed circuits.

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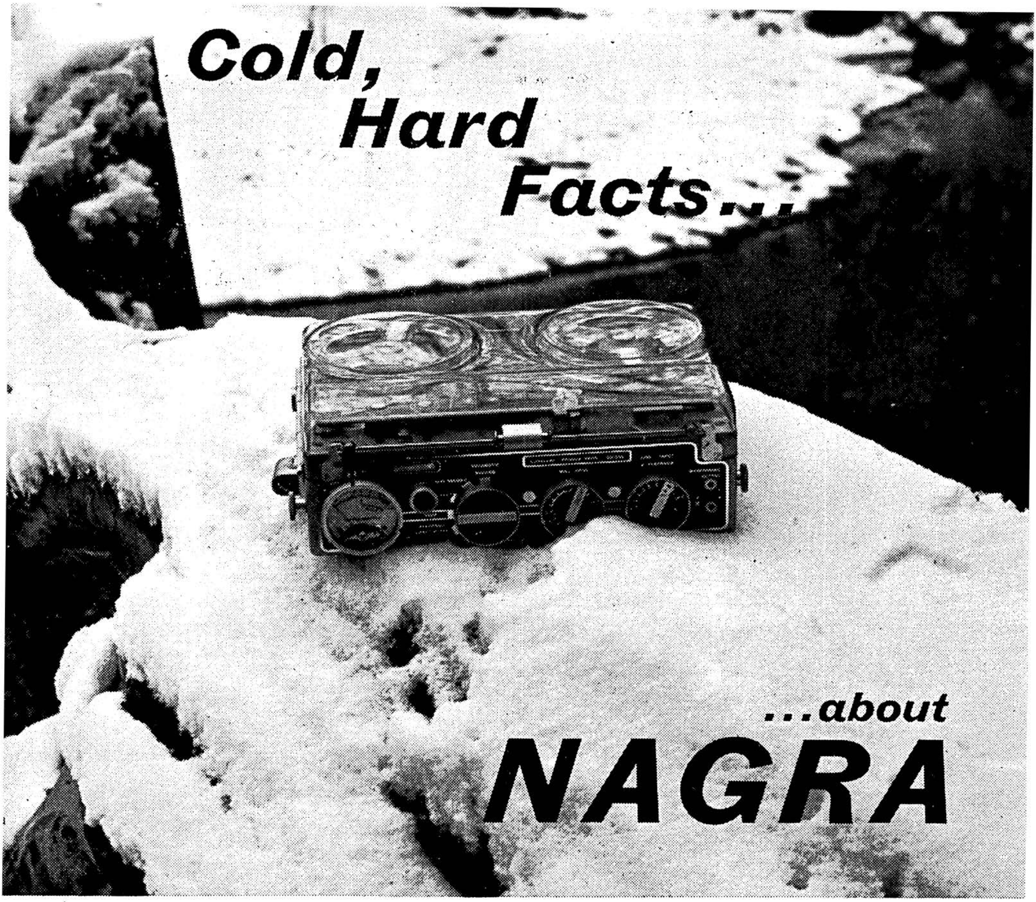

- Neopilot version for lip-synchronisation filming.
- Frequency response 30 c/s to 18,000 c/s ± 1 db at 15 i.p.s.
- C.C.I.R. equalisation.
- Wow and flutter ± 0·06% RMS at 15 i.p.s.
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These are typical performance figures and just part of the story. If you would like to know more, ask for literature from the sole U.K. agents for Nagra Tape Recorders made by Kudelski:—

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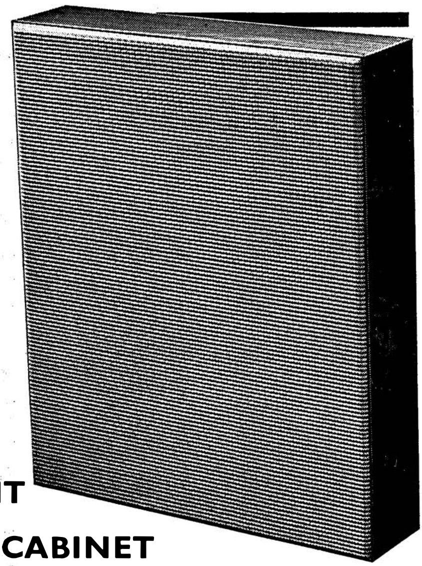

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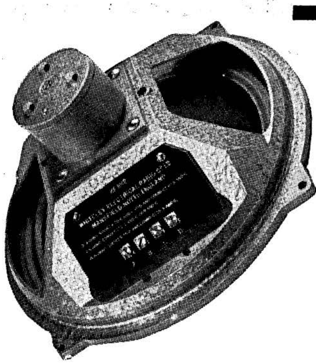

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Improved it. perfected it.
developed new machines that kept you ahead year after year...
If your two latest machines excelled all rivals...
you'd be proud.
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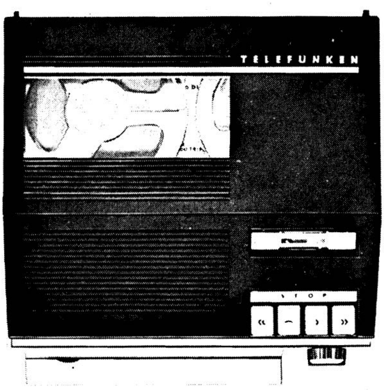

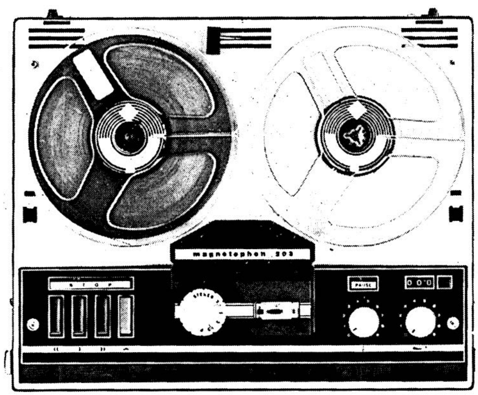

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M300

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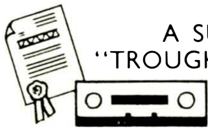

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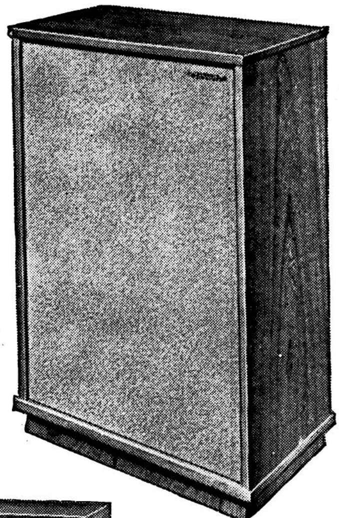
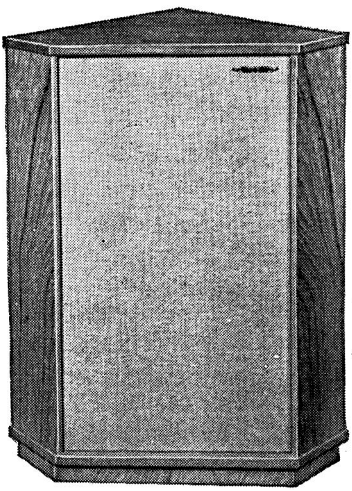


"Lancaster" corner-mounting
fitted with 12″ or 15″ Dual Concentric
Height 2′ 9″ Width 2′ 1″ Front to rear corner 1′ 4¾″



"III LZ" Mk. II,
Aperiodic enclosure with III LZ unit
Height 1′ 3″
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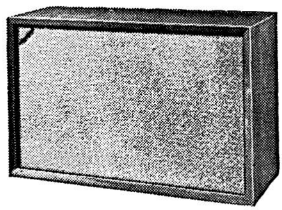

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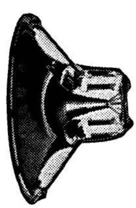

Cross section of Monitor Dual Concentric

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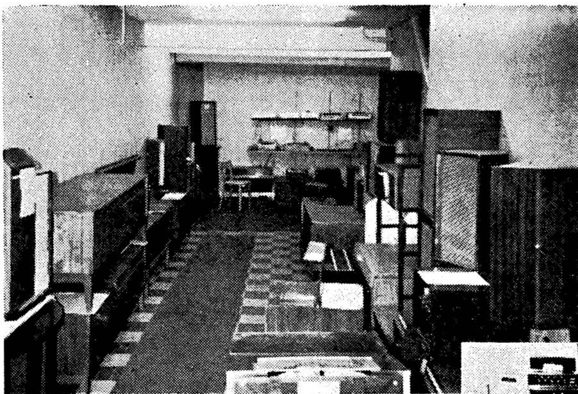

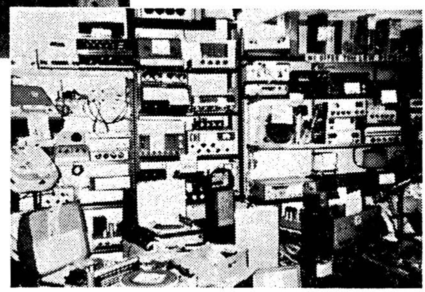

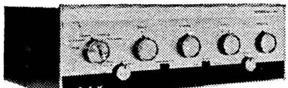

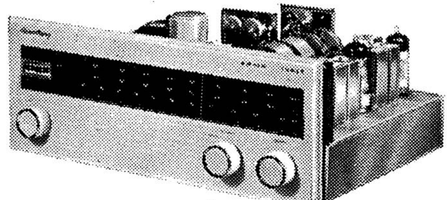

Illustrated: *above* LEAK Stereo 30. *Right*: Armstrong Model 224—just two examples of the high quality R.E.W. range.

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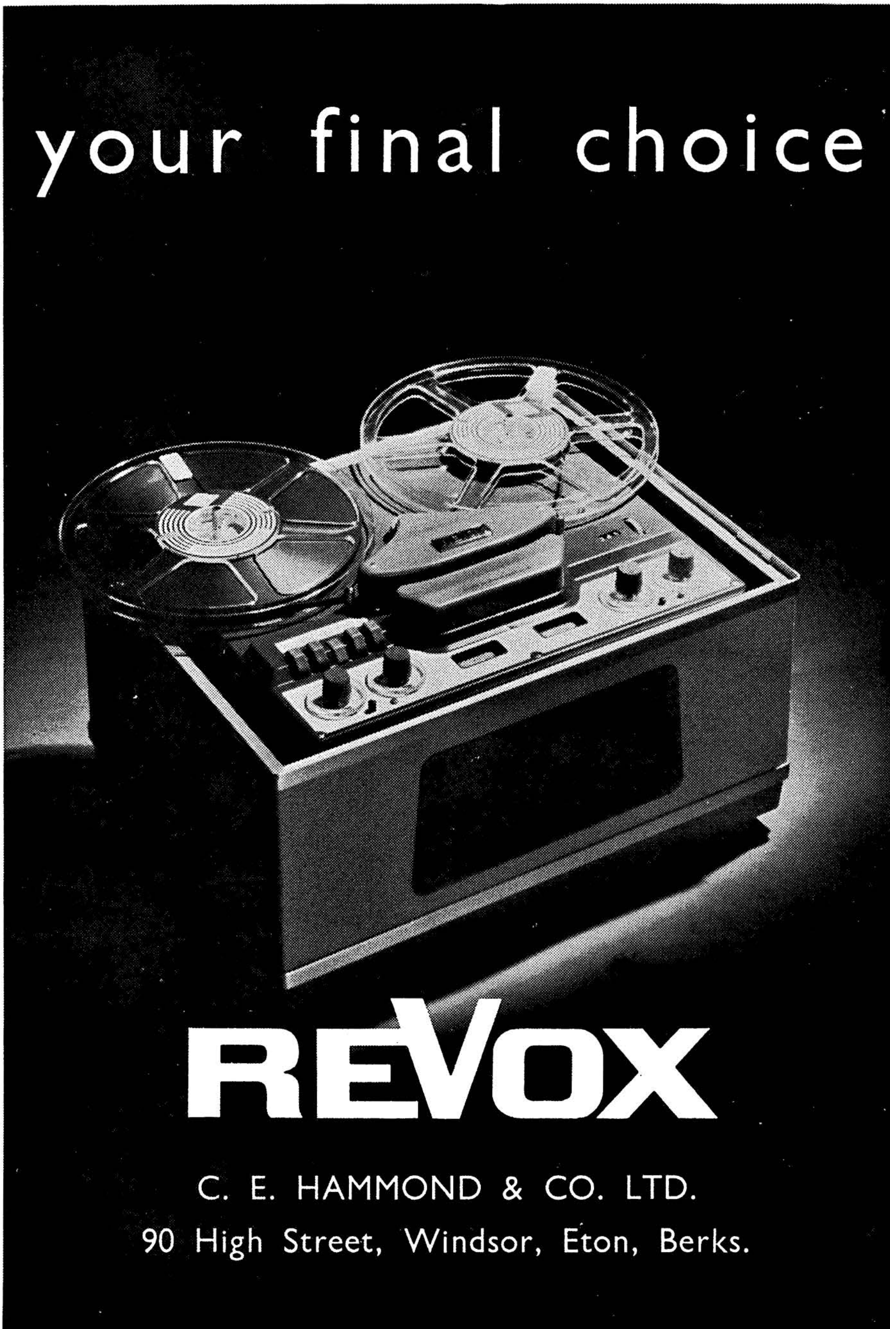
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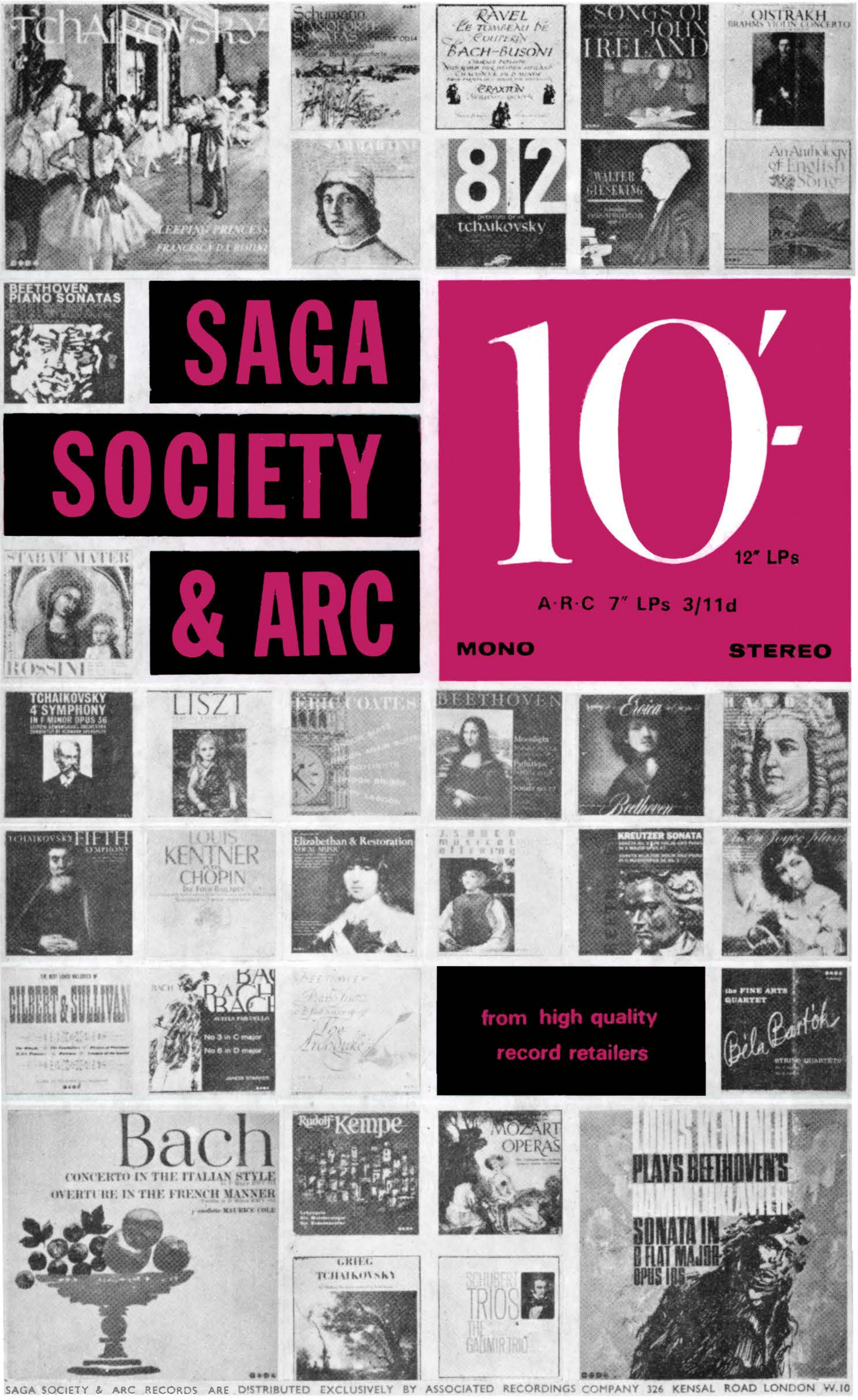

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