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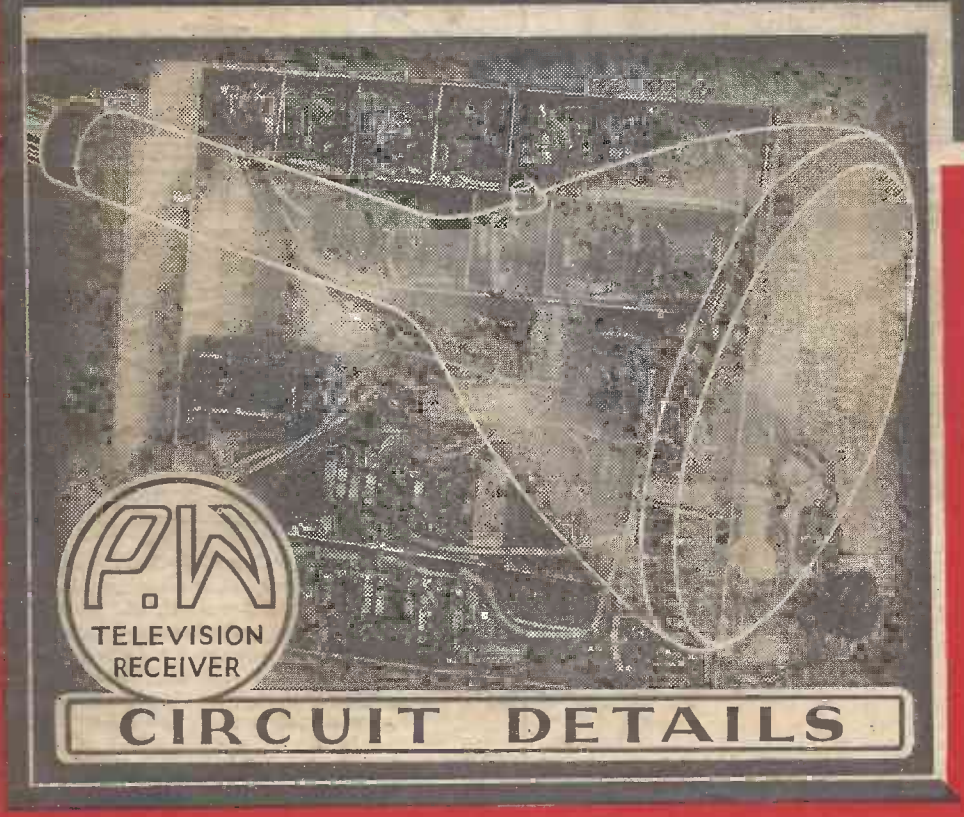
EDITOR:
F.J.CAMM

PRACTICAL WIRELESS

AND PRACTICAL TELEVISION



CHIEF CONTENTS

Practical Wireless
and PRACTICAL TELEVISION
18th YEAR OF ISSUE
EVERY MONTH
VOL. XXVI. No. 522 JANUARY, 1950
Editor E. J. CAMM

COMMENTS OF THE MONTH — BY THE EDITOR

The Practical Wireless Television Receiver

ELSEWHERE in this issue will be found the second of our series of articles describing the construction of the PRACTICAL WIRELESS Television Receiver. The chassis was exhibited at Radiolympia, and readers will from the preliminary article given last month now be aware of its specification and the essential features of its design. The complete list of components will enable the reader intending to build it to gather his components together before embarking upon construction. Carefully study the circuit diagram and make yourself "wire perfect" before commencing to build. Moreover, do not deviate from the specification. Buy only the high quality components specified and you will be assured of excellent results. We shall publish details of the modifications necessary to render the receiver suitable for the Sutton Coldfield transmission in a later article.

R.I.C. withdraws from T.A.C.

MEMBERS of the Radio Industry Council who recently met the reconstituted Television Advisory Committee to discuss the Government's plans for the extension of television to the rest of the country, say that they are "disturbed" to note the revised terms of reference of the Television Advisory Committee announced by the Postmaster General. The Radio Industry Council (the organisation of manufacturers in all sections of the British Radio Industry), feel that under its revised terms of reference it will not be possible for the Television Advisory Committee to be effective, and they have decided that no useful purpose will be served by attending further meetings.

The original terms of reference of the T.A.C. were to advise the responsible minister on television policy with particular reference to the planning, after consultation with industry, of future television services, including the standards to be adopted, the co-ordination and, where necessary, the institution of research into the principles and practice of television, the encouragement of the pooling of television patents and their use in the national interest and the investigation of all development in television at home and abroad, including its use in cinemas.

The revised terms of reference are: "To advise the Postmaster General on current development problems of the B.B.C.'s television service."

This narrows down very considerably the ambit of the T.A.C. British Television has developed at the hands of private enterprise and certainly owes very little to the original T.A.C. The advice it gave in its original report has in many cases not been implemented, and few of its members have made themselves qualified to give the advice they were required to do. They have not, for example, studied the Continental system. Industry, as in the past, will develop along its own lines and, as achievement follows development, its adoption will be forced upon the country willy nilly. In other words there is no need for a Television Advisory Committee. It should be disbanded.

Unrest in the B.B.C.

WHEN Lord Reith (whose book "Into The Wind" we shall review next month) was Director General of the B.B.C. there was some dissension among the staff, but the team does not seem any happier under later management; for we hear of great dissatisfaction there and staff changes continually. It would seem that there is lack of departmental co-operation and co-ordination in the B.B.C., and that promotion is not by merit. Moreover, unqualified men are selected for high posts and naturally the really qualified men resent having to work under them.

It is difficult to see how the organisation of the B.B.C. can be rectified after all these years. It was in our view wrongly organised at the start because a man with business ability and previous experience was not placed in charge. It has progressed by experiment, trial and error. By the time experience was gained a muddle was created and the B.B.C. has never really recovered from that. The fact that it has succeeded in maintaining a good service is beside the point. It could have succeeded at but a tithe of the cost and with a much smaller and, therefore, more workable personnel. It is a collection of water-tight compartments or cells sealed off from one another and each regarding itself as a separate entity.—F.J.C.

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ROUND the WORLD of WIRELESS

Broadcast Receiving Licences

THE following statement shows the approximate number of licences issued during the year ended September 30, 1949.

Region	Number
London Postal	2,278,000
Home Counties	1,623,000
Midland	1,688,000
North Eastern	1,872,000
North Western	1,567,000
South Western	1,032,000
Welsh and Border Counties	717,000
Total England and Wales	10,777,000
Scotland	1,118,000
Northern Ireland ..	196,000
Grand Total ..	12,091,000

The above figure includes 171,000 television licences, an increase of 8,850 during the month.

Licences are required not only by householders who operate sets which they own but also by those who use rented or hired sets.

B.I.R.E. Meetings

THE following meetings have been arranged for December: London Section: London School of Hygiene & Tropical Medicine, Gower Street, W.C.1 (meetings commence at 6.30 p.m.). December 15th: A. L. Whitwell (Graduate): Electronics in Aircraft Design. North-Eastern Section: Neville Hall, Newcastle-upon-Tyne (meetings commence at 6 p.m.). December 21st: C. Laverick: A Review of the Basis of Electronics. South Midlands Section: The Technical College, The Butts, Coventry (meetings commence at 7 p.m.). December 15th: Mr. Lane: H.T. Supply for High Power Transmitters. Scottish Section: Electrical Department, University, Glasgow (meetings commence at 6.30 p.m.). December 1st: A. A. M. Turnbull (Member): Electronics in Industry.

B.B.C. Engineering Changes

THE B.B.C. announce that it has decided to split the operations and maintenance department of the engineering division into two parts. One part, consisting of the studio, transmitter, recording and lines departments will continue to be in charge of Mr. L. Hotine, Senior Superintendent Engineer.

Mr. M. J. D. Pulling, M.A., M.I.E.E., has been appointed to take charge of the other part, the television department, with the title of Senior Superintendent Engineer, Television.

Mr. D. C. Birkinshaw's post as Superintendent Engineer, Television, is not affected.

Berry's and Export

WE are pleased to hear that Berry's (Shortwave) Ltd., have been favoured with an order for 40 transmitter-receivers for the Falkland Islands.

New Hungarian Short-wave Broadcasts

THE Hungarian Radio began short-wave broadcasts at the end of October, from the following stations:—

(1) 48 metres (6,247 kc/s, 2 kilowatts).
(2) 30.5 metres (9,820 kc/s, 2 kilowatts).

News in foreign languages will be broadcast from both the above stations at the following times:—

English, 9.30 p.m. G.M.T.
Russian, 5.30 p.m. G.M.T.
French, 6.0 p.m. G.M.T.
German (for Austria), 7.20 p.m. G.M.T.
German (for Germany), 8.30 p.m. G.M.T.

Broadcasts in Serbian and Slovak will continue on medium wave (549.5 metres) as usual. The German medium-wave broadcast will be at 8.20 p.m. instead of 6.40 p.m. as previously.

Television Sales Record

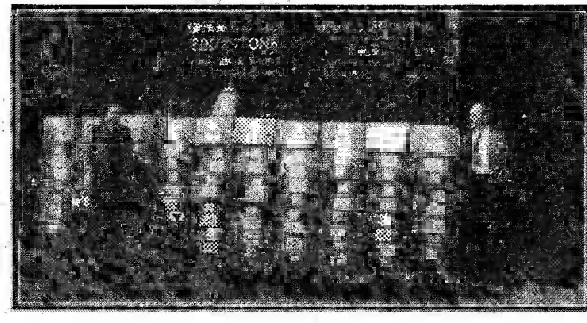
MORE than 21,000 television receivers were sold by manufacturers to the trade in September, 1949; as many as were sold in all the years before the war and only 6,000 less than in the whole of 1947. The previous highest monthly sales figure was 13,000 in December, 1948.

Production of television receivers in September exceeded 18,000, also a record.

Manufacturers' home sales of radio receivers reached 100,000, or nearly twice the August figure, and in addition, 8,000 radio-gramophones were sold.

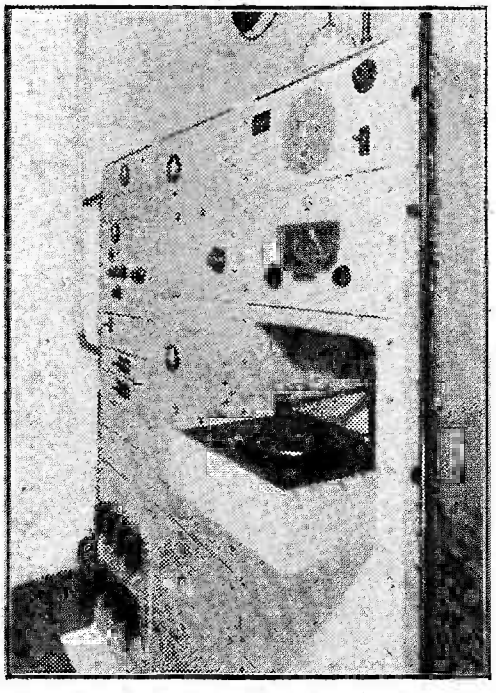
Eddystone Exports

THE illustration below shows a single despatch for export of 50 Eddystone receivers to the markets of the world. These receivers are becoming very popular overseas on account of their fine short-wave performance.



Sound Equipment at N.I. Office

AN interesting sound equipment installation recently completed by The General Electric Co., Ltd., is in the Central Office of the Ministry of National Insurance at Benton, Newcastle-on-Tyne, where a staff of 7,500 are employed in keeping up to date the National Insurance and Family Allowance records of the whole population.



General view of radio, record-player, and amplifier racks at the N.I. offices.

The installation consists of two separate 300-watt amplifier assemblies supplying groups of 196 and 164 loudspeakers. The primary purpose of the system is to enable general announcements and operational instructions to be put over to the whole staff without a moment's delay. In addition the system is adapted for relaying gramophone records and B.B.C. musical programmes.

Broadcasting Committee, 1949

THE Broadcasting Committee, under the Chairmanship of the Rt. Hon. the Lord Beveridge, K.C.B., F.B.A., heard oral evidence from Mr. K. W. Blackburne, C.M.G., O.B.E., and Mr. J. B. Millar on behalf of the Colonial Office, and from Mr. A. H. Joyce, C.I.E., O.B.E., on behalf of the Commonwealth Relations Office, on Wednesday, November 9th, 1949.

Later the Committee will hear evidence from Mr. Geoffrey Cooper, M.P., and the Radio Writers' Association represented by Mr. L. du Garde Peach, Ph.D., M.A., Mr. Humphry House, Mr. Frank Muir, Mr. John Watt and Miss Helen Lehmann. On the same day they will hear Sir Waldron Smithers, M.P., and the Listeners' Association, represented by the Rt. Hon. Viscount Craigavon, Lieut.-Gen. Sir Gifford Martel, K.C.B., K.B.E., C.B., D.S.O., M.C., Mr. A. T. Holmes and Captain C. H. Rolleston, R.N.

Switzerland Calls in Seven Languages

FROM its studios in Neuengasse 28, Berne, the capital of Switzerland, the Swiss Shortwave Service directs twelve separate transmissions daily on short waves, not to speak of the European medium-wave service in French, German, Italian and Schwyzerdütsch.

The nine daily transmissions in English are beamed as follows: one to Great Britain and the Republic of Ireland; three to the North American Continent; one to Australia and New Zealand; one to the Western Coast of Australia and the Far East. Others are beamed separately to South-East Asia, India, Pakistan, and the Middle East. The broadcasts in Spanish and Portuguese are transmitted to listeners in Spain and Portugal, and South America.

B.S.R.A. Exhibition

A COMPREHENSIVE exhibition of sound recording, reproducing and allied equipment is planned for the week-end of May 20th-21st, 1950, immediately following the British Industries Fair. Special lectures and demonstrations will also be arranged, together with the Annual General Meeting.

New Exide Chief Engineer

MR. E. C. McKinnon, M.I.E.E., who has been Chief Engineer of the Chloride Electrical Storage Co., Ltd., for 45 years, has relinquished the post and is succeeded by Mr. C. P. Lockton, M.Sc. Tech., A.M.I.E.E., who has been Mr. McKinnon's assistant and deputy for the last 25 years. Mr. McKinnon's services will continue to be available to the Company in a consultative capacity.

Mr. Lockton was educated at Berkhamsted School, Herts, and proceeded in 1920 to Manchester University, where he studied Electrical Engineering at the College of Technology under Professor Miles Walker. After taking his degree in 1923 he was appointed as assistant designer to the British Electric Plant Co., Ltd., of Alloa, Scotland. He joined the Chloride Company as an assistant engineer in September, 1924.

The Osram Valve and Electronics Department

THE GENERAL ELECTRIC CO., LTD., announce that the department previously known as the Osram Valve Department is now known as the Osram Valve and Electronics Department.

The reason for the change is that the department has widened its scope to deal with the rapidly expanding world of electronics and it will now handle the sales and technical inquiries in connection with transmitting and receiving valves, electrometer valves, magnetrons, television and industrial cathode-ray tubes, photocells and auxiliary apparatus, voltage stabilisers, current stabilisers (barretters), visual tuning indicators, neon indicators, thyratrons, ionisation gauges, Geiger-Muller tubes and lighting arrestor vacuum tubes.

Tuning Indicators

Principles and Practical Circuits Described

By E. G. BULLEY

THE principles of tuning indicators must be first understood before one can fully appreciate the many applications to which this type of device can be put. These tubes are known under various trade names, the most common being the "electron ray tube" and the "magic eye," the former being of American origin, whereas the latter is typically British.

Tuning indicators are in effect voltage indicators, and this will be appreciated when one realises that they are so designed as to give a visible indica-

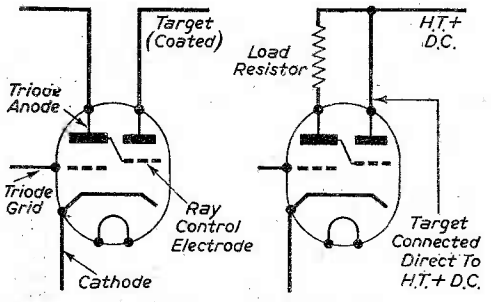


Fig. 1.—Essential parts of the tuning indicator.
Fig. 2. (right)—Standard circuit showing how the indicator functions.

tion of the various changes in the controlling voltage, this being accomplished by means of a fluorescent target. Before proceeding with the actual explanation of the workings of such indicators, it is as well to mention, however, that the indicators themselves consist of an indirectly-heated cathode, control grid, anode, fluorescent target and a ray control electrode in a glass envelope. It can, therefore, be said that such a device contains two main parts, namely, a triode section and an indicator section, both sections being dependent upon a common cathode. Reference to Fig. 1 will clarify this point.

Principle of Operation

As in radio valve practice, electrons are emitted from the cathode and are attracted to the target, the latter being at a positive potential. On striking the target the electrons cause the fluorescent coating to glow, the area of fluorescence being dependent upon the ray control electrode. This control electrode is connected to the triode section, and is in effect a grid. To simplify this let us assume that the positive potential is increased on this electrode, then the area of fluorescence is reduced, and likewise, if the voltage is made less positive then the fluorescent area is increased. This can be clarified by stating that it is the usual practice to connect the target electrode direct to the D.C. positive high-tension feed, whereas, the positive D.C. high tension required for the triode anode is usually tapped off this feed and taken to the anode via a suitable load resistance. If no anode current is flowing in the triode anode circuit, the whole or the biggest portion of the target fluoresces, and likewise, as the anode current commences to flow, a voltage drop is developed across the load resistance (see Fig. 2) which has the effect of reducing the target cathode voltage and a reduction in the area of fluorescence results.

The value of the load resistor will naturally depend upon the type of indicator being used, but it is usually in the order of one megohm, the presence of which enables the triode section to act as a D.C. amplifier.

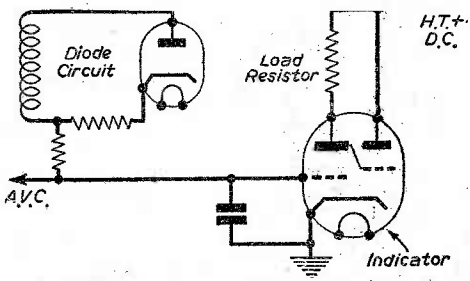


Fig. 3.—Typical indicator connected to the A.V.C. line.

Main Uses

Tuning indicators are perhaps mostly associated with radio receivers, whereby the sharpness of the fluorescent area indicates that the receiver is correctly tuned. Indicators for this purpose usually have their grid connected to the A.V.C. line, the reason being that, as the signal increases in strength and a voltage drop occurs across the load resistor, the grid is made more negative resulting in a drop in anode current and an increase in the area of fluorescence.

A basic circuit showing a typical indicator connected to the A.V.C. line is shown in Fig. 3, where it will be appreciated that the grid in this instance is controlled by the A.V.C. diode circuit.

Another method is shown in Figs. 4 and 5, wherein the grid of the indicator is controlled from a diode detector circuit and thus enables the visual tuning to be obtained much lower than

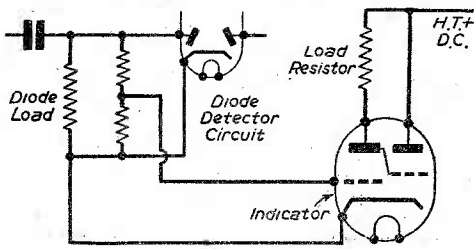


Fig. 4.—Another circuit with diode control.

the delay point. However, receivers that employ a delayed A.V.C. system usually have the indicator excited by a diode, a disadvantage being that the indicator is liable to the flicker effect. This effect, however, can be eliminated by the addition of a suitable smoothing condenser between the grid of the indicator and earth, a suitable value being .05 μF. Reference to Fig. 5 will assist the reader to understand the previous paragraph.

Test Equipment

Indicators can be used with great success in measuring equipment, and are to-day found in many commercial products. A typical application is that of the vacuum tube voltmeter, wherein the indicator replaces the meter. Its use is to check the various circuits in radio receivers, as well as to measure stage gain. Other uses to which such an instrument can be put include that of the measurement of A.V.C. voltage and the checking of the efficiency of bypass condensers.

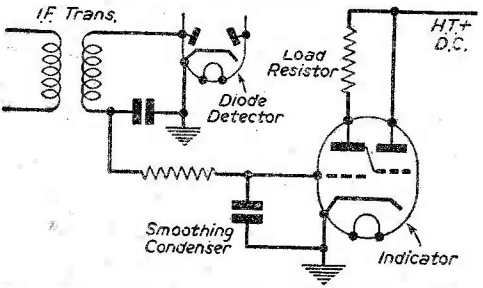


Fig. 5.—In this circuit delayed A.V.C. is utilised.

Lime Grove Studios

Some Facts About the B.B.C.'s Recent Acquisition for Television

SOME time ago, film production ceased at the Lime Grove Studios, Shepherd's Bush, and shortly afterwards it was announced that the contents would be sold by public auction. It seemed certain that this famous home of the screen drama would sever its connection with histrionics and become a factory for manufacturing something much more prosaic; petrol pumps, pills or prams. Everything pointed to this eventuality.

In this year of 1949 a film studio of this size has become a "drug on the market," to say the least, and the B.B.C. were said to have turned it down for either television or radio as being "unsuitable." Furthermore, a glance at the auction catalogue revealed that all the lights, wiring, power plant and sound-proofing were to come under the hammer. Once these were removed all hope of it ever being used again for films or converted for television could be abandoned.

Under the Hammer

The seven-day sale commenced on October 25th, when many items of furnishing and equipment from Islington and Highbury studios and the Universal Newsreel were offered. On the next day, Lime Grove lots came up for disposal and the auctioneer knocked down desks, duplicators, tip-up seats and fluorescent fittings at a rate approaching a hundred lots an hour. Then came a ray of hope. The slag-wool sound-proofing on the walls failed to find a buyer and was withdrawn. Rumours began to circulate. B.B.C. buyers were bidding more forcefully. The huge power-plant in the basement was withdrawn. The rumours became stronger and stronger and—dramatic as a Gainsborough picture—a vague announcement was made that the premises had been bought by the B.B.C. for television. Phew! Only just in time! Or was it clever bargaining on the part of the B.B.C., forced to abandon or postpone the development of the White City site as a TV centre by the Government economy measures on capital expenditure on building?

A Good Bargain

The B.B.C. are said to have paid £250,000 for the Lime Grove Studios, after having turned down a previous offer by the Rank Group some months ago. The figure then mentioned was in the region of £300,000—a bargain, representing a small percentage of the money actually spent on these premises during the course of its thirty-five years' use as a motion picture studio.

Let us consider what the B.B.C. have got for their money. First of all they have secured five ready-made studio stages, sound-proofed, heated, wired, ventilated and ready for use. The dimensions are:

Stage 2:	85ft	x	40ft.
Stage 3:	115ft.	x	55ft.
Stage 4:	120ft.	x	85ft.
Stage 5:	85ft.	x	71ft.
Stage 6:	85ft.	x	65ft.

These stages are above the ground floor, but all have large service lifts for the conveyance of scenery, properties, equipment and vehicles. A plenum ventilation system is installed which reduces the effects of fog. There are five preview theatres of various sizes, including one big enough for the recording of fairly large orchestras and another for the re-recording and post-synchronising of dialogue. There are over three hundred other rooms, including dressing rooms, make-up rooms, property rooms, maintenance shops, dark rooms, engineers' shops, carpenters, plasterers and paint shops, film editing rooms and film vaults, recording rooms, a foundry, restaurant, conference rooms, offices and wardrobe store. These are premises that B.B.C. producers have been dreaming about for months—for years. Just how much of the fittings and fixtures have been bought by the B.B.C. still remains a secret. But, significantly, the power plant was withdrawn from the sale and rumour has it that the B.B.C. is the purchaser.

The Power Unit

Down in the basement is the sub-station where 1,500 kVA transformers break down the high-

voltage supply (from the Electric Supply Board), to 415 volts, 3-phase, 50-cycles. This is converted into 115 volts direct current for the lights on the studio stages by means of two 250 kW and four 125 kW motor generator sets. In addition, there are a number of small diesel-electric generators with an output of 22 kVA each at 415 volts, 3-phase, fitted with Isenthal automatic voltage regulators. The D.C. output of the plant was said to be 10,000 amperes, capable of being overloaded to 15,000 amperes for short periods. This generating plant is said to be fairly old, but it has been well maintained and has many more years life in it. Banks of condensers filter out the commutator ripple which would otherwise be audible on arcs.

In film production direct current is essential for arc lighting and for compact light source lamps. It is not essential for tungsten lamps, but it is usually convenient to operate all lamps on 110-115 volts D.C. For Technicolor photography at least 12,000 amperes load is frequently demanded for large sets. But on black-and-white films loads in excess of 5,000 amperes are rarely required. Thus, the Lime Grove plant was capable of servicing two or three production units simultaneously, excepting on colour films. The usefulness of this output may be gauged by comparison with the 125 kW load required recently for televising Billy Smart's New World Circus from Woodford and 500 kW available for the unbelievably insignificant Alexandra Palace Studios. The current consumption for lighting the average television transmission at Alexandra Palace is about 100 kW, and a maximum of 250 kW is available for each of the small stages, supplied partly by small D.C. motor generator sets, but principally in alternating current for use on tungsten lamps only.

History of Lime Grove Studios

The original Lime Grove Studio was built by the Gaumont Co., Ltd., in 1914. It was a "glasshouse" type studio on the first floor, with workshops and offices underneath. At first, daylight diffused by the muranese glass was the principal light source, to be supplemented in the dark winter days by a few enclosed type arc lights, similar to the type still used in drawing offices on blue-print machines. Gradually the amount and variety of arc lights increased, and their greater controllability ultimately led to the total abandonment of daylight. The glass was blacked out. In this period the most famous silent films made at Lime Grove were "Ultus," "Byron," "Mademoiselle from Armentieres," the first production of "Bonny Prince Charlie" and "Hindle Wakes."

In about 1924 the premises were considerably extended, two large stages being added to the original glass No. 1 stage. Four years later more additions were made, very extensive buildings being erected on the site of the historic No. 1 glasshouse stage, which was demolished.

Talking Pictures

In 1928 the studio was wired for talking pictures with the British Acoustic recording system, and considerable structural alterations were made to render it sound-proof, particularly from the rumble of the adjacent Metropolitan Railway. Gainsborough Pictures took it over and made some of the most successful British films here, including "The Good Companions," "The Thirty Nine Steps," "The Man Who Knew Too Much," "The Iron Duke," "Quartet," "The Wicked Lady" and "Fanny By Gaslight." Significantly, the last film made there was "Don't Ever Leave Me!" Since this is not a film-fan magazine, names of film stars may be of no special interest, but mention should be made of George Arliss, Conrad Veidt, Jessie Matthews, Fredric March, Margaret Lockwood and, well, all the top-line stars of two generations of cinemagoers, who trod the stages at Lime Grove. And the film directors included Alfred Hitchcock, Walter Forde, Anthony Asquith, George Pearson, Jack Raymond, Maurice Elvey and scores of others. A couple of years ago no less than 780 technicians, craftsmen and staff were employed at these studios.

The discontinuance of film production at Lime Grove Studios by the J. Arthur Rank Organisation was due to the concentration of production effort to the two more modern plants at Denham and Pinewood, and to the Ealing Studios, independent, but closely associated with the Rank Group.

Future Possibilities

The film industry's loss is television's gain. The future prospects of television in England have suddenly brightened, and the solid bricks and mortar of Lime Grove take the place of the drawing-board fantasies of the White City scheme. Here is a practical plant, within far easier reach of the West End than the Alexandra Palace, capable of being put into service within a reasonable time. Norman Collins is to be congratulated. This is the best thing he has ever done for British television!

B.B.C. Year Book, 1950

BACK to pre-war size, with 176 pages of text and 44 pages of photographs, the B.B.C. Year Book for 1950 is extremely wide in its scope.

The range of Royal broadcasts and their importance in welding every part of the British Empire together is reviewed in a leading article by H. V. Hodson on "Radio and the Crown."

The job of the announcer, who for so many personifies the B.B.C., is a perennially intriguing one to the listener, and John Snagge explains the various aspects of his work in "Announcing From the Inside." Grace Wyndham Goldie, in a fascinating glimpse behind the scenes at Alexandra Palace, describes some of the complexities met with in producing a television talk.

Sir Steuart Wilson, Head of B.B.C. Music, deals with the vast range of broadcast music and the magnitude of the opportunity afforded in this field, and Richmond Postgate, Head of School Broadcasting, discusses some of the many and interesting problems arising in his own sphere.

The B.B.C. Year Book for 1950 costs 3s. 6d. (by post 3s. 10d.) and may be obtained through any newsagent or bookseller, or, in case of difficulty, direct from the B.B.C. Publications Department, The Grammar School, Scarle Road, Wembley, Middlesex.

Variable Bass-correction Circuit

The Design of Single R-C Circuits Giving Bass-correction for Recording Loss, and a Device Giving Any One of Three Different Bass-correction Characteristics

By K. KEMSEY-BOURNE

AS gramophone enthusiasts will know, when a disc recording is made sounds of different frequencies are not recorded truly in proportion to their intensities. The frequency-characteristic of a typical recording head is shown in Fig. 1. Above a certain frequency C (the cross-over point) the head cuts at constant velocity and below this frequency at constant amplitude. This falling characteristic in the bass is necessary, to prevent excessive amplitudes at low frequencies. Constant energy over the frequency range covered is not represented by constant amplitude of the grooves but by constant vibrational velocity

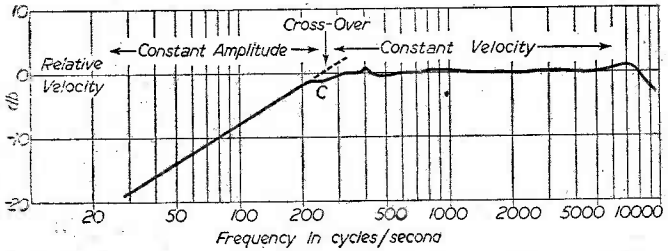


Fig. 1.—Response/frequency characteristics of disc recorder head. Note the cross-over at 250-300 c.p.s.

this velocity is proportional to amplitude times frequency, so that the lower the frequency the higher the amplitude would need to be.

The cross-over point is not sharply defined. The curve "rolls off" (or flattens) gradually, but the cross-over may be taken as where the straight part of the sloping line cuts the horizontal. The design and construction of the recording head determine where the cross-over point lies; the point can be moved by altering the damping or the natural resonant frequency of the head itself.

Bass Correction

When a record is played this deficiency in the bass frequencies must be corrected for by boosting the bass up to the frequency C. This boost must balance the recording loss as closely as possible, but must have no effect on the response above the cross-over. The drop in the recording characteristic is usually 6 decibels per octave below the cross-over. This means that the relative velocity drops to one half its value as the frequency falls by the same factor. If a characteristic is stated to be dropping at 6 db/octave below 500 cycles, then taking an intensity of 0 db at 500 cycles as standard the intensity is 6 db down at 250 cycles, 12 db down at 125 cycles and so on. The appropriate positive boost will correct for this.

In Fig. 2, A represents the recording characteristic, B is the corrected response of the pick-up and playback equipment, and C shows the overall linear effect of adding the two, that is, of playing that record with that pick-up. The characteristics are shown here as straight lines throughout; in practice the curves are smoothed off at cross-over.

Differences in Characteristics

Unfortunately for us, different recording companies, such as H.M.V., R.C.A.-Victor, Decca, Telefunken, Odeon and Columbia, do not all use the same recording characteristic; in fact, one firm will use different curves at different times and it is difficult to find out just what was used for any given disc. Ideally, this information would be printed on record labels, but so far record manufacturers will not do this. If all the makers used the same frequency characteristic then, as shown in Fig. 2, one standard bass-correction circuit would do for all records.

Fig. 3 shows what happens when a disc recorded with a characteristic represented by A (cross-over at 1,000 cycles) is played back with an inappropriate correction circuit. B shows the characteristic of a boost circuit with a cross-over at 500 cycles. (Compare this with Fig. 2.) By adding A and B together we can see the effect of playing a disc made to curve A on playback equipment working to curve B. This is shown at C. The

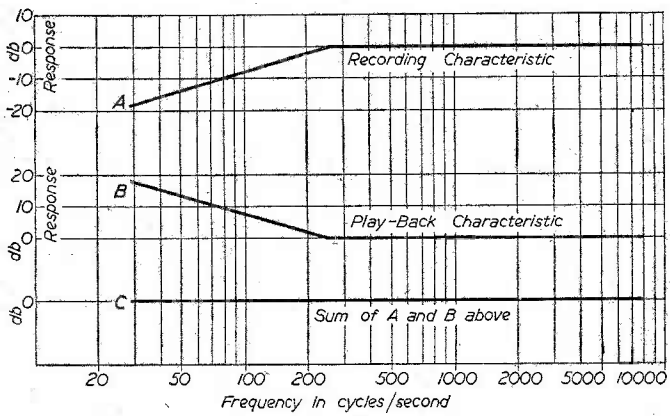


Fig. 2.—Method of correcting for recording loss at bass frequencies.

sound produced will be deficient in bass and middle frequencies, and the effect will be unpleasantly tinny. Conversely, if a record made with a cross-over of 500 cycles is played on equipment giving bass boost up to 1,000 cycles it will sound heavy, or "boomy."

It is not practicable to have separate correction circuits for all the possible cross-over frequencies, but a simple device will enable us to select the most appropriate one from three characteristics. In general, American recordings have a higher cross-over frequency than English discs, and so require more bass boost.

Correction Circuit

The basic circuit, for one cross-over frequency, is shown in Fig. 4. A low impedance pick-up is shown transformer-matched to the input stage of an amplifier through the correction circuit $R_1R_2CR_3$.

R_3 is a high-resistance grid leak; this is made as large as practicable, say ½-1 Megohm. If the pick-up has an impedance of 110 ohms, and the transformer has a step-up ratio of 1 : 70, then the loading reflected by the secondary is 110×70^2, which may be taken as 550,000 ohms. Call this Z. Now $(R_1 + R_2)$ is made equal to Z, and in addition R_1 is made equal to 0.9 Z, while R_2 is made equal to 0.1 Z. So that in the case quoted R_1 is 500 kΩ and R_2 is 50kΩ (k stands for 1,000).

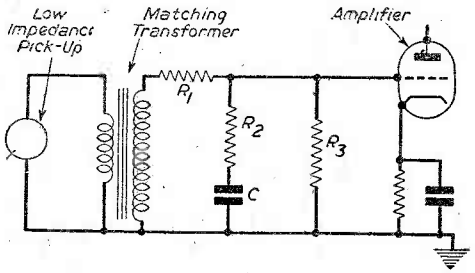


Fig. 4.—Simple bass-correction circuit that can be designed to give boost at 6 db per octave up to any desired frequency. See text for the design formula.

These values of resistance will hold whatever the cross-over frequency desired, in this example.

The design formula used to calculate the value of C is

$$C = \frac{1{,}000{,}000}{2\pi F R_2} \text{ microfarads } (\mu F)$$

where F is not the cross-over frequency itself, but a point just below it where the drop in the recording characteristic is 3 db.

Practical Values

Three commonly encountered values for the cross-over point are 250, 500 and 1,000 cycles, and one or other of these will suit most commercial recordings, English or foreign. The values of F to be taken for the formula above are correspondingly 200, 400 and 800 cycles. The values of C, calculated from these values of F, are 0.016, 0.008 and 0.004 μF.

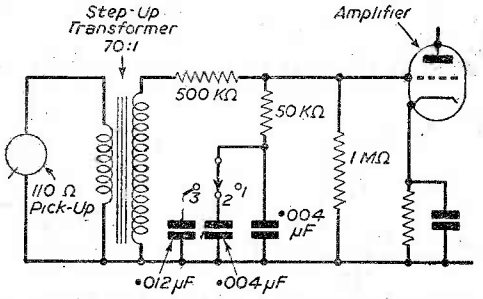


Fig. 5.—The circuit of Fig. 4 modified to give any of three characteristics. Boost is available for cross-over frequencies of 250, 500 or 1,000 cycles/second.

The diagram of Fig. 5 shows how correction for the three cross-over points can be readily obtained by switching. With the switch in position 1 the capacity in circuit is 0.004 μF and correction is for a cross-over of 1,000 cycles. Position 2 connects 0.008 μF for a cross-over of 500 cycles, and position 3 switches in 0.016 μF, for 1,000 cycles.

Other or intermediate cross-overs may be corrected for by similar means, and a similar simple calculation may be done for pick-ups of other impedance.

The correction circuits should be mounted well away from leads carrying A.C. currents. A shielded box containing the components, with external connections by screened cable, is desirable to minimise hum pick-up.

The insertion loss of the network is 20 db.

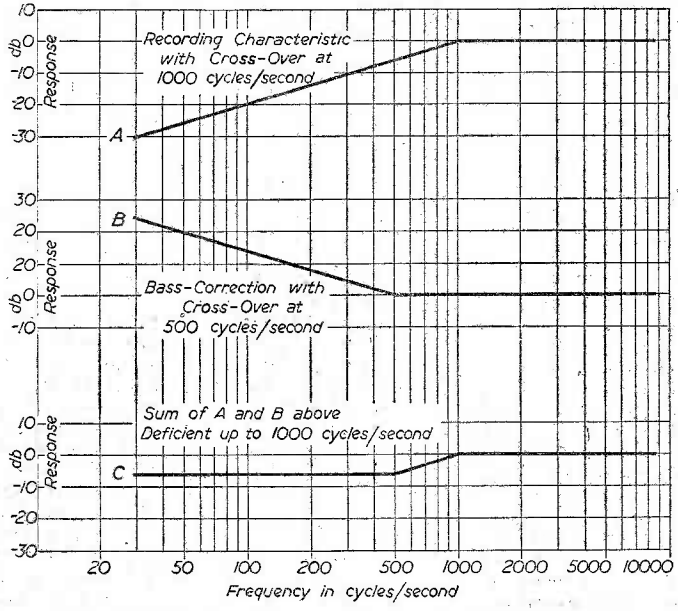


Fig. 3.—Showing the effect of play-back with the wrong bass-correction characteristic.

On your Wavelength

by THERMION

ACCENT ON TELEVISION

AMONG my friends are those who have been building wireless sets for more than 30 years, and it is understandable that in those 30 years the fierce flames of enthusiasm which almost consumed them in those early days have waned somewhat. The production of a new valve or of a new circuit does not perhaps revivify their enthusiasm. During a recent round of visits to the circle of my old cronies I was most surprised to find that each of them either has built, or is building, a television receiver. One of them has constructed the Viewmaster and I must say that it yields very excellent results. This particular friend has only the simplest instruments, and I asked him how he had managed to line it up. He pointed to a few very cheap instruments costing altogether about £5 and, as a fact, said that it required very little lining up. Having completed the wiring he switched on and obtained pictures straight away—not perfect, of course, but the receiver required only minor adjustment which he was able to effect within an hour.

Of course these old experimenters start off on the construction of a television receiver with the advantage of their many years of experience, but even so it is obvious that television has advanced to such a very great extent since the war that the need for expensive equipment for lining up has gone. My congratulations to those who sponsored the Viewmaster for being one of the very first in the field to cater for the home constructor.

You will also be interested, I hope, to learn that your Uncle Thermion is engaged on the construction of a viewer. It is not yet complete, but by the time my next contribution becomes due I hope to be able to let you have my personal experiences. Of course I am not new to television. I was one of the first dozen to purchase one of the Baird kits of parts for the old 30-line disc machines, from which I achieved only partial success. I thought at the time, and nothing has occurred to alter my point of view, that the thing was a mechanical joke and ought never to have been placed on the market. It was not even original and it is monstrous nonsense to say that Baird invented it. It was invented by Nipkow. It is difficult indeed to see what Baird had to do with it. The machine as marketed must have been designed by some elementary schoolboy without any knowledge whatever of workshop processes, otherwise how can one account for the Heath Robinson methods employed to assemble the contraption? In my view it did television more harm than good. As a laboratory experiment the thing was justified. As a commercial proposition to which investors were invited by specious promises to invest their money it certainly was not. I remember Baird giving an interview to the Press at a time when he was appealing for capital, saying that television would be in every home by Christmas of that year. Of course the gullible people invested their money, and they all lost it.

The synchronising gear always amused me. Some schoolboy "technician" must have written the instruction manual. He had learned-off one phrase which appealed to him. It was "sporadic fluctuations in speed," and every time he referred to the synchronising gear (which looked as if it had been lashed up from Meccano parts) he would talk learnedly about these sporadic fluctuations. The disc machine contributed precisely nothing to our knowledge of television, and it was an imposition on the public and on investors to inflict it upon them. Nor do I think that Baird was mentally equipped to produce real television. He was a dear old Scotsman who loved to bask in the limelight of publicity and public adulation as a great scientist.

The present Baird company, of course, is a highly specialised organisation employing first-class technicians and turning out a first-class job. Its only connection with Baird of the past is the name. Incidentally, a friend of mine who has just purchased the new Baird portable television receiver, which dispenses with the dipole and makes use of a mains aerial, reports that it is extremely good. Another friend who has purchased the Everyman at £35 reports that it is giving highly satisfactory results. When the original Baird company crashed and was taken over by a business organisation it began to make progress, until to-day it is in the first flight of television manufacturers and in many directions abreast of its competitors.

There can be no doubt that television for home constructors is here and that it will give a terrific fillip to constructors who maintain an academic interest only in their former love. I have witnessed a demonstration of the PRACTICAL WIRELESS television receiver. I know of the months of work and the extreme care which has been put into the design. You may embark upon its construction with the certain knowledge that when completed you will have a first-class instrument, backed by the skill of the technical staff. I am as keen to get to work on my own television receiver as I was to tickle a crystal with a cat's whisker in the days of 2MT. If you are looking for fresh fields to conquer take up television. It will keep you up until the small hours of the morning, upon the constructional side anyhow, as did shortwave listening when you first took it up.

London-Birmingham Television Radio-relay Link

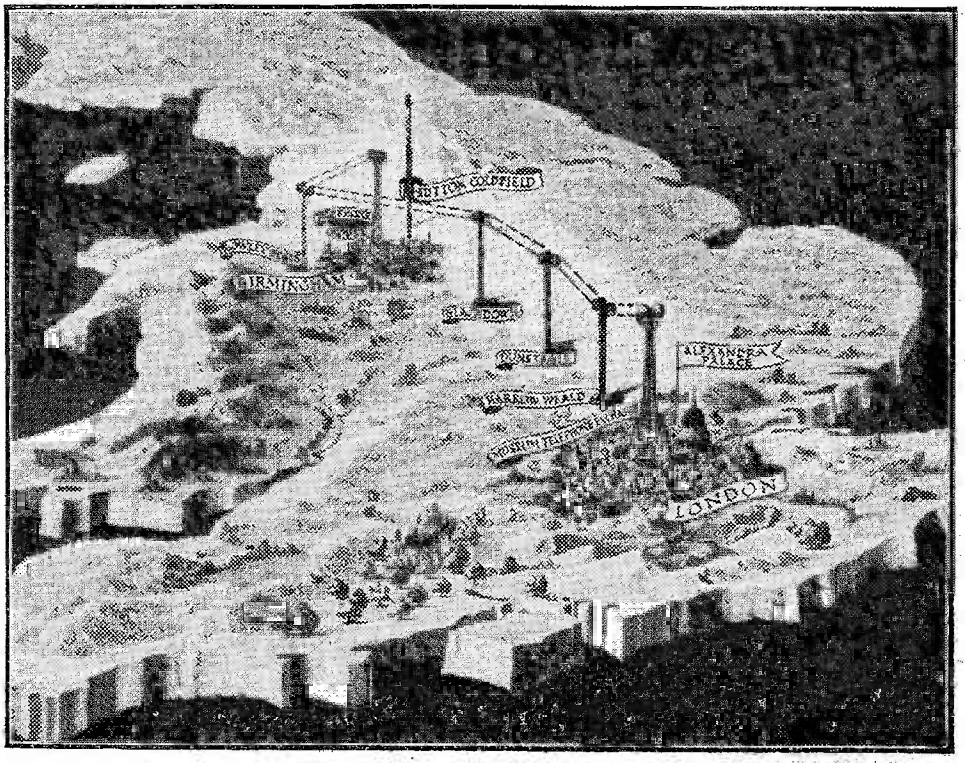
Full Details of the New Layout and Circuits

THE London-Birmingham Television Radio-relay Link has been designed, manufactured and installed by the General Electric Co., Ltd., to a specification set by the United Kingdom Post Office.

It is suitable for the transmission of 405 line, 50 frames/second television signals of the waveform transmitted at present by the B.B.C. from Alexandra Palace and, in the future, from Sutton Coldfield. The contract issued by the United Kingdom Post Office in May, 1947, was for the interconnection of London and Birmingham, but required that the system should be so designed that it could be extended up to 400 miles. The London Terminal of the system is at Museum Telephone Exchange, Howland Street, and the Birmingham Terminal is at Telephone House, Newhall Street.

When completed, the radio-television link will provide for simultaneous two-way transmission of television signals between the two cities. At the present stage a reversible link is installed, so that transmission in either direction can be obtained as desired. This reversible service has been provided with just over 60 per cent. of the complete radio equipment and without the erection of the final special repeater-station towers. The aerials are erected on temporary masts and the equipment is installed in the buildings at the feet of the masts. For the two-way link the radio equipment will be installed in special cabins at the tops of the repeater station towers. A pair of paraboloid aerials on one of the four temporary masts is shown on page 13. The present reversible system uses two frequencies of transmission: 870 and 890 Mc/s. A station which receives on 870 Mc/s. transmits on 890 Mc/s. and vice versa. These two frequencies are used for either direction of transmission with the reversible link and will eventually be used for one direction of the two-way link, 917 and 937 Mc/s. being used in similar fashion for the other direction. These frequencies correspond to wavelengths around 33 cms.

The use of these frequencies necessitates optical

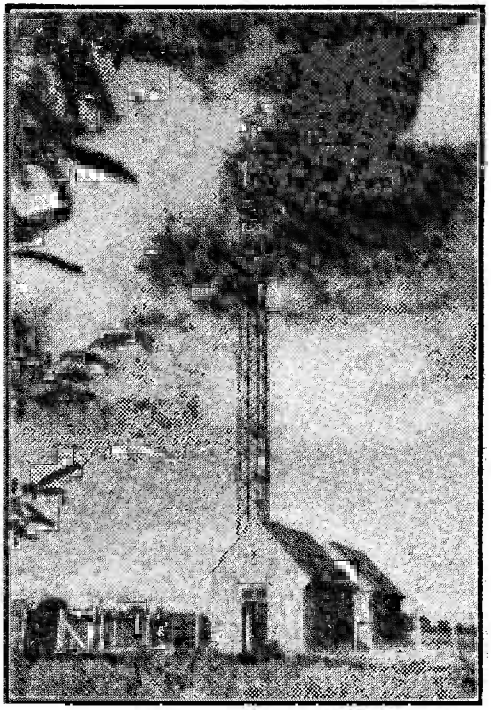


The route of the London-Birmingham television radio-relay link.

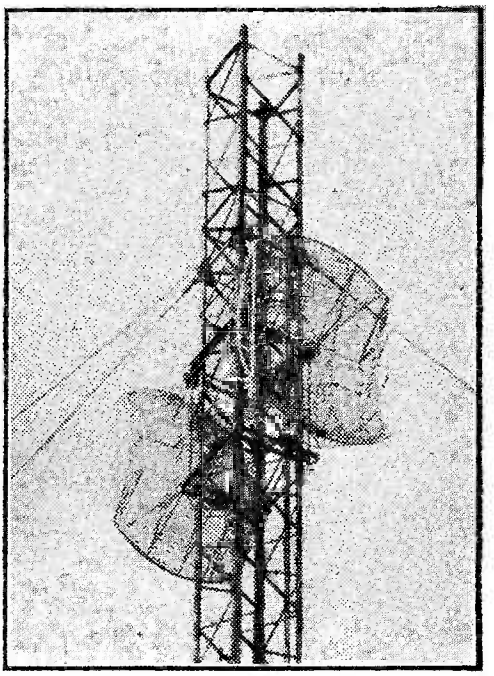
paths between transmitters and receivers for satisfactory and consistent performance. It has therefore been necessary to use four repeater stations between London and Birmingham. Each repeater station receives the signal from the previous station, amplifies it and transmits it to the next one. The sites for the four repeater stations were chosen after an extensive series of field trials, many of which were carried out before a tender was submitted. The final choice by the Post Office had to take into account a number of factors, such as the technical results of these trials, the preservation of amenities, the proximity to airfields, etc., following which the Post Office had to arrange for the erection of the buildings. The route is shown on page 12 and from this it will be seen that extensive use has been made of natural features—the "Elstree" ridge just north of London, the Chiltern Hills, the Cotswolds and the high land to the west of Birmingham. The station to the west of Birmingham would be suitable for extension of the system northwards. The system was originally designed for maximum repeater station spacings of forty miles, and it will be seen that this has been achieved in two of the sections.

Frequency Modulation

The television signal is transmitted over the television link by frequency-modulation of the 900 Mc/s. carrier. The frequency-modulation of the carrier is achieved at a terminal station in two steps. The vision-frequency signal is used to frequency-modulate an oscillator between 32.5 and 35.5 Mc/s. and the modulated oscillation is amplified and applied, together with the output of a 900 Mc/s. generating chain, to the final stage of the transmitter. In this stage, frequencies are produced which differ from that of the R.F. generating chain by amounts equal to the frequency of the modulated oscillation. Both these signals, the frequency of one of which is above, and the other below, that of the R.F. generating chain, are frequency-modulated by the vision-frequency signal to the same extent as was the original 34 Mc/s.



Exterior of the Dunstable repeater station.



Typical aerial array on temporary mast.

oscillator. One of these frequency-modulated carriers is selected by filters and is the signal transmitted.

At a repeater station, the received signal is heterodyned by a local oscillator to give a difference frequency of 34 Mc/s. This I.F. signal is amplified, and the transmission process is repeated. The transmitted signal is not demodulated to vision-frequency until the receiving terminal is reached. By the use of this system the difficulties of amplifier design and operation at low vision frequencies are avoided.

Different Frequencies

The transmitting frequency at a repeater station cannot be the same as the receiving frequency, since the receiver would then receive power from the local transmitter as well as from the previous station. For this reason the frequency of the receiver local oscillator cannot be the same as that of the transmitter master oscillator. Therefore, at a repeater station the local-oscillator frequency is derived from part of the transmitter master-oscillator output by heterodyning it with the output of a crystal controlled oscillator whose frequency

is equal to the difference between the received and transmitted frequencies. By arranging that the local- and master-oscillator frequencies are each above, or each below, the received and transmitted frequencies respectively the transmitted frequency is made independent of the drift of the station master oscillator and is affected only by the small drift of the crystal controlled oscillator. Since only two frequencies are used for one channel the shift frequency is the same at all repeater stations, and is alternately added to or subtracted from the station master-oscillator frequency.

The power transmitted from each station is of the order of 10 watts, and the received power for free space propagation over a 40-mile path is just over a microwatt. Thus the gain of a repeater station is 70 decibels, or 10,000,000 to 1 in power.

The vision-frequency signal is fed into the terminal modulator from Post Office equipment via a coaxial cable. The output of the terminal modulator is a frequency-modulated 34 Mc/s signal which is applied to the terminal transmitter, and the R.F. output of the transmitter is taken through output filters and an output monitor to the transmitting aerial. This consists of a paraboloid reflector formed from light-alloy tubes and energised by a coaxial-line fed dipole and parasitic reflector. The full diameter of the paraboloid is 14ft., but its horizontal aperture has been cut to 10ft. with very little loss of gain (since horizontal polarisation is used). The gain of the aerial is 27.5 decibels with reference to that of a half-wave dipole. Coaxial cables are used throughout as feeders for the 900 Mc/s energy.

Duplicate Channels

Duplicate signal channel equipment and power units with changeover switching are provided to maintain the operation of the link in the event of a failure in the working equipment. The equipment which is not in use is kept warmed-up in a standby condition, so that it is ready for immediate operation. The aerial system and transmitter output filters are not duplicated, and therefore a radio-frequency switch is provided in the feeder between the transmitter and its output filters.

Changeover switching between the power units and the signal channel equipment is so arranged that each channel equipment can be connected to either power unit.

At repeater stations, the R.F. input from the receiving aerial is fed through the receiver input filter and an R.F. switch to the selected receiver. The transmitter feeder arrangement is the same as at a terminal transmitting station. Duplicate equipment is provided as at a terminal station, the receiver and transmitter being considered for switching as one unit. At a terminal receiving station, the feeder arrangement is the same as for the receiver at a repeater station.

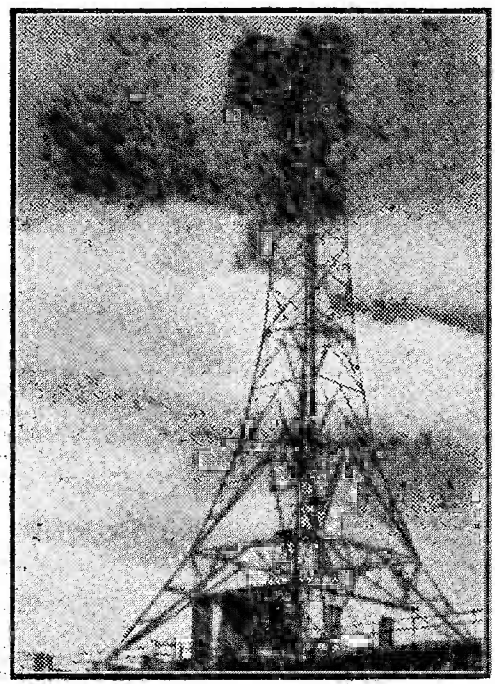
An auxiliary generator is being provided by the Post Office at each repeater station so that operation can be maintained in the event of a failure of the mains supply.

Each channel is controlled from a control point in the same Post Office building as the receiving terminal for that channel. Fault monitoring is provided on the units of the equipment, and the fault indications are transmitted to the appropriate control point over a four-wire Post Office line by a voice frequency signalling system. This signalling system also conveys the control signals from the control point to the radio stations. The fault indications given at the control point for each radio station will include information on whether the station is working, which channel equipment and power unit have been selected, and the occurrence of a fault and consequent automatic changeover in the equipment. Indication will also be given as to whether the mains supply to the station is on and, in the case of a repeater station, whether the standby generator is working. A fault on the supervisory system will also be indicated at the control point. From the control point it will be possible to switch the equipment at all the stations, on and off, and to make a changeover between working and standby units. These operations may be performed for all the stations at once or for each station individually. It will also be possible to check the supervisory system from the control point. If the supervisory system fails, the stations will continue to work on pre-set time switching.

Test Equipment

Control and monitoring equipment is provided at each station by which all the normal operations for that station can be carried out. All the radio stations and the control points are linked by a control telephone, which has selective ringing but a common speech channel for all the stations.

In addition to the main signal channel equipment, comprehensive test equipment is being supplied for the assessment of the overall vision-frequency



London terminal tower on the Museum telephone exchange.

response of the complete system from terminal to terminal. In addition, a monitor for the transmitted picture and waveform is being supplied for each control point, each radio terminal and each repeater station. Special radio-frequency testing equipment is also being provided for each radio station.

The system makes use of a range of advanced techniques in valve and circuit design, and the radio-frequency equipment is based upon the Osram disc-seal triodes DET 24 and ACT 25, which are used in coaxial-line circuit equipment. Such circuits are markedly different from circuits performing similar functions at lower frequencies. The new circuit components derive their characteristic form from the fact that they are produced on lathes and not by the assembly of coils, capacitors and resistances. Each tuned circuit is essentially a length of coaxial transmission line, and a particular feature of the circuits used in the television link is that they have been designed for reliable and stable operation over long periods by elimination of sliding contacts and by robust construction.

Silicon Crystal

The transmitter consists of a master oscillator (DET 24) stage, a first R.F. amplifier (DET 24) stage, a second R.F. amplifier (ACT 25) stage, and a modulated (ACT 25) or frequency-changer stage. In addition, there is a (DET 24) frequency-shifter stage for the derivation of local-oscillator power, together with its associated 20 Mc/s crystal-controlled shift-frequency generator. The transmitter is designed for normal operation at full output with a drive of 4 volts peak-to-peak of intermediate-frequency signal. This I.F. signal is amplified to a level sufficient fully to modulate the end stage of the transmitter in a wide-band amplifier using Osram A1820 and KT67 valves.

The receiver uses a silicon crystal as frequency-changer, local oscillator power being fed from the transmitter via a filter consisting of two cavity resonators, which removes unwanted components generated in the frequency-shifter. The receiver I.F. amplifier consists of two stages each using a pair of Osram E1714 low-noise triodes, followed by three automatic gain-controlled stages each using a pair of Osram Z77 pentodes, and a further two stages each using a pair of Z77 valves, the output stage being a cathode-follower consisting of a pair of Osram A1820 valves.

The radio-frequency filters used in the system are of two main types, i.e., band-pass filters comprising pairs of coupled resonant cavities, and special band elimination filters, which are based on the properties of multiple resonant lengths of transmission lines. Similar resonant line principles are made use of in the contactless R.F. switch, which is used for switching over to standby receivers and transmitters.

Two Aerials

For the reversible link which is now being operated, only two aerials are provided at each repeater station, and since the transmitter and receiver are both connected to each aerial, there is a physical path from transmitter to receiver. The change of direction of transmission is produced by the operation of further contactless-switches, and the receiver is protected from signals from the transmitter by the combination of line and cavity filters.

In conclusion, it is worthwhile to record the history of the system. The Post Office specification was issued in November, 1946, and extensive field-trials to prove the practicability of the system were carried out by a small research team from the G.E.C. Research Laboratories during December, 1946, and January, 1947, at the depth of the most severe winter for many years. An instruction to proceed with the project was received by the G.E.C. in May, 1947. The building up of the team at the Wembley Research Laboratories began immediately, and the design of the system was commenced. Just over a year later, in June, 1948, a successful demonstration was given of transmission of 405-line television signals, using apparatus typical of that which had been developed. This followed upon the conclusion of extensive field-testing of the route which had been finally chosen. The next year was devoted to the elimination of teething-troubles and to the engineering of the equipment. The production and installation of the equipment was a joint effort by G.E.C. Telephone Works, Coventry, and G.E.C. Research Laboratories, Wembley, and culminated on August 31st, 1949, in the first transmission of television signals from a temporary terminal station at the Wembley Research Laboratories, through Harrow Weald, Dunstable, Blackdown and Turners Hill Repeater Stations to the Telephone House Terminal Station at Birmingham. This transmission included pictures broadcast by the B.B.C. from Alexandra Palace and received at Wembley for relaying through the link.

Servicing Examination

THE Radio Trades Examination Board and the City and Guilds of London Institute announce that the first Television Servicing Certificate Examination will be held on May 2nd and 4th, 1950, and the practical examination on a date to be announced later. In this instance, London will be the only centre and it may, therefore, be necessary to restrict the number of entries. Admission to the examination is limited to candidates who have passed one of the following examinations :

(i) The Radio Servicing Certificate Examination held jointly by the City and Guilds of London Institute and the Radio Trades Examination Board,
(ii) the examination in radio servicing held by the Radio Trades Examination Board from 1944 to 1946,
(iii) the examination in radio service work of the City and Guilds of London Institute held from 1938 to 1947,
(iv) the "third year" examination in radio service work of the Union of Lancashire and Cheshire Institutes,
(v) the examination in radio servicing held prior to 1944 by the British Institution of Radio Engineers,
(vi) the examination in radio servicing held prior to 1944 by the Scottish Radio Retailers' Association.

The closing date for the examination is Thursday, December 15th, 1949. Regulations and entry forms are obtainable on application to the Secretary of the Board, 9, Bedford Square, London, W.C.1.

Making a Record Changer—3

Final Details of an Effective Radiogram Accessory

By H. GARLICK

PERHAPS the best way of fitting the idler pinion is to mark on the chassis a circle with the same diameter as the pitch circle of the turntable gear, with the centre spindle as its centre, and then with the motor and its gear wheel mounted in position mesh the idler gear and move it to a position where the estimated pitch circle of the idler lines up with the marked circle. Then mark the chassis through the centre of the idler and drill a hole $\frac{1}{16}$in. bigger than the idler carrier. With the carrier made and fitted see that the motor drives the pinion and then fit the turntable.

Adjust the carrier by trial and error so that the gears mesh correctly. One other small job should be done here. Measure the distance from the centre of the turntable spindle to the centre of the carrier, make a point on the turntable at the same distance from the centre and drill a 3/16in. hole. With the turntable in position the hole should come exactly above the carrier in one position and allow for oiling the carrier spindle without removing the turntable. One item remains to be made prior to adjusting the whole unit and that is the record centre support (Fig. 27). This is a piece of mild steel machined to fit in the top of the centre spindle and having the same diameter but with part of it offset. If a slot is cut in the bottom of this spindle so that it always locates in one position with the pin which is across the bottom of the bore of the centre spindle and a number of records are placed over the top of the offset spindle it will be seen that the records will not go past the offset portion. The crank is so made, however, that if the bottom record is pushed sideways it will slide along the crank until it is over the centre spindle and will then drop on to the turntable. The crank will allow only one record to move sideways at once. When a record is being played the upper records are supported at the centre on the crank and at the edge on the supporting table previously described. If the table is so adjusted that the record edge drops off the table at the same instant that the centre hole moves into line with the centre spindle the record will fall evenly on to the turntable. The length of the offset spindle must be carefully measured, so that when a record is placed on it the record is level. The table supporting the edge of the record can best be adjusted by trial and error. The sizes given for making the table leave room for filing the table edge so that the record clears as it slides down the centre spindle but rests on the table when it is on the cranked portion of the spindle. The sliding plate must also be adjusted by filing, so that when it is away from the table edge it is clear of the record edge by 1/16in., but when it moves forward to push the record it must overhang the table edge slightly. It is not necessary to run the mechanism to get this part working properly, as the sliding plate can be operated by hand, the spring bringing it back to normal. Use an old record for these adjustments, but make sure it is standard size. Test also with at least eight records in position, as the bottom records

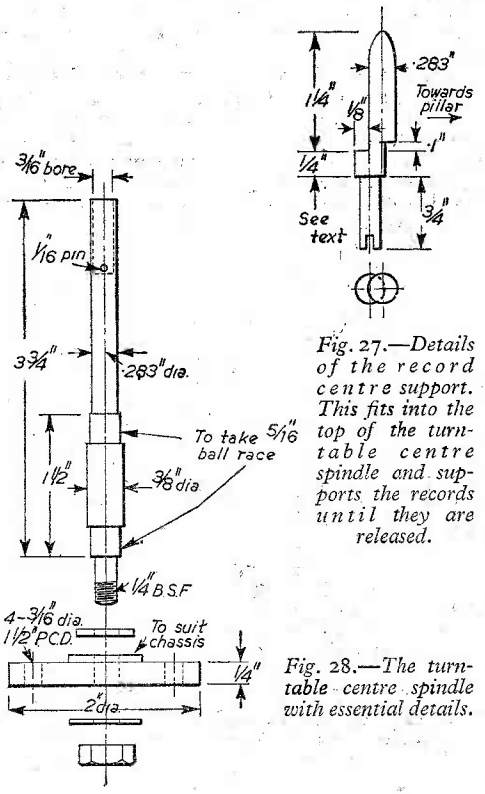
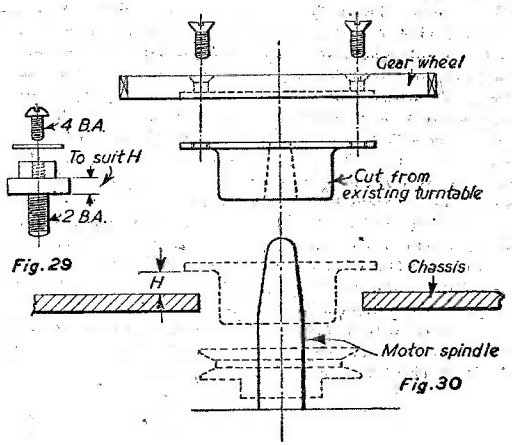


Fig. 27.—Details of the record centre support. This fits into the top of the turntable centre spindle and supports the records until they are released.

Fig. 28.—The turntable centre spindle with essential details.



Figs. 29 and 30.—The idler pin, and details of the positioning of the gear wheel and driving pulley.

do not slide as easily with the weight of the upper records on them. The cranked spindle can be mounted two ways. The correct way is with the cranked portion towards the table. To get the pin in the centre spindle in line so that the slot in the bottom of the cranked spindle locates the crank in the correct position it will be necessary to rotate the centre spindle.

Fit the wire belt and wire up the motor through a toggle switch mounted on the chassis. A .1 μF 1,000-volt working condenser should be wired across the switch to reduce sparking.

Adjusting the Mechanism

As the unit now stands all the parts are made and the turntable revolves with the motor running, although as yet the record-release mechanism is not set to push the bottom record automatically.

The pick-up can now be attached to its pivot and a test record placed on the turntable. As was previously mentioned, the lifting spindle requires finishing off now that the turntable is in position and it will be seen that if the lifting spindle is placed in position the track will prevent the pick-up head from coming in contact with the record. Therefore a slot must be cut in the bottom end of the lifting spindle to correspond with the flats on the lifting arm. Drop the lifting spindle through the guide so that it rests on the lifting arm and with the track set in the correct position mark two lines across the bottom face of the lifting spindle in line with the flats. Remove the lifting spindle and using the marked lines as a guide cut a slot down the spindle. The simplest way to cut the slot is to put two blades side by side in a hacksaw and saw down to the required depth, finishing off the sides with a file to be an easy fit on the lifting arm flats. The depth of the slot must be so set that when the lifting arm is on the flat part of the cam on the main driving spindle and the bottom of the slot is resting on the arm, the track is about 1/16in. below the pick-up arm when the needle is on the test record.

It will now be observed that if the main driving spindle is rotated the cam will lift the arm, and therefore the track will come into contact with the pick-up arm, thus causing the pick-up head to be lifted a considerable distance above the record. On the completion of a revolution the pick-up will be lowered on to the record again. During the adjustments here described the main driving spindle should be operated manually and it is as well to move the friction disc assembly along the spindle out of the way. With the pick-up resting in the eccentric groove at the record centre the two arms on the pick-up centre spindle should be parallel to the main driving shaft and the swivel links parallel to the chassis at 180 deg. to each other (Fig. 31). When the spindle is now rotated the pick-up is lifted from the record during the first quarter of a turn and then the outer link strikes the arm and slides the pick-up along the track. The distance the pick-up travels is set by the link, the nearer it is to the pick-up centre spindle the farther will the pick-up swing, and it should be set to swing the pick-up to about 2in. outside the record edge. Rotating the shaft further brings the other link into contact with the other arm and the pick-up will now swing inwards. This link must be carefully set along the spindle, so that the pick-up cannot be swung too far over the record but should stop over the record edge. Completing the revolution causes the pick-up to lower into the starting groove and the track to drop clear of the pick-up arm.

The next step is to adjust the record release cam so that as the pick-up swings outwards and clears the record the cam contacts the push rod and so moves the slide along the table. The friction drive and its associated components can now be adjusted. With the changing mechanism in the playing position set the slot in the rubber disc so that the rubber bush idles in it and then adjust the trip lever so that the end face is against the stop pin. Now set the spring-loaded roller which is attached to the under side of the chassis so that it exerts pressure on the sloping portion of the cam which was machined on the boss. This pressure must not be too great but just sufficient to cause the driving spindle to move when the trip lever is lifted clear of the stop pin. As the slot moves and causes the rubber disc to contact the rubber bush

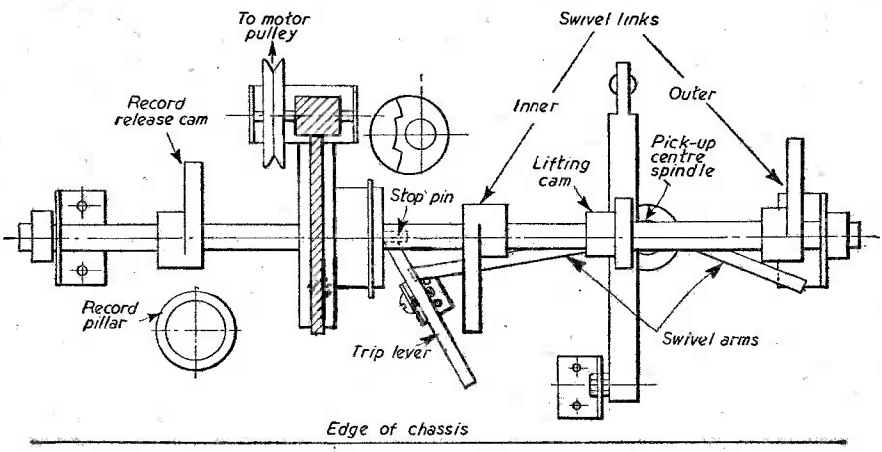


Fig. 31.—General view of the layout of the parts on the main spindle. As shown, the mechanism is in the "stop" position, with the pick-up on the edge of the record.

the two engage, and so the driving spindle makes one revolution and stops when the pin strikes the stop lever. The arm attached to the pick-up centre spindle which is nearest to the trip lever must now be adjusted by sliding it up or down the pick-up spindle so that the arm strikes the sloping face of the trip lever as the pick-up reaches the end of the playing groove (Fig. 16). As the pick-up traverses inwards towards the eccentric groove the arm presses against the sloping face and so pivots the trip lever slightly, thereby lifting the other end clear of the stop pin. When the changing cycle commences the arm, of course, swings away from the sloping face and the spring returns the trip lever to a position where the stop pin will strike it on the completion of a revolution. These adjustments to the arms will upset the setting of the links and these will again have to be adjusted to compensate. Try the pressure of the pick-up in pivoting the trip lever by moving the pick-up over the record by hand. Very slight resistance should be felt, too great a resistance will prevent the needle following the groove and indicates that the pressure of the spring-loaded roller is too great, or the trip lever spring too strong, or both. The second-motion spindle bracket can now be set so that the rubber bush presses tightly against the rubber disc. The bolt holes for holding the bracket to the chassis should be elongated to allow for this adjustment. Rotating the second-motion shaft pulley will now drive the rubber disc, and therefore the main driving spindle, until the slot in the rubber disc disconnects the drive.

Testing the Unit

With everything adjusted correctly the changer is ready for a test run and the wire belt can be fitted and the motor switched on. As the pick-up travels from the playing groove to the eccentric groove the cycle should commence and the pick-up should lift clear of the record until it reaches its maximum height, then swing outside the record edge, the bottom record on the spindle should drop on to the turntable and the pick-up should then swing inwards to a point just inside the record edge and be lowered into the starting groove. Repeat the cycle a number of times and check that the needle always drops in exactly the same position. If the pick-up arm tends to slide along the track occasionally instead of stopping over the record edge file a small slot in the track at an appropriate point and so shaped that as the pick-up swings outwards the arm overrides the slot but stops against it as the pick-up swings inwards. (See inset diagram Fig. 10.) If the pick-up drops too quickly on to the record alter the shape of the lifting cam so that the pick-up descends at an even speed. During the last quarter of a revolution of the main spindle it will be seen that due to the weight of the pick-up acting on the cam the spindle will tend to be driven by the cam rather than by the friction drive. The friction drive now acts as a brake and prevents the spindle rotating too fast, but make sure the rubber bush does not reach the idling position until the pick-up is on the record. See that the wire belt is strong enough to hold against the varying loads without stretching and therefore causing an intermittent jerking motion to the spindle. If the belt slips or is noisy it can be cured by cutting a piece of insulating tape to fit into the groove of the pulleys. Always use standard needles of the semi-permanent type, suitable for playing at least eight records without changing. If any non-standard type of needle is used make sure it clears the top record during the changing cycle with eight records on the turntable. If the chassis is fitted into a cabinet so that the mechanism is enclosed the only noise heard as the records change will be that of the records falling from the support. To reduce noise being transmitted through the cabinet mount the chassis on rubber blocks. Oil the moving parts occasionally, but see that no oil gets on to the friction rollers.

When the changer is loaded up with eight records, switched on and the pick-up placed in the starting groove of the record on the turntable it will play a complete programme lasting almost half-an-hour without further attention. Twelve-inch records can be played, but the pick-up must then, of course, be manually operated.

Books Received

WORLD RADIO HANDBOOK FOR LISTENERS.
Published by O. Lund Johansen (Denmark). 112 pp.

THIS handy book gives interesting and important details of the principal transmitters throughout the world. In addition to the population of the town or country, it also gives the number of listeners, official address, number of stations (in the case of countries), details of the daily programmes, highlights of the programmes, announcements or calls, and the interval or identifying musical signals. There are also illustrations showing personnel connected with the stations. The book will be found of the utmost value to those who are interested in long-distance listening.

BASIC TELEVISION.
By Gernard Grob. Published by McGraw-Hill Publishing Co., Ltd. Price 55s. 6d. 596 pp.

THE sub-title of this book is "Principles and Servicing" and this will give an indication of the material covered. It is a comprehensive course in television for servicemen and technicians and, being an American production covers quite a lot of material on frequency modulation. To render the book suitable for use in classes as a text book it contains at the end of each chapter a set of review questions. In addition to standard theoretical details the book also includes practical circuits of standard American television equipment. There are some interesting photographic reproductions of tuning signals showing different forms of distortion or faults, and some of the more intricate circuit details are very well covered.

PRACTICAL WIRELESS CIRCUITS.
Published by Geo. Newnes, Ltd. 168 pp. 115 illustrations. Price 6s.

THIS is the fifteenth edition of the handy book first published as Twenty-five Tested Wireless Circuits in 1931. It has been revised and brought up to date from time to time and now includes the circuit of a modern television receiver and gas-discharge tube time-bases for use with electrostatic tubes.

GUIDE TO BROADCASTING STATIONS.
Fifth edition. Compiled by Wireless World. Published on September 28th, 1949, at 1s. 6d. (postage 1d.), by Iliffe & Sons, Ltd. Size 5⅝in. x 4¼in. (D16mo). 88 pages.

ALMOST without exception Europe's four hundred long- and medium-wave broadcasting stations will be changing their wavelengths next March when the Copenhagen Frequency Allocation Plan comes into operation. In order that this new edition of "Guide to Broadcasting Stations" should not become out of date within a few months, it has been enlarged and includes, in addition to the present operating details of Europe's stations, those which will come into force on March 15th, 1950.

Operating details of nearly 1,300 short-wave stations of the world, which have been checked against the frequency measurements made at the B.B.C. receiving station at Tatsfield, are also given in tabular form both geographically and in order of frequency.

In addition to the above information on broadcasting stations, this booklet includes details of Europe's television and E.H.F. broadcasting stations, and special service stations—such as meteorological and standard frequency transmitters, world time constants, revised list of international call signs, and wavelength-frequency conversion table.

A Direct-reading Valve Voltmeter

A Simple Instrument with Wide Application

Described by E. N. C.

THE valve voltmeter has a very wide application, and in the hands of the radio serviceman and experimenter can prove a very useful instrument. As is well known the valve voltmeter scores over the ordinary type of test-meter due to the fact that it draws negligible power from the circuit under test and, therefore, gives a more accurate indication of the conditions existing, when the circuit under test has a high internal impedance. For example, if one wants to measure the anode volts on a valve in a low-frequency amplifier, where the valve is likely to have a high value of anode load resistance, the valve voltmeter will give the correct indication without the necessity of calculating the drop in voltage due to the current taken by the instrument—which in some cases may be greater than the current taken by the valve itself. The valve voltmeter will measure the voltage developed on the A.V.C. line in radio receivers and, therefore, serve as a check as to whether this part of the circuit is working correctly or not.

The Circuit

As can be seen from Fig. 1, the voltmeter is essentially a D.C. coupled cathode follower which supplies a low current consumption instrument, the other end of the instrument being tied to a Cossor S.130 neon stabiliser valve which has developed across it a constant voltage. Any instrument which has a full-scale deflection of 250 μA or less is suitable for this position, the only difference being in the value of series resistances used for the various ranges. Resistance values will be given for the following instruments: 0-100 μA, 0-200 μA, 0-250 μA. The first five ranges of the voltmeter are attained by switching the value of series resistance, while the last two are effected by switching the grid of V2 down the input potential divider chain. The input resistance on D.C. measurements is 20 MΩ, and on A.C. this is shunted by the diode capacity plus stray circuit capacity, which altogether amounts to some 20 pF. This makes the voltmeter suitable for use on the higher audio frequencies, and in some cases up to radio frequencies, since the input impedance is no less than that of a large number of oscilloscopes.

Construction

Half-wave rectification is suitable in this circuit, but full-wave can be used if desired. A separate heater winding should be provided for each valve. The transformer specification appears in the component list. The whole unit should be housed in a metal box for screening purposes, and a drawing of a suitable box and chassis is shown in Fig. 2, together with a suggested layout, Fig. 3, but each constructor can, of course, utilise his own ideas. It should be noted that the accuracy of the voltmeter is mainly governed by the accuracy of the meter and

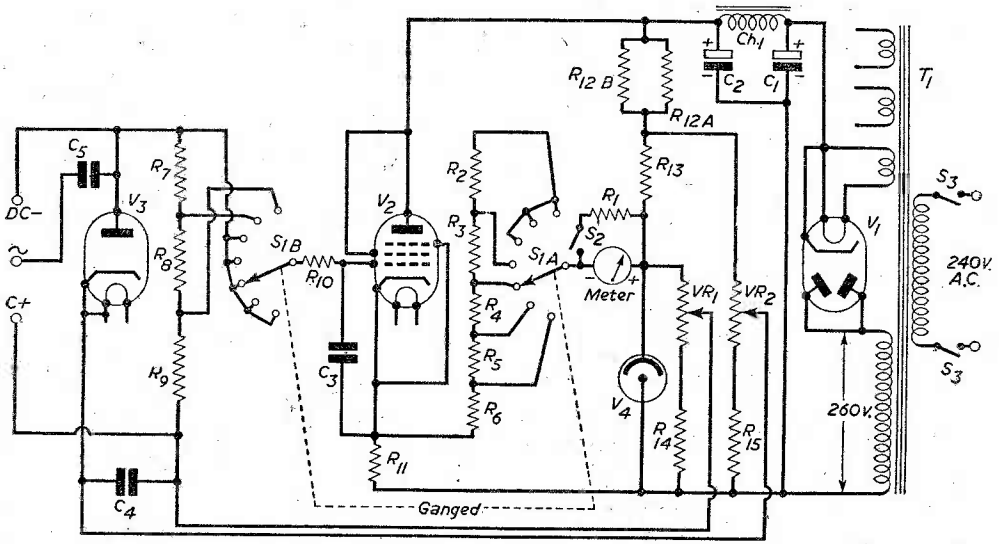


Fig. 1.—Theoretical circuit of the valve voltmeter. The neon must be connected the right way round to ensure stability—that is, with cathode earthed.

series resistances, and on the two highest ranges by the accuracy of the input potential divider. These resistances, therefore, should be carefully selected, and in the case of the series resistors these should, if possible, be wound with Eureka wire. The series resistances and the instrument form a D.C. voltmeter on their own, so it may be possible to purchase these together already matched. The input potential divider can be made up of Erie resistors by taking values which are slightly lower than the rated value and adding to them to make up the correct value. The ranges of the instrument reach up to 500v, but if a range of up to 100v. is sufficient the input potential divider is not necessary and can be replaced by a single resistor of 20 MΩ, and a smaller type of input rectifier can be used; the grid resistor being then returned permanently to the top of the input resistor. S1B is not then necessary.

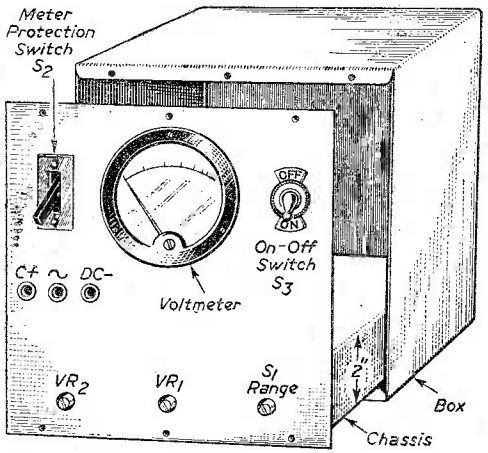


Fig. 2.—General appearance of the finished instrument.

C3 should be a good type of condenser with negligible leakage, as this can cause inaccuracy of the voltmeter. It should preferably be of the mica type.

Meter Protection

A good meter protection system can be quite complicated, so rather than include an automatic device it was thought that an easier method of protection was desirable. R1 and S2 were included for this purpose. R1 is a resistance which is approximately one-tenth of the meter resistance and S2 a Post Office type Dewar key, although the plunger type of wavechange switch can be used if desired. During normal operation S2 is closed and R1 shunts the instrument, making it approximately 10 times its normal full-scale deflection. When the voltmeter is connected to the circuit under test, the reading is noted. If it is less than one-tenth of full scale the key can be pressed and the correct reading taken. It is almost impossible to overload the instrument heavily with voltages of the correct polarity when S2 is closed, because over a certain magnitude of input volts V2 merely cuts off.

With regard to the wiring of the unit, the only main point to be careful of is that the input potential divider and S1B should be kept away from the chassis and mains leads to keep down stray capacity and hum.

Series Resistor Values

Instrument (0–100 μA.)

R6 = 50,000Ω	±.5 per cent.	5v.
R5 = 50,000Ω		10v.
R4 = 150,000Ω		25v.
R3 = 250,000Ω		50v.
R2 = 500,000Ω		100v.

Instrument (0–200 μA.)

R6 = 20,000Ω	±.5 per cent.	4v.
R5 = 20,000Ω		8v.
R4 = 60,000Ω		20v.
R3 = 100,000Ω		40v.
R2 = 200,000Ω		80v.

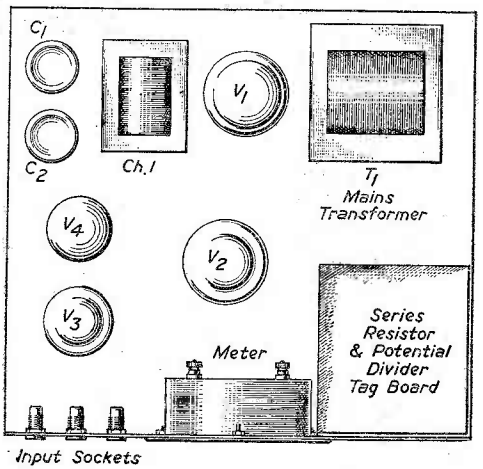


Fig. 3.—Chassis layout.

Instrument (0–250 μA.)

R6 = 20,000Ω	±.5 per cent.	5v.
R5 = 20,000Ω		10v.
R4 = 60,000Ω		25v.
R3 = 100,000Ω		50v.
R2 = 200,000Ω		100v.

When switching the unit on or off it is desirable to have it on a high range because, when the neon valve strikes, the meter needle is given a kick which is minimised by being switched to a high range.

When the unit is completed, switch on and wait for warming up to take place. After a short period the neon stabiliser will strike and a glow will be noticed inside the anode assembly. Advance VR2 to the top of its travel; this will bias the diode past cut-off. If everything appears to be in order, switch down to the lowest range and then set the meter needle to zero by adjustment of VR1. Having done this, carry out the following check. Take a short piece of wire and push one end into the common + socket. Press S2 to release the shunt from the meter, then push the other end of the wire into the D.C. — socket.

(To be continued)

Practical Hints

Simple Remote Control

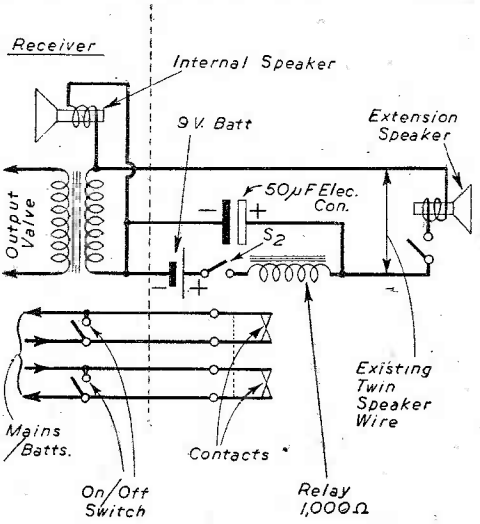
A RECENT period of illness called for the provision of switching the radio on or off from the extension speaker at the patient's bedside. Not wishing to fix extra wiring to operate the necessary relay, the following circuit was employed, making use of the existing wiring.

A double pole G.P.O. type relay with a 1,000-ohm operating coil (ex-Government, price 1s.), a 9-volt grid-bias battery, a 50μF 12-volt working electrolytic condenser, and a single-pole switch were mounted on a small piece of plywood, wired as shown in the circuit, and screwed inside the receiver. A toggle on/off switch was fitted to the extension speaker.

The contacts of the relay are connected across the contact(s) of the receiver on/off switch, the receiver being left *off*. In operation a small D.C. current passes through the speech coils of the extension and receiver speakers and the secondary of the output transformer, the 50μF condenser completing the audio frequency path.

The remote control unit is switched out of use by S2; this does not affect the normal operation of the extension speaker.

If the receiver on/off switch is ganged with the volume control the contacts of the relay should be wired in series with the mains or battery supply, as the case may be, and the receiver left *on* at the required volume.—N. ALDRIDGE (Buxton).



A simple remote control circuit.

THAT DODGE OF YOURS!

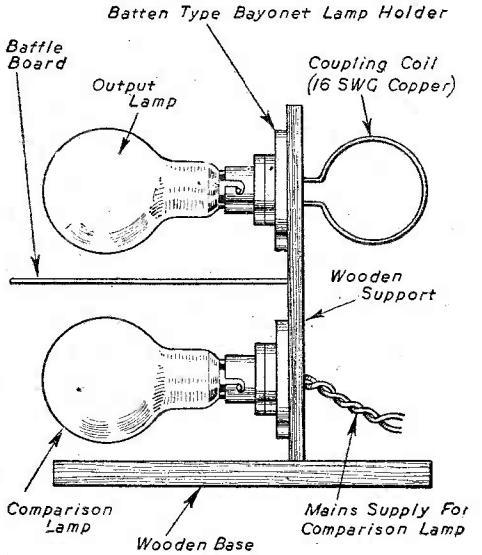
Every Reader of "PRACTICAL WIRELESS" must have originated some little dodge which would interest other readers. Why not pass it on to us? We pay half-a-guinea for every hint published on this page. Turn that idea of yours to account by sending it in to us addressed to the Editor, "PRACTICAL WIRELESS," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2. Put your name and address on every item. Please note that every notion sent in must be original. Mark envelopes "Practical Hints."

SPECIAL NOTICE

All hints must be accompanied by the coupon cut from page iii of cover.

Estimating RF Power Output

AN output lamp is connected to a coupling coil, which is brought near the tank coil of an oscillator. The output from the oscillator then causes the lamp to glow. Assuming the output lamp is a 15 watt, then if a similar lamp of the same rating is plugged into the comparison socket and lit from the mains, one is able to compare the brilliance of the two lamps, and if more or less identical in brilliance, it can be assumed that the output is equal to the wattage rating of the comparison lamp. Likewise, differently rated lamps can be used if one wants to measure or estimate an oscillator.—L. D. BULLEY (Southgate).



A lamp comparison arrangement.

The Practi Television

An Analysis of the Circuit

THIS receiver has been designed to provide ease of construction and ease of operation, and the main details will be seen in the circuits published on this page. Below is the vision section, and on the right the sound and mains sections, whilst on page 26 will be found the sync. separator and hard-valve time-bases. An examination of the vision circuit will show that there are a few unusual features and unusual ratings for some components. The contrast control, for instance, operates only on the first stage and is a simplified arrangement which permits of effective control without the risk of instability being introduced due to common stage couplings. The total bias resistance for each of the R.F. stages is higher than is customary, and this assists not only in stabilising the receiver but also reduces the total H.T. consumption and gives a guarantee of longer life to the valves. It will be noted that the H.T. and L.T. supplies to the various valves are grouped and split. All heater "a" terminals are fed from

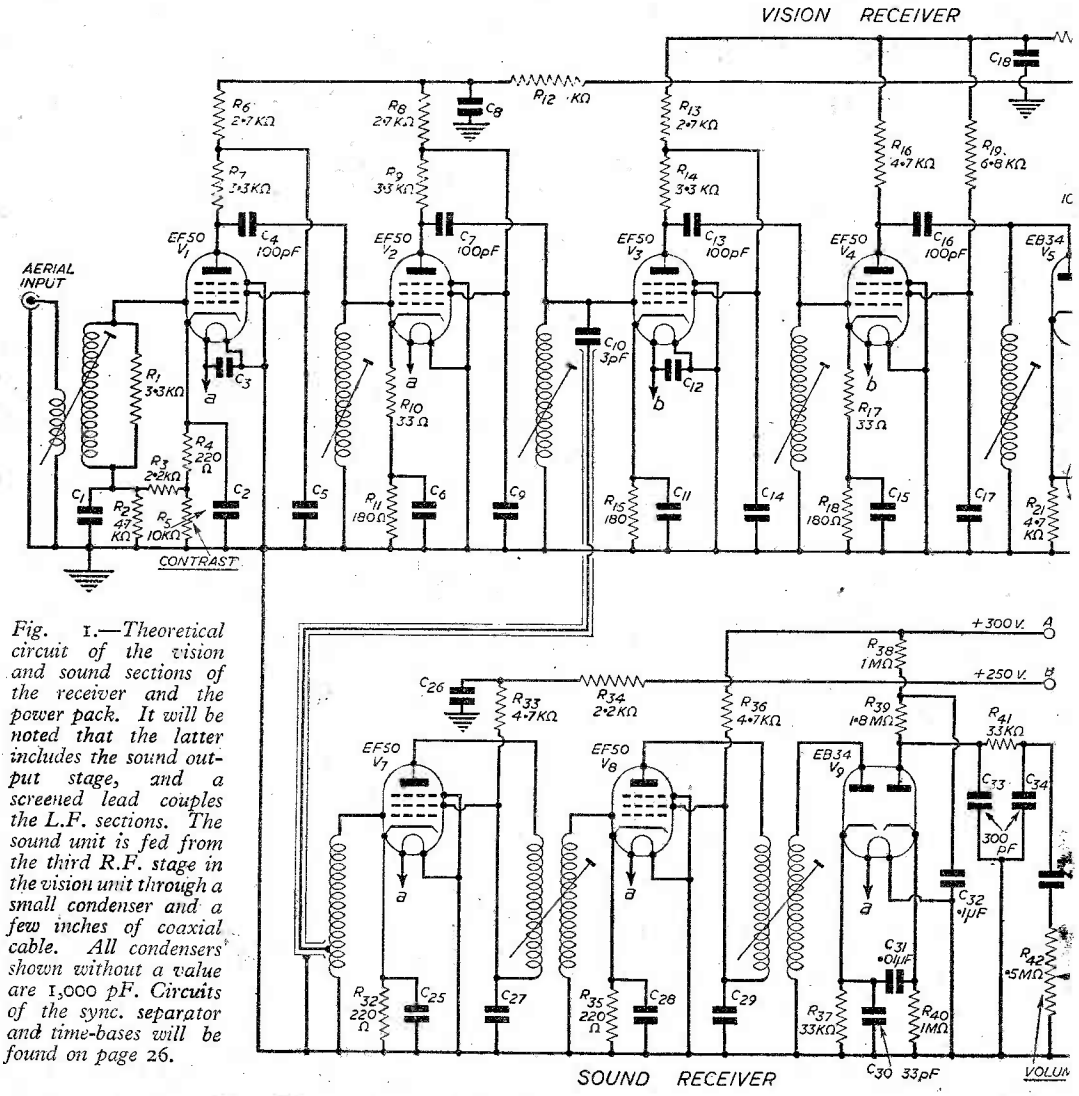
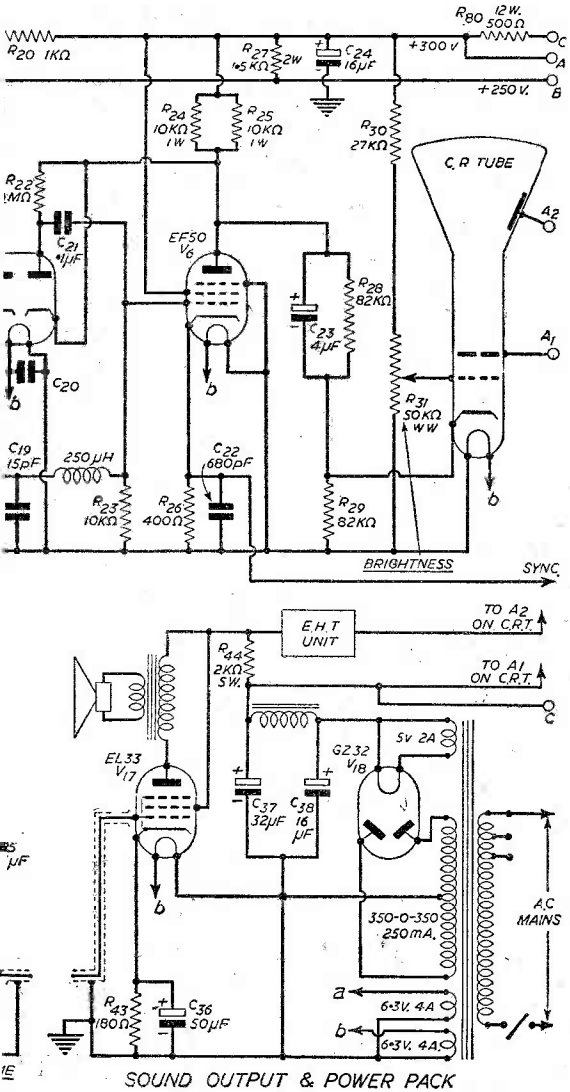


Fig. 1.—Theoretical circuit of the vision and sound sections of the receiver and the power pack. It will be noted that the latter includes the sound output stage, and a screened lead couples the L.F. sections. The sound unit is fed from the third R.F. stage in the vision unit through a small condenser and a few inches of coaxial cable. All condensers shown without a value are 1,000 pF. Circuits of the sync. separator and time-bases will be found on page 26.

cal Wireless Receiver—2

ınd Main Constructional Features

one heater winding, and those marked "b" are fed from another separate winding. The H.T supply is dropped to suit different stages, and in the vision and sound receivers it will be seen that in addition to using two separate feeds—one at 300 volts and one at 250 volts—the stages



SOUND OUTPUT & POWER PACK

are successively decoupled so that a gradually increasing H.T. is applied from stage to stage up to the output.

Tuning Circuits

The tuned circuits in the vision receiver are single wound, permeability tuned units, all having the same windings, and utilising Aladdin formers. On the sound side transformer coupling is employed. The feed to the sound receiver is tapped off from the third R.F. stage, thus giving two R.F. stages common to both vision and sound. This coupling is effected through a very small condenser (3pF) fed into a 3in. length of coaxial cable to prevent radiation and feed-back from one unit to another. The anode load resistors act as dampers on the tuned circuits and flatten the tuning to provide the necessary band width, whilst the decoupling resistors, coupled with the alternative run of wiring, and the H.T. decouplers ensure that there is no feed-back through the H.T. supply to give rise to instability. Although standard types of interference suppressor are fitted to both units it must be remembered that they may be omitted if desired, simply ignoring the second section of the two double diodes. On the vision side there is some loss of brightness with any form of interference suppressor and in some areas or districts it may not be necessary to use this part of the circuit.

Sensitivity

For full modulation of the tube specified an input only a little in excess of 100 μV is required so that the receiver should be perfectly satisfactory up to the fringe area. This input will give adequate sound output—this part of the circuit having its own volume control.

Controls

There are only two "panel" controls, the sound volume control just mentioned, and a brilliance control combined with on-off switch. The latter may be omitted if desired, and a toggle type switch mounted in some part of the containing cabinet. This latter arrangement is sometimes desirable where there are young children about who may be in the habit of playing with control knobs.

The contrast control is mounted on the chassis to act as a pre-set control, and once set up need not be touched unless the aerial is changed or valves age and call for increased input. The time-base controls are all mounted on the chassis and are provided with slotted spindles so that once set they need not be touched unless valves are changed.

Constructional Features

As will be seen from the illustration on our cover this month, resistors and condensers are, in the main, grouped on small group boards. These may be made up individually and they complete part of the wiring, so that when placed into position, interconnecting wires to valveholders, etc., complete the wiring. Each group board is related to a definite part of the circuit, there being one for each

of the time-bases, one for the sync. separator section, and one for a common input supply source. It will be noted in the circuits that there are separate large capacity electrolytics shown at each section. These are, actually, the main H.T. smoothing capacitors, but instead of using one or two large capacity condensers in the mains unit they are split up into small sections and included at each part of the circuit so that they act more efficiently as decouplers, provide better smoothing, and are cheaper in replacement when called for. The total H.T. smoothing capacity is thus 78 μF.

List of Parts

On page 27 will be found a full list of the components required for the receiver and it will be noted that a special choke is required with a rating of 250 μH. This choke must have a low, self-capacity and its construction will be described in a later issue. All other components are standard items in good supply and no difficulty should be experienced in obtaining any of them.

(To be continued)

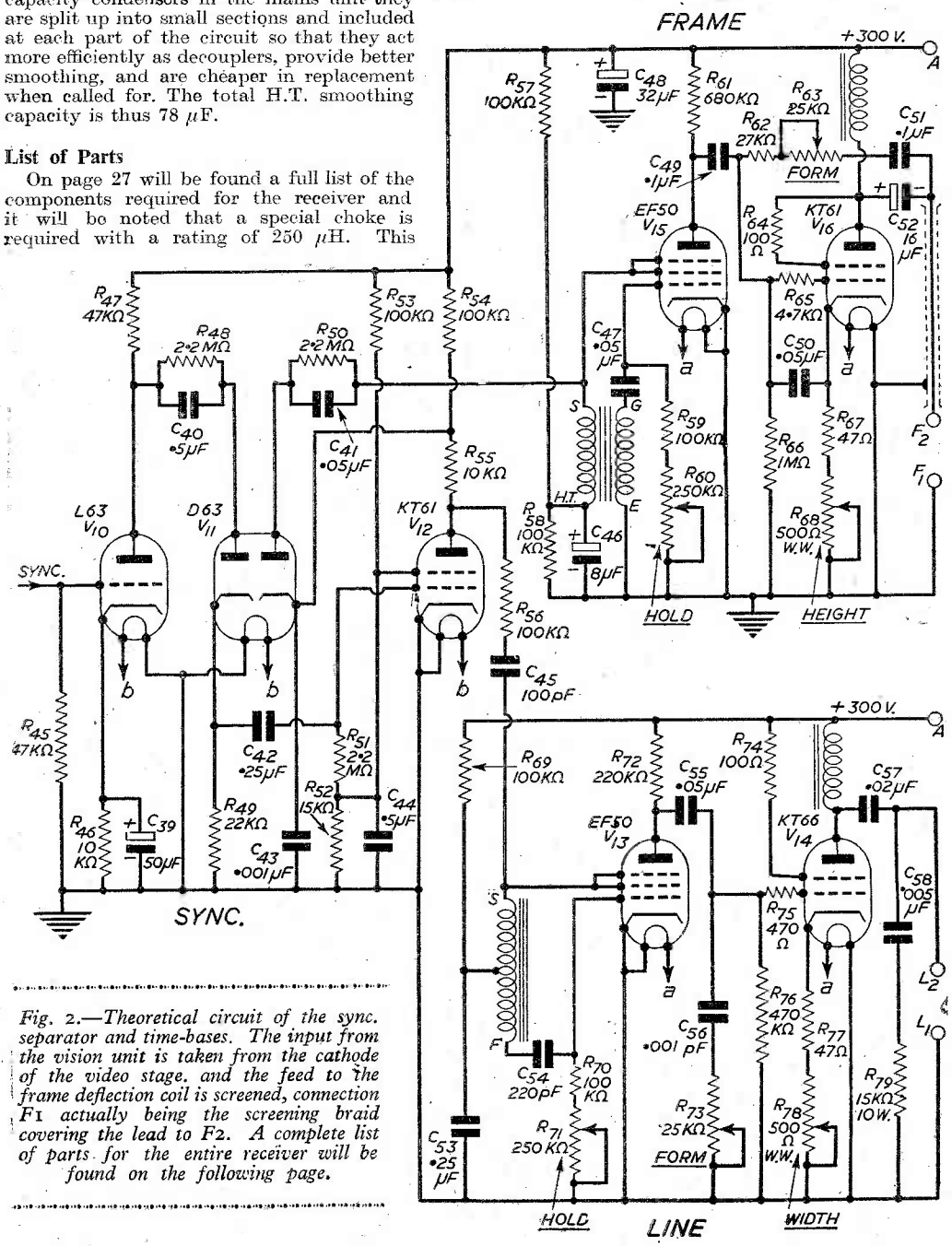


Fig. 2.—Theoretical circuit of the sync. separator and time-bases. The input from the vision unit is taken from the cathode of the video stage, and the feed to the frame deflection coil is screened, connection F1 actually being the screening braid covering the lead to F2. A complete list of parts for the entire receiver will be found on the following page.

LIST OF COMPONENTS

CAPACITORS

C1, 2, 3, 5, 6, 8, 9, 11, 12, 14, 15, 17, 18, 20, 25, 26, 27, 28, 29, 43, 56	1,000 pF. Type CM2ON.	T.C.C.
C4, 7, 13, 16, 45	100 pF. Type CM2ON.	T.C.C.
C10	3 pF. Ceramic	Erie
C19	15 pF. Type SMWN	T.C.C.
C21, 32, 49, 51	.1μF. Type 343	T.C.C.
C22	680 pF. Type SM2N	T.C.C.
C23	4μF. Type BR 435	Dubilier
C24, 52	16 μF. Type BR.1650	Dubilier
C30	33pF. Type SMWN	T.C.C.
C31, 35	.01μF. Type 346	T.C.C.
C33, 34	300pF. Type SMWN	T.C.C.
C36, 39	50μF. Type BR.501	Dubilier
C37, 48	32 μF. Type CT.3250	Dubilier
C38	16μF. Type CT.1650	Dubilier
C40, 44	.5μF Type 343	T.C.C.
C41, 47, 50, 55	.05μF. Type 343	T.C.C.
C42, 53	.25μF Type 343	T.C.C.
C46	8μF Type BR.850	Dubilier
C54	220pF. Type MWN	T.C.C.
C57	.02μF. Type 2045	T.C.C.
C58	.005μF Type 2045	T.C.C.

RESISTORS

R1, 7, 9, 14	3.3kΩ
R2, 45, 47	47kΩ
R3, 34	2.2kΩ
R4, 32, 35	220Ω
R5	10kΩ Type CLR.4089/22 Colvern
R6, 8, 13	2.7kΩ
R10, 17	33Ω
R11, 15, 18, 43	180Ω
R12, 20	1kΩ
R16, 21, 33, 36, 65	4.7kΩ
R19	6.8kΩ
R22	10MΩ
R23, 46, 55	10kΩ
R24, 25	10kΩ—1 watt
R26	400Ω
R27	1.5kΩ—2 watt
R28, 29	82kΩ
R30, 62	27kΩ
R31	50kΩ (combined with on/off switch) Type CS Dubilier
R37, 41	33kΩ
R38, 40, 66	1MΩ
R39	1.8MΩ
R42	.5MΩ Type C Dubilier
R44	2kΩ—5 watt Welwyn
R48, 50, 51	2.2MΩ
R49	22kΩ
R52	15kΩ
R53, 54, 56, 57, 58, 59, 69, 70	100kΩ
R60, 71	250kΩ Morganite Type "A"
R61	680kΩ
R63, 73	25kΩ Morganite Type "A"
R64, 74	100Ω
R67, 77	47Ω
R68, 78	500Ω Type CLR.3001 Colvern
R72	220kΩ
R75	470Ω
R76	470kΩ
R79	15kΩ—10 watt Welwyn

All above are Erie ½ watt type except where stated otherwise.

Frame circuit feed choke, Type LUS8F
Line circuit feed choke, Type LUS6L
Frame oscillator transformer, Type TUY5/86
Line oscillator transformer, Type TQ/116
Scanning coil unit, Type S.914H
} Haynes Radio, Ltd.

One P.M. focusing unit, Type R.17 Electro Acoustic Industries, Ltd.

Mains transformer, Type R.180
Smoothing choke, Type C.281
} Gardners Radio, Ltd.

R.F. E.H.T. unit, Type P.W.—Hazelhurst Designs, Ltd.

10in. loudspeaker with 7,000-ohm transformer, Type S101.2T—Whiteley Electrical Radio Co., Ltd.

Valves :

Nine EF50, Two EB34, One EL33, One GZ32 } Mullard

One L63, One D63, Two KT61, One KT66 } Osram

One C.R. tube, Type MW22-14c and base to suit—Mullard.

Eight Formers, PP5925
Eight Cores, PP5920 Grade "A"
} Aladdin Radio Industries, Ltd.

Four "Cinch" insulated double-bank mounting strips, No. 75/998
Five 3-way tag strips.
} Benjamin Electric, Ltd.

250 μH choke (see text).

Nine B9G ceramic valveholders, Type L500/C/Ag
Nine octal valveholders
One 7-way plug and socket, Type L.530/531
} Belling & Lee, Ltd.

One 3-pin shielded plug and socket, Type P.162—A. F. Bulgin & Co., Ltd.

One rubber mask (black or white according to taste)—Long & Hambly, Ltd.

One piece ¼ plate glass, 10in. by 8½in.

Five-eighths plywood for speaker and tube mount.

Aluminium and tinplate for chassis.

Nuts ; bolts ; connecting wire ; P.V.C. insulating sleeving ; flex ; one yard rubber draught excluder ; six rubber grommets ; one yard coaxial cable ; one yard twin-screened cable ; one yard single screened cable ; few ounces 32/34 s.w.g. silk-covered wire for coils.

Practical Series-condenser Heater Circuits—1

The Use of a Condenser in A.C. Receivers with Series-connected Heaters Described

By E. N. BRADLEY

WHILST many readers will know that a condenser may take the place of a resistance or barretter as a mains dropper in series-connected heater chains in A.C. receivers, most of them are probably in the position of the writer, who had never bothered to test out the scheme for himself until he was made aware of the fact that during the winter months the cost of current from the domestic supply would increase. A rooted objection to paying for what he did not use led to the decision to construct and test a condenser-fed receiver, the details of which are given later.

When valve heaters are connected in series, as they are in all universal mains receivers, a resistance or a barretter must be used to drop the mains voltage, at the required current, to the voltage needed across the heater chain. The power loss in the resistance or barretter is a loss indeed, and faithfully recorded by the house meter as such; any simple change in construction which can reduce this loss of power without adding new disadvantages of its own will clearly be highly beneficial. The power consumption of a series-condenser heater circuit is that of the valve heaters alone.

The one outstanding disadvantage of the series-condenser type of heater supply system is, of course, that it is useless for D.C. operation, but for constructors with A.C. supplies the system has nothing but advantages to offer.

In Fig. 1 are shown the three types of series heater supply circuit, that at (a) being the normal resistance-fed circuit such as is found in midget sets where the resistance is a line-cord; that at (b) being a barretter-fed circuit as found in larger A.C./D.C. receivers, and that at (c) being the condenser-fed heater supply circuit for A.C. operation.

The circuit at (a) has very poor regulation, for any fluctuation in the mains supply must clearly vary the current through the circuit and thus the voltages dropped across the resistor and the valve heater chain. The regulation of the circuit at (b) is excellent, for the barretter is a device which will pass a constant current for very widely varying supply voltages, and thus this circuit not only maintains the valve heaters at the correct operating current during supply fluctuations, but it also permits an extra valve or valves to be added to the receiver, should this be desired, without the need for changing the barretter type or the heater circuit arrangements to any great degree. Under similar conditions the circuit at (a) would need a change to be made in the value of the resistance.

The circuit at (c) has also surprisingly good regulation, maintaining an almost constant current if the operating conditions of the system are correctly chosen and even permitting the addition of a valve to the circuit without requiring a change in the capacitance of the condenser.

Apart from this, however, are added the very real advantages of negligible power loss in the condenser and, therefore, no heating of the component.

All constructors of A.C./D.C. receivers will know the method of calculating the resistance value of circuit (a) or the barretter range of circuit (b); the voltages of the valve heaters (which must all, of course, require the same current, 0.2 Amp. for the majority of British valves) are added together to give the total heater chain voltage to which must be added the voltages across any dial lamps in series with the valves. This final voltage is then subtracted from the mains voltage to give the voltage which must be dropped across the resistor or barretter.

The Theory

To obtain the value of the condenser to be used for any set of valves in circuit (c) a very different calculation must be employed.

A voltage drop with negligible power loss is obtained across the condenser since the component is acting as a reactance. A condenser passes A.C., but with a phase shift (of 90 deg. in a theoretically perfect condenser; of slightly less than 90 deg. in practice), the current leading the voltage. The current flowing into the condenser on the section of a cycle giving charge flows in the same direction as the voltage, but on the section of a cycle where the condenser is discharging the current flows in the opposite direction to the voltage; consequently, the energy taken to charge the condenser is returned to the circuit on discharge.

(*To be continued*)

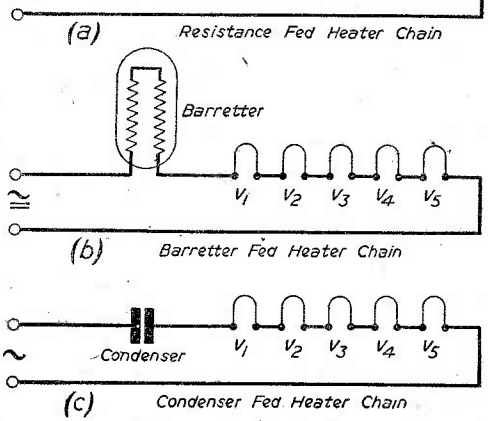


Fig. 1.—The basic feed methods for a series heater chain.

Building a Television Receiver

Modifications Required for Reception of the New Midland Transmitter

By S. A. KNIGHT

THE following coil modifications and additions are necessary to make the set originally described under the above title (PRACTICAL WIRELESS, February to July, 1949) suitable for single-sideband reception from Sutton Coldfield.

These changes have been made and checked against signal generator signals only, the actual transmissions not being used. The receiver performs as it should on such tests and it is not likely that any other changes will be necessary when it is used on the actual television signal.

Other small modifications are listed at the end. These are not connected with change in frequency in any way and apply to receivers used for Alexandra Palace as well as for Sutton Coldfield.

Vision Unit

Referring to Fig. 1 in the February, 1949, issue, the following changes are required:

L_1 wound 4.5 turns, each spaced 1/32in. with the coupling 1.5 turns interwound at the earthy end. Wire, 34S.W.G. enam./S.S.C.

L_2 wound 5 turns as above, with sound output coupling 1.5 turns interwound at the earthy end.

L_3 wound 4.5 turns as above.

A sound rejector coil must be included in the vision I.F. circuits to suppress sound breakthrough when the I.F. coils are tuned to the lower sideband. This coil (as are the above) is wound on an Aladdin former as follows:

Twelve turns close-wound of 24 S.W.G. enamelled copper.

The ends, being fairly springy, should be bound down to the former with cotton and the whole painted with polystyrene cement. This coil is wired in the cathode circuit of V_6. Disconnect R_{29} and C_{27} from chassis and include the rejector coil in series with their ends and chassis. Shunt the rejector with 100 pF. 10 per cent. silver-mica or ceramic condenser. See Fig. 1.

Finally, shunt VC_1, the oscillator tuning with a 10 pF. ceramic condenser. This will permit easier tuning and allows the circuit to resonate at the new frequency of 48.75 Mc/s. (61.75-13 Mc/s.).

This completes the vision chassis changes.

Sound Unit

Referring to the theoretical circuit of the sound chassis (April, 1949) the following changes are required:

L_1 wound 4.5 turns, each spaced 1/32in., with the coupling from vision unit 1.5 turns interwound at earthy end

L_2 wound 4.5 turns, each spaced as above.

Remove the fixed parallel capacity from the oscillator tuning condenser, leaving only the 20 pf. variable across the coil. This enables the circuit to tune up to the new frequency of 55.25 Mc/s. (58.25-3 Mc/s.).

All coils are wound on the formers originally specified and all are wound with 34 S.W.G. enam./S.S.C. wire, the bottom end starting $\frac{3}{16}$in. from the base of the former; 24 S.W.G. enamel wire is used only on the rejector coil.

Alignment Frequencies

The following sets out the alignment procedure for the modified receiver and assumes that all parts have been set up as previously described (July, 1949) and are in working order. It is not anticipated that any of the vision I.F. coils need modification; on the original model the new frequencies could be covered within the possible core adjustment. It may just happen, however, that one or more of the coils will not peak at the new frequency, and in this case a rewind will be necessary, generally two or three extra turns being probable. The operator must judge for himself; if the core is right in and the peak has not been reached, more turns must be added. Parallel condensers must *not* be added.

Short out the oscillator coil on both units, set the signal generator (S.G.) to 12 Mc/s., inject into the grid of V_6, and tune L_7 for a peak on a 0—1 mA. meter in series with R_{30}. (Shunt the meter with 0.001μF.) The tuning here is fairly flat.

Transfer the S.G. frequency to 9.5 Mc/s. and adjust the rejector coil core for a *minimum* on the output meter. This should be sharp and must be set carefully. It may happen that the tolerance of the parallel 100 pf. condenser is such that a peak cannot be obtained; in this case try another condenser.

Transfer the S.G. to the grid of V_5, set it to 10.75 Mc/s and adjust L_6 for maximum output.

Transfer the S.G. to the grid of V_4, set it to 12.75 Mc/s and adjust L_5 for maximum output.

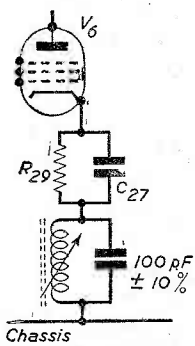


Fig. 1. — The sound trap is included in the cathode lead of the last I.F. valve.

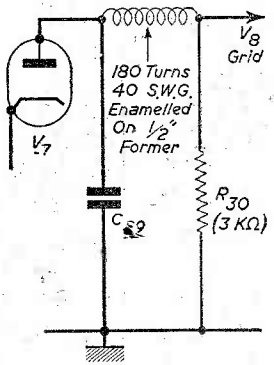


Fig. 2. — Modified diode filter on the vision unit.

Transfer the S.G. to the grid of V_3, set it to 11.5 Mc/s and adjust L_4 for maximum output.

The I.F. stages are now staggered to one side of the I.F. frequency of 13 Mc/s. and the rejector coil gives adequate discrimination against 9.5 Mc/s. sound frequencies automatically produced at the frequency-changer anode.

The next procedure is complicated by the fact that the oscillator condenser must be set to give an I.F. output of 13 Mc/s, at which the gain of the I.F. circuits will be *one-half* of maximum and *not* maximum. The following method is simple and gives close results to those desired.

Remove the short from the oscillator coil, transfer the S.G. to the grid of V_2 and set it to

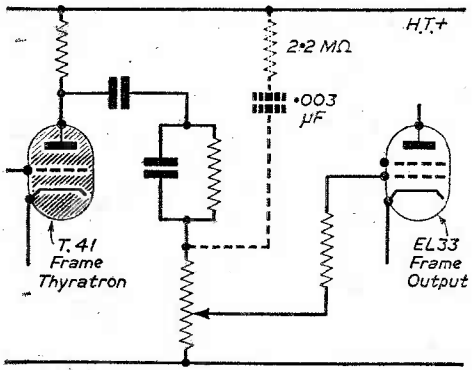


Fig. 3.—Modification to the frame time-base circuit to correct for non-linearity of the frame scan.

61.75 Mc/s. Working with a fairly low input adjust VC_1 for maximum output. Note the output meter reading carefully. Increase the S.G. input to double its previous value and offset VC_1 by *closing* the vanes more until the output reading has *fallen* to its first value. Now adjust L_3 for maximum output in the usual way.

Transfer the S.G. to the aerial socket, set it to 60.25 Mc/s and adjust L_2 for maximum output. Set it to 61 Mc/s and adjust L_1 for maximum output.

This completes the vision alignment.

Turning now to the sound receiver, the I.F. circuits are aligned to 3 Mc/s exactly as previously described. The R.F. coils are aligned as follows :—

Connect the S.G. to the grid of the first sound valve (SP 61), set it to 58.25 Mc/s, and adjust the oscillator tuning (first removing the short) for maximum sound output. Now transfer the S.G. to the grid of V_2 in the vision unit, set it to 58.25 Mc/s and adjust both L_1 and L_2 on the sound unit for maximum sound output.

This completes the sound alignment.

Other Notes

Those without signal generators must follow the instructions previously given in regard to alignment for Alexandra Palace frequencies. This set is more difficult to align without such an aid, however, and it is not recommended that it be attempted. Once the I.F. stages are set up by signal generator the oscillator and R.F. stages can, of course, be set up on an actual transmission. The vision oscillator is the main trap for the unwary ; it must be set so that the vision output is *one-half* of maximum, and set to that side of such maximum which makes the capacity of the oscillator tuning condenser larger. If the oscillator is set so that the receiver peaks on vision single-sideband working is lost and in any case sound will appear on the picture.

It is wise to set the oscillator on an actual transmission even if signal generator alignment has been followed throughout—not an actual tuning procedure but a check on the setting.

Other Modifications

The following short list covers some simple circuit changes that have been made by the writer since the original description of this receiver and which have led to some small improvements generally :—

The input to the vision detector diode has been modified to the circuit shown in Fig. 2. Here a single coil replaces the double coil L_8 and L_9 and condenser C_{30} is removed entirely. R_{30} is replaced by a 3 kΩ.

To correct slight non-linearity at the bottom of the raster the frame time-base has been modified as shown in Fig. 3, where an additional condenser of 0.003 μF. mica and a resistance of 2.2 MΩ are connected in series between the H.T. rail and the junction of the two output grid resistances.

The screen resistance of the line output valve (807) has been increased to 7 kΩ 2 watts. This enables a wider line scan to be obtained. Any tendency to overlap on the left hand edge of the picture that cannot be completely ironed out by the Linearity control can be removed by connecting a mica 0.0005 μF. condenser directly between the cathode pins of the line thyratron and the line amplifier valve.

The above modifications are not strictly necessary and the latter two need only be made if the fault mentioned is manifest to any marked degree.

Several readers have made enquiries about moving the contrast control from off its bracket on the vision unit. This can be done simply by using single screened lead (capacity not important) of required length to connect the control to the vision unit tags, the outer being the earthed return for the slider.

Programme Pointers

Some Recent Programmes are Reviewed in This Article by Our Music Critic, MAURICE REEVE

WELCOME back to those two excellent Sunday morning features, "Music Magazine" and "The Critics." I have always found them that happy and rather rare combination of the broadcast programme which entertains with intelligence. Taken together, the six subjects they deal with: music, drama, theatre, books, art and radio, must surely contain something for everybody: the person who is not interested in any of it has, we hope, not yet been born. Experts in all these branches deal with them, with the happiest combination of authority, deference to the other side, reminiscence and detailed analysis yet with all a gaiety and an absence of "teaching" which are wholly delightful. Their first appearances after the summer vacation were well up to standard.

Plays

I HEARD a number of good plays last month, and readers may care for my views thereon. "Keep Murder Quiet," which might well have borne the sub-title, "Bulldog Drummond Avenges his Father," featured that excellent actor, Leslie Perrins, in the role of Sir Roger Spain, who devotes his life, or a few years of it, to solving the mysterious death of his father, and proving his own theories that it was murder and not suicide. Like all plays of its type, this one, by Lance Sieveking and Selwyn Jepson, contains Scotland Yard officers and other characters who fail to answer some of the simplest riddles; presumably there would be no story if they did. But it was a good one of its genre, and Mr. Perrins was well served by his company.

The Light programme honoured itself with particular distinction, and was, in consequence, welcomely more substantial than usual to at least one listener, when it presented Dame Edith Evans in Hugh Ross Williamson's "Queen Elizabeth" on September 28th. The play deals mainly with the Virgin Queen's discovery of her lover(?), the Earl of Leicester's secret marriage, bigamous at that, to the widow of the Earl of Essex. Her outburst of scurrility, vituperation and invective were magnificent to listen to, and full worthy of a Queen and a virgin. Dame Edith made us hold on to our sets in case she shook them off or over. It was a splendid performance and the part suited the famous actress better than Candida. Subsidiary to this episode, ran the pursuit of the Queen by the Duc d'Anjou, heir to the King of France, and of her masterly handling of it in her country's interests.

The play vividly brings out the many sidedness of this most remarkable of women, and affords a role of great glamour and gracefulness to the actress capable of taking the chance. Dame Edith certainly took hers; and, among others, Andrew Cruikshank as Leicester, Laidman Browne as Burleigh, Lydia Sherwood as the Countess of Essex, and Reginald Beckwith as d'Anjou, made notable contributions.

What endless fascination the great Queen's story still holds! And the more we get to know the story, with all its passion, intrigue, statecraft, heroism and glory, the more we thrill to it. Like great music or great anything else, it is also an endless source of inspiration to the executive artist, and, in consequence, is always giving rise to new discoveries, speculations and theses on this, that and the other. We can never know enough about it, neither can we tire of hearing it recounted.

"Alien Corn"

THIS play by Sidney Howard, was a very interesting, if not wholly convincing or satisfactory, story, of a German-American girl whose greatest ambition in life is to become a celebrated concert pianist. But the need for "security," is the bugbear of her life and the "villain of the piece." "Security," according to the author, damps her spirits and kills, or nearly kills, her ardour, just as it fills her soul with mundane and petty thoughts. Just at the end, however, and I have no doubt chiefly to escape imminent entanglement with a married man, she rushes from the room shouting "I will become a great pianist." Whereupon, after a discreet pause, a voice informs us that we have been listening to "Alien Corn, etc., etc., etc." We give a stretch, shut off, and that's that.

I liked the delineation of some of the characters (the scene of the play was an American university), and having been a music student myself, I warmed to them and their arguments and discussions. Joan Hart played the would-be Eileen Joyce and Frederick Schiller, her father. Those who didn't speak in broken English did so in impeccable American.

"Morning Departure"

"MORNING Departure," by Kenneth Woolard, retold a wartime incident of a submarine sunk, I think, in Portland Harbour, with the loss of most of her crew. But the five or six survivors were able to contact her main base and, in spite of much red tape and official barbed wire, procure a salvage ship. Just as the salvaging was about to succeed, however, the ship is needed for a major operation elsewhere. Grappling irons are released and the poor fellows, so near to rescue, abandoned. One of the war's most cruel episodes in which sentiment, even humanity, are allowed no voice.

The drama lay in the fact that the submarine had gone down outside the range of its home base; consequently the services of the salvage ship could only be obtained against all the home base and Admiralty standing orders. As a result, when the incident within "home" waters occurred, the shortage of salvage equipment (it was in 1940) compelled the sacrifice of the submarine. Moving performances were given by James McKechnie, Alan Wheatley and others.

Round the World

I'M afraid I could not share the enthusiasms of most of the critics on Mr. Wynford Vaughan-Thomas's eight-day voyage round the world. Comparisons with the hero's eighty-day journey of 1875, by Jules Verne, seemed to make the whole thing border on the absurd. Why listeners should be asked to tune-in daily to John Snagge, in almost bated breath, speculating as to whether Mr. Vaughan-Thomas was approaching Sydney. Whether he was in Sydney or what the chances of his having left Sydney were, I cannot imagine. Excellent chap though he is, I couldn't possibly enthuse over his having had three, four or one hour's sleep between points A and B, nor could I interest myself in whether he had to rush his ham, eggs and coffee at the airport at point C, or was able to consume them in quiet and comfort. As to the possibility or impossibility of his shaving of a morning. I just couldn't care less. In conclusion, I thought the speech of the Mayor of Sydney, which occupied a good half of one of the episodes, and in which His Worship welcomed Mr. Vaughan-Thomas like a Francis Drake and wished him God-speed on his next lap like a Vasco da Gama, one of the silliest, boring, most pompous and fatuous efforts I had heard for a long time.

Battle of Britain

THE Battle of Britain, in which the story of Hitler's "Operation Sea Lion" was told, based on official documents, was as excellent as the others in this series were. Compiled by Chester Wilmot, narrated by Leo Genn, and produced by Laurence Gilliam, it was exciting, dramatic and factual. Like the events of good Queen Bess's reign, it is a story that will stand telling and re-telling over and over again. May it always be told as well.

The Gustav Mahler concert, in which the B.B.C. Symphony Orchestra was conducted by Bruno Walter, was a high light. It served to show what the general public loses by refusing to patronise the more unfamiliar masterpieces and preferring the hackneyed and the commonplace. In spite of the difficulties entailed in the production of such music, it undoubtedly would be in response to a popular demand. It is glorious stuff and was splendidly performed. Incidentally, there was a public performance the previous evening, rapturously received by a huge audience. But it was the first for very many years.

Goethe Festival

ANOTHER splendid evening of superb orchestral playing was the British Goethe Festival Concert, given by the Vienna Philharmonic, under Furtwangler. Music inspired by Goethe's writings culminated in a coruscating performance of the seventh symphony. The completely contrasting styles of two countrymen, Walter and Furtwangler, were absorbingly interesting to study at such close proximity to each other.

News from the Clubs

STOURBRIDGE AND DISTRICT AMATEUR RADIO SOCIETY

Hon Sec.: W. A. Higgins, 28, Kingsley Road, Kingswinford.

AT a meeting held at King Edward's School, Stourbridge, there was a talk on "Home Construction of T.V. Receivers" by Mr. R. J. Lean, of Birmingham. Apparatus was on view with many interesting innovations. Station visits have been arranged for listening members. Meetings every first Tuesday in the month.

THE MIDLAND AMATEUR RADIO SOCIETY

Hon. Sec.: A. W. Rhodes, 135, Woolmore Road, Birmingham, 23.

AN evening to be remembered was the annual dinner held recently. Distance appeared to be no trouble, as many journeyed from Devon, Aberdeen, Yorkshire, and London. Some of the distinguished Hams in England are members of this provincial society and the evening was well spent in the company of such as G5VM President, R.S.G.B., and G6CL, secretary of R.S.G.B. The usual monthly meetings take place on the third Tuesday of the month, at 6.30 p.m., the Imperial Hotel, Birmingham. Visitors are welcome.

BRIGHTON AND DISTRICT RADIO CLUB

Hon Sec.: L. Hobden, 17, Hartington Road, Brighton.

ATTENDANCES at club meetings have increased in the winter months. Several new members have joined our ranks. Still more are welcome. Weekly talks are arranged in advance and members notified of these and other items of local interest in club circular, "Brighton Link." Future programme includes a demonstration of television from Government surplus and a series of talks on radio servicing. A talk is also promised from a representative of the B.B.C. Morse classes are available for those wishing to commence or improve their CW.

LOTHIANS RADIO SOCIETY (EDINBURGH)

Hon. Sec.: Ian Mackenzie, 41, Easter Drylaw Drive, Edinburgh 4.

THE next meeting of the society will be held on Monday, December 12th, at 7.30 p.m., at 25, Charlotte Square, Edinburgh, when Mr. W. Bloxam will deliver a talk on V.H.F. At recent meetings a very interesting talk and demonstration of Model Control was given by G. F. Tuck, GM3BBW.

The Society extends an invitation to any prospective members to attend these meetings further particulars from the Secretary.

SOLIHULL AMATEUR RADIO SOCIETY

Hon Sec.: G. Haring, 121, Bradbury Road, Olton, Birmingham.

AT the last meeting members of S.A.R.S. were treated to a lecture on "Regional Broadcasting" by Mr. Cooper, of the B.B.C., which was greatly enjoyed by a large gathering.

Appreciation was expressed to Mr. Bastin and his helpers of the "Flat-Committee" on the fine work they had done with the alterations and decorations of the new premises.

Application has now been made for the club callsign, which is eagerly awaited.

Visitors and new members are always welcome at S.A.R.S. on alternate Wednesdays at 7.30 p.m., c/o. Tucker's Switches, Ltd., King's Road, Tyseley, Birmingham.

READING RADIO SOCIETY

Hon. Secretary: Frank Hill (G2FZI), 997, Oxford Road, Tilehurst, Reading, Berks.

RECENT activities of the Reading Radio Society have been as follows: A show of films by Messrs. Bakelite, Ltd., on "The Nature of Plastics," in which the effects of chemical structure on the physical characteristics of the materials were demonstrated.

Mr. Bedwell, of Marconi's Wireless Telegraph Co., gave a talk on the design and construction of V.H.F. portable transmitter-receivers, using commercial models as used by the police to demonstrate his points.

All meetings are held at Abbey Gateway, The Forbury, commencing at 7 p.m.

KINGSTON AND DISTRICT AMATEUR RADIO SOCIETY

Hon. Sec.: R. S. Babbs, B.Sc., 28, Grove Lane, Kingston.

AT the meeting held at Kingston Hotel on November 9th, the competition for the best radio equipment built during the past year took place. There were 14 entries, most of which shewed originality in design and skill in workmanship. The winner was presented with the "G6BI" Cup to hold for the ensuing year.

Each exhibitor gave a short description of his work and the meeting was voted as one of the best by the large attendance present.

The next meeting on December 7th, will be a lecture on B.C.I. and T.V.I. by a G.P.O. Engineer.

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

Electric Coil Winder

SIR,—Regarding the automatic coil winder described in an earlier issue, I have come across a useful piece of gear which can be used in the construction. It is an ex-R.A.F. Position Indicator which is sold for a few shillings and contains the essential material for making a good job of the winder, especially the infinite ratio gear, maximum 3 : 1 approximately, which gives fine control for the wire feed.—WILLIAM W. MCLEAN (Rosyth).

Meter and Rectifier Resistance

SIR,—Your correspondent "Puzzled" of Liverpool might well be in the state of mind his *nom-de-plume* suggests, for to the uninitiated the setting up of a D.C. milliammeter to read A.C. volts is not an easy matter. As with most electrical problems, however, this one yields to proper treatment, and these notes are given in the hope that they will enable the puzzled ones to become enlightened.

When a meter is used with a rectifier to read A.C. volts, it actually reads the *mean* value of the current passing through it. The required R.M.S. value is greater than the mean value by the ratio 1.11, i.e., the "form factor" of a sinusoidal waveform. Consequently, an instrument having a F.S.D. of 10 mA. D.C. will read 11.1 mA. R.M.S. A.C. To convert the meter to read volts follows the well-known principle of inserting series resistance, but the ohmic values for the ranges required will now depend upon the voltage to be measured and the volts dropped across the rectifier.

The method is to subtract the rectifier volts drop from the total volts to be measured, and divide the remainder by 1.11 times the meter F.S.D. in amperes (0.01 A in this case).

It is noticed that "Puzzled" proposes to use a 10 mA. movement. He will therefore require a Westinghouse 10 mA. instrument rectifier for his meter. The makers quote 0.9 v drop for this rectifier for 10 mA. F.S.D. on ranges above 10v. It will be seen that for higher ranges the error due to this 0.9 v. drop can be neglected for most practical purposes.

Unfortunately, these rectifiers do not have a linear characteristic on low voltage ranges, and for the 5 v. range suggested by "Puzzled" it would be necessary either to calibrate an additional scale for this or to step up the voltage to, say, 50 v. with a transformer in order to preserve the linearity of the instrument scale.—W. E. THOMPSON (St. Leonards-on-Sea).

Television in Belgium

SIR,—As I wrote to you a year ago, I have been receiving here regularly the sound of Philips' experimental television transmission from Eindhoven (well over 50 miles) with your "VHF-adaptor." Encouraged by these results, I decided to build a complete television receiver. I obtained a R3170A receiver plus an indicator unit 6 from a firm advertising in your magazine, around which I built the receiver.

I added to the four-stage I.F. part an extensive three-stage H.F. amplifier with the new EF42, and a two-stage V.F. amplifier. Time-bases with EF50's in transitron. The sound is in F.M., I.F.-amplifier with 3 x EF42, and a normal limiter-discriminator circuit.

Reception of Eindhoven is really perfect, although I use only an *indoor* aerial, a half-wave dipole, *without* reflector!

With separate H.F.-part, equipped with grounded-grid triodes (CV66), reception of the B.B.C. is possible (some 200 miles!), although I must confess that reception quality is poor and only sometimes a "commercial quality" is obtained. Nevertheless, I hope to be able to erect soon a proper outdoor aerial (Yagi), which will give a considerable gain and make reception more comfortable.

We here in the Benelux countries are ready to start with television, but are still waiting a governmental decision: whether 625 lines, or 405. Of course, 625 is better, but if we adopt 405 (as France does) we'll be able to exchange programmes with Britain (. . . and profit by the experience of the country which is still leading in the world for television technique!) Whatever resolution will be taken, let it be soon! We too want to profit by one of the finest inventions of the twentieth century!—KAREL KIESEL (Belgium).

Home-made Television Receivers

SIR,—With reference to Mr. David Wayne's letter in your December issue, I have found that the Miller time-base gives anything but a linear trace at low frequencies; this is revealed in no uncertain manner with the aid of an oscilloscope. I also found that cathode-coupled push-pull output, using a 6SN7, gave further distortion at frame frequency. After some "juggling" this drawback was overcome by feeding the sections of the 6SN7 through a small push-pull driver transformer (ex-Government) and using cathode bias to eliminate the slight non-linearity left.

The VCR97 I am using has cut-off on frame, but there is enough area left to give the required ratio "picture" (5in. by 4in., to be precise). Of course, if the tube was the other way round the usable area would be much smaller.—E. J. SOUTHWARD (Beckermet).

"High Fidelity"—Is It Worth It?

SIR,—There must be a large number of your readers interested in "high fidelity" who build, successfully or otherwise, some of the amplifiers or "Hi Fi" radios published in these pages.

I wonder how many are really successful and genuinely satisfied? It would be interesting to know how other readers have coped with what I have found to be quite a tricky problem. I built my first amplifier in the early 1930s. A nice job, with two P.M.202s driven from an A.F.5C and using 150 v. wet H.T., a P.U. which was heavier than a soundbox, and the famous Stentorian loudspeaker. I was very proud of that amplifier and enjoyed many an evening giving recitals to my friends with it.

Being a real enthusiast, I progressed as the years went on. A.C. was fitted in my house and I built bigger and better. When war broke out I was using a "quality" amplifier with a heavy crystal P.U. and a good 10in. speaker.

The war put an end to my dabbling, and the enemy even came and destroyed it all. But I started again when I came back. Things were difficult, but I picked up bits here and there, and with a couple of PX4s and N.F.B., quite a respectable speaker and quite ancient pick-up I "knocked up" something to be going on with until I could settle down to building the real thing. Our adverts. in P. W. soon began to tell us of lightweight pick-ups, speakers with frequency range something like 20 c/s. to 20 kc/s. and records which were really Hi Fi recordings, and we had articles and circuits galore.

Well, I got "cracking," read everything I could get my hands on, kept all the circuits, and collected all the parts—the best of everything—a lightweight pick-up, speaker with 20 c/s. to 20 kc/s frequency range, output transformer which weighs about 12 lbs., 1,000 v. smoothers—in fact, everything of the best. Plus some of the new F.F.R.R. recordings.

What a beautiful amplifier! I took infinite care to build a really good job. And what did I get?

Oh, beautiful reproduction; it seems absolutely flawless. But I just can't listen to it!

The scratch on new records is like tearing calico, and on some records it is a positive whistle at scratch frequency. So now I've got to go to the expense of building a pre-amplifier with tone controls to cut out the frequencies which I have gone to such trouble and expense to provide. It does seem illogical, doesn't it?

At Radiolympia I seemed to spend hours with experts and demonstrators, but I got no further forward. The pick-up experts, when they found it wasn't their P.U. I was using, said my pick-up had a peak at 7,000 c/s, and the loudspeaker experts, that my speaker had one at 9,000 c/s. I don't believe that, although it would account for my troubles.

I am determined not to wantonly cut all my "tops" off. So who can produce a pre-amplifier with non-resonant tone control which will cut out scratch and still leave me my Hi Fi reproduction? I've tried the usual bass lift and top cut circuits and they give me an output which compares very unfavourably with my pre-war amplifiers.—THOMAS BARKER (Norwich).

The Fidels

SIR,—I must commiserate with "Thermion" in admitting the non-possession of a quality receiver, and yet, perhaps, he is spared much anguish thereby; but surely there is still ample room for improvement even though, in his view, this desideratum is "already nigh perfect."

Although personally I have yet to experience this degree of perfection, I am still undeterred in my pursuit of this elusive quality.

Is it necessary to be in "two places at once" to judge whether or not the received sound (or noises, as he terms it) conforms more or less faithfully as transmitted when listening, say, to a voice that is familiar in the flesh?

I am, of course, disregarding recorded items, of which, to my mind, we get far too many.

However, I dare say you will, in due course, publish another quality receiving circuit which will, if I may tender a suggestion, be called "The nigh-perfect receiver."—WILFRID GARTLANDS (Highbury, N.5).

6K7 Pocket Receiver

SIR,—As I am continually travelling around the country, usually into "out-of-the-way" villages and during the dark evenings, I find "consolation" in PRACTICAL WIRELESS, and a small "6K7GT" set designed by F. G. Rayer. This set works everywhere, even amongst the mountains of Scotland, but the current consumption is "too hot." I use two cycle batteries in series, "800" Ever Ready, but these only last at most two hours. This comes a bit expensive at 2s. per pair of batteries.

I would now like to try another small set, but must definitely have one with less consumption, not only from the cost point of view but also to avoid the difficulties of carrying extra batteries or even obtaining them in some country places.

Having lost my earphones in a train, I have an ex-Air Ministry earphone having two bobbins of 810 ohms.—F. LINES (Stanmore).

Tuned Earth

SIR,—There must be quite a lot of S.W. enthusiasts among readers of PRACTICAL WIRELESS; are there any who have tried tuning the earth connection by putting a variable capacitor in series with it? I no longer have a S.W. receiver working, and so I am not able to try this experiment, but for some time it has seemed likely to me that earth leads could be electrically improved by this means. The disadvantages of longish wires ought to be offset at the resonant frequency and a much better path provided for the R.F. currents. This ought to be useful to sufferers from the ill-planned circuit which leads to body-capacity effects—but I don't know. I'd be very interested to hear of any practical experiences in this connection.—M. BAMFORD (Macclesfield).

Impressions on the Wax

Review of the Latest Gramophone Records

THE latest addition to the H.M.V. Record Library Series is a "complete" recording of "Faust" by a mainly French cast and chorus and the Royal Philharmonic Orchestra, conducted by Sir. Thomas Beecham, Bart. Sir Thomas shows the listener (as he showed the French artists taking part in this recording) that he understands "Faust" thoroughly. There are two omissions to note, first "Even Bravest Heart," from Act 2. This was put specially into an English production to give the great Santley a bit more prominence when he sang the role of Valentine. That has now become a custom in England, but it is not performed in France and this recorded performance follows the French custom. The Walpurgis Scene is also omitted mainly because this is usually left out of productions on account of difficulties of staging. Likewise the ballet music is omitted as this comes in the Walpurgis scene. It is issued on automatic coupling only, the numbers of the sixteen double-sided records being *H.M.V. DB.* 9422-37.

Kermesse scene: "Calf of Gold" on *H.M.V. DB*6964; Waltz: "Soldiers' Chorus" on *H.M.V. DB*6965; "Church Scene" on *H.M.V. DB*6966 and "Death of Valentine" on *H.M.V. DB*6967, are all selected excerpts from the above opera. They begin and end neatly and provide a short, interesting selection for those who do not want the whole opera.

"Harp of the Hills" and "Down Among the Dead Men" on *H.M.V. B*9844 is the second record by the Lyrian Singers who were featured in the B.B.C. "Welsh Rarebit" programme. They were formed in 1922, and are limited to 15 singers who are required to have first-class qualifications. A comment on "Down Among the Dead Men" is not out of place. Emphatically the song is not sung in this recording as you usually hear it. The arrangement is most striking.

"The Harry Lime Theme" and "The Café Mozart Waltz," played by the Café Vienna Quartet on *Columbia DB*2611, are two numbers from the film "The Third Man." It is likely that neither the humble zither player, Anton Karas, nor Carol Reed, the producer of the film, expected the naïve, quaintly attractive music by Karas to make such a successful début. "The Harry Lime Theme" is rapidly gaining ground as a popular number and is being played by dance bands. This particular recording captures all the nostalgic atmosphere of the picture. The instruments used are the electric guitar, electric Spanish guitar, Spanish guitar and string bass.

Variety

"Aladdin," by Jessie Matthews and the Columbia Pantomime Company on *Columbia DB*2621/2, is a topical recording for this time of the year. A splendid cast was assembled with Jessie Matthews playing Aladdin. Margaret Eaves is the Princess and Denis Noble the Emperor. The part of Widow Twankey is played by Charlie Penrose, who brings the comedy to the fore. He is ably assisted by Miriam Ferris as Mrs. Washee. Horace Percival is Abanaza, the wicked uncle, the same part he played in the West End pantomime last year, and the deep voice of the Genii emanates from Edward Dykes. Many of the artists coped with the various sound effects. They had a wonderful time and their enjoyment and enthusiasm is apparent when listening to these records.

Selections from the film "Look for the Silver Lining," played by Peter Yorke and his Concert Orchestra, on *Columbia DB*2615, is a medley of fine, old tunes, including "Time on my Hands," "Who," and, of course, "Look for the Silver Lining," which originally appeared in the 1920 show "Sally." The film recently released in London is based on the life story of the late Marilyn Millar, world famous Broadway actress and dancer.

The band of the Manchester Works of Fairey Aviation have made a recording of Mozart's "Sleigh Ride" and Batten's "Normandy March," both arranged by Wright on *Columbia DB*2609. This band which was formed only 12 years ago has covered itself with glory, winning top honours in the Belle Vue championships no less than five times between 1941 and 1949, while in Holland, at Hillegom and Aalsmeer, it secured international championship honours. The band is fortunate in having for its conductor the famous trumpet and cornet player Harry Mortimer.

One of the greatest names in show business, the ever-young Al Jolson, returns to the films again. He has recorded two numbers from the film "Jolson Sings Again," on *Columbia DB*2613. Accompanied by Guy Lombardo and his Royal Canadians, Jolson sings "Rock-a-bye Your Baby" and "April Showers." The film is not yet scheduled for showing in this country.

Dance Music

Woody Herman and his Orchestra have made a new addition to the Columbia Swing Music Series, with a recording of "Lady McGowan's Dream" on *Columbia DB*2597. This is by the composer of "Summer Sequence." The title is fanciful; there is no story. Again Ralph Burns, the composer, seeks to fuse modern jazz with the traditional European music.

Spike Jones and his City Slickers are as funny as ever in their latest recording of "All I Want for Christmas (is my two front teeth)" and "Happy New Year" on *H.M.V. B*9855. "Two Front Teeth" is all about a nosey child who, hearing a noise downstairs, slides down the banisters with painful results. After that, every time she tries to speak she whistles.

Harry Parry and his Octet have recorded, "I've Got You Under My Skin" and "Blue Acara" on *Parlophone R*3244. This record is issued in the 1949 Super Rhythm-Style Series.

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R.S.G.B. TECHNICAL PUBLICATIONS. "R.S.G.B. Bulletin" Monthly Journal; current issue 1/6, five recent back issues 2/6. "Valve Technique," 104 p.p., 3/9; "V.H.F. Technique," 96 p.p., 3/9; "Microwave Technique," 68 p.p., 2/3; "Transmitter Interference," 32 p.p., 1/6; "Service Valve Equivalents," 32 p.p., 1/3; "The Transmitting Licence," 32 p.p., 1/-. Prices include postage. RADIO SOCIETY OF GT. BRITAIN, 28, Little Russell St., London, W.C.1.

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MAINS TRANSFORMERS, fully interleaved and impregnated. Primaries, screened. 200-250/v., 50 c.p.s.; midget upright-mounting type, 3-2½-3ins., 250-0-250v., 60 m.a., 6.3v., 1.5a., 5v. tapped 4v., 2a., **16/9**; Standard drop-through type, 250-0-250v., 60/70 m.a., 6.3v., 3a., 5v., 2a.. **12/11**; Fully Shrouded types. 425-0-425v., 200 m.a., 6.3v.-4v., 4a., C.T., 6.3v.-4v., 4a., C.T., 5v.-4v., 3a. **41/6**; 350-0-350v., 150 m.a., 6.3.v., 4a., 5v., 2a., **27/6**; 350-0-350v., 120 m.a., 6.3v.-4v., C.T., 3a., 5v.-4v., 2a., **25/-**; 350-0-350v., 100 m.a., 6.3v.-4v., 3a., 5v.-4v., 2a., **21/6**; 250-0-250v., 80 m.a., 6.3v., 6a., 5v., 3a. (for 1355 conversion, **22/9**; half-shrouded drop-through types, 350-0-350v., 80 m.a., 6.3v., 3a., 5v., 2a., **15/9**; 350-0-350v., 100 m.a., 6.3v., 3a., 5v., 2a., **19/9**. Electrolytics, Can 8-16 mfd., 450v., **3/3**; 16-16 mfd., 450v., **3/9**; 16-32 mfd., 350v., **2/11**; 32 mfd., 350v., **1/9**; 8-8-8 mfd., 400v., **2/9**. Selenium Rectifiers, 120-0-120v., 40 m.a., **1/3**; 12v., 4a., H.W., C.T., **1/3** ea., **11/9** doz.; 250v., 65 m.a., **3/9** ea. Chassis (Receiver), 16 s.w.g., undrilled aluminimum. 10-5½-2in., **3/3**; 11-6-2½in., **3/9**; 12-8-2½in.. **4/3**; 16-8-2½in.. **5/3**. Brand new ex-Gov. Valves. EA50, 8D2, 2/3 ea., 3 for **5/9**; EF50 **4/-**; SP2. 6J5GT, 6K7G, 6C5G. **4/11** ea., 3 for **14/6**; 6SH7. **2/3** ea., 3 for **5/-**; KTWG62, KTW61, 5U4G; 5Z4 (Met), **5/9** ea., 3 for **16/-**; 6V6G, 6J7 (Met), 6K7 (Met), 6SN7GT, 6X5GT, **5/11** ea.; 6K8 (Met), 6V6 (Met), 6F6G, **6/6**. Send 2½d. stamp for full bargain list of spares. Special list for trade. All new guaranteed goods. C.W.O. or C.O.D. over £1. Postage extra under £3. RADIO SUPPLY CO., 15 Queen Square, Leeds, 2.

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TYPE 165 AMPLIFIERS.—2-EF36, 2-EL32, EBC33, etc., with circuit, **18/6**, or less valves, 5/-. Type 25 Receivers: 2-EF39, 2-EF36, EK32, EBC33, etc., with circuit **23/6**, or less valves **7/6**, Valves (guaranteed): EK32, EF36, EF39, EBC33, EL32, 6J5GT, 6SN7GT, **4/-**; IT4, 6K7G, 6Q7G, 6V6G, **5/-**; 6K8M, 5Z4M, 6J7M, **6/6**; KT66, 35L6, 35Z4, **8/6**. Many other bargains. Postage and lists free. ELECTRAD RADIO, 64, Gt. Victoria St., Belfast.

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XMAS GIFT OFFER to "P.W." Readers.—To all purchasers of the new, super Collaro RP49 A.C. Mixed Auto-Changer, finished in hi-black and chrome and fitted with hi-fi crystal pickup, repeat and reject mech., price **£14/6/8** carr. paid, we present any two records of your choice! Send your order promptly! Fully guaranteed. The Collaro AC47 centre-drive Gram. Motor with variable speed and 12in. non-magnetic turntable, ideal for moving-coil pickups, etc., price **£5/18/4**. The Collaro AC504 Gramophone Unit—Motor, Pickup (latest magnetic type) and Autostop, fixed speed (78 r.p.m.), 10in. turntable, price **£5/3/2**. Collaro AC506 Gramophone Unit—as 504 but variable speed, centre-drive and crystal pickup, price **£8**. 4-watt Quality Amplifier, 6V6 output with special neg. feedback circuit, pickup and tuner inputs. 2/3 ohms output (or to order), **£5/19/6**; Complete Kit, **£5/10/-**. Black crackle case, **15/-** extra if reqd. 12-watt Quality Amplifier, push-pull 6V6 output (3, 7.5 and 15 ohms), neg. feedback, gram., mike and tuner inputs, price **10 gns.**; complete kit, **£9**. Available in super black crackle cabinet, **£2** extra. No. 1 High Quality Tuner, T.R.F., infinite impedance detector, M. & L. waves, excellent reports from "Williamson" and "Leak .1" amplifier users, **£5**; complete kit, **£4/10/-**. Immediate delivery of all above items. Terms C.W.O. or C.O.D. any amount. P.W. Bargain List 2½d. Please note new address: NORTHERN RADIO SERVICES, 16, Kings College Rd., Swiss Cottage, London, N.W.3.

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ACCUMULATORS.—Dagenite, 2v. 16 A.H. multi-plate, unspillable: price **8/6** post free. FREEWILL RADIO, 219, High St., Tooting, S.W.17.

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The Council invite offers for the establishment within the City of a radio relay and television re-diffusion system, subject to the persons submitting offers being in a position satisfactorily to demonstrate that the system would be capable of being operated in a sound manner.

Offers, giving technical and financial details, should be sent to the undersigned so as to reach him by Monday, 2nd January, 1950.

L. O. NEED, Town Clerk.
Guildhall, Gloucester.

TUITION

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Practical Television

Vol. 2. No. 1 NEW SERIES JANUARY, 1950

Televiews

"FAR from the B.B.C. being short of money for the development of television or for broadcasting in general, if we look at the last published accounts presented to Parliament" we find that there is a sum of £2,348,172 unexpended balance on capital account, so there is no question of shortage of money." That is an extract from the speech of the Assistant Postmaster General in the House of Commons on July 30th, 1949.

In the "Glasgow Herald" dated September 7th, 1949. appeared the following: "There has been no question of any necessary finance being withheld by the Government from the B.B.C. . . . For the periods after the end of this year no bar has been imposed on television expansion, although the whole B.B.C. capital programme has been subject to a slight cut."

These two statements illumine the criticism of B.B.C. television policy. Mr. C. O. Stanley, C.B.E., in a recent speech to the British Institution of Radio Engineers, in referring to these statements said that he thought that the question of capital expenditure restriction is only an excuse from a Government point of view. If it can afford to spend millions of money on the new Brabazon and on the National Theatre, it can surely afford the comparatively small amount we need for television stations.

Mr. Stanley had some severe criticisms to make of the Television Advisory Committee. He thinks its composition is wrong and that while there are some good people on it, there are many others who are merely ciphers or stooges. "The Chairman has many other duties, so is absent a great deal. The T.A.C. operates very closely with the G.P.O. and industry's attendance at meetings always gives us the impression that the G.P.O. dominates the situation. When the T.A.C. did send forward a report to the Postmaster General, he obviously had to rely on his experts to advise him, but these were the very same experts who had rubber stamped their own policy in the Television Advisory Committee, so the thing was a shallow set-up that did not mean anything."

The objects of the T.A.C. were: *To co-ordinate and, where necessary, to initiate research and to give guidance, without discouraging individual effort, to seek expert opinion freely, and to do its utmost to promote goodwill between all concerned. To encourage pooling of patents and their use in the national interest. To watch all developments of Television at home and abroad, including its use for cinemas, bearing in mind the importance of export trade and the desirability of the adoption of international television standards.*

A part of the Hankey report reads: "*Initially, the programme should provide for the establishment, as soon as practicable after the reinstatement of the service in London, of television services in possibly six of the most populous centres in the provinces, the selection of the centres and the order of provision of the services being left for consideration by the Advisory Committee in the light of the technical and other relevant conditions prevailing at the time.*"

The report went on to say that it was hoped it would be found possible to provide a service from a television station in the Birmingham area within about a year of the re-establishment of the London service. That report was issued in 1943!

Reviewing these statements in the light of developments to date it is obvious that little has been done to implement them. Members of the committee rely rather too much upon reports instead of going to other countries and watching developments there.

The report said that there was general agreement in the evidence taken by the Committee that: "the first step towards building up an export trade is to provide television at home and to show the world that as a nation we have become television conscious and have in being a service —available in the provinces as well as in London—of a standard that meets with the approval of the British public. A flourishing home market in television receivers is an essential pre-requisite of export trades."

This report, like so many others, expresses pious hopes, but relies upon luck.—F.J.C.

Telenews

Duodecal Base C.R. Tubes

THE first Mullard television tubes in the new duodecal base are now coming off the lines. Production is limited at the moment and it will be some time before a complete change over to the new base will be accomplished.

The principal feature of the duodecal base is the large diameter spigot which accommodates the exhaust stem, and this offers very important advantages in manufacture.

Aerial Decision

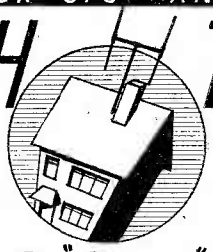
GRANTHAM Town Council have reconsidered their decision banning the use of television aerials on council houses. After considering various reports they have agreed that aerials may be used but must be on masts, and not attached to chimney stacks.

R107 and Interference

IT is reported that Mr. A. J. Hudson, BRS17511, has found that the oscillator section of the ex-Government receiver type R107 can cause interference to television reception at distances of the order of 400 yards. In a number of cases harmonics up to the fifth have proved troublesome.

TELEVISION PICK-UPS AND REFLECTIONS

UNDERNEATH THE DIPOLE



By "Scanner"

"TELEVISION'S Challenge to the Documentary Film" was the provocative title of a recent debate organised by the British Film Academy. The speakers, Andrew Miller Jones and Robert Barr, and the chairman, Mary Adams, were all from the B.B.C., and the audience of film producers and technicians were given some idea of the trends of development of television presentation. "The recorded programme is second-hand material on sound radio, lacking the sparkle and impact of studio transmission," said Miller Jones. "This effect is even more marked with television; filmed plays or documentaries lack that spontaneity which is so important to our medium." Robert Barr admitted the convenience of the motion picture film for recording scenes out of range for the normal television relays, for bridging gaps and providing linking shots between studio scenes. But he, too, seemed preoccupied with the importance of maintaining direct transmissions as much as possible. Both speakers paid tribute to the highly developed documentary film, emphasising that the television medium was still "in its infancy" and that they were learning a great deal from their film colleagues.

Question Time

WHEN question time came round, the chairman and speakers were surprised by indications of disagreement from the audience. Harry Watt, famous director of the Australian film "The Overlanders," satirically deprecated the inferiority complex of the B.B.C. men as regards their own medium and also film documentaries. "Don't slavishly imitate the documentary film of to-day, which hasn't progressed at all for the last five years!" he said. Speakers from the audience thought that if the film record could be transmitted with a quality equal to, or better than, the direct studio transmissions, the viewing audience wouldn't care whether it was direct or "canned." This point of view was supported by a visitor who said that the most important sponsored television programmes in America were filmed and not transmitted direct, with the exception of news and sporting items.

A New Technique

THERE is a great deal to be said for both points of view. On the one hand, the pre-filming of staged television presentations permits an improvement in general polish of production, with a flexibility which allows for a certain amount of editing and "tightening up" before being transmitted. But the methods of production must follow the style already successfully established for the "direct" television play rather than the film. Technical qualities of recorded sound and photographed picture have improved very rapidly, and the time is not far distant when it will not be possible to detect the difference, shot for shot. Direct studio transmissions force the actual "production" into a limited space of time, but a considerable period is also occupied with detailed preparation and rehearsals. In my opinion, costs will be the ultimate factor; and these are determined by the total time spent by the producer and his actors either in preparation for one "large chunk" of transmission or, on the other hand, in obtaining a better performance in a series of filmed scenes of five or 10 minutes' duration. The latter is favoured in America, largely because of the great number of television stations—and a similar view may prevail when we have five or six transmitters in various parts of the country. Reproduction of filmed sequences has been found to be of better quality than relays over long land-lines of direct studio transmissions.

T.V. Laughs

VISITS by the outside television units to theatres have not always been successful. One is conscious of shortcomings of acoustics, scenery and lighting; and the broad mannerisms of the stage players seem unconvincing compared with the quiet restrained technique of the television studio. But the transmission of "Lady Audley's Secret" from the Bedford Theatre Camden Town was in quite a different category. This play was put on in the same manner as it was when it was first produced in 1862, with all traditional artifices of the theatre of that time, including stage whispers of terrifying volume and "asides" to the audience. It must be immediately admitted that the large audience at the Bedford responded nobly to these confidences, and played their own part by hissing the villainess and cheering the hero. Obviously, they enjoyed themselves and contributed largely to the enjoyment of viewers. This is a specialised type of humour which could not be put over in a better setting, and Peter Dimmock, the B.B.C. producer, is to be congratulated on getting plenty of fun out of John Pernose's amusing production.

Another play which provided laughs—but this time unintentional—was L. A. G. Strong's story of a film company in an Irish village, "The Director." The spectacle of a film director giving contracts to "local talent" men and women for principal parts in a serious picture, after the flimsiest of "film tests," was absurd, to say the least. But viewers who know only the rudiments of photography must have been shaken when the solitary cameraman of the play retired to a temporary dark room (converted from a hotel snug), and appeared a short time later with prints of the tests, presumably sound and picture, already synchronised, for showing in an improvised theatre which was off-stage! The B.B.C. television producers should

remember that there are many film men in their audience, and should take a little more care with detail. But in this case, any man-in-the-street who is a regular cinema-goer or reads a film journal would not believe some of the fantastic doings of "The Director."

The Circus

IT must be admitted that the transmission of Billy Smart's New World Circus from Woodford was not a technical triumph. But the show itself was good, and the kiddies loved it when it was repeated on a Sunday afternoon. The announcer, Wynford Vaughan Thomas, was the subject of a successful leg-pull by the circus clowns in the last item of the programme, "The Water Radio." A last moment change of positions by the clowns put the announcer in a favourable position for receiving the contents of a tank of water from inside the "Radio," followed by showers of sawdust. I must say that Vaughan Thomas played up to the trick very well indeed, and this fruitiest of old circus gags must have raised a lot of laughs in the house.

If the technical qualities of the picture were not up to standard, it was not through lack of light in the Big Top. There were no less than twenty-five kw. incandescent spot lights, apart from a few other lamps, in use. Billy Smart's own huge 200 kW. mobile generator was insufficient to supply electricity for the B.B.C. lights as well as the fairground and circus. So another huge monster of a mobile generator was used, capable of supplying up to 260 kW. of D.C. at 110 volts on a three-wire system. A Davey Paxman 400 h.p. Diesel engine coupled to a huge Siemen's generator did the job with ease, and without making too much noise.

Television Aerial Construction—1

Practical Details for Both the London and Midland Stations

By R. SHATWELL

ALTHOUGH much technical data has been written on the subject of television aerial construction, little of a practical nature is available for the amateur embarking on experimental television work, and in spite of recent reductions in the prices of such aerials, the expense is considerable, particularly when the opening of a station in the vicinity at a later date renders the experimental aerial obsolete.

The dipole and reflector, or H type aerial, is the most generally useful, and even on fringe areas is capable of good results and the construction of this type will be the subject of this article. As a matter of interest, this aerial is giving a reasonably good picture in the centre of an industrial town in the Manchester district, the 1 kilowatt test transmissions on the Sutton Coldfield frequency being received daily on a home constructed television receiver with 2.5 Mc/s single side-band width, the aerial being temporarily mounted at such a height that the centre of the dipole is at roof height.

The cost of the aerial was 4s., the feeder, 15s., and the chimney brackets a further 4s. This was accomplished by buying the necessary metal from a scrap dealers, where it is sold by weight, the insulating material being bought from government surplus stores. Although this was drilled, the holes were, after assembly, packed with Bostik glazing compound.

Design

Dealing first with the technical side of the design, refer to Fig. 1. The length (a) is a function of the wavelength and is obtained as follows :—

(a) = 1.56 × M. (in feet) where M is the wavelength in metres. (Vision channel)

or

$$(a) = \frac{467.4}{f} \text{ (in feet)}$$

where f is the frequency in kilocycles. (Vision channel)

For all practical purposes this is 7ft. 6in. for Sutton Coldfield, and 10ft. 5in. for Alexandra Palace, and this is the total length of the two halves of the dipole element.

The reflector (b) should be slightly longer than the dipole, and is normally .51 of the wavelength. For the Sutton Coldfield frequency 7ft. 9in. is sufficient. For Alexandra Palace, 10ft. 9in. is suitable.

The dimension (c) is not quite so critical, and is usually fixed by mechanical considerations. The gain obtained by the use of a reflector is affected only slightly by variation of its spacing from the dipole between one eighth and one quarter of a wavelength, but since the curve depicting this gain slopes rather steeply below one-eighth there is more likelihood of "flutter," through vibration of the elements with one-eighth spacing. For Sutton Coldfield 4ft. spacing is both technically sound and mechanically easy, but the comparative spacing for Alexandra Palace is 5ft. 6in., and this increases both the weight and flexibility of the assembly. The loss in using 4ft. spacing for Alexandra Palace is not likely to exceed .5 decibel, and this spacing is therefore optional. The mast is centrally positioned.

Construction

Turning to constructional matters, (a) and (b) are of $\frac{3}{8}$in. dural or aluminium tube, (c) is of $\frac{7}{8}$in. tube, again dural or aluminium. The mast can be of wood or metal, but $1\frac{1}{4}$in. dural tube was used in the original model, a 10ft. mast being used. Aluminium should not be used on the Alexandra Palace aerial, as the greater size imposes a greater strain on all elements.

All the following dimensions refer to the Sutton Coldfield frequency. The changes necessary for Alexandra Palace are both simple and obvious.

First cut the tubing to size as follows :

2 lengths $\frac{3}{8}$in. diameter— 3ft. 9in. long.

1 length $\frac{3}{8}$in. diameter— 7ft. 9in. long.

1 length $\frac{7}{8}$in. diameter— 3ft. $10\frac{7}{8}$in. long.

Mast—not less than 1¼in. diameter and about 10ft. long.

Each end of the 7ft. 9in. length should be plugged with either wood, ebonite or aluminium, and one end of each of the 3ft. 9in. lengths similarly treated. The opposite ends of these two tubes should be cut as shown in Fig. 2, and drilled with a 9/64ths drill 1⅜in. from this end. An elongated ½in. diameter hole should be drilled and filled in the centre of the ⅞in. tube, as shown in Fig. 3.

The next step is to cut out the pieces of insulating material shown in the exploded view (Fig. 4). The best method of doing this is to cut out the pairs together, so that identical dimensions are assured. The holes in each set should be drilled with the four pieces clamped together. Note that in one set additional centre holes are required, and that these are smaller than the outer.

The two 3ft. 9in. lengths are then positioned and bolted with 4 B.A. bolts through the holes already drilled. There should be a ⅜in. gap in the centre between the ends and the cut away portion faces the front. Making sure that the tubes form a straight line drill the 7/64ths holes from the paxolin into the tube, and fix *one side* of each tube with a 6 B.A. steel bolt and nut, and file off any of the bolt projecting through the nut inside the tube.

The 7ft. 9in. length is then fixed centrally in the other set of paxolin insulators and after drilling through from the paxolin, bolted by 4 B.A. bolts, two only being necessary. This, the reflector, can now be fixed to the crossbar by 4 B.A. bolts, a ⅜in. gap being left between the reflector tube and the end of the crossbar. Fix by one bolt first, set at right-angles *exactly* and, tighten up this bolt before drilling the second. The elongated hole in the crossbar should be facing along the line of the reflector.

The dipole must now be similarly fitted at the other end of the crossbar, a ⅜in. gap again being left, but great care is essential to ensure that it is perfectly in line with the reflector as well as at right-angles to the crossbar.

The mast fitting is the next step. Two 16 s.w.g. plates of aluminium or light alloy, are used, with packing pieces of either metal or paxolin between them and the ⅞in. crossbar, to make up the difference between this and the mast. The run of the cable, shown dotted, makes it necessary to position the front fixing bolt off the centre of the crossbar. Four 2 B.A. bolts are used here and again care is essential to line up the mast with the aerial assembly.

The mechanical construction complete, the coaxial cable, which should be of 75-80 ohms impedance, must be fitted. In the original model 30 yds. were fitted, and has proved to be sufficient for most needs. It is necessary to remove the dipole element from the crossbar by removing the two 4 B.A. bolts passing through the crossbar, and also to remove the mast, leaving the fixing plates attached to the crossbar. The cable must then be threaded through the mast, and via the elongated hole through the crossbar, until a foot or two projects at the dipole end of the crossbar. Strip off about an inch of the rubber sheathing, and with a pointed instrument unpick the metal sheath up to the rubber. Twist this together and solder a 6 B.A. tag to it. Bare about ½in. of the inner conductor and solder a similar tag to this, taking care not to melt the insulation. These tags are now fixed to the dipole by means of the unused 7/64ths holes in the ends of the elements. 6 B.A. bolts are used, passing through the paxolin and elements. Since there are already nuts at the opposite side of the tube, the bolts must be cut to length first, leaving room for the tag and a 6 B.A. nut.

The inner conductor goes to the upper element and the metal sheath to the lower.

(To be continued.)

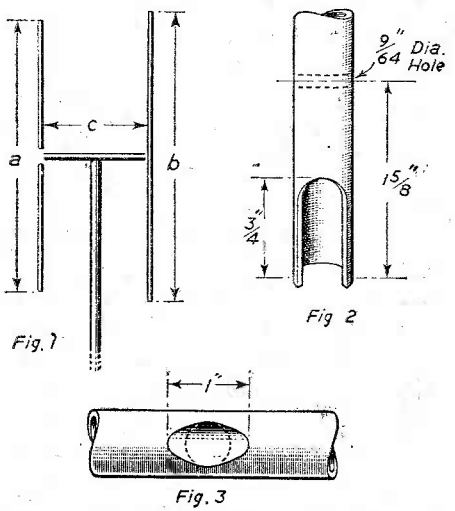


Fig. 1.—Standard "H" aerial with main measurements indicated. Fig. 2.—The lower ends of the aerial are cut as shown here. Fig. 3.—Centre of the cross piece.

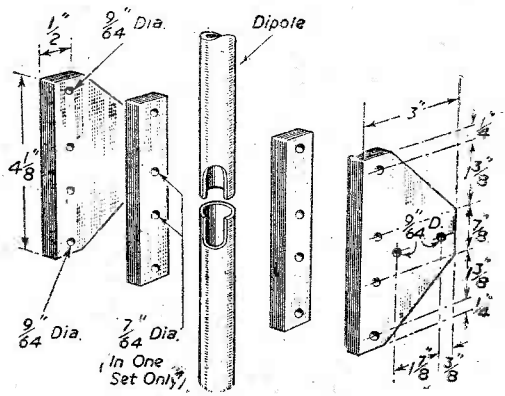


Fig. 4.—Essential details of the clamp. Two sets of these are required.

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1937 Crystal Receiver .. PW71*
The "Junior" Crystal Set PW94*

STRAIGHT SETS

Battery Operated

One-Valve : Blueprints, 2s. each.
Beginners' One-valver .. PW85
The "Pyramid" One-valver (HF Pen) .. PW93*
Two-valve : Blueprints, 2s.
The Signet Two (D & L F) PW76*
Three-valve : Blueprints, 2s. each.
Selectone Battery Three (D, 2 LF (Trans)) .. PW10
Summit Three (HF Pen, D, Pen) PW37*
The "Rapide" Straight 3 (D, 2 LF (RC & Trans)) PW82*
F. J. Camm's "Sprite" Three (HF, Pen, D, Tet) PW87*
Four-valve : Blueprints, 2s. each.
Fury Four Super (SG, SG, D, Pen) PW34C*

Mains Operated

Two-valve : Blueprints, 2s. each.
Selectone A.C. Radiogram Two (D, Pow) PW19*
Three-valve : Blueprints, 2s. each.
Double - Diode - Triode Three (HF Pen, DDT, Pen) PW23*
Four-valve : Blueprints, 2s. each.
A.C. Fury Four (SG, SG, D, Pen) PW20*
A.C. Hall-Mark (HF Pen, D, Push-Pull) .. PW45*

SUPERHETS

Battery Sets : Blueprints, 2s. each.
F. J. Camm's 2-valve Superhet PW52*
Mains Sets : Blueprints, 2s. each.
F. J. Camm's Universal £4 Superhet 4 .. PW60

SHORT-WAVE SETS

Battery Operated

One-valve : Blueprint, 2s.
Simple S.W. One-valver PW88*
Two-valve : Blueprints, 2s. each.
Midget Short-wave Two (D, Pen) PW38A*
Three-valve : Blueprints, 2s. each.

No. of Blueprint

Experimenter's Short-wave Three (SG, D, Pow) PW30A*
The Prefect 3 (D, 2 LF (RC and Trans)) .. PW63*
The Band-spread S.W. Three (HF Pen, D (Pen), Pen) PW68*

PORTABLES

Three-valve : Blueprints, 2s. each.
F. J. Camm's ELF Three-valve Portable (HF Pen, D, Pen) PW65
Parvo Flyweight Midget Portable (SG, D, Pen) PW77
Four-valve : Blueprint, 2s.
"Imp" Portable 4 (D, LF, LF, Pen) .. PW86*

MISCELLANEOUS

Blueprint, 2s.
S.W. Converter-Adapter (1 valve) PW48A*

AMATEUR WIRELESS AND WIRELESS MAGAZINE

CRYSTAL SETS

Blueprints, 1s. each.
1934 Crystal Set .. AW444
150-mile Crystal Set .. AW450

STRAIGHT SETS

Battery Operated

One-valve : Blueprint, 2s.
B.B.C. Special One-valver AW387*
Two-valve : Blueprints, 2s. each.
A modern Two-valver .. WM409*
Three-valve : Blueprints, 2s. each.
Economy Pentode Three (SG, D, Pen) WM337
PTP Three (Pen, D, Pen) WM389

Mains Operated

Two-valve : Blueprints, 2s. each.
Consoelectric Two (D, Pen), A.C. AW403
Economy A.C. Two (D, Trans), ... WM286
Four-valve : Blueprints, 3s. each.
All-Metal Four (2 SG, D, Pen) WM329
Harris Jubilee Radiogram (HF, Pen, D, LF, P).. WM386

SUPERHETS

Battery Set : Blueprints, 3s. each.
'Varsity Four WM395*

SPECIAL NOTICE

THESE blueprints are drawn full size. The issues containing descriptions of these sets are now out of print, but an asterisk beside the blueprint number denotes that constructional details are available, free with the blueprint.

The index letters which precede the Blueprint Number indicate the periodical in which the description appears. Thus P.W. refers to PRACTICAL WIRELESS, A.W. to *Amateur Wireless*, W.M. to *Wireless Magazine*.

Send (preferably) a postal order to cover the cost of the Blueprint (stamps over 6d. unacceptable) to PRACTICAL WIRELESS Blueprint Dept., George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

No. of Blueprint

PORTABLES

Four-valve : Blueprints, 3s. each.
Holiday Portable (SG, D, LF, Class B) .. AW393*

SHORT-WAVE SETS

Battery Operated

One-valve : Blueprints, 2s. each.
S.W. One-valver for America AW429*
Two-valve : Blueprints, 2s. each.
Ultra-short Battery Two (SG, det Pen).. .. WM402*
Four-valve : Blueprints, 3s. each.
A.W. Short-Wave World-beater (HF Pen, D, RC, Trans) AW436*
Standard Four-valver Short-waver (SG, D, LF, P).. .. .. WM383*

Mains Operated

Two-valve : Blueprints, 2s. each.
Two-valve Mains Short-waver (D, Pen), .. AW453
Four-valve : Blueprints, 3s.
Standard Four-valve A.C. Short-waver (SG, D, RC, Trans) WM391*

MISCELLANEOUS

Enthusiast's Power Amplifier (10 Watts) (3/-) WM387*
Listener's 5-watt A.C. Amplifier (3/-) .. WM392*
Harris Electrogram battery amplifier (2/-) WM399*
De Luxe Concert A.C. Electrogram (2/-) .. WM403*
New Style Short-wave Adapter (2/-) WM388

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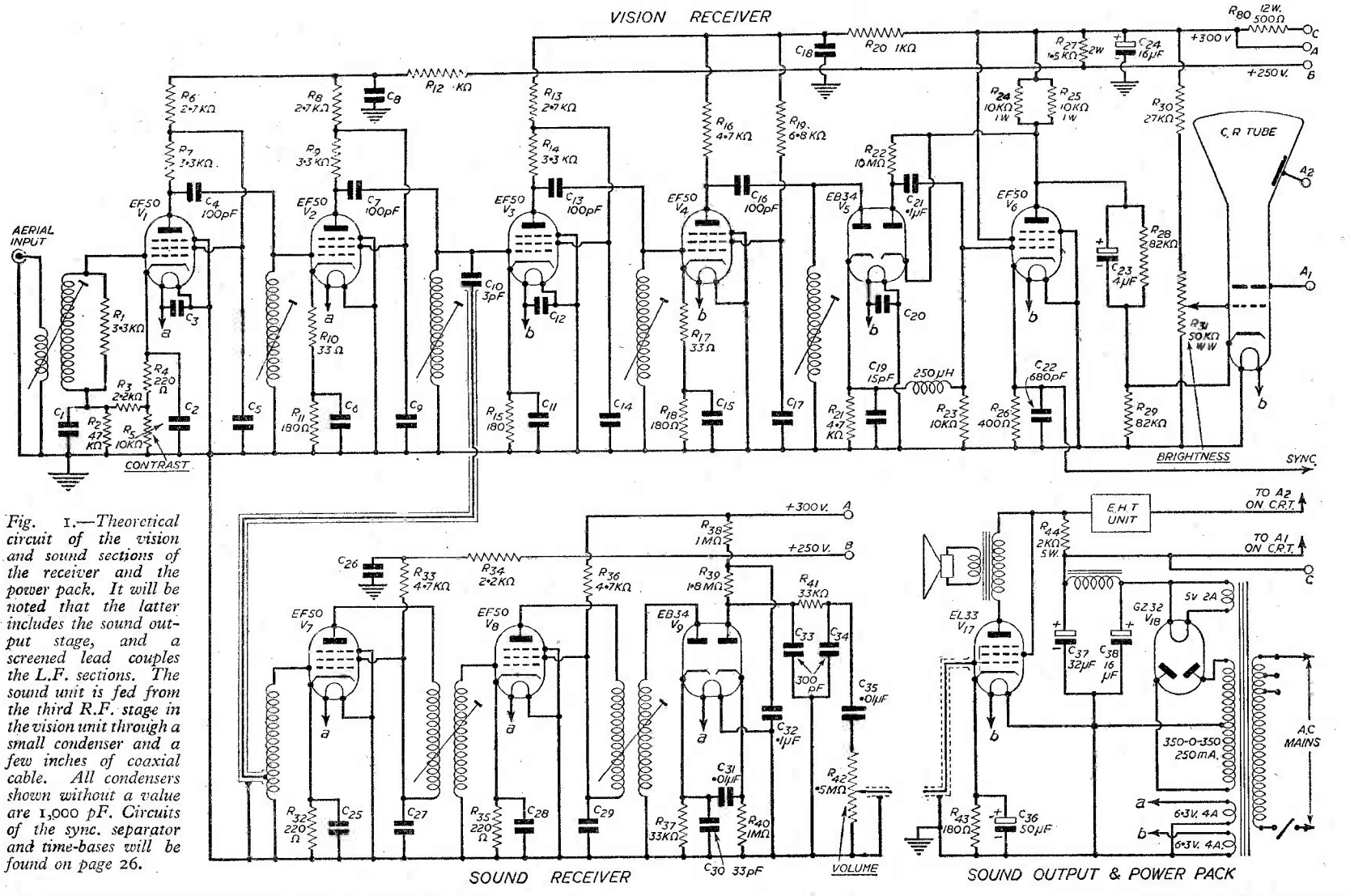

Fig. 1.—Theoretical circuit of the vision and sound sections of the receiver and the power pack. It will be noted that the latter includes the sound output stage, and a screened lead couples the L.F. sections. The sound unit is fed from the third R.F. stage in the vision unit through a small condenser and a few inches of coaxial cable. All condensers shown without a value are 1,000 pF. Circuits of the sync. separator and time-bases will be found on page 26.