

British

R A D I O A N D

TELEVISION

Incorporating "The British Radio Maker and Exporter"

Vol. IX No. 12

APRIL, 1955

By Subscription only,
15s. a year post free

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(P624B)

The PERFECT TEST TEAM



The illustration depicts a set of modern "AVO" testgear being used to measure the "Q" of the secondary winding of the second I.F. transformer on a chassis of unknown characteristics—just one of many tests which can be performed by this combination of instruments.

A signal of predetermined frequency from the "AVO" Wide Range Signal Generator is being fed into the Electronic Test Unit, where it is amplified and fed

to the secondary winding of the transformer. The Electronic Testmeter is connected across the tuned circuit under test and, from the readings obtained and the controls of the Electronic Test Unit, the "Q" of the circuit can be determined.

The three instruments, shown as a team, cover a very wide field in measurement and form between them a complete set of laboratory testgear, ruggedly constructed to withstand hard usage.



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As a "Q" Meter, it indicates R.F. coil and condenser losses at frequencies up to 20 Mc/s.
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This superb radiogram costs only **62 GNS**

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No. 28

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Incorporates BSS sense of tracking
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The popular TRUVOX Radio
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Broadcast Programmes.
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Plug).
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The Light Programme can now be
received and recorded with the new
SENIOR RADIO JACK which adds
the 1500 m. wavelength to the two
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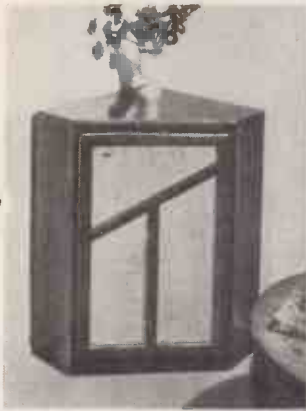
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TX1105

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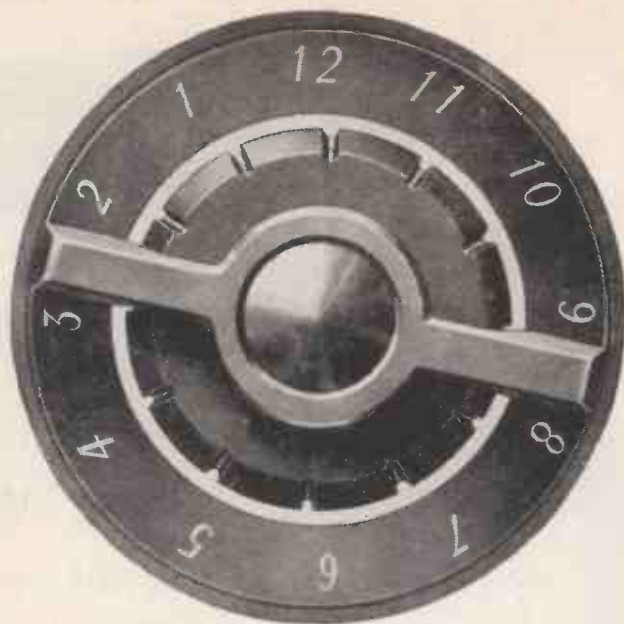
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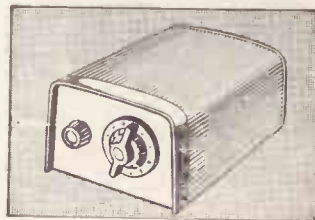
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We make no apology . . .

for returning to the subject of alternative programmes for the owners of 'English Electric' single channel receivers. We have already advised dealers of the production of Rotomatic Tuner units especially designed for every 'English Electric' single channel model. All of these units are factory pre-set and require no more than plugging in to give full coverage of all present and proposed transmissions.

If you want to be in the lead in satisfying the requirements of 'English Electric' television set owners, write now to:



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The ENGLISH ELECTRIC Company Limited, Domestic Appliance and Television Division, East Lancashire Rd., Liverpool 10

British
TELEVISION
1927-1955 "The British Radio Maker and Exporter"

Editorial and Advertising Offices:

92 Fleet Street, London, E.C.4

Telephone: CENTral 4100

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Test Reports: R71 Cossor 456 car radio; TV65 Peto Scott TV1411 series; Index to Volume 9 of "British Radio and Television." Annual Subscription to any part of the World 15s. post paid.



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An instrument of proved reliability which will accurately and rapidly check TV tubes for HEATER-CATHODE LEAKAGE, INTER ELECTRODE INSULATION, EMISSION, etc. Tests any component for insulation and resistance up to 50 megohms.

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Many tubes which would previously have been discarded because of low emission may now with this instrument, be reconditioned for a further period of useful service.

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Write to-day for information to

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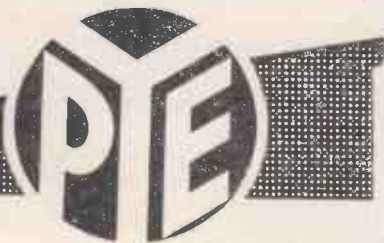
BLACK BOX DEMONSTRATIONS WIN NEW CUSTOMERS!



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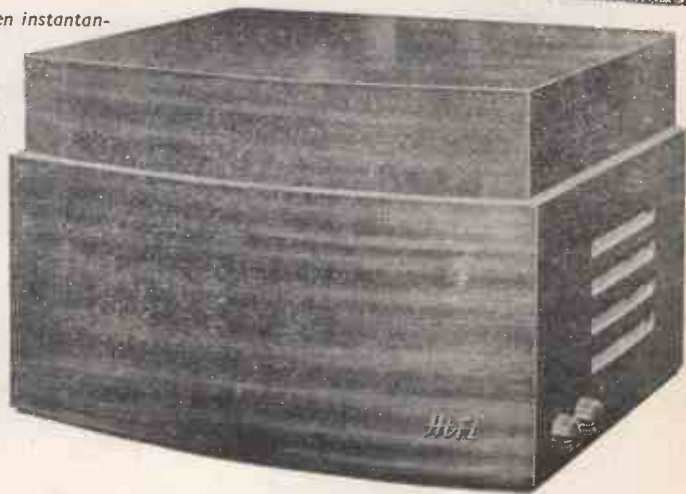
Demonstrations of the Pye Black Box in your own shop will undoubtedly make *your* sales soar. There's very little cost involved and it's so easy to do. If you *do* need help there are plenty of sales aids and assistance available from Pye Ltd., so write today.

Results of demonstrations so far have been instantaneous and most profitable to dealers.



Hi Fi

R E C O R D
P L A Y E R



P Y E L I M I T E D O F C A M B R I D G E

Tele-opinion

Ten Years of Progress

WITH this issue of *British Radio and Television* volume nine comes to an end. Next month the magazine starts on its tenth successful year of progress with more than ten thousand trade readers to underline the fact that our progressive and vigorous editorial policy has been the right one.

B.R.T. was born in May 1946 as *The British Radio Maker and Exporter*, but the title was soon changed to *British RADIO and Television*. The accent was on *radio*, for at that time television was still just a memory of pre-war experiments, and the future was unknown.

But *B.R.T.* has always kept a keen eye on technical progress, and it soon became obvious that the emphasis in the trade and industry was shifting unmistakably from radio to TV. So, without changing the title of the magazine, we too shifted the emphasis, and the magazine became *British Radio and TELEVISION*.

EXCLUSIVE

The need for a trade journal devoted exclusively to the specialised and highly technical field of radio and television has never been questioned, and it was the recognition of that need which was responsible for the birth of *B.R.T.* In Vol. 1, No. 1, published in May, 1946, we introduced the magazine as *an independent journal exclusively devoted to radio and television, a journal which does not dissipate its influence and interests by serving other associated industries.*

That we have successfully filled this need by providing a journal unique in style and coverage is more than emphasised by our continually expanding circulation, and, in consequence, the ever-increasing size of our issues.

UP-TO-DATE

Our aim has been, and still is, to provide accurate and up-to-date information of value to dealers and servicing men and others in the trade and industry, enabling them to keep abreast of developments in radio and TV techniques and to cope more easily with day-to-day problems in servicing. The past year has seen a 50 per cent increase in the number of servicing Test Reports we publish each month, and the establishment of an independent technical section dealing solely with servicing problems and circuit developments.

Articles written by specialist contributors cover new techniques from the point of view of the dealer, and as television expands so we shall continue to provide essential information on the increasing complexities of the medium.

In addition we are devoting more and more space to news and new products, presenting the latest topicalities and technicalities to our readers.

ECONOMICS

Times change, but so do production costs. Although the subscription price of *B.R.T.* has never been increased since its inception, the costs of paper and printing and engraving have soared; but in spite of this we have managed to go on giving increased service to our readers and advertisers. There comes a time, however, when the economics of publishing make it necessary to balance costs against income if progress is to be maintained.

Reluctantly, therefore, the directors of *British Radio and Television* have decided that *as from next month (the first issue of Vol. 10) the annual subscription must be increased to £1*—a more realistic figure in view of present-day production costs.

At £1 per annum—or 1s. 9d. per month, post free—*B.R.T.* is still the best value in trade journalism. The back-number value of the Test Reports in each issue alone is worth 2s. We are confident that our readers will recognise the need for this necessary increase in price after nine years at the lower rate of 15s.—a figure which has now become uneconomic.

With the increased subscription we shall, of course, be able to offer our subscribers an even better service. And, more important, we shall be able to promise a further ten years of progress, keeping pace with TV development as it occurs.

£1 - Starting Next Month

AS from the next issue of "*British Radio and Television*" (May, 1955) the annual subscription fee will be increased to £1. The new rate will apply to all new subscriptions received after April 30, and to all subscription renewals in respect of the May or following issues.

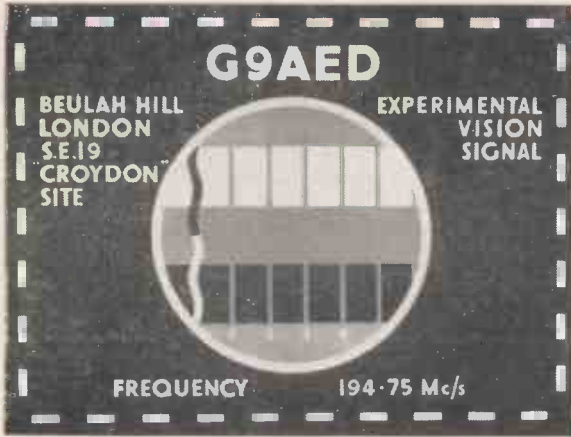


THEN—and NOW

THE shifting balance between radio and television during the past nine years is reflected in the heading design of *British Radio and Television*. When the magazine first started the accent was on radio, as is clearly seen in the reproduction of the cover title shown above. Later, television began to expand, and then to boom, and *B.R.T.*, keeping in step with changing conditions in the trade and industry, adopted the new-style heading shown below—with the accent on television.



ROUND-UP OF THE MONTH'S NEWS AND VIEWS



BAND III TEST CARD ON THE AIR

ITA-Belling-Lee
Band III Test
Transmissions
start this month

THIS new test-card will be seen on Band III sets in the London area this month. G9AED is the call-sign allocated to the Band III experimental transmitter for which the P.M.G. has issued a licence to Belling and Lee, Ltd. With the co-operation of the Independent Television Authority the transmitter and mast will be located on part of the same piece of ground as their temporary mast and transmitter. The site is actually named on the 1-in. Ordnance map sheet No. 170 as Beulah Hill, with a map reference 333696. Transmissions are due to commence on April 1.

The test card is primarily intended for the investigation of ghost images and provides the following features: (a) A wavy line in black and white, followed by white, grey and black. This line is wavy to differentiate from the vertical range marks. With ghost signals the wavy line predominates, and positive or negative ghosts can be identified. (b) Vertical lines numbered 1, 2, 3 and 4 indicating the additional path in miles that the ghost has travelled, *i.e.*, if the reflecting object is situated directly behind the receiving aerial, in line with the transmitter, the distance of the reflecting object is exactly half the extra distance travelled by the delayed image. (c) A circle to enable approximate linearity adjustments to be made to the receiver. (d) The black-and-white border to the card corresponds to the similar design on test card C and indicates the edge of the picture.

The "Belling-Lee" mast is a 75ft. self-supporting Skytower to which has been added a 16ft. top mast carrying the aerial system comprising four stacked bays, each of four vertical half-wave folded dipoles spaced equidistant. Thus there are 16 dipoles designed to give all-round coverage and, it is hoped, a power gain of four.

The transmitter which has been designed and constructed in its entirety at Enfield, has an output of 250 watts, thus the E.R.P. of the station will approximate 1 kW. The equipment will be housed in a temporary wooden hut measuring 24ft. x 10ft.

It is hoped to transmit between the hours of 10 and 12 and certain unspecified periods during the afternoon, excluding Saturdays, Sundays and public holidays. It should be appreciated that the equipment is just as liable to develop a "technical hitch" as is that used by other television services and that it has not been possible in the time to build stand-by equipment for every stage, so in the event of breakdown there will be a certain amount of unavoidable inconvenience.

E.M.I.—Capitol Conference

RECENT visits to the Hayes headquarters of E.M.I. during the past week by Glenn E. Wallich (President of Capitol Records Inc.) and Alan Livingston (Vice-President in charge of Repertoire) have marked a further stage in the consolidation of the mutual interests of these two big record groups.

Cordial discussions with the top E.M.I. executives have covered the general lines of future development on both sides of the Atlantic, with the close co-operation of the present executive direction of Capitol, which will continue unchanged. In particular, the worldwide search for new artists for the Capitol and E.M.I. labels will now be co-ordinated.

As the present licensee agreements for the distribution of Capitol records in the various markets reach the end of their term, new arrangements appropriate to both groups will be announced.

BAIRD DEVELOPMENT AND SERVICE AT BRIGHOUSE

BAIRD development is being transferred to Brighouse, Yorks, it is announced by the company. Component manufacturers' representatives are asked to note that all matters relating to development will now be dealt with by T. C. Isaac at Princess Works, Brighouse.

The Baird television service department is also being transferred to Princess Works, Brighouse. Baird tape recorders will still be serviced at Battersea.

EKCO SERVICE TROPHY WINNERS

RESULTS of the Ekco Service Trophy contest have been announced by E. K. Cole, Ltd. The silver mounted "soldering iron" trophy (illustrated), is awarded annually to the successful dealer in each of the five main television areas. In addition, the personnel of his service department receive supplementary prizes. The dealer is allowed to retain the trophy for one year, when it is replaced by a miniature replica which becomes his own property.

The entries were of a very high standard and E. W. Shepherd, service manager of E. K. Cole, Ltd., states that the vast measure of support given to the competition by Ekco dealers has underlined the importance of such a contest and has given this company added impetus to launch a similar competition in the near future.

Following are the five prize-winning Ekco dealers: London Area—Stanwood Radio Ltd., London, E.10; Midland Area—Jewkes and Co. Ltd., Birmingham, 1; Northern Area—Radio Equipment (Yorkshire) Ltd., Huddersfield; Scottish Area—Fairbairn Ltd., Ayr; Wenvoe Area—Red Dragon Radio and Television Service, Neath.

The following dealers are runners-up, having submitted very commendable returns: London Area—Woods Radio, London, S.E.25; Midland Area—Jolly's Radio Ltd., Great Barr, Birmingham; George Green (Leicester) Ltd., Leicester; Northern Area—Trojan (Radioelectric) Ltd., Wythenshawe, Manchester; Comet Radiovision Services Ltd., Hull; Scottish Area—Thomas Machell and Sons, Glasgow, C.4; Alexander Biggar Ltd., Glasgow; Wenvoe Area—Bourne Radio and Television Ltd., Upper Parkstone, Dorset; Enfield's Radio Services, Midsomer Norton, Nr. Bath.



FOR ALL IN THE TRADE AND THE INDUSTRY

**REGENTONE
£½M
SHARE
DEAL**



WILLIAM HARRIES, Chairman and Managing Director of Regentone Products, Ltd., has sold 51 per cent. interest in the capital of his company and its subsidiary companies, Regentone Radio & Television, Ltd., and United Components, Ltd., and its associated company, Radio Gramophone Developments Co., Ltd., to Lloyd's Packing Warehouses (Holdings), Ltd., for an amount exceeding £500,000.

Mr. Harries will remain chairman and managing director of Regentone, and the directors of the subsidiary companies are unchanged. They are: *United Components*—W. Harries, J. H. Williams, T. A. Robins, R. E. Izzard and C. P. V. Vaufrourard; *Regentone Radio and Television*—W. Harries and J. D. D. Noble; *R.G.D.*—W. Harries, J. H. Williams, T. A. Robins and W. F. Harries.

The policy of all companies remains unaffected by the transaction. Main reason for the deal is to safeguard Regentone and its subsidiaries from crippling death duties which, according to Mr. Harries, could amount to some £800,000.

Mr. Harries, who is 48 and reputed to be a millionaire, started assembling radio sets in a small way in 1936 when he sold his drapery business and bought 10 radio shops with the proceeds. During the war he bought Regentone Radio and made radios for the Canadian Army in a converted London garage. Eventually, a modern factory was built at Romford, Essex, and Regentone, from a virtually derelict concern, became a prosperous company with a turnover in the region of £3,000,000

The well-known firm of R.G.D. was bought by Mr. Harries in 1953.

Three more Thorn Factories

A 60,000 sq. ft. factory on the Pallion Estate near Sunderland has been acquired by Thorn Electrical Industries, Ltd., for the production of radio-gramophone cabinets for their Ferguson Division. It is expected that the new factory will provide employment for a further 200 people in one of the few remaining areas where unemployment still exists.

For the expansion of their Ferguson television production the Company has also acquired an additional factory in Great Cambridge Road, Enfield. A third factory at Uxbridge, Middlesex, is being taken over and will be used to expand production of special lighting fittings by the Company's subsidiary, George Forrest & Co. Ltd.

These three factories are in addition to new buildings which are in course of erection on nine acres of land recently purchased by the company at Enfield.

PYE-POLYGON AGREEMENT

PYE, Ltd., announce that they have formed an association with the Polygon Record Company. Alan Freeman is now conducting the business of the Polygon Record Co. (1954), Ltd., from 66 Haymarket, London, S.W.1. This is also the address of the Nixa Record Co., Ltd.

WOLSEY SERVICE DEPOT

WOLSEY Aerial Service have established an aerial installation service depot at 37 Bishopridge Road, Norwich, Norfolk, telephone Norwich 21166. The depot is the result of many requests from local traders.

Bulgin Phone Number

NEW telephone number of A. F. Bulgin and Co., Ltd., Bye-Pass Road, Barking, Essex, is R1Ppleway 5588, still with 5-line service.

RGD T-TEN RADIO

WE are advised by R.G.D., Ltd., that their model *T-Ten* radio receiver advertised on page 848 of the March issue of *B.R.T.* does not have a built-in aerial as stated, but has provision for an external aerial.

**ACCENT
ON
HI-FI**

London dealer opens new-style demonstration of hi-fi sound equipment



Picture shows bandleader Felix King at the control desk of the high-fidelity sound reproduction exhibition, inaugurated recently by Messrs. Arthurs at their showrooms at 150-152, Charing Cross Road, London. Designed to cater for the fast-growing public interest in high-quality reproduction, the project was an instant success and is now being continued indefinitely.

Open during normal shop hours (8 a.m. to 6 p.m.), the exhibition houses a comprehensive display of high-fidelity equipment which is ready wired up for instant demonstration, thus enabling prospective customers to select any combination of equipments for comparison purposes. The master switch panel controls no less than 12 different loudspeakers and eight amplifiers. There are 12 different record players and a good display of tape recorders.

Apart from the exhibition, special demonstrations are given every Saturday morning and afternoon and any weekday evening by special arrangement. Admittance to these demonstrations is by ticket only, available on request to the company.

Although the work involved in organising the exhibition was speculative, the response has far exceeded all expectations and the enterprise of Arthurs should be a spur to other dealers that the current interest in such equipment is worth cultivating. Such comparative demonstrations (in a "walk-around" atmosphere) are a sure means of breaking down sales resistance and creating additional opportunities.

We shall be at the

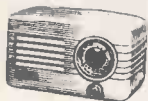
**NORTHERN
RADIO
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CITY HALL
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**MEET
US
ON
STAND
39**

EVERY ONE A WINNER

Champion MODEL 832 MINUET

Broadcast band receiver.
AC/DC Mains.

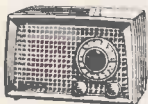


£9.5.0

(Tax Paid)
(£7.0.0 plus
£2.5.0 P.T.)

Champion MODEL 825 SERENADE

AC/DC Superhet L. & M.
Wavebands.



11½ gns.

(Tax Paid)
(£9.2.9. plus
£2.18.9 P.T.)

Champion MODEL 822 MAYFLOWER

Bty Portable L. & M. wave-
bands. Superhet.

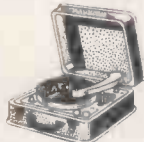


12½ gns.

(ex btys)
(Tax Paid)
(£9.18.9 plus
£3.3.9. P.T.)

Champion MODEL 805 REV-LER

3-speed Portable record
player with amplifier and
speaker.



14 gns.

(Tax Paid)
(£11.2.6. plus
£3.11.6. P.T.)

Champion MODEL 820 RADIO-REVLER

luggage type Portable 3-speed
radiogram. AC superhet. L
& M. wavebands.



26½ gns.

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(£21.1.3. plus
£6.15.3. P.T.)

Champion MODEL 830 BERKELEY

3-speed autochanger Table
Radiogram. AC Superhet
L. & M. wavebands.



33 gns.

(Tax Paid)
(£26.4.8. plus
£8.8.4. P.T.)

Champion MODEL 834 CURZON

Console 3-speed Auto-
changer Radiogram. AC
superhet. L. and M. wave-
bands.



45 gns.

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NEWS ROUND-UP

CONTINUED

New Recording Tape costs £1 per spool

A NEW magnetic recording tape with an exceptional performance has been introduced by Salford Electrical Instruments Limited, at an unusually low price. Sold under the trade name of *Puretone* for 20s. a spool, it is a paper-based material with an output and frequency response which compares favourably with those of plastics tapes costing almost twice as much.

The new tape is sold in lengths of 1,200ft. wound on specially designed plastics spools slotted to facilitate rapid threading, and other lengths of tape will shortly be available. The 1,200ft. reels give 32 minutes playing time at 7 1/2 in./sec. or 64 minutes at 3 1/2 in./sec. Twin track recording is also possible and this doubles the playing time; the tape can be used on all types of recorders.

The highest grade oxide with a particle size range from 0.5-1.5 microns, is used in the magnetic coating. The base, which is superior to that of many other paper tapes, consists of a high quality super calendered Kraft paper.

The coating has an unusually high-gloss finish, which, coupled with the addition of a lubricant, greatly reduces the friction and wear on the recorder heads. Intimate contact with the heads and improved high frequency response is thus ensured. On a typical recorder the response curve is substantially flat within ± 1 db over a range of frequencies from 50 c/s to 10 kc/s.

Puretone has the high tensile strength of about 6 lb./sq.in. breaking strain with a coercive force and remanence of 220 oersteds and 700 gauss respectively. The problem of static, the principle disadvantage of plastics-based tapes, is eliminated with this tape.



V. P. Cole, formerly with E. K. Cole, Ltd., and Vidor, Ltd., has joined Grundig (Gt. Britain), Ltd., as sales manager, and will operate temporarily from the Kidbrooke Park Road head office.

n.b.

As from the May issue the annual subscription for British Radio and Television will be increased to...

£1

SEE PAGE 875 FOR FULL DETAILS

E.M.I. Expansion in Electronics

CONSIDERABLE expansion of the activities of the E.M.I. group in the field of commercial and industrial electronics is indicated by the recently announced change of name of Emitron Television, Ltd., to E.M.I. Electronics, Ltd.

The new company will be a controlling and co-ordinating company absorbing as subsidiaries the three existing companies: E.M.I. Engineering Development, Ltd., E.M.I. Factories, Ltd., and E.M.I. Research Laboratories, Ltd.

It will be directed by a strong Board consisting of: J. F. Lockwood, Chairman of Electric & Musical Industries Ltd.; L. J. Brown, Managing Director of Electric & Musical Industries Ltd.; G. E. Condliffe, Managing Director of E.M.I. Research Laboratories Ltd.; C. Metcalfe, Managing Director of E.M.I. Engineering Development Ltd.; J. B. Stevenson, Managing Director of E.M.I. Factories Ltd.; S. J. Preston, Patents Division, Electric & Musical Industries Ltd.

E.M.I. Electronics, Ltd., will be concerned with the design, development and marketing of all electronic devices other than those for Government requirements.

Under W. C. Morgan as manager it will unify control of the existing and widely used E.M.I. electronic products such as test and measuring equipment, r.f. heaters, stroboscopic balancing and testing devices, industrial and broadcasting television equipment, film scanners, microwave relay links, klystrons, magnetrons and television transmitting tubes (including the famous C.P.S. Emitron), photo multipliers, etc.

Other fields with which the new company will be actively concerned cover the rapidly extending developments of "automation"—electronic computation; process, machine and factory control, in which research and design work are already well advanced.

Important progress has also been made in the field of colour television, and it will be recalled that demonstrations were given last October to the broadcasting authorities and the press of a new and simplified system of studio equipment suitable for compatible colour transmissions by any of the recognised broadcasting standards.

Soak test conveyor speeds

television production

AT the modern Romford factory of Regentone Radio and Television, Ltd., where large quantities of television and radio sets are produced each day, a new "soak test" conveyor has been installed to speed up the testing of television chassis before final assembly and despatch.

For the satisfactory testing of newly assembled television chassis, several hours of continuous operation are necessary since it is during this period that any faults in new sets are normally discovered by the purchaser. The ever increasing rate of manufacture at the Regentone factory made the stationary testing of assembled chassis for this period a drag upon the production line and the soak test conveyor has been introduced to speed up this part of the process.

Supplying electricity to the individual chassis whilst in motion presented a problem which has been successfully overcome by the use of miniature current collection arms running along hard-drawn copper bars.

Each bank of three television chassis is supplied via two of these miniature arms which are completely swivelling and are particularly suitable for installations of this kind, having been specially developed by British Insulated Callender's Cables Limited, who co-operated with Regentone in the design and installation of the current collection equipment.

To minimise the risk of sparking, which would cause unwanted interference to the sets, each miniature arm is fitted with a carbon insert slipper head. A feature of the electrical equipment is that multi-colour pilot lights are installed to give notice of any faults and to indicate which part of the circuit needs attention.

PYE HI-FI DEMONSTRATION VAN IN EDINBURGH

During his three-day visit to Edinburgh, to demonstrate and lecture on the Pye Black Box, Mr. Peter Craig-Raymond (at the wheel of the Pye van) stopped outside Edinburgh Castle to talk to Welsh supporters visiting the Scottish capital for the Scotland v. Wales Rugby International. Edinburgh was one of the places visited in the series of Black Box demonstrations that Pye are organising throughout the country during the next few months.

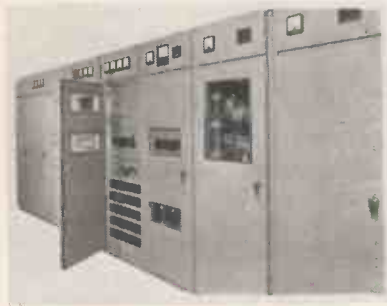


NEWS ROUND-UP CONTINUED

Crystal Palace TV Station

THE latest of a series of contracts signed between the B.B.C. and Marconi's Wireless Telegraph Co., Ltd., for equipment for the Crystal Palace television station, provides for the construction and erection of the transmitting aerial array.

This follows upon orders for the two vision transmitters, the two sound transmitters, control and monitoring equipment, two vestigial sideband filters, two combining units and the main transmission lines, work upon all of which has been in progress for some time at Marconi's.



One of the new 15kW vision transmitters made by Marconi W/T Co. for the B.B.C.

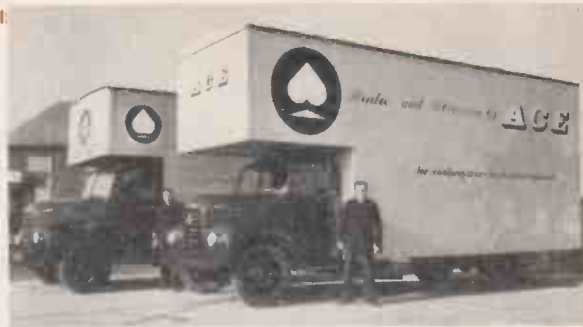
The Crystal Palace installation, which is to replace Alexandra Palace, will be the B.B.C.'s largest television station, and will incorporate the most modern transmission techniques. It is scheduled to go on the air early next year.

In the system planned for this station, the two 15kW vision transmitters and the two 4½ kW sound transmitters will be fed into one aerial. This will be accomplished by feeding the respective outputs from one vision and one sound transmitter into a combining unit, whence it is conducted by a common main transmission line* to half the aerial system. The remaining pair of transmitters will be connected in a similar manner to the other half of the aerial.

The two vision transmitters will thus be effectively working in parallel, as also will their sound counterparts.

*Footnote.—The essential function of a transmission line is to convey the power output from the transmitter to the aerial array at the top of the tower. As stated, at Crystal Palace two main transmission lines are required, each to carry the combined outputs of a vision and sound transmitter to one-half of the aerial. The length of each of these lines will be approximately 700 ft. (including the height of the aerial above ground).

NEW TRANSPORT FLEET FOR ACE RADIO



New additions to the Ace Radio transport fleet, commissioned in January of this year. The vehicles are Thames chassis, the smaller being a 30 cwt. diesel and the larger a 3-ton diesel employing the new Ford 4D type engine. The bodies are pantechnic in dimension to give maximum payload of current Ace models, and have a capacity of 750 cubic feet and 1,500 cubic feet respectively. Other vehicles will be added to the fleet during the year.

FERGUSON DESIGNER WINS SIGN CONTEST

FIRST prize of £100 in a competition sponsored by the Electrical Sign Manufacturers' Association has been won by John K. W. Hopgood, M.S.I.A., a member of the Ferguson Radio Corporation's Design Unit.

Contestants were supplied with perspective drawings of an imaginary factory building and were asked to design an illuminated sign display. Entries were judged by a distinguished panel representing architectural, town planning and

advertising interests, headed by Sir Hugh Casson, Kt., R.D., M.A., F.R.I.B.A., F.S.I.A. and marks were awarded for advertising value, architectural harmony, daytime appearance, practicability, etc.

The prize presentation was made at a luncheon at the Savoy Hotel last month, when the chief guest was Mr. William Deeds, MP., Parliamentary Secretary to the Ministry of Housing and Local Government.

New C.R.T. Tester at Mullard Glasgow Depot

A NEW equipment designed to test television picture tubes to laboratory standards was brought into operation recently at the Mullard Valve Service Depot, Glasgow. The equipment is capable of testing to the laboratory test specification all direct viewing tubes whether fitted with straight or ion-trap guns and the design is based on tube testing equipment used in the Mullard tube factories.

The design of the tester makes for ease of handling by the operator. For example, the tube can be turned from the vertical to the horizontal position for screen inspection by means of a low geared motor on pressing a button. Faults can be quickly located, however obscure and an accurate technical assessment of the trouble can be easily obtained which is invaluable to the central service organisation for statistical records and quality control.

The test procedure begins with a check on the insulation between electrodes, including a measurement of heater-cathode insulation, the voltages applied being in excess of those which occur under normal operating conditions in a television set. Next, operating voltages are applied and a raster is put on the screen. Adjustments are made to focus controls and, if necessary, to the ion trap magnet, and under normal brightness conditions the tube face is examined for screen uniformity and brightness under focused and de-focused conditions.



Characteristics of the tube, including emission, cut-off, stray emission, and gas current are now measured, and the tube is subjected to overload conditions to investigate arcing, brushing, and insulation breakdown. Readings are taken on 16 voltage and current meters of the wide scale type. Special key type switches ensure easy and reliable operation.

Elaborate safety precautions include the fitting of armour plate glass to the front of the tube screen, and automatic disconnection and short circuiting of the e.h.t. voltage when the tube is in a position to be handled by the operator. Safety switches automatically disconnect the mains when the rear doors of the tester are opened for servicing. Power packs and time-bases are built as separate units for ease of removal.

TWO MORE

MODELS OF PERFECTION FROM

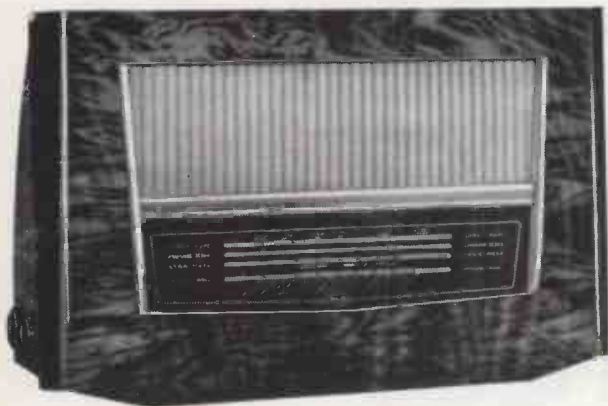


MODEL 1755T A magnificent 17-valve, 17" Table Television with 13-channel tuning and a 6½" speaker. New exclusive 'SYNCHROLOCK'. Fully automatic IMPROVED PICTURE CONTROL. Brilliant and correctly contrasted pictures. Permanent picture stability. Tinted screen. Negative feedback. Walnut veneered cabinet. AC/DC mains.

82 Guineas TAX PAID

List Price £64.8.1. Pur. Tax £21.13.11

Available to accredited dealers only



THE 'T-TEN' Handsome Table Radio Receiver. 5 valves, 3 wavebands, 6½" P.M. speaker, negative feedback, extension speaker and gramophone pick-up sockets. Walnut veneered cabinet. AC mains.

20 Guineas TAX PAID

List Price £15.18.0. Pur. Tax. £5.2.0.

The Aristocrat of Radio & Television

RENOWNED IN THE INDUSTRY FOR A QUARTER OF A CENTURY

RADIO GRAMOPHONE DEVELOPMENT COMPANY LIMITED, EASTERN AVENUE, ROMFORD, ESSEX.

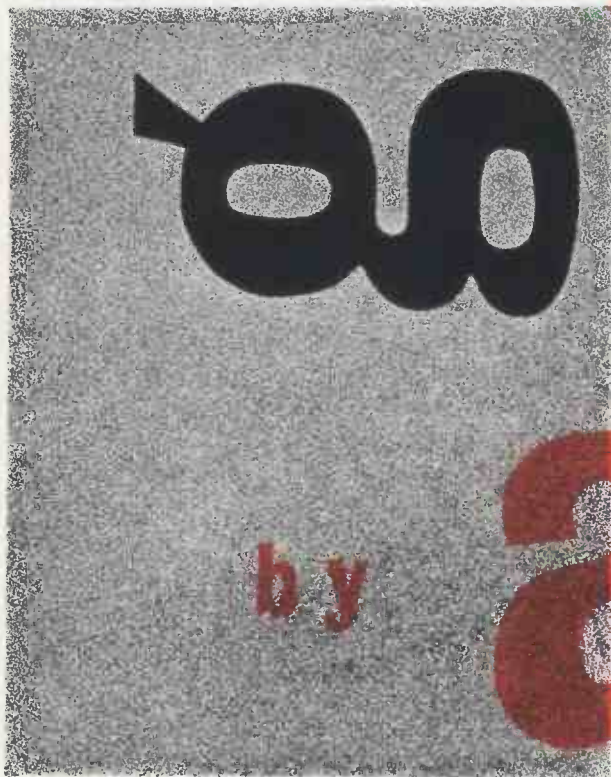


The TUDOR

AC Bureaugram

59 gns. tax paid

ACE began to specialise in radiograms in 1935.
 We've been making them ever since,
 each year's designs improving
 on those that went before.
 In 20 years we've learned to build them well—
 and to know a winner when we've got one.
 And this year we have two—
 and for appearance, performance
 and sheer value for money
 we've never done better!



grams

AC, Standard Cabinet 52 gns.
 AC/DC, Standard Cabinet 60 gns.
 AC, De Luxe Cabinet 55 gns.
 AC/DC, De-Luxe Cabinet 63 gns.

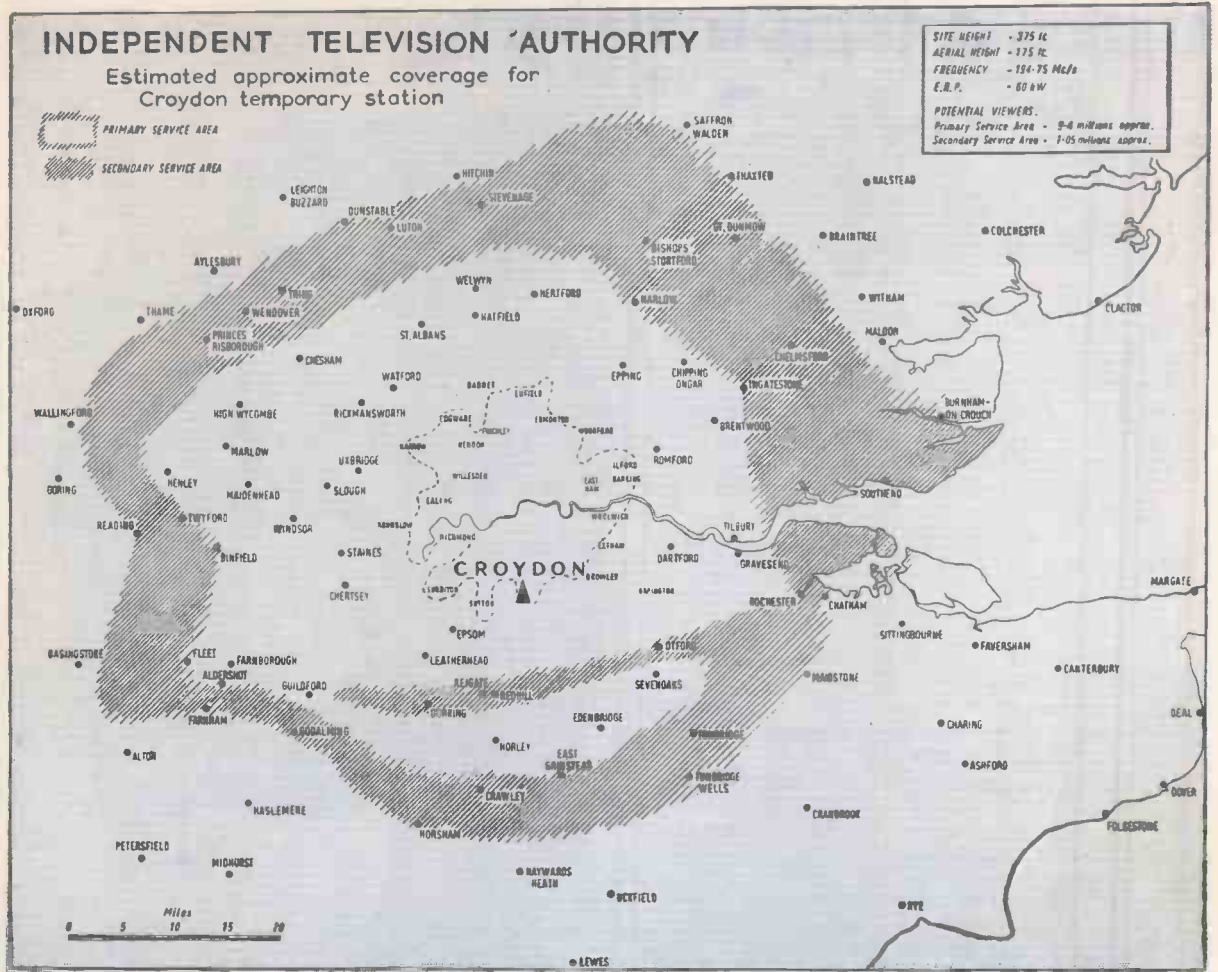


all prices include tax.

The ELIZABETHAN

ace

ACE RADIO LTD
 TOWER WORKS, TOWER RD. LONDON, N.W. 10



Ten million potential viewers in London Commercial TV Zone

MORE than ten million potential viewers will be within range of the first commercial television station when it opens at Croydton in the autumn. Of these 9.4 million will be within the primary service area and 1.05 million within the secondary service area. The map above shows the estimated reception zones based on a careful assessment agreed by the I.T.A., the G.P.O., and the radio industry.

The map shows that the estimated primary service area extends from the transmitter out to some 40 miles to the west (near Henley) and for about 35 miles to the north (near Hertford), but rather less to the east and south. The secondary service area extends out to nearly 50 miles to the north, west and east. To the south, however, because of the screening effect of the North Downs, the secondary service area extends out to only about 25 miles.

The present plan is that the temporary Croydton station should operate for about 18 months, by which time the I.T.A. hopes that its permanent transmitting station for the London area should be ready for operation. The permanent station will have a much higher mast and an effective radiated power of about three to four times that of the temporary station. This will extend both the primary and secondary service areas and give generally improved reception conditions. In short, no one receiving the transmission from the temporary station should be worse off and many people will be better off.

Copies of the map will be distributed to their dealers by many of the larger manufacturers together with information on receivers suitable for conversion for Band III operation. With this information it will be possible for dealers to advise customers and to make a start on the immense task of converting existing sets for new service. B.R.E.M.A. stress the importance of carrying out as many conversions as possible during the summer months to ease the pressure which is bound to occur once the Croydton station goes on the air.

It is expected that a signal strength of approximately 2mV will be available at the edge of the primary service area, and about 1/2mV at the edge of the secondary service area. At present there are about 1,160,000 TV sets in use in the primary zone and some 140,000 in the secondary zone, but this figure is steadily increasing.

Interference is not likely to be more troublesome on Band III although in certain cases the suppressors fitted to automobiles and electrical appliances for Band I purposes may not be entirely suitable for the new frequency band, and new components or modification of the fitting may be necessary. In fringe areas (i.e., beyond the shaded zone, where favourably situated viewers will be able to obtain reasonable reception) the highly directional nature of the aeriels required will result in ignition interference being of shorter duration.

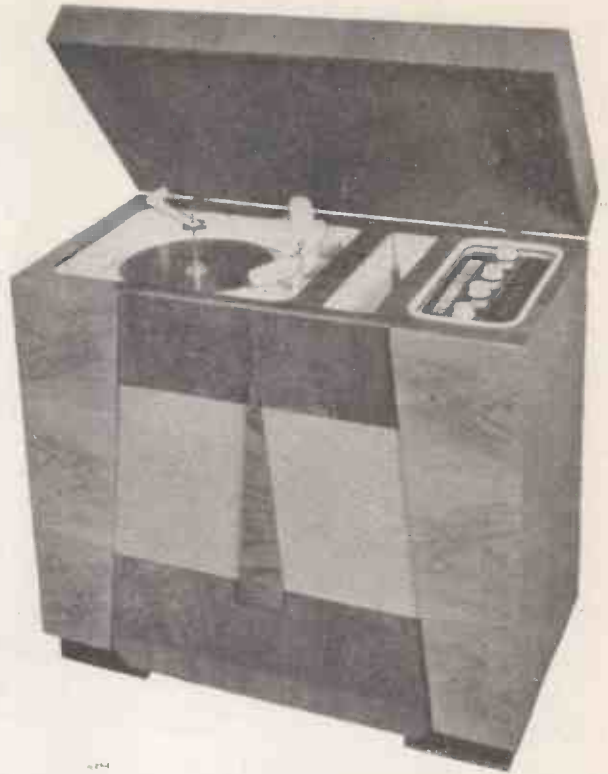
Most manufacturers are ready to market converters for their own Band I models, and certain firms are producing general-purpose converters for use with any make of set.

If it's a McCARTHY MC553G ...

...it sells!

AT ONLY **44** gns

Modern design, perfect performance and a sensible price sell these McCarthy MC553G Radiograms on sight and hearing. This 3-speed, 5-valve Radiogram in a beautifully finished, warm-toned walnut veneered cabinet has an irresistible popularity and steady demand. To ensure your supplies of this ever popular Radiogram, order NOW, for rapid turnover.



- ★ FULLY AUTOMATIC 3-SPEED RECORD CHANGER
- ★ NEGATIVE FEED BACK
- ★ 8in. LOUDSPEAKER
- ★ CHASSIS EASILY REMOVED FOR SERVICING
- ★ 200-250 VOLTS, 50 c/s. A.C. MAINS

Write now, to your distributor, for leaflet B.R.T. giving full details

- N.W. ENGLAND. Ernest Hathaway & Co. Ltd., "Sartor House," 37 Derby Street, Manchester, 8. Hardman & Co. Ltd., P.O. Box No. 23, Hardale House, Balllie Street, Rochdale. S. Hathaway & Co. (Liverpool) Ltd., 1/3 Pall Mall, Liverpool, 3.
- N.E. ENGLAND. Robert Hardman Ltd., 3 Queens Square, Leeds, 2.
- NOTTS. Robert Hardman Ltd., 3 Queen Sq., Leeds, 2. Mansfield Factors (Electrical Supplies) Ltd., 50 Stockwell Gate, Mansfield.
- LINCS. Mansfield Factors (Electrical Supplies) Ltd., 50 Stockwell Gate, Mansfield.
- MIDLANDS. S. Hathaway & Co. (Midlands) Ltd., 50 High Street, Henley-in-Arden. R. A. Poole (London) Ltd., Cox Street, Coventry. R. A. Poole (London) Ltd., 40-42 St. James Street, Cheltenham. E. A. Wood Ltd., 100 Aston Road, Birmingham, 6. E. A. Wood Ltd., "Eltic House," 61 Belgrave Gate, Leicester.
- KENT. H. E. Kettle Ltd., Knightbridge Street, Maidstone.
- SURREY AND SUSSEX. John Street Manufacturers Ltd., 88 Springbank Road, Hither Green, London, S.E.13.
- S. & W. ENGLAND. Robshaw Brothers Ltd., 105 Commercial Road, Bournemouth.
- REMAINDER OF ENGLAND AND WALES. Radio & Electrical Mantel Co. Ltd., Felgate House, Studland Street, Hammersmith, London, W.6.
- CHANNEL ISLANDS. Robshaw Brothers Ltd., 105 Commercial Road, Bournemouth.
- SCOTLAND. Bryterlite Electrical Co. (Glasgow) Ltd., 39-43 Robertson Street, Glasgow, C.2.
- N. IRELAND. Bryterlite Electrical Co. (Belfast) Ltd., 11 College Square, Belfast.

McCarthy radio

Manufactured by FELGATE RADIO LTD., FELGATE HOUSE,
STUDLAND STREET, HAMMERSMITH, LONDON, W.6.



The latest in Radio and TV Receivers and Accessories

MARCONIPHONE 2-BAND TV RECEIVERS

The Marconiphone Co., Ltd., Hayes, Middlesex

TWO new television receivers—a 14in. and 17in. table model respectively—are released by Marconiphone. Specifically designed for first-class reception of Band I and Band III programmes, they incorporate a tuner unit of the incremental inductance type with built-in coils for all 13 channels. This is an integral part of the chassis and therefore permits the channel selector and the fine tuning control to be mounted on the front of the cabinet. There is a single coaxial aerial socket catering for a combined Band I and III feeder.

Circuit features include: flat-faced aluminised Emiscope picture tube with inbuilt dark screen and special non-reflecting mask; frame flyback suppressor enabling full use to be made of the extended brightness range; stable preset p.m. focusing system; "sync cancelled" vision a.g.c. to counteract fading, aircraft flutter and differences in signal strength between Band I and Band III signals. This obviates major adjustments by the user when the set is switched from one band to the other.

Impulsive interference on vision is reduced by an adjustable "black spotter" type of limiter. An automatic suppressor circuit takes care of sound interference. For diathermy and similar kinds of interference there is a wide-range tunable filter which can be connected at will via alternative sockets for the feeder cable.

H.t. supply is from two rectifier valves instead of metal rectifiers. The 17-valve circuit has a high degree of sensitivity, designed to provide the best possible reception on both bands. Easily accessible controls for picture shift, squaring, linearity, etc., make for quick



The new Marconiphone 14in. table TV.



initial setting-up of the receiver. The tube is carried on the chassis and this can be easily removed as a complete unit if necessary. A number of test points have been provided and brought out to the back of the chassis for servicing measurements *in situ*.

These receivers operate on a.c. or d.c. mains voltages from 195 to 255 volts. Consumption is approximately 130 watts. Both models are housed in cabinets finished in walnut veneers. Prices: Model VT68DA (14in.) 66 gns. (tax paid); Model VT69DA (17in.) 79 gns. (tax paid).

H.M.V. 3-SPEED RADIOGRAM

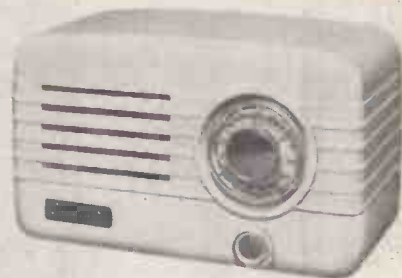
The Gramophone Co., Ltd., Hayes, Middlesex

TO meet the increasing demand for a compact, high-quality, inexpensive radiogram, the company have made their Models 1507 and 1508 portable 3-speed radiograms available at the competitive price of 32 gns. (tax paid). This move is timed to take advantage of the fact that the spring and summer months are the popular season for portable or transportable radios and gramophones.

NEW CHAMPION MODELS

Champion Electric Corporation, Champion Works, Newhaven, Sussex
ILLUSTRATED are two new instruments introduced by the company. Model 832—the *Minuet*—is a 4-valve t.r.f. radio for broadcast band, selling at the low price of £9 5s. (£7 plus £2 5s. purchase tax). The moulded cabinet is available in ivory, red, blue or green. A "Selectopex" dial is fitted and the receiver has an inbuilt aerial.

Model 834—the *Curzon*—is a console-type radiogram incorporating a



New models by Champion: the *Curzon* console radiogram (left), and the *Minuet* 4-valve t.r.f. radio receiver for broadcast band reception.

3-speed autochanger with high-fidelity pick-up head of the crystal turnover type. The radio chassis covers two wavebands: 195–550m. and 800–2,000m. and has floodlit "Selectopex" tuning. The receiver has a built-in Ferrite rod aerial and an extension socket for tape recorder, etc. Two record storage compartments are contained in the cabinet. Price 45 gns. (tax paid).

Both models are available through the usual wholesale channels.

NEW PLESSEY PRODUCTS

The Plessey Co., Ltd., Ilford, Essex.

A RECENT addition to the Plessey range of loudspeakers is a general purpose 15in. permanent magnet unit suitable for use in cinema and public address installations or as the bass reproducer in dual loudspeaker systems, in which full use can be made of its low fundamental resonance and smooth response.

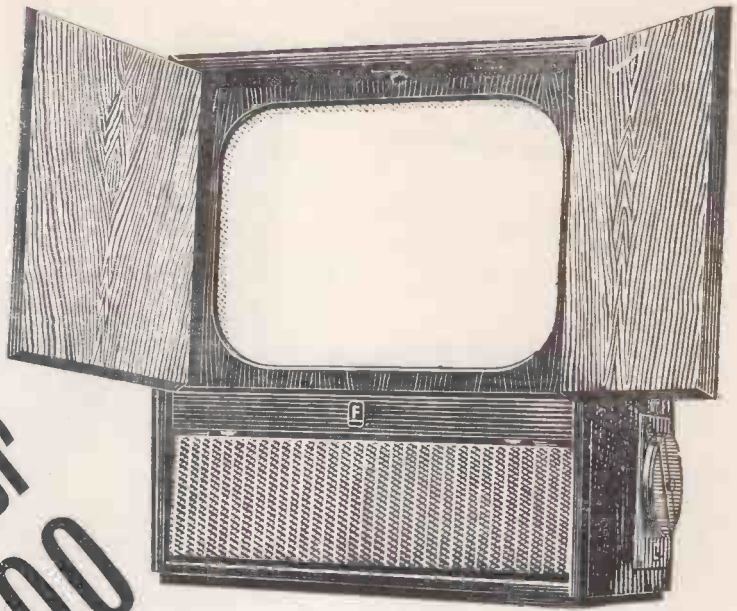
The loudspeaker is of robust construction and elaborate precautions have been taken to ensure consistent results under the most adverse climatic conditions.

The chassis, which is cast in aluminium to give great mechanical stability and is finished in an attractive crackle black enamel, holds a felt cone driven by a 2in. speech coil. This is wound on an aluminium former and protected against atmospheric action by a baked varnish impregnation. Additional protection is given by the outside suspension and moulded speech-coil dome, which excludes all dust.

The coil moves in a gap having a field strength of 15,000 gauss, energised by a permanent magnet giving a total flux of 228,000 lines. The bass resonance can be arranged to occur at any frequency between 30 and 60 c/s to suit individual requirements, while the useful high frequency response extends to 8 kc/s.

(Continued on page 887)

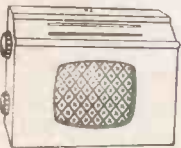
The
biggest
picture under
£100



MODEL 20T4 89 gns.

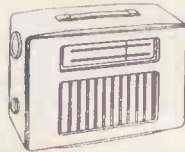
This Ferranti projection model with its 20" (diagonal) screen gives the biggest picture under £100. That's still the biggest news — sales news — in television today. We are continuing to take advantage of the fact in our national advertising — sales are

continuing to rise, as more and more customers ask for the 20T4. It's a 13-channel receiver. It has all the qualities of the most expensive set, but at a table model price. No wonder it's one of the most popular sets on the market.



MODEL 545 AC/DC
Transportable
17 gns.

MODEL 945 A.C.
Mains & Battery
Portable 19½ gns.



FERRANTI

CLEARLY FERRANTI FOR SIGHT & SOUND

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Please quote *British Radio and Television* when replying to advertisers' announcements



Continued

The speaker can also be supplied, at slight extra cost, with a velour surround to the cone in place of the paper corrugations. This results in reducing the resonance to 25 c/s with a smoother response characteristic.

Ceramic Capacitors

A new range of inexpensive ceramic capacitors, known as *Cascaps*, has been introduced by the company. The material used is of the barium titanate type, having high permittivity and dielectric strength, enabling miniature capacitors to be produced for operating at high voltages over a wide temperature range and used in applications where precision of capacitance is not of primary importance.

Cascaps are available in two basic types, one for purposes such as r.f. decoupling and the other for radio interference suppressors. By varying the composition of the ceramic, the capacitors can also be made suitable for special applications.

The normal types are constructed in capacitances ranging from 0.0005 to 0.01 μF , 500V d.c. or 300V a.c. working with a breakdown voltage of 4,000V d.c. and an insulation resistance of 10^{11} ohms. With these excellent electrical characteristics, a 0.005 μF capacitor measures only 0.664in. in diameter and is 0.187in. thick.

Since the miniature capacitors required in radio interference suppressors rated at 230V a.c. Class Y are required by BSS.613 to have a breakdown voltage of 2,760V a.c. or d.c., a special range of *Cascaps* has been developed with capacitances of 0.0005, 0.005 and 0.01 μF , to meet the requirements of Class X and of 0.0005 and 0.005 for Class Y. These are little larger than the normal *Cascaps*, the diameter and thickness of a 0.005 μF Class Y capacitor being 0.898in. and 0.135in. respectively.

EDITOR SUPER TAPE RECORDER

Tape Recorders (Electronics), Ltd.,
3 Fitzroy Street, London, W.1

AS announced last month, the company have introduced a new tape recorder, known as the *Editor Super*, retailing at the competitive price of 55 gns. This new model incorporates all the features of the *Editor* tape recorder and has in addition a number of additional features usually found on more expensive instruments.

The recorder is compact in design, and is housed in an attache-type case finished in leather or simulated crocodile with gilt locks and fittings and detachable lid. Dimensions are $16\frac{1}{2} \times$



The *Editor Super* tape recorder.

12 x 5in. (with lid 7in.). Total weight is 33 lb.

A useful facility is that in addition to record and playback, the instrument can also be used as a straight amplifier for p.a. purposes. Control of tonal balance is provided, and the two signal inputs have independent volume controls. The tape deck, of new design, is powered by three drive motors: the rewind/record-playback switch is electrically and mechanically interlocked to prevent accidental erasure. Recording is twin-track at either 7 $\frac{1}{2}$ in. or 3 $\frac{1}{2}$ in./sec. A "magic-eye" visual recording level indicator is incorporated.

Input mixing of two independent sound sources is possible, each input being independently controlled for gain and monitoring. Drop-in tape loading and fast forward and fast rewind without unlacing tape ensure simple operation.

The instrument, which is for operation on 200-250V 50 c/s a.c. mains, is supplied complete with a Ronette crystal desk microphone and a 1,200ft. reel of standard high-coercivity tape. The maker's claim that the frequency response of the amplifier is such that the instrument is suitable for use with pre-recorded music tapes.

Full specifications are contained in a leaflet available from the manufacturer.

ANTIFERRENE BAND III ADDEX AERIAL KITS

Antiferrene, Ltd., Bicester Road,
Aylesbury, Bucks

AS in the first stage the Band I and Band III transmitters will not be co-sited in London and Holme Moss, there will be many receiving sites situated more or less between the Band I and III transmitters where the two signals will arrive from approximately opposite directions. In these situations a different method can be used to fit the *Addex* Type "X" kit to the *Antex* which will provide for reception from these opposite directions.

This special arrangement can only be used with the *Antex* aerial due to its special construction and cannot be applied to "H" or other types of aerials, the company state. This type of conversion, which only uses half the *Addex* kit (2 rods) is claimed to provide a gain on Band III equal to that of an "H" array and does not affect the normal Band I reception.

As the acceptance angle of the adapted array is quite broad it can also be used at sites not directly between

the transmitters by beaming the aerial to favour the weaker transmission. If beaming the aerial at one transmitter results in it being at an angle of more than 60 degrees with respect to the direction of the other, then it may be advantageous to use the standard *Addex* fitting (using four rods).

Addex "D" type Kit

This *Addex* kit, which comprises two rods for use with single dipole aerials, can also be used quite satisfactorily with room and loft aerials (with $\frac{1}{2}$ in. dia. rods). A fully descriptive leaflet relating to the bi-directional *Antex* aerial (with *Addex* adaptors) and the various methods of adapting indoor and loft aerials is available from Antiferrene appointed wholesalers, or direct from the company at Aylesbury.

LINE OUTPUT TRANSFORMER TESTER

R.A.E. Manufacturing Co., 135 Kentish
Town Road, London, N.W.1

ILLUSTRATED is the R.A.E. line output transformer tester, Model CIA, which comprises a 1in. oscilloscope in a special circuit designed to check the damping characteristic of television line output transformers. It uses the method of injecting a pulse into the primary, and inspecting the resulting wave train on the screen. A full description of the method was given in the July, 1954, issue of *B.R.T.* (page 185).



The R.A.E. line output transformer tester

Only two connections are needed, and the transformer is left in circuit. As the connections are to the line output valve anode and boosted h.t. point, it is often unnecessary to remove the chassis.

The instrument is finished in durable bronze hammer finish with contrasting cream panel, and has a carrying handle around which the test leads may be wound. It measures 6 $\frac{1}{2}$ in. x 4 $\frac{1}{2}$ in. x 3in. and is easily carried in the tool kit. For operation on 200-250V a.c. mains.

Price of Model CIA is £11 5s. net trade; the instrument is guaranteed for twelve months.

(Continued on page 889)

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**new stations
new wavelengths
new programmes
and new**

2 Band, 13 Channel

MARCONIPHONE

Table Receivers

Look at these points — they readily show why Marconiphone will lead the field in 1955.

- ★ 13-channel Tuner Unit of the incremental inductance type designed as an integral part of the circuit.
- ★ No additional tuning coils required for specific stations — they are already there!
- ★ One station selector control only.
- ★ Up to the minute AGC system to cater for the widest possible signal strength variation between transmitters, besides counter-acting picture fading and flutter.
- ★ New Emiscope aluminised tubes, with dark screen filter, for day-light viewing.
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14" Model VT 68DA 66 gns.

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Continued

FULL VISION MICROPHONE

Lustraphone, Ltd., St. Georges Works, Regents Park Road, London, N.W.1

THE new Lustraphone Model LFV/59 "Full Vision" microphone is designed to offer minimum visual obstruction for TV, broadcasting, recording and public address purposes, and is cylindrical in shape with a diameter of face the size of a penny. The polar pattern is omnidirectional, and the unit is fully protected against wind effects when used outdoors, etc.

Frequency response is substantially flat from 150-14,000 c/s. Output level is -88db below 1 volt-dyne-sq.cm. at 25 ohms. Impedance is 25 ohms. The microphone case is finished in silver grey hammer styling, and is mounted on a flexible "Stayput" tube attachment permitting the microphone to be tilted to any desired position. Diameter of the microphone face is $1\frac{3}{16}$ in.; length is 5in.; length of case flexible "Stayput" tube is 6in.

The unit is supplied with 21ft. of high-quality twin-screened and p.v.c.-sheathed microphone cable. Weight of the hand microphone Model LFV/H59 is 6oz.; weight of the stand microphone Model LFV/59 is 10oz. Prices: 8 gns. and 8½ gns. respectively.

NEW MURPHY F.M. RADIO

Murphy Radio, Ltd., Welwyn Garden City, Herts.

MODEL A242 (illustrated) is the first Murphy radio receiver having a waverange covering the new v.h.f. f.m. service in addition to the normal long, medium and short wavebands. The circuit is a 9-valve superhet covering the following bands: 87.5-100 Mc/s; 16.7-50.4m.; 187-571m., and 1,000-2,000m.

An inbuilt dipole aerial for f.m. is incorporated, and this also acts as a plate aerial for the reception of strong a.m. signals. Bandpass characteristics of the receiver have been designed to give best possible quality on f.m. An 8in. p.m. loudspeaker is employed.

The cabinet is of the semi-baffle type, having a large frontal area relative to



Murphy A242 a.m.-f.m. radio.

depth. The framed front is cross-banded with French walnut, which is the veneer used on both top and sides. The speaker fret is "Tygan," a woven plastic material, and the metal trims at top and bottom of the scale are gold anodized aluminium, as are the discs on the face of the controls.

Designed for operation on 200-250V a.c. mains, Model A242 measures 17in. × 21in. × 8½in. and weighs 23½ lb. Price £35 (tax paid).

VALIDUS BAND III TV CONVERTERS

Validus Aerials, 57 Hornsey Road, London, N.7

THE company are introducing a Band III converter designed to enable television receivers which do not have arrangements for alternative programme reception to receive both the new commercial and B.B.C. services without modification to the set. The converter is suitable for use with either t.r.f. or superhet receivers.

The unit is supplied aligned to the required channel and is easy to instal. Provision is made for separate aerial inputs for both Bands I and III. All inputs and outputs are for 70-80 ohms impedance. Electrical performance ensures full bandwidth with an overall gain of 10db.

The converter is suitable for use with either a.c. or a.c.-d.c. receivers, and can be mounted on the rear of the set with controls easily accessible. Dimensions are 6½in. × 4½in. × 2½in. An inbuilt power unit operates on 250V 50 c/s a.c. mains; consumption 10 watts.

The unit is finished in stove crackle enamel and is supplied packed in a carton. Price 5 gns. net trade; guaranteed for twelve months (valves three months).

For adapting existing Band I dipole and H-aerials to Band III operation there are attachable elements and a director, giving good overall gain with a range of 15 to 20 miles. Attachments are also being made for indoor aerials in the Validus range, and these should give satisfactory reception within 5 miles of the transmitter.

The company are also introducing a 2-stage preamplifier for use on Band III. In addition details of a new range of TV aerials will be released in the near future.

ELPICO AMPLIFYING EQUIPMENT

Lee Products (International), Ltd., Elpico Works, Olive Road, Hove, Sussex

DETAILS of their new range of sound amplification equipment are announced by the company. Amplifier Model AC85 is a medium-power a.c. mains amplifier of 16 watts output suitable for general p.a. applications. Incorporating its own amplifier, the unit has mixing facilities for low and high gain inputs from microphone, gram and radio and provides equalisation for standard 78 r.p.m. and long-playing records; independent bass and treble tone controls are fitted.

Specifications include: Rated power output 12.5 watts. Power output with 1 per cent. distortion 13 watts. Maximum power output 16 watts. Output impedances 3 and 15 ohms. Input impedances—gram 500kΩ, microphone input 82kΩ. Sensitivity for rated output at 400 c/s with tone controls at the mid-position. Gram input 120mV. Microphone input 5mV. Frequency response 16 c/s to 16 kc/s ±1db. Hum level 80db below rated output. Input power supply 200-250V at 50/60 c/s (other voltages to order). Power consumption 55 watts. Internal fuse rating 2 amps. Voltages available at the feeder octal socket 180-250V 20mA dependent upon current drawn.

The instrument is housed in a specially designed bronze cabinet with carrying handle and rubber feet. All controls are recessed and illuminated from within. Price 22 gns.

Loudspeaker Model L10/6 is a high-flux 10in. p.m. speaker of impedance 3 ohms. It is supplied with 12 yards of cable and connecting plug. Dimensions: 15in. × 15½in. × 8in.

(Continued on page 890)



Three new Elpico products: From left to right they are the Model AC85 16W Amplifier, the type M401V stand microphone, and the type L10/6 10in. p.m. loudspeaker



Continued

Three microphone types are available. Model M401V is a pedestal stand instrument incorporating 12ft. of cable. Price 4½ gns. Model M411 is a hand unit in moulded rubber grip with fixing clip, including 6ft. of cable. Price 3 gns. Model M403A is a studio-type microphone with adjustable friction slide action on the stand, which is heavy for stability. Supplied with 12ft. of cable. Price 6 gns. All microphones are of the crystal type having wide frequency range.

NEW EMITRON OSCILLOGRAPH TUBE

Electronic Tubes, Ltd., Kingsmead Works, High Wycombe, Bucks.

AN entirely new oscillograph tube incorporating post-deflection acceleration is now in quantity production at the High Wycombe plant of Electronic Tubes, Ltd. This Emitron tube—type 4EPI—has many new features making for improved performance and reliability in all oscillographic applications, especially where high frequency operation and high writing speed with good definition are required.

Post-deflection acceleration confers the great advantage of high deflection sensitivity combined with good brightness, as compared with conventional tubes. With the latter, high deflection sensitivity is usually obtained by restricting the anode voltage and consequently the brightness of the display, but the new 4EPI tube gives a deflection sensitivity of about 1 mm/volt with a final accelerator potential of 2,000 volts. For high writing speeds this voltage can be increased up to 8,000 volts. Thus, detailed studies of small amplitude waveforms can be made easily and with the minimum of amplification.

The use of side connections to the deflector plates allows the tube to operate at very high frequencies (*i.e.* with millimicrosecond pulses) due to the extremely low deflector plate capacity and inductance.

Other features of this new Emitron tube include: 4in. diameter screen with



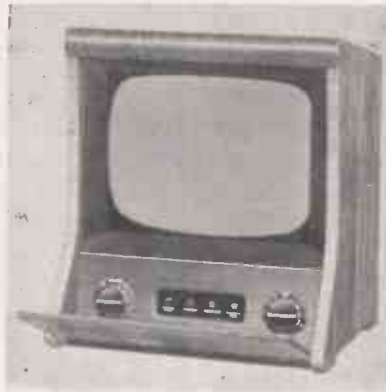
Emitron type 4EPI oscillograph tube.

green fluorescence of medium persistence; beam trap for triggered operation; compact construction giving space economy in equipments—its length is only 15in.; specially designed all-glass construction for use under severe climatic conditions.

PYE 17in. TABLE TV

Pye, Ltd., Cambridge.

PYE, LTD., have recently announced a new TV set—a 17in. table television receiver incorporating a number of improvements, including two 6½in. loudspeakers—one on either side of the cabinet instead of a single one in the front.



The new Pye 17in. table TV.

Other improvements include negative feedback on sound, with tone control; improved automatic frequency control (on horizontal scan oscillator). All plug socket connections between chassis and tube unit facilitate easy removal. The controls are located behind the hinged front panel and consist of volume/on-off and tone (concentric), vertical hold, contrast, brightness, horizontal hold, station selector and fine tuner (concentric).

The cabinet of the new set is finished in walnut veneer and measures 21½in. high by 18½in. wide by 24½in. deep. Retail price is 81 gns. (List Price £63 12s. 4d., plus £21 8s. 8d. tax.)

TELERECTION BAND III CONVERSION KITS

Telection, Ltd., Antenna Works, St. Pauls, Cheltenham, Glos.

THE company are introducing a series of conversion kits for attaching to Band I television aerials to enable both Band I and Band III transmissions to be received. Kit No. 1 is priced at 7s. 6d. and consists of two "V"s with hold-fast clips for use with single dipole and Telection *Paravex* aerials.

The No. 2 conversion kit (15s.) consists of two "V"s with hold-fast clips

and one Band III reflector with instant fixing junction unit for use with Band I "H"-type aerials.

Both kits are simple to fit, and are technically designed to give optimum performance; the company point out, however, that for two-band operation they will only be effective in areas of high signal strength near to the Croydon I.T.A. transmitter.

NEW BRAUN A.M.-F.M. RADIO

Winter Trading Co., Ltd., 6 Harrow Road, London, W.2

THE latest imported model of the Braun a.m.-f.m. radio receiver is now available from Winter Trading. Known as the Braun 4D, the receiver consists of a 4-waveband a.c. mains superhet covering l.w., m.w., s.w., and the v.h.f.-f.m. band 87.5–100 Mc/s. Six valves are used (including magic-eye tuning indicator) plus selenium rectifier. A built-in dipole aerial provides adequate signal pick-up for f.m. and other wavebands in areas of high signal strength.

Piano keyboard switching gives selection of the following: (1) on-off switch; (2) gramophone; (3) long waves; (4) medium waves; (5) short waves; (6) f.m. band. Output is via four loudspeakers to ensure the best possible quality of reproduction. A service diagram is printed on the inside of the inspection panel under the cabinet.

Apart from the four speakers, Model 4D is technically similar to Model 555UKW, which the company have been importing hitherto.



The Braun "4-D" a.m.-f.m. receiver.

MULLARD VALVE VOLTMETERS

Mullard, Ltd., Century House, Shaftesbury Avenue, London, W.C.2

THE Equipment Division of Mullard, Ltd., announce three new valve voltmeters, two of which are general purpose laboratory instruments capable of measuring both direct and alternating voltages with a high degree of accuracy; the third, which measures only alternating voltages, incorporates a wide band amplifier to provide high sensitivity. All three voltmeters are mains-operated.

(Continued on page 946)

THE 1955 COMPONENT SHOW

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Here is something destined to revolutionise the whole process of assembly. Developments already carried out in the T.C.C. laboratories indicate that this new technique, by the elimination of much costly chassis presswork, permits great savings to be effected in time, labour and materials.

The advantages are not confined to production alone. Already much evidence has been accumulated to prove that the Printed Circuit permits the immediate achievement of higher standards of performance with a far greater degree of consistency and reliability than hitherto deemed possible.

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Special Preview of the R.E.C.M.F. Exhibition

Announcing the AERIALITE BAND 3 PROGRAMME



AERIALS



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DOWNLEADS

BAND III AERIALS—The Aerialite range of aerials will include (a) Aerdaptors—add-on units for existing Band I dipoles and H-aerials; (b) Separate Band III multi-element aerials for attaching to existing masts or mounting separately; and (c) Composite aerials for new installations and two-Band reception.

(a) **Aerdaptors**—Quickly clamped on units which require no alteration to existing Band I dipoles or H-aerials.

- Model 600 (for H aerials) 15s. 0d. per set retail
 - Model 601 (for single dipoles) 7s. 6d. per set retail
 - Model 602 (for single dipole or H) 30s. 0d. per set retail
- The Model 602 has auxiliary boom carrying Band III reflector which enables any directivity on Band III to be achieved.

(b) **Band III Aerials**—These aerials have quick-fitting elements, all alloy tube construction and polythene low-loss insulators. Retail Prices:—

- | | | | |
|--|---------|--|---------|
| <i>Arrays only 1" mast fixing</i> | | <i>Drainpipe or 2" mast end mounting</i> | |
| Model 700 XO 3-element ... | £2. 5.0 | Model 706 E (dipole, director) | £2. 7.6 |
| Model 701 XO 4-element ... | £2.12.6 | Model 707 E (dipole, 2 directors) | £2.15.0 |
| Model 702 XO 5-element ... | £3. 0.0 | Model 708 E (dipole, 3 directors) | £3. 2.6 |
| <i>Arrays only 2" mast fixing</i> | | | |
| Model 700 XT 3-element ... | £2. 7.6 | | |
| Model 701 XT 4-element ... | £2.15.0 | | |
| Model 702 XT 5-element ... | £3. 2.6 | | |
| <i>Aerials cranked arm wall mounting</i> | | <i>Aerials 6-foot chimney lashing</i> | |
| Model 700 CW 3-element ... | £3. 7.6 | Model 700 S, 3-element ... | £3.17.6 |
| Model 701 CW 4-element ... | £3.15.0 | Model 701 S, 4-element ... | £4. 5.0 |
| Model 702 CW 5-element ... | £4. 2.6 | Model 702 S, 5-element ... | £4.12.6 |
| <i>Aerials cranked arm chimney lashing</i> | | | |
| Model 700 CL, 3-element ... | £3.17.6 | <i>Aerials 10' x 2" mast, double chimney lashing</i> | |
| Model 701 CL, 4-element ... | £4. 5.0 | Model 702 T, 5-element ... | £7.15.0 |
| Model 702 CL, 5-element ... | £4.12.6 | | |

Aerials cranked arm mounting off existing chimney brackets. Models 700 CB, 701 CB, 702 CB—same price as CW types.

(c) **Composite Aerials.** Details of these will be released in early April.

CONVERTORS—The Aerialite Convertor has been attractively styled so that it can be placed on top of or at the side of the T/V receiver. The control knobs are well positioned for easy and quick adjustment and the on/off switch controls both the receiver and the convertor.

It will work efficiently with any type of receiver and the high gain on the Band III frequencies ensures adequate picture strength. Retail price **£9.10.0**

AERAXIAL—This specially developed cable for Band III aerial installations is the answer to achieving minimum attenuation without increasing the cost. The patented five-cell construction ensures maximum air to polythene ratio around the conductor. The high-performance figures are proved by the following attenuation figures at 200 Mc/s (per 100 ft.), Aeraxial Cat. 597-4.5db; Super Aeraxial, Cat. 499-2.6db Standard or conventional Coaxial—6.2db. Retail prices: Cat. 597 8½d. per yd. Cat. 499, 1/8 per yard.

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PREVIEW

A GUIDE TO THE HIGHLIGHTS OF MAIN EXHIBITS THAT WILL BE FEATURED AT THE PRIVATE EXHIBITION OF THE RADIO AND ELECTRONIC COMPONENT MANUFACTURERS FEDERATION TO BE HELD AT THE GROSVENOR HOUSE, PARK LANE, LONDON, W.1, FROM APRIL 19th TO 21st, INCLUSIVE

THE radio component industry in this country has an outstanding record of achievement that reflects to a considerable extent the expansion and vigour of the radio and television industry generally. The annual exhibition of the Radio and Electronic Component Manufacturer's Federation occupies a position of ever-increasing importance in the world of technical exhibitions, and it is true to say that few fields of industry do not employ to some extent the products of the British component industry in one way or another. Apart from the familiar radio and television spheres, components are used in telecommunication equipment, navigational aids, radar installations, mobile radio, industrial electronics, sound equipment, and in Defence.

The exhibition provides for manufacturers, technicians and designers from all over the world a privileged view of the latest trends and developments in electronic components, valves, and test equipment. It is, in effect, a comprehensively dressed shop window of concise dimensions illustrating a cross-section of the output of an industry which produces annually some thousand million components, valves and accessories. And since it is essentially a show devised by specialists for specialists, and was never intended to cater for a wider public, invitations to attend the exhibition during its three-day run are restricted to those who possess a genuine professional interest in electronics.

This preview highlights some of the major exhibits which, since the trend of to-day's components influences the design of to-morrow's sets, will be of interest to readers in the retail trade. Because of the limited space available, and due to the fact that some manufacturer's will not have decided on what they will be showing until a few days before the exhibition opens, it is not possible to mention individually every item on view or every exhibitor. The following pages, therefore, are intended as a general guide to those items of trade interest which were known to us at the time of going to press.

Test Equipment

Most dealers and engineers are generally interested in the test equipment displayed at the exhibition. The basis of all advancing technology is accurate measurement, and in this

sense the design of test equipment is a sure pointer to the state of progress in technological spheres.

A number of interesting instruments will be seen on the Physical Society's stand, one of the most popular with component manufacturers being the breakdown tester, type RM215, which provides a continuously variable a.c. and d.c. output voltage up to 5kV. In addition to indicating actual breakdown the instrument also shows insulation leakage by means of a magic eye. Other equipment on this stand includes an a.f. signal generator (type L063) having an extended range from 10 c/s to 110 kc/s, a universal impedance bridge (type UB202), and a selection of coil and condenser comparators.

Taylor Electrical will be exhibiting a comprehensive range of test equipment of interest to the trade. Two "new look" models of new design in grey hammer-finished cases are the TV sweep oscillator, type 92A, and the valve tester, type 45C. The sweep oscillator is specifically designed for the

alignment of television receivers and covers a frequency range from 3 to 250 Mc/s, the sweep being controllable from 2 to approximately 15 Mc/s at all frequencies.

The valve tester is a new and improved version of the previous types 45A and 45B, and accommodates nearly all modern valves, whether British, American, or Continental. It also has facilities for checking television picture tubes by means of an adaptor.

The Taylor electronic test meter, type 171A, is an accurate valve voltmeter having a.c. voltage ranges from 1-250V a.c. and d.c. voltage ranges from 1-1,000V d.c. and, 25kV by means of an external adaptor. The resistance ranges go up to 1,000 megohms. With the r.f. probe voltages at frequencies from 10 c/s to 200 Mc/s may be measured.

Signal generator, type 67A, another Taylor exhibit, covers frequencies from 100 kc/s to 240 Mc/s and includes both Band I and Band III TV service frequencies. A recent introduction is the r.c. oscillator, type 191A, which generates sine and square waves at frequencies from 10 c/s to 100 kc/s, the output level being maintained constant within ± 1 db throughout the entire range.

Two members of the Pye group of companies will be exhibiting test equipment. W. G. Pye and Co. have an audio frequency oscillator with a frequency range of 20-20,000 c/s and an output continuously variable from 0-20V peak-to-peak. Other items include electrostatic voltmeters covering ranges from 1-18kV, and a d.c. micro-voltmeter which has a full-scale range of 20 microvolts and adjustment to reduce sensitivity by factors of 0.1, 0.01 and 0.001.

The other Pye firm, Labgear (Cambridge), Ltd., will be showing, among others components of interest, a standing-wave ratio indicator which measures the standing-wave ratio on a coaxial line.

Several test instruments of new design will be exhibited by Marconi Instruments, Ltd., of which the latest is the vacuum-tube voltmeter type TF1041. This instrument measures up to 300V.



Taylor Sweep Oscillator, Model 92A, for TV alignment

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Garrard
record playing units



GARRARD ENGINEERING AND MANUFACTURING CO. LTD.

and 700 Mc/s unbalanced, in six ranges, also d.c. up to 1,000V balanced or unbalanced in seven ranges. There are seven other ranges for the measurement of resistances between 0.2 ohm and 500 megohms. A feature of the instrument is the large meter for fast and precise reading.

Three Marconi signal generators will be shown. Type TF801B has a range of 10 to 500 Mc/s, and provides a calibrated source of e.m.f. continuously variable from $0.1\mu\text{V}$ to 0.5V. An interesting feature of the design is the contactless waveband selector switch eliminating the variable factor of r.f. contact resistance. Type TF1077 is a frequency-modulated signal generator covering 19.7 to 102.5 Mc/s with a precision piston attenuator allowing the open-circuit output to be set to any level between 200mV and $0.2\mu\text{V}$. Output may be either c.w. or frequency-modulated from an internal 1,000 c/s oscillator, or an external modulation source may be used. Type TF995A/1 is an f.m.-a.m. signal generator with a frequency range from 2 to 216 Mc/s in five bands, output level range being $0.1\mu\text{V}$ to 100mV. The output may be c.w., f.m., a.m., or simultaneously f.m. and a.m.

For u.h.f. applications Marconi will also be exhibiting a u.h.f. signal generator, type TF1078, covering the frequency range 960 to 1,250 Mc/s in one continuous band. Other instruments on view will include frequency measuring apparatus and a high speed oscilloscope.

Showing for the first time at this exhibition will be the new Advance video generator, type R1 (illustrated) which provides a signal source of variable frequency from 30 c/s to 10 Mc/s in two bands (30 c/s to 3 Mc/s and 3 to 10 Mc/s). The instrument thus covers



Marconi Instruments Vacuum Tube Voltmeter, type TF1041



Advance Signal Generator, type R1

audio, supersonic, and television requirements.

The scale, which is directly calibrated in frequency, is 27in. long. The instrument uses an r.c. phaseshift oscillator to cover the two wide frequency bands. The output, via cathode follower stage, is 1V r.m.s. at low impedance (open circuit) and 10V r.m.s. at high impedance. A crystal voltmeter is incorporated in the instrument to monitor output.

Other instruments to be shown by Advance include a pulse generator and a "Q" meter intended for laboratory use, and a turret attenuator of novel design for radio-communications.

A wide range of electronic measuring instruments will be exhibited by Dawe Instruments, Ltd. Type 614 is a sensitive valve voltmeter for measurements of voltage from a few hundred microvolts to 30 volts at frequencies between 10 c/s and 100 kc/s; up to 750V d.c. may be superimposed on the input signal. Type 615 a.f. microvolter is a combination of a variable attenuator and meter which provides an accurate small voltage from an external oscillator; range $1\mu\text{V}$ to 1V.

The Dawe insulation tester type 402 is a handy portable instrument for measuring insulation properties and leakage resistance without destructive breakdown over the range of 0.1 to 10,000 megohms. The decade capacitor box type 210 is a precision condenser assembly comprising four capacitors selected by a low resistance switch in such a manner as to provide ten sequential values. Type 303 is an impedance comparator for production testing, grouping, and adjusting inductors, condensers and resistors at a frequency of 10 kc/s. Ranges: $20\mu\text{H}$ to 100mH; 20pF to $1\mu\text{F}$; 40 Ω to 100k Ω .

The Automatic Coil Winder and Electrical Co., Ltd., will be exhibiting a wide range of Avo test equipment. Of particular interest are the new signal generators which will be in production in a few months. The Avo valve tester, type 160, is a new pan-climatic model

designed for simplicity of use. Other instruments will include the Avo valve characteristic meter, Mark III (illustrated), tropicalised Avometers, and the Avo 25,000V d.c. multiplier.

Coil Winding Machines

The Automatic Coil Winder and Electrical Co., Ltd., will of course be showing specimens of their large range of coil-winding machines, including at least one prototype of a new kind of wave-winding machine. The company's representatives on the stand will welcome the opportunity to discuss coil winding and instrumentation problems with visitors.

Radio Instruments, Ltd., will be showing a range of Neville coil-winding machines. Of particular interest to radio and electrical component manufacturers are the bench or table-mounted models, of which a typical example is the Pretoria, a bench or table-mounted automatic coil winder (gauges 20-50 s.w.g.) embodying a special foot-operated clutch. The Hamilton model is a hand machine for winding small quantities of coils.

Aerial Equipment

The chief centres of interest on the stands of exhibitors showing aerial equipment will no doubt be in the new Band III arrays and add-on units, and aeriels for the Band II f.m. transmissions.

In addition to their standard Band I (horizontal and vertical) series of J Mast and Lightweight aeriels, J-Beam expect to be showing a range of Band III equipment, including skeleton-slot attachments, a 6-element broadside array and a double 6-element array for fringe areas. This range will incorporate the J-Beam end feeding method and will be suitable for attaching to any existing aerial installation. A splitter unit will be required where a single feed is used to the receiver. As the development of these aeriels is not yet completed, the models on show will be prototypes.



The new AVO Valve Characteristic Meter, Mark III

Ferranti Valves for Radio and Television



The Electronics Dept. of Ferranti Ltd., manufacture a wide range of Valves and Cathode Ray Tubes for Radio and Television receivers. Valves for domestic use include B7G and B9A miniatures, Octal and Loctal based types. Television Cathode Ray Tubes are produced in all the popular sizes, up to 21in. rectangular. Enquiries to Electronics Dept., Moston, Manchester, 10.

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Visit the Ferranti STAND No. 44 at the R.E.C.M.F. Exhibition, April 19-21

FE161

Belling & Lee will be showing Band III adaptor kits, in addition to aerials for Band I and Band II. Kit L924 comprises two rods and four polythene spacers which can be snapped on to a Band I dipole and results in a $\frac{1}{2}$ -wave spaced Band I dipole or $2 \times \frac{1}{4}$ -wave spaced end fed Band III dipoles in phase; it can also be attached to a standard H aerial. The Band III gain is 2db and the expected useful range 10-15 miles. Kit L926 comprises a folded dipole and director for attachment to a Band I dipole, giving an overall gain of 4db and an expected useful range of up to 20 miles. It features substantially correct impedance matching and utilises the existing dipole as a partial reflector on Band III. The same manufacturers are, of course, also exhibiting a wide range of suppressors, attenuators, filters and other miscellaneous aerial equipment.

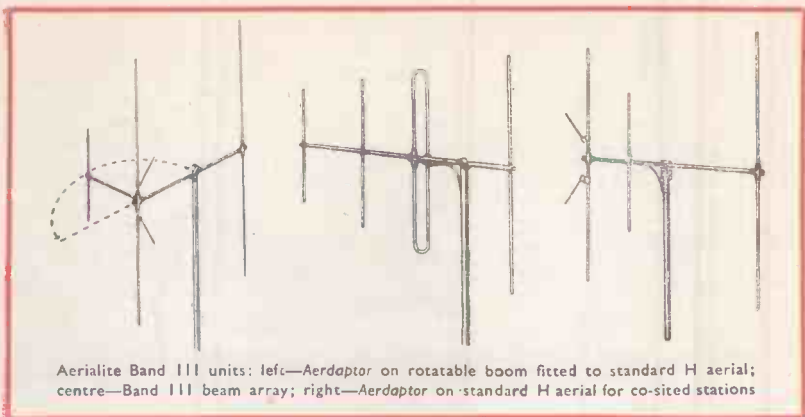
A wide range of Band I, II and III aerials will also be shown by Antiference, including composite aerials for Band I/Band III reception with multimoded element arrangements, separate multi-element arrays and add-on units. The latter, called *Addex* Band III adaptors, can be fitted easily to any existing Band I aerial.

All the Antiference aerials incorporate the patented "Snapacitor" principle of assembly which simplifies aerial installation and ensures improved life due to the elimination of metal-to-metal contacts which are prone to corrosion.

Aerialite are also showing separate and composite Band III arrays in addition to their standard Band I range. The add-on units (*Aerdaptors*) are for quick attachment to existing dipole or H aerials and are intended for areas relatively close to the transmitters. They are available in two types, model 600 for use where the stations are co-sited and Model 602 for use where the Band I and Band III stations are in different directions—an auxiliary boom can be swivelled to give any desired directivity to the Band III attachment. Separate Band III aerials include three, four and five element arrays based on a folded dipole and designed for high gain on channels 8 and 9, incorporating quick-fixing elements and a low-loss polythene insulation.

Amongst the car radio aerials on show will be the Antiference *Autex* aerial which can be easily fitted to any position on the car body work. On the same stand will be shown one of the anti-static radio aerials—the *Exstar* which incorporates Ferrite cored transformers and is claimed to provide noise-free reception from 10-2,000 metres.

To facilitate the demonstration of receivers on both Band I and Band III frequencies and to cater for multiple



Aerialite Band III units: left—Aerdaptor on rotatable boom fitted to standard H aerial; centre—Band III beam array; right—Aerdaptor on standard H aerial for co-sited stations

outlet installations, such as in blocks of flats or for showroom demonstrations, where several receivers are required to be fed from a common aerial system, various units will be on show. For example, Aerialite will exhibit multi outlet boxes, distribution units and preamplifiers which could combine to give full multiple distribution facilities.

The preamplifiers (PA1, single stage; PA2, two-stage) are factory aligned to any specified channel and provide high gain with a 4 Mc/s bandwidth and low noise level. The distribution unit (type DA1) which may be connected direct to the aerial where the signal is strong, feeds six receivers from the same input and incorporates a cathode follower stage. The input is via a star

network coupled to an additional socket to enable further units to be added to cater for 12 or more outputs.

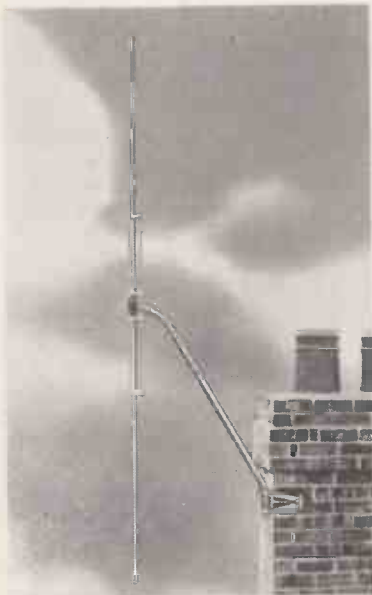
Sound Equipment

There is a growing interest in loudspeakers of all types due to the increasing popularity of high-fidelity home reproducing equipment, the trend towards wider frequency range radio receivers, and a general movement towards more faithful sound reproduction. Another aspect of note is the general improvement of the smaller loudspeakers which, while retaining their small physical dimensions, provide higher acoustic efficiency on low inputs, a wider frequency response, and higher magnet efficiency.

Rola Celestion are showing a wide range of units, ranging from $\frac{1}{2}$ -in square up to 18-in. diameter, with a special emphasis on space-saving models with the high efficiency of larger models. They will be showing models suitable for all types of radio and television receivers, radiograms, car radios, inter-communication systems and other apparatus requiring a loudspeaker.

Included will be elliptical speakers and the exhibit will show models with power handling capacities from $\frac{1}{4}$ to 40 watts.

Rola Celestion will also be showing for the first time a new pressure unit (type DC10 less transformer; type DC12 with 100W line transformer). The unit has an impedance of 15 ohms and a power-handling capacity of 10 watts peak with a frequency response of 120 to 9,000 c/s. The unit uses a one-piece linen-reinforced moulded phenolic diaphragm which is assembled into a pressed aluminium phase equalising throat, the whole assembly being a self-centring unit which slides over and locates on the outside of the magnet assembly top plate. This enables the unit to be changed in the field without special tools or soldering iron in less than one and a half minutes.



Belling-Lee Band III adaptor unit (type L924) fitted to standard dipole



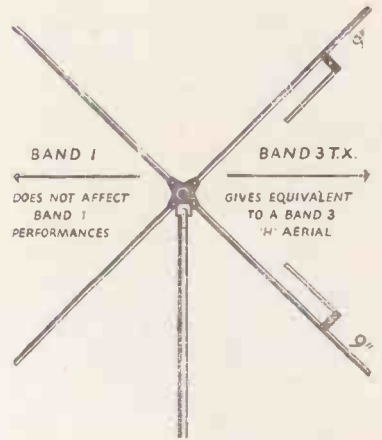
"Antex" plus "Addex" pulls in both!

Since, initially, Band 1 and Band 3 transmitters will not be co-sited in London and Holme Moss many receivers will be situated between the Band 1 and Band 3 transmitters and the signals will arrive from approximately opposite directions. Here a different method of fitting the "Addex" Type 'X' kit to the "Antex" aerial should be used to provide reception from opposite directions. The method can only be used with the patented "Antex" aerial with its special construction and cannot be applied to 'H' or other types of aeriels.

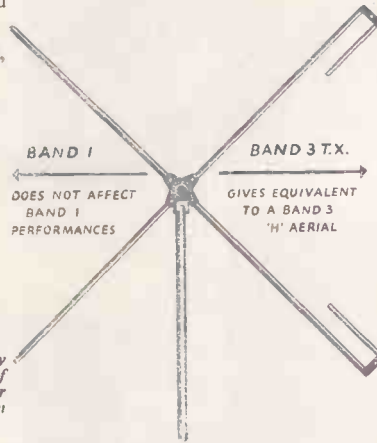
The conversion uses only half an "Addex" kit (two rods), providing a gain on Band 3 equal to an 'H' array without affecting normal Band 1 reception.

The acceptance angle of the adapted array is quite broad and can be used at sites not directly between transmitters, by beaming the aerial to favour the weaker transmission. If beaming the aerial at one transmitter brings it to an angle of more than 60 degrees in relation to the other it may be advantageous to use the standard "Addex" fitting (using four rods).

Right is an illustration of an "Antex" array with two "Addex" units fitted at the ends of aerial rods to provide Channel 2 reception for Band 1 and Band 3 transmissions arriving from opposite directions.



The above illustration shows the "Antex" with two "Addex" units positioned to receive Channel 1 signals from Band 1 and Band 3 transmitters situated in opposite directions from the receiver.



R. E. C. M. F. Exhibition
Stand No. 56 April 19-21

Sales Division, Bicester
Road, Aylesbury, Bucks.

Tel. Aylesbury 1467/8/9



Whiteley Electrical will show the complete range of *Stentorian* high fidelity speakers now incorporating the patented Cambric cone from 2½ in. to 18 in. in diameter, including 8 in., 9 in. and 10 in. models fitted with universal impedance speech coils, providing instant matching at 3, 7.5 and 15 ohms.

Electric Acoustic Industries are showing their range of *Elac* loudspeakers including 2½ in. and 3½ in. models designed for maximum efficiency for use in inter-communicating apparatus, small personal receivers and similar applications. Also on view will be a 7 in. × 4 in. elliptical unit recommended for use with television receivers and designed for wide overall response and reduction of magnetic interference.

Other models will include 10 in. type for use where high quality is required at moderate power, an 8 in. model suitable for TV receivers where magnetic interference must be minimised (it has a completely shrouded magnetic system) and various small models.

New speakers exhibited by Richard Allan Radio, Ltd., include 7 in. × 4 in. and 10 in. × 6 in. elliptical types with various magnet assemblies and also new models in the 8 in. diameter range.

Truvox have an interesting small compact reflex loudspeaker primarily intended to aid the main sound equipment in small areas where there is high background noise. It has a 13 in. air column, a frequency response of 375 to 8,000 c/s and a power-handling capacity of 3 watts, and the diaphragm and speech coil assembly are moulded in fabric reinforced phenol-formaldehyde.

Other Truvox p.a. units include the LH/100, a super power speaker with a power rating of 120 watts of a design recently proved successful for propaganda purposes in war-zones. Mounted on a collapsible tripod it consists essentially of six driving units coupled to separate re-entrant sound columns which terminate in a common bell of 18 in. diameter. The air column is 52 in.

On show will be the company's latest pressure-type driving unit which has a power handling capacity of 30 watts and embodies the latest type magnet with recessed front plate and swaged-in centring ring ensuring permanent concentricity of the magnet gap. A special feature of the unit is a pressing incorporated in the throat which allows perfect acoustical coupling in the critical area between the diaphragm and horn throat opening.

More speakers will be exhibited on the stand of *Reproducers and Amplifiers*, including 7 in. × 4 in. elliptical units. All models embody a unique centring device in which metallic tape speech coil leads are moulded between a 2-ply

centring member. Additionally, the 800-series features a zero external magnetic field, a property achieved by a patented method which eliminates the field entirely and is claimed as an improvement over the "closed" magnetic circuit method. A choice of flux density is available for each of the sizes of speaker and there are a number of different cones, amongst which are those giving a frequency response particularly appropriate to f.m. receivers.

The R. & A. 900-series differs mainly in the larger magnetic systems employed and the models are available with flux densities of 10,000 or 12,000 gauss.



Cosmocord Acos type GP59-3 turnover crystal pickup cartridge

Gramophone Pick-ups

With the current great interest in high-quality record reproduction, the stands featuring pick-up equipment will be an important attraction to visitors. The display on the Cosmocord stand will show a range of *Acos* pick-ups, replacement pick-up heads, cartridges, and other allied components. Two new cartridges of particular interest to manufacturers are the GP59-3 and the GP61-1, both incorporating the new flat type stylus. The improved ceramic cartridge (GP61-1) will be of interest to overseas buyers and exporting manufacturers. New additions to the *Acos* range on show include the HG055 pick-up head, specially designed for the Burne-Jones pick-up.

Of special interest on the *Goldring* stand will be the No. 500 high-fidelity variable reluctance pick-up cartridge and the two versions of the high-quality transcription arm (one for professional use, the other for home applications) which has been introduced to exploit the capabilities of the cartridge. The arm has many interesting features, including an adjustable cantilever counter balance.

In addition to the range of *Goldring* pick-ups and gramophone accessories there will be shown a new replacement-stylus kit, comprising a comprehensive range of styli suitable for most of the well-known record players and gramophone units. Boxed for counter display, complete with dealer's index for easy recognition, each stylus is individually card-mounted with full replacement instructions.

Other Sound Equipment

Amongst the miscellaneous items of sound equipment is the comprehensive range of microphones which will be shown on the *Cosmocord* stand. The exhibit includes details of suitable microphones for use with transistors, available to hearing aid manufacturers.

Tape recording, another of the current booms, is represented on the *Truvox* stand where components and accessories will be on show. The mark IIIU Tape Deck, designed for building into all types of tape recorders, features B.S.S. sense of tracking for playing the new pre-recorded tapes, and will take all standard reels, drop-in loading being used. Powered by three shaded-pole a.c. motors and with a silent drive eliminating wow and flutter, control is by a push-button panel electrically and mechanically interlocked with a separate patented electric type push-button brake.

Also on view will be the Type C amplifier designed expressly to correctly operate the tape deck but which can be used additionally for gramophone reproduction and incorporates a two-station radio receiver for direct listening and/or recording with a *Truvox* radio jack. The amplifier, which has a frequency response substantially flat from 70-10,000 c/s, includes a 45 kc/s oscillator and gives an erase voltage of at least 150V. Output is 4 watts at 3 ohms and the hum level is 50db down at this rating. Level indication is by magic eye indicator.

On the same stand will be seen a dictation attachment to convert the tape recorder into a complete dictation and transcription machine, operated by a foot pedal to leave the hands free during use. There is also a telephone attachment for use with tape recorders which can be fitted to most commonly used telephone hand-sets (by means of a suction cap) in order to record two-way telephone conversations. Other exhibits include the *Stethoset* and *Monoset* headphones.

Ferroglyph tape recorders having tape speeds from 11/16th in./sec. to 15 in./sec. will be exhibited on the *Wright and Weaire* stand. They will be in a variety of portable and rack-mounted forms to meet the varying needs of industry, research, education and entertainment. Auxiliary apparatus for use with *Ferroglyph* recorders includes an endless loop signal operation switch units, and pulse units. *Wright and Weaire* are also showing their wide ranges of coils, transformers, ceramic switches, vibrator units, and transformers, including a series of audio transformers in gas-tight hermetically-sealed containers.

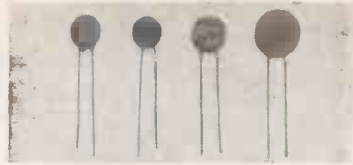
For use with tape recorders a range of *Scotch Boy* magnetic recording tape will be shown by the Minnesota Mining and Manufacturing Co., Ltd. The display will include a range of Scotch Boy self-adhesive electrical tapes which are now available in a variety of materials to meet the needs of coil and component manufacturers.

Capacitors

Capacitors have probably been the subject of more intensive development during the past few years than any other type of components. Many new types designed for a wide variety of applications will be on show this year. Main improvements relate to miniaturisation and tolerance to excessive temperature, humidity and mechanical shock.

Wingrove and Rogers are introducing two new types to their range of *Polar* gang condensers, designed to meet the needs of f.m.-a.m. receivers. New additions are included in the range of miniature air-dielectric trimmers. The display will include various types of *Polar* flywheel drives and a selection of slow-motion drives for capacitors.

Last year Standard Telephones and Cables, Ltd., introduced a complete range of electrolytic capacitors employing tantalum electrodes under the name of *Stantelum*. This year the



L.E.M. FEC-type ceramic disc condenser range

company are showing examples of later designs having improved mechanical properties. The range meets the need for a reliable wide-limit capacitor having a space factor compatible with its working voltage. Due to the inert nature of the materials employed in their construction tantalum capacitors do not deteriorate with shelf life.

London Electrical Manufacturing Co., Ltd., are showing comprehensive ranges of capacitors of various types. The *Catacon* range of moulded silvered mica condensers is now available from 10pF to 250,000pF, and they are suitable for operation from -40°C . to 100°C . Type 1106, a miniature high-stability silvered mica condenser is available from 10pF to 150pF, and is suitable for operation from -70°C . to 100°C .

The L.E.M. range of F.E.C. silvered ceramic condensers has been extended and now includes tubular types from

1pF to 10,000pF, disc types from 470pF to 10,000pF, and the new lead-through pattern specially designed to have small physical size, low inductance, and low initial cost. F.E.C. ceramics are suitable for interference suppression in a wide range of small domestic and industrial electrical equipment.

T.C.C. are showing a number of new condenser types, including a new range of low-leakage high-quality electrolytics (*Superlytics*) designed for grid-coupling purposes in l.f. amplifiers. The type CE58 sub-miniature electrolytic condensers are available in various capacities of even smaller dimensions than those shown last year; measuring only $\frac{1}{2}$ in. \times $\frac{1}{2}$ in., they are designed for use in transistor amplifiers.

Among the many different kinds of capacitor exhibited by A. H. Hunt (Capacitors), Ltd., is the recently developed *Midget Supermoldseal* W96 in a new insulating housing which is proof against humidity, mechanical shock, and heat contact. Temperature range for this type is -40°C . to 100°C . The miniature *Midget Supermoldseal* W99 type is now available for use up to 85°C . at voltages of 400 and 600 d.c. An exceptional temperature range of -100°C . to 120°C . is claimed for the type-approved *Midget Thermetic* W97.

(continued on page 921)

Stand No.
43
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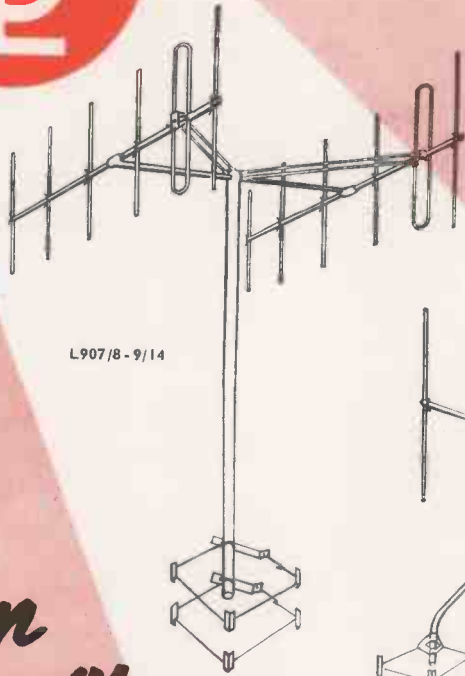
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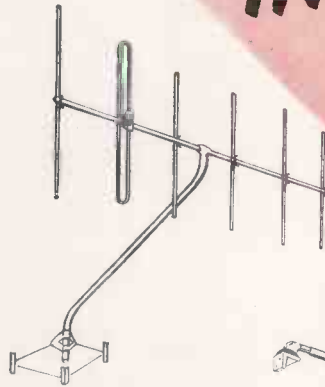
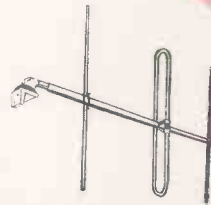
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We were pioneers in television aerial design and we still pioneer today: the fact that (with the co-operation of the I.T.A.) we are radiating a band III television signal from April 1st, is evidence of our position.

Every type of "Belling Lee" band III aerial has been proved on a local transmitter and is the subject of patents applied for.

We cordially invite you to inspect our Stand No. 16 at the R.E.C.M.F. Exhibition Grosvenor House.

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TECHNICAL GEN for SERVICING MEN

Edited by James Huxley

HELP YOURSELF

to all the technical gen in this feature, which is your feature, presenting details of faults encountered by engineers in current radio and television sets, and explaining how those faults were diagnosed and overcome. The aim of this feature is to guide

AND HELP

all in the radio and TV trade.

If you have come across any unusual fault in a set recently, write and tell James Huxley, "British Radio and Television," 92 Fleet Street, London, E.C.4. All published contributions are paid for, and your contribution may help

OTHER ENGINEERS



Murphy VII4

Arcing Blows Fuses Symptoms were intermittent blowing of fuses when the set warmed up.

The UU8 rectifier was changed and the h.t. line checked for short circuits. Testing revealed nothing and the fuses continued to blow at varying intervals. On removing the line oscillator valve (T41) or the line amplifier valve (PEN46), the fault did not occur. (Note.—The e.h.t. rectifier was, of course, removed for this test to prevent ion burns—mains e.h.t. being used.)

Both valves were refitted to the set and the line output transformer secondary winding was removed at the earth tag on the chassis. No further fuses blew on test until the winding was again connected to chassis.

The transformer was replaced and the set functioned normally. The original transformer was given a high voltage test and this revealed arcing taking place between the primary and secondary windings.—R.E.L., Worthing.

Ekco T221

Width Coil Fault The fault was obviously no e.h.t. After proving that V13b (20L1) was oscillating, by inserting a

microammeter in the low potential lead from VR8 (line-hold control), a new 20L1 was tried just to play safe. This made no difference and it was obvious that the fault was in the output stage. Every component was checked and counter checked and suspecting the line output transformer it was replaced,

even though it read correctly against the new item. And still no e.h.t.

Then, by a process of elimination, it was found that the width coil had become high resistance to a value of 100kΩ. The coil in question is inserted across part of the line output transformer and the high resistance must have been cancelling out part, if not all, of that section of the transformer's inductance.

Removal of the coil assembly, which incorporates the line linearity coil, showed it to be now completely open circuit. A replacement panel overcame the fault.

This receiver is a new model, but it will be found that the service manual covering the T207 is very similar, except for the valve line-up which is a new Mazda range.—J.K.G., Exeter.

Write to James Huxley

on Service Department matters, and pass on all the hints and tips and dodges that you have found useful in dealing with day-to-day service problems. Articles on all subjects of technical service interest are welcomed. All published contributions are paid for.

Philips Projection TV

E.H.T. Unit Fault We have recently come across three receivers in the Philips 1800A and 600A series with the following symptoms. Brilliance varies and the oscillation note of the e.h.t. generator fluctuates; or, alternatively, no brightness or e.h.t. In each case the fault was found to be in the e.h.t. oscillator transformer, S10, S11 (maker's manual). The primary of this transformer should normally have a d.c. resistance of 380Ω, but has been known to vary up to 10,000Ω, creating the above symptoms.—J.B., Crawley, Sussex.

H.M.V. 1124

Poor Short Waves The fault on this model was intermittent and poor results on the two short wave bands SW1 and

SW2. After connecting up and switching first to SW1 and then to SW2, and then tapping the set, a great deal of noise resulted. As this noise appeared to be connected with the coil pack it was removed and the set connected up again. On tapping the coil pack the noise appeared but a good deal of searching revealed no dry joints or similar trouble causes. It was finally noticed that a PK screw (one of the two securing the screening plate to the chassis of the coil pack) was not fully driven home. This allowed the screening plate to vibrate and the contact of metal to metal apparently caused the noises which were apparent only on

(Continued on page 905)

ANNOUNCEMENT

FM RECEIVER ALIGNMENT GENERATOR MODEL 1324

This Alignment Generator will be available later this year to provide the Service Engineer with a compact test set with which all essential alignment procedures on FM Broadcast Receivers may be undertaken.

Accurate trimming for correct overall and IF response curves is easily carried out and facilities will be provided for discriminator alignment and checks on its sensitivity and distortion.

Watch for the release date and price.



COSSOR

Model 1322

Telecheck and Marker Generator for Bands I and III

Model 1322 — used in conjunction with a cathode ray oscillograph — provides equipment for the display, measurement and correct adjustment of RF and IF response curves of television receivers. This entirely new instrument comprises a swept oscillator covering the Television BANDS I and III (5-75 Mc/s. and 155-255 Mc/s.) and a frequency marker oscillator so that precise calibration of the oscillograph display may be made; accuracy of the frequency of the marker pips being verified by reference to an internal crystal. The

alignment oscillator is set to the video carrier to which the receiver is tuned and the sweep (either 1 Mc/s. or 10 Mc/s.) is automatically derived from the time base voltage of the display oscillograph. The response of the "strip" under test to the frequency band applied is then presented on the screen of the cathode ray tube. The RF output of Model 1322 is available at 75 ohms and is adjustable from a maximum of 40 millivolts to a minimum of 10 microvolts through a coarse and fine attenuator.

TELECHECK CONVERTER FOR BAND III Model 1321

This adaptor provides owners of Model 1320 "Telecheck" with an extension of the frequency range of the original instrument into the BAND III television channel. Thus, alignment procedures adopted for BAND I RF/IF "strips" are available also for BAND III receivers. A selection of the desired BAND is made by means of a switch. Pattern generator facilities for picture time base linearity checks have been retained. Model 1321 Adaptor is designed for permanent attachment to the standard "Telecheck" providing a neat, light and compact unit. Mounting is effected by four screws and the inter-connecting wiring is carried in a single insulating sleeve.



COSSOR ELECTRONIC INSTRUMENTS

Write for illustrated leaflets about both these instruments:

COSSOR INSTRUMENTS LIMITED (Dept. 14) Highbury Grove LONDON N.5

Telephone: CANbury 1234 (33 lines)

Telegrams: COSSOR, NORTHERN, LONDON

Cables: COSSOR, LONDON



TECHNICAL GEN

Continued

the ranges SW1 and SW2. No noise was experienced on long or medium wave bands.

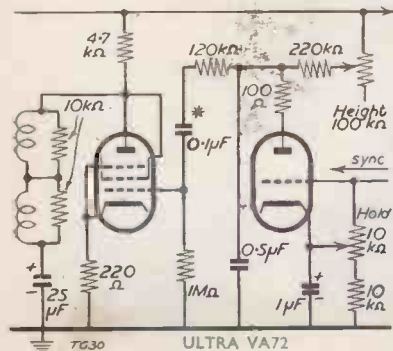
In removing this coil pack it is unnecessary to undo any connections under the chassis. Simply undo the aerial and earth connections and the 4 PK screws securing the coil pack to the main receiver chassis. Push the side furthest away from the wavechange switch knob up into the chassis and gently pull the wavechange switch spindle downwards away from the chassis. The pack can then be bent outwards—the leads are long enough to allow this. Insert a card between the coil pack and the main receiver chassis to avoid shorts and the set can then be operated with all the coils and trimmers exposed to view.—H.W.G., Hayes, Middlesex.

Pye V4

Faulty Volume Control One of the above sets came in for a line fault which was cured by replacing the ECL80 line oscillator. At the same time, a noisy volume control was cleared by the application of switch cleaner. Then, unaccountably, the set began motor-boating. Valves and components were checked without success until we turned our attention to the volume control. This had risen from 500kΩ to nearly 2MΩ, probably due to the action of the switch cleaner. Replacement cured the fault.—E.A.T., London, E.6.

Ultra VA72 Series

Varying Frame Linearity The customer complained of frame cramping after about 20 minutes. The receiver was removed from the cabinet and while checking components it was noticed that the frame scan was slowly returning to normal.



Because of this no fault could be found. The set was replaced in the cabinet and left to run again, but the fault re-appeared.

Again the chassis was removed and eventually C30 (0.1µF) was found to be leaky—but only when the set was in its cabinet! Presumably this was due to the higher temperature prevailing under those conditions.—R.P.H.D., Stourport-on-Severn, Worcs.

Cossor 930

Three Typical Faults Here are three faults encountered on models in this series. On one of the receivers the complaint was a weak and ragged picture with weak and muzzy sound reproduction. Withdrawing the r.f. strip and trying the aerial direct on the L1 input immediately cured the trouble. A replacement was tried across the series capacitor C72 (39pF) which is between the high-pass filter and L1 with the aerial input in the normal position and the receiver then operated normally.

As this fault was cleared in the customer's home, the 39pF capacitor was later checked on a capacity bridge and was found to have gone down to about 2pF.

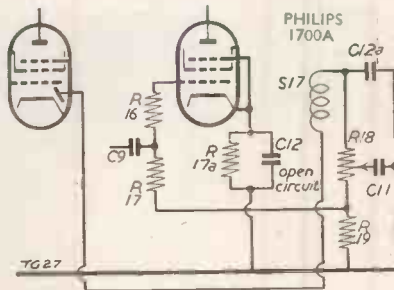
Another fault on this same model was intermittent jumping up and down of the contrast level, accompanied by loss of bandwidth. The fault was traced to the V2 anode decoupling capacitor C11 (0.003µF, disc ceramic) which had gone open-circuit. On removing the plastic cover of this faulty component, a dry joint was revealed on one of the leads.

The third fault, originally on a 930 chassis but later also found on various models, including the 927, 938, 932A, which have come in for service, refers to loss of raster after the set has been switched on for about an hour.

The first sign of trouble was the change in line scan frequency before the raster vanished. The fault was traced to a leaky line time-base capacitor C53 (470pF). When this fault first occurred, the valves V11, V12 and V13 were replaced in turn as these have previously caused trouble in these models.—R.E.L., Worthing.

Philips 1700A

Poor Regulation This set was collected with a report of poor e.h.t. regulation. This fault can usually be tied down to S11-S10, or S12-S14, or R18-R19. These components together with valves and condensers C11 and C12A we checked but tested o.k. The total h.t. current in the e.h.t. unit should be 25 mA for minimum brilliance but, on checking, an h.t. current of 35 mA was measured.



The voltage developed across S17 was about 250V a.c. but there were only 130V d.c. across R18-R19. The one component I hadn't checked was C12 which proved to be o/c. A new condenser was fitted and all voltages and currents were then normal, also e.h.t. regulation.—N.K., London, W.5.

Marconi TIIDA

Speech Coil O/C Fault: General instability (high screech and intermittent buzz). To trace this fault tests were made in the normal manner. Valves were checked and found o.k. and tests for poor smoothing, inadequate decoupling, faulty wiring in all stages did not lead to the cause of the trouble. After about four hours work, the speaker was accidentally moved—and the instability cleared immediately.

The output transformer, which is mounted on the speaker frame, was tested and found in order. The speaker speech coil was also tested and at first this seemed to be satisfactory, but after repeated checking it proved to have an intermittent open-circuit. Replacement of the speaker cleared the trouble.—A.D., Newton-le-Willows.

Stella 1500U ERT

Frame Break Through A fault frequently encountered on this model is a buzzing on sound which can be varied by operating the frame-hold control. The sound detector is the triode section of an ECL80, the pentode section of which is used as the sync separator. Interaction between the two sections results in the frame pulses being fed into the sound stages.

While the obvious cure would appear to be a new ECL80, it often happens that several new valves have to be tried before a suitable one can be found to operate satisfactorily in this stage.

As the triode is strapped as a diode (anode and cathode to earth), and the grid used as the diode "anode," a simple remedy is to use an ordinary crystal diode. The lead to the grid is removed from the valveholder and

(Continued on page 907)



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TECHNICAL GEN

Continued

connected to one side of the crystal diode, the other side going to earth. The grid pin is then strapped to earth to complete the grounding of all triode electrodes.

As the sound detector is now completely isolated from the time base circuits, a sure and permanent cure is effected. The crystal diode should be earthed to some point other than the sync separator grounded electrodes, since common impedance coupling may result.

This modification has been carried out in several sets of this model and has proved highly successful despite a slight loss of sound sensitivity.—V.D.C., Bristol, 5.

Ferranti 14T3

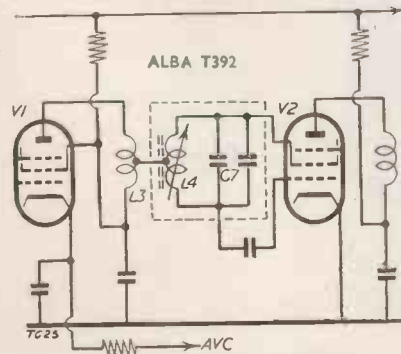
Tube Base Plating Symptoms were picture going intermittently dark with all the effects of a soft tube which is, incidentally, a Ferranti TR1414. The heater voltage on the tube was varying slightly and on testing the heater with an ohmmeter this also showed variations

Examination of the tube base revealed that the plating was of poor quality and in cleaning this completely off, all the fault symptoms disappeared and the set has now been functioning satisfactorily for some months.—R.E.L., Worthing.

Alba T392

Sound & Vision Inter. According to the owner the fault was no sound or vision, but nine times out of ten the set worked perfectly when switched on. In the workshop, the fault did occur eventually and was found to be due to no oscillation in the mixer stage V2 of the r.f. strip.

However, when measuring V2 voltages the stage was jerked into oscillation and would remain so for several hours.



The same would happen if the components were disturbed in any way. V2 was changed in vain, and the wiring was inspected very carefully for dry joints.

Coils L3 and L4 were removed from their screening cans and it was noted that C7 was pressed hard against the turns of L4, otherwise everything was found in order.

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The components were put back and the circuit reconnected, but this time when the set was switched on, the fault was in evidence permanently thus enabling the defective component to be tracked down. This proved to be C7 (20pF) which was open circuit.

It had been intermittently o/c before, but prising it away from L4 during the inspection had completed the break.—A.S., London, N.W.11.

R.G.D. 1455T

Resistor Causes Short The customer described the fault on a recently delivered receiver of above type as "a flying saucer

on the screen," and on test the description was found to be well justified. At first the fault was thought to have been in the deflector coils but these proved to be perfectly satisfactory and well insulated. Further examination under the chassis revealed the fault to be a short circuit between pin 6 (anode) and pin 5 (heater) on the ECC82. This was caused by the 47kΩ resistor lead being too close to the other pin.—E.L.B., Hornchurch.

Sobell T225

Video Amp. Failure We were recently called out to a job involving the above model, which was reported to have no picture. On arrival there was found to be no raster and from a quick meter check everything appeared to be in order. Fearing that the tube might be at fault, the set was removed to the workshop.

A more detailed test led us to believe that all supplies to the tube were correct. A new ion-trap was tried and finally a new c.r.t.; the result was the same—still no raster. Trying another approach to this perplexing case, we checked over the figures and compared them with those given in the service manual.

It was noticed that the c.r.t. cathode voltage was 13 volts higher than specified and, checking back to the video stage, the voltage drop across the anode load was found to be zero and the cathode reading of the video amplifier was 2 volts lower than normal. A new EF80 was fitted and the cathode of the c.r.t. then showed a reading of 180 volts as against the previous 193 volts. Everything was then normal.

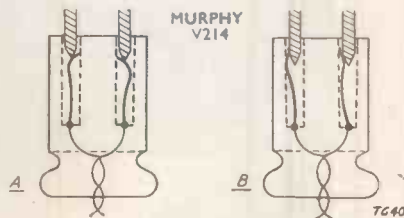
A further note that may assist "on the spot servicing" for the Sobell Models T225, T274 and T277 is when the trouble is intermittent sound. This is usually due to the crystal diode sound detector becoming faulty; a replacement effects the cure.—B.A.H., Bristol, 5.

Murphy V214

Watch This Socket This fault, though simple in origin, led to a good deal of head scratching in the workshop. We

had twice visited the customer's home but had found no evidence of a fault. Eventually the receiver was put on soak with its own mains lead and the symptoms reappeared.

This range of receivers has a mains input plug consisting of two flat blades which locate against phosphor bronze springs in the socket attached to the



mains lead. Contact should properly be along the flat of the spring, the blades entering as shown in the diagram "B." However, one of the springs in our particular socket had become distorted and was making intermittent edge contact—see the left-hand blade in the diagram "A."

Replacement of the socket effected a complete cure.—H.W.H., Bargoed, Glam.

H.M.V. 1126

Short Circuit Trimmer The receiver came in with a report that it was intermittent on medium waves, but on test it refused to exhibit the intermittent condition. On upending the set, however, the signals stopped suddenly and only resumed when the set was stood upright again.

It was noticed that when signals stopped on medium waves, the long and short wave ranges were operating normally. This pointed to a fault in the medium wave oscillator circuit. It

(Continued on page 909)

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was soon established that the medium wave oscillator trimmer was short circuit, but the interesting thing is that the inside tubular portion of the adjustable section (this is a concentric tubular trimmer) was completely loose and away from its securing rivet and it was a wonder that it operated at all.

Incidentally, it has been found with this type of trimmer which has a partial short circuit on rotating, that interchanging the adjustable portion from one of the other trimmers in the receiver will often put matters right.—H.W.G., Hayes, Middlesex.

Sobell 516AC

Noise & Instability Excessive noise and instability has occurred, in various forms and on several occasions, on receivers in this range. The instability in this particular case was marked on all bands and some noise was apparent on the gramophone position.

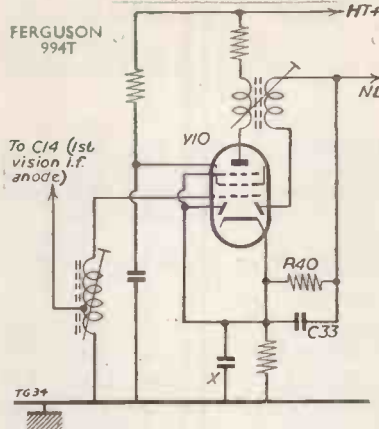
The 6Q7 was replaced with no improvement and as the fault was obviously not caused by valve trouble the chassis was removed for inspection. Quick tests by short-circuiting input points narrowed the field to the detector stage. Having experienced trouble previously with switch connections it was decided to disconnect the a.f. coupling to the switch and connect the condenser direct to the detector.

This cured the trouble. Careful visual inspection revealed no track across the switch, but a megger test showed a high resistance path from adjacent contacts carrying h.t. voltage to the oscillator anode. Replacement of the switch wafer effected a total cure.—H.W.H., Bargoed, Glam.

Ferguson 994T

Unusual Contrast Fault A rather unusual fault occurred on one of these receivers after a simple vision fault had been cleared. Reducing the contrast control from normal to minimum caused the picture to tear and the sound to cut off. Checking with no signal input showed that at the critical setting of the contrast control an r.f. pattern appeared on the raster accompanied by a slight plop.

After fruitless searching around the first video i.f. stage attention was directed to the sound i.f. and detector stage (EBF80). Prodding the cathode by-pass capacitor caused the fault to disappear and re-appear at will. Although replacement cured the fault,



the defective capacitor tested as perfect on the bridge and placing a good one across it whilst still in the set would not remove the fault condition. Can anyone explain? — R.A.B., Birmingham, B.

Pye VT4

Wrong Factory Wiring A peculiar fault was found in a Pye VT4 which was a new set just unpacked before being sent to the customer. On testing, the picture was severely over-contrasted and the contrast control was inoperative. The

chassis was removed and tests showed that everything was in order. After some considerable time it was discovered that the pulses to the a.p.c. amplifier were positive-going and the pulse transformer was suspected, a new one being fitted.

It was finally noted that the transformer was marked with a very small green spot on one side to indicate the way of assembly. After checking a similar type in another receiver it was found that the transformer had been incorrectly assembled at the factory.—R.G.F., Melrose, Roxburgh.

Cossor 938

Some Typical Faults These are three faults encountered on the above model. In the first case, symptoms were oscillator tuning drift to the extent of having to retune the oscillator slug in the turret tuner by about 4 turns. Normal voltage testing showed that the oscillator voltage was low. The anode feed resistor was then found to have gone high—from 10kΩ to about 20kΩ.

The second fault showed frame folding up to about 4in. high and distorted to a wedge shaped raster. The condition was intermittent and testing during the faulty period revealed that

(Continued on page 913)

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PART ONE

IN THIS TWO-PART ARTICLE THE TECHNICAL ASPECTS AND PROBLEMS OF THE NEW F.M. SERVICE ARE DISCUSSED AND ANALYSED FROM THE VIEWPOINT OF THE SERVICING MAN



by Gordon J. King, A.M.I.P.R.E.

ALTHOUGH it has been looming on the horizon for some considerable time, frequency modulation (f.m.) is now coming well into prominence, and soon a section of the new B.B.C. f.m. service will be operational. Needless to say, this new mode of transmission is almost sure to present a new set of problems and unfamiliar circuit techniques to service engineers; with this in mind it is, therefore, the aim of this article to explore f.m. generally so far as it will be of interest and assistance to dealers and their engineers.

Frequency modulation is not really a new technique, for long ago—during the days of the crystal set—its use was advocated as an artifice for reducing static interference of wireless transmission and reception. At that time, however, it was argued that such a mode of transmission would be bound to lead to radiation of spurious signals far removed from the carrier frequency and well outside the then accepted transmission bandwidth.

During those days, of course, the higher frequencies were not considered wholly suitable for broadcast transmissions, and since it was envisaged that the f.m. sidebands would be liable to “splash” into an adjacent band, interest accordingly subsided.

About 14 years later, when engineers were more knowledgeable with respect to short-wave transmission and reception, and when the interference problem looked like becoming insoluble, f.m. was again seriously considered. It was progressively developed experimentally in the U.S.A. some years before the war; and, as was envisaged by one f.m.'s pioneers—Major E. H. Armstrong—it proved to give greater freedom from interference of all kinds, as many of us will recall from experience of Army f.m. equipment during the war.

How f.m. differs from a.m.

We need not delve too deeply into the characteristics of amplitude modulation (a.m.) here, for we all have a jolly good idea as to how it works—or we should have! To refresh our memories, however, and for the sake of comparison, let us glide over its more important features.

For a start, we are all aware that a signal (whether it be video or audio) is transmitted on an a.m. system by using a carrier wave of constant frequency, and varying its amplitude in accordance with the wave-pattern of the intelligence it is desired to carry.

As an example, let us suppose that the carrier frequency is, say, 50 Mc/s, and it is wished to carry a pure audio signal (sine-wave) of, say, 500 c/s. The audio will be applied to the carrier (at the transmitter) in such a way that the carrier will remain unaffected from the frequency aspect—it will still be at 50 Mc/s—but its amplitude will be increased during the time when the audio signal swings positive and decreased during the time when the audio swings negative.

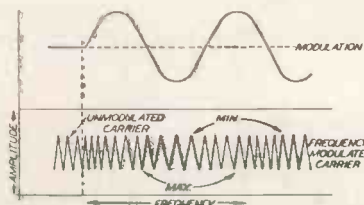
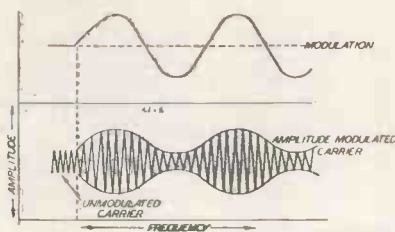


Fig. 1. Waveform diagrams showing how (a) the frequency, or (b) the amplitude of a transmitter's output can be made to vary in sympathy with a given audio modulation.

The ratio of change of the amplitude of the carrier wave is directly proportional to the degree of modulation—generally known as the modulation “depth.” The maximum modulation depth in this connection is limited at a maximum (100 per cent. modulation) when the amplitude of the carrier wave just falls to zero at the negative peaks of the applied modulation signal.

Under this condition the carrier wave rises to just twice its static or unmodulated amplitude at the extreme positive peaks of the modulation signal. All this is shown in the diagram at Figure 1 (b).

With frequency modulation things are somewhat different, two of the fundamental characteristics here are (a) that the amplitude of the carrier wave remains essentially unaltered as the result of the applied modulation signal; and (b) that the instantaneous frequency of the carrier wave varies in sympathy with the modulation signal—increasing during the positive section and decreasing during the negative section. This is illustrated at Figure 1 (a).

A further important characteristic of f.m.

Now, before we continue we must fully realise that there is no simple connection between the frequency of the modulation signal and the frequency to which the carrier wave is deviated during the modulation cycle.

The extent of this deviation—measured as frequency generally in kc/s—is analogous to the modulation depth as we know it from the a.m. aspect. Therefore, the louder (the greater) the modulation signal the greater will be the deviation of the carrier wave from its nominal frequency.

From the actual modulation point of view, an increasing modulation frequency will give rise to an increasing rate of change of the carrier frequency within the deviation limit governed by the amplitude of the modulation signal. Or in other words, the more rapid the change or deviation, the higher the modulation frequency; the greater the deviation, the greater the modulation depth. Clearly, then, the deviation can

be the same for a 50 c/s note as for a 10,000 c/s one.

The question of sidebands

It was at one time argued that several f.m. channels could be occupied in the frequency spectrum necessary for high quality a.m. transmissions. At this time it was believed that high modulation frequencies—such as up to 15 to 20 kc/s—could be transmitted on a carrier whose deviation was limited to a few hundred kc/s. On the face of it, this seems reasonable enough.

Unfortunately, this doesn't follow in practice, for it has since been established that, the same as with a.m., a single frequency modulated wave can be resolved into a carrier and sidebands.

So far as amplitude modulation is concerned, the effect of applying modulation to the carrier wave at a depth of 100 per cent. would be to add two additional frequencies each of half the amplitude of the carrier wave—these additions, as we are no doubt aware, are called sidebands. Let us suppose that our carrier wave is 100 Mc/s and our modulation frequency is 1,000 c/s, then the "upper" sideband would have a frequency of 100.001 Mc/s and the "lower" sideband a frequency of 99.999 Mc/s.

Although the receiver is tuned to 100 Mc/s and accepts the carrier at full response, it is easy to realise that unless the response of the tuned circuits is sufficiently wide the output at the sideband frequencies is going to be somewhat suppressed.

Bandwidth and bandpass circuits

In order to maintain a good high frequency response from a receiver, therefore, this makes it necessary to employ bandpass circuits that give little attenuation of response over twice the highest modulation frequency. Clearly, then, good high frequency response is more readily obtainable on the short wave and ultra high frequency bands, for here the frequency of the carrier wave is many times greater than the highest modulation frequency.

With frequency modulation the bandwidth problem is somewhat aggravated, for unlike a.m., a single frequency modulated signal produces a series of pairs of sidebands; these pairs being separated from the carrier by one, two, or three, etc., times the modulation frequency.

Thus, the f.m. sidebands do in fact extend out in both directions beyond the limits of the deviation frequency and, furthermore, they require more frequency space than do equivalent a.m. sidebands.

The minimum deviation limit is governed by the highest modulation frequency it is proposed to carry by the system. Essentially, this means that the deviation must not be less than the maximum frequency of modulation; or, in other words, a deviation of at least 15 kc/s must be allowed to cater for a modulation frequency of 15 kc/s—excluding the effect of the multiple sidebands, it will be seen that this, in terms of bandwidth, is the same as for amplitude modulation. This being, of course, twice the highest modulation frequency, since the above case means swinging the carrier over 30 kc/s, 15 kc/s either side of the nominal frequency.

Although it will be appreciated that, since each frequency modulated frequency involves a series of sidebands the frequency spectrum required for an f.m. station is greater than an a.m. one, the bandwidth required for an f.m. channel is not really excessive because the high order sidebands diminish in amplitude and soon become sufficiently small to be neglected.

The B.B.C. f.m. stations use, and are to use, a deviation of plus or minus 75 kc/s corresponding to 100 per cent. modulation. This demands a deviation bandwidth of 150 kc/s; and, since it is proposed to make each f.m. channel 220 kc/s wide, sufficient room will be available to prevent interference from adjacent channel sidebands.

This channel width will be considered adequate when it is realised that with a maximum frequency of deviation of plus or minus 75 kc/s and a modulation frequency of 15 kc/s, the above bandwidth will cover all high order sidebands greater than about 1.5 per cent. of the unmodulated carrier.

We should now be clear on the fact that an f.m. channel is considerably wider than an a.m. one, and that f.m. channels must be accommodated in the v.h.f. regions where there is—at present anyway!—plenty of elbow room. Clearly, the present long wave broadcast band would not be wide enough to cater for a single f.m. channel, while, with a bit of luck, the medium waveband would hold about two normal channels.

One can well realise why early protagonists of f.m. were forced to put aside their experiments, bearing in mind, of course, that little was known of v.h.f. transmission in those days.

The problem of interference

We have now reached the stage where it should be fairly clear that the r.f.-i.f. section of a receiver will handle an f.m. signal in an identical manner to an a.m. one, provided that the associated tuned

circuits are adjusted to pass all the sidebands of significant strength; it is not until the signal arrives at the detector circuits that its treatment is different from an amplitude modulated signal—this we shall discover later.

For the present let us investigate the effect of interference on f.m. Most of us are aware, from television experience, of the effect that impulsive interference has on an a.m. modulated signal. We know that electric motors and car ignition systems superimpose "spikes" of noise on the envelope of an amplitude modulated carrier. Since we are using frequencies in the same region as television for f.m. we can expect to pick up noise "spikes" from the same causes on the f.m. carrier.

These actual noise pulses are of little consequence, however, for they can be easily suppressed on arrival at the detector stage, or before the detector stage by means of a limiter, without detracting from the quality of transmission—bearing in mind that we are interested only in the frequency modulation of the carrier wave.

On the face of it, therefore, it would appear that an f.m. system would provide complete freedom from any interference giving rise to amplitude variations of the carrier. Unfortunately, this is not strictly true, for, apart from producing amplitude modulated "spikes" or pulses of interference on the carrier, impulsive interference tends also to incite an instantaneous change in the frequency of the carrier wave. The interference does this by altering the phase of the carrier oscillations over a period of time governed by the characteristics of the interference.

Differences in interference on a.m. and f.m.

This instantaneous phase change gives rise to the same action as the modulation itself has on the carrier wave; the rate of change of the carrier frequency is modified by the disturbance and since the detector stage is obviously sensitive to this sort of thing it results in noise.

Similarly, phase fluctuations also occur if an unwanted carrier happens to fall within the frequency spectrum of an f.m. channel. The f.m. and unwanted carriers produce the well known heterodyne effect, but apart from causing an amplitude fluctuation—resulting in a beat note—the unwanted signal also evokes a phase change of the carrier.

The effect of interference on the reception of an f.m. signal is not really as bad as it may now seem. Indeed, in this respect it is far superior to a.m., and this is the main reason for its adoption by the B.B.C.

This alleviation of interference is due to the fact that the vast majority of

noise is made up of voltages of varying amplitude which are rather difficult to reject in a receiver operating on a.m.

As has already been intimated, an f.m. receiver rejects a.m., either by use of a limiter stage or by the use of a special detector stage which has the property of limiting the signal amplitude and thus "shaving" off noise pulses.

Although noise pulses and interfering carriers give rise to a degree of virtual frequency modulation of the carrier (really phase modulation), the effect on f.m. is less severe than what it would be on a.m. as the result of noise pulses or heterodynes of equal magnitudes.

As an illustration, let us consider the effect of impulsive noise on a.m. and f.m. systems, both having equal transmission bandwidths—say, 20 kc/s. This means, of course, that the maximum deviation of the f.m. system is 20 kc/s.

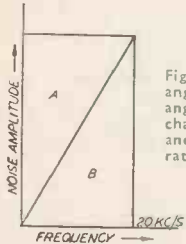


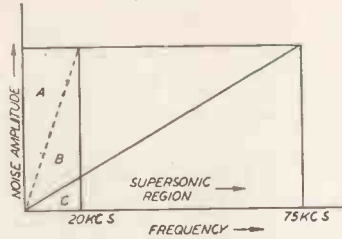
Fig. 2. Showing the triangular (A) and rectangular (A&B) noise characteristics of f.m. and a.m. receivers. Noise ratio is 2:1 in favour of f.m.

Now, owing to its transient nature, impulsive interference is made up of components at all frequencies. On an a.m. system such interference will cause the receiver to respond equally at low and high frequencies. On the f.m. receiver, however, the noise output at 20 kc/s will be equal to the noise output of the a.m. receiver at the same frequency, but—and this is the important point—the response to the noise components will fall in proportion to their frequency.

This produces a noise characteristic as shown in Fig. 2. Here the noise output from an a.m. set is contributed to by all component frequencies of a noise pulse (area A plus area B). The noise output from an f.m. set, however due (to noise pulses of equal amplitude), reduces proportionally with frequency, so that the lower frequency components of a noise pulse have progressively less effect on an f.m. set (area B). Clearly, with both systems using equal bandwidths, the f.m. system gives a 2 to 1 better signal-to-noise ratio.

In practice, however, as we have already seen, the f.m. deviation is set at a maximum of plus/minus 75 kc/s. This feature further assists the alleviation of noise, as many of the noise frequencies fall in the supersonic region—above normal hearing—and are of little consequence.

Fig. 3. Showing how extended frequency deviation further improves the f.m. signal-to-noise ratio (area C).



This effect is shown in Fig. 3, where it can now be seen that the interference disturbance is concentrated in area C. Extending the deviation frequency above the normal audio pass band has the result of improving the signal-to-noise ratio a further 4 or 5 times.

The above effect is still further assisted by the use of pre-emphasis at the transmitter and corresponding de-emphasis at the receiver. The transmitter modulator has a rising frequency characteristic so that the higher modulation frequencies are amplified more than the lower ones. At the receiver a compensating circuit restores the relative audio amplitudes to normal, while at the same time also reducing the noise which, as the result of the result of the "triangular" noise distribution, accompanies the higher audio frequencies.

Yet another factor which gives f.m. an advantage over a.m. in securing freedom from interference is the fact that little disturbance is evidenced from two stations working in the same channel provided the local signal strength of the wanted station is little more than double the local strength of the unwanted station.

This most desirable feature is really outstanding when it is considered that to achieve the same results from an a.m. system the wanted station would

have to be something like thirty times the strength of the unwanted one!

This makes it readily possible for channel sharing without the necessity of taking extreme precautions so far as signal polarisation and unusual atmospheric conditions are concerned, as is the case with television. With f.m. each transmitter of a common frequency network can be situated to have its own zone providing relatively interference free reception.

The question of quality

Apart from providing a greater freedom from interference, which is really an aid to quality, f.m. does not really give better quality of reproduction than a.m. The extended bandwidth given to f.m. will eventually permit the transmission of better quality sound than what we are at present used to on the long and medium broadcast bands. The same could, of course, be said of a.m. occupying a wide bandwidth at v.h.f.

With present broadcast reception it is becoming an accepted habit (from the domestic aspect!) to reduce the disconcerting effect of interference by turning on the tone control and thereby cutting the higher audio frequencies and some of the interference. With f.m. this will not be necessary to such a large degree, and this in itself is bound to result in enhanced quality.

Soon one of our problems may be in convincing a customer that he is in fact getting good quality. Surely we are going out of an age of bass-boost (really top-cut) into an age of top-boost—the question is will the customer like it?

It doesn't seem very long ago that the customer's main aim was in acquiring a receiver that rattled the windows on bass notes—generally speaking, it will probably be agreed, a good top response seemed less important.

TV DISTURBANCE TESTING

—continued from page 916

ponents can result in the complete absence of signal or varying degrees of distortion.

Commonest fault is the anode resistor of the diode going high—this causes distortion. Failure of the diode will result in no signals. Simplest check is to short the cathode to the anode of the limiter diode; if sound is restored, then the valve should be replaced.

To check for a high or o/c limiter resistor a 4.7 megohm resistor may be shunted across the original component. If this clears distortion a new resistor is required.

Other Sound Stages

Going back to the final sound r.f. stage—if clicks are heard when disturb-

ance tests are applied to the grid of this valve then it can be assumed that the following stages are o.k., and it will be necessary to go forward a stage to the next sound r.f., applying the same tests as already outlined.

This procedure can be repeated, working systematically towards the front end of the receiver, until the dead stage is located—by the absence of clicks from the speaker.

A maximum of two sound r.f.s. or i.f.s. is normal in most television receivers. Once the dead stage has been found normal servicing techniques employing a multi-range test meter can be used to isolate the faulty component.

It has been necessary to consider in some detail methods of diagnosing sound receiver faults so that the same methods may be more easily understood when applied to the less familiar territory of the vision receiver. The basic principles involved are exactly the same, but the method of interpretation differs in that a visual instead of an aural indication of the disturbance signals is obtained.



TECHNICAL GEN

Continued

half of the frame coil was short circuiting due to bad soldering on the scanning coil tag board.

In the third fault, it was a case of no raster. The 21A6 anode was red hot. Cause was traced to the 6AB8 line oscillator (V12) which had an intermittent short circuit to cathode resulting in the 1kΩ cathode resistor burning out.—R.E.L., Worthing.

Sound Distortion

Speaker Gets Needed After clearing an Alba TV set of sound distortion due to an open-circuit anode resistor in the detector circuit, a fidelity radiogram was brought in with similar type of distortion. Checking of a.v.c. and output stages revealed that everything was in order.

After a great deal of time was wasted on re-checking the circuit, a substitute speaker was tried and this immediately cured the trouble. On examining the original speaker it was found that a gramophone needle had become attached to the permanent magnet and was brushing against the speech coil.

This points to the desirability of using a tested speaker when checking for distortion.—H.G.P., London, N.W.8.

Murphy V200

Poor Frame Lock It has been found that the cause of intermittent frame lock on this model is often due to a low value sync coupling capacitor between the v.f. amplifier valve (a 10F1) and the sync separator (a 20F2). The component is C32, a 0.05 μF capacitor, mounted above chassis alongside the v.f. amplifier valve. It is often not suspected as one would expect the line sync to also be affected but this is not always experienced.

The same capacitor can also be the cause of line tearing. This time the fault is completely masked as the line and frame sync circuits are satisfactory, as are the time-bases. It can be cured by removing the insulated cover from the capacitor and earthing the metal case to chassis or by replacing with a moulded case capacitor. This also applies to Model V202C.

Another fault found on this chassis produces an alarming effect in that the screen is covered in diagonal lines and flyback traces. This is due to the main frame correction capacitor C64 (0.1 μF) going open-circuit. It is connected from the h.t. end of the frame oscillator

transformer primary to chassis and is situated on the tag board adjacent to the frame oscillator transformer.—R.V.A., Birkenhead.

Pye VT4

Turret Tuner Trouble A short circuit in the h.t. line was traced to the turret tuner. The seals were broken and the casing dismantled. A burnt-out resistor indicated where the fault was. This turned out to be a 33Ω resistor in the anode circuit of V1 and where its lead passed through the chassis the insulation had broken down. Care was taken not to disturb the wiring of the unit and, during the repair, the turret was clamped in a small vise.—R.E.J., Llanrwst.

Alba 3613

Valve Change Hint This receiver would cease oscillating on the long-wave range and although a number of DK91's were tried, none proved satisfactory. It was found that, using an Amplion Service Convette, oscillation ceased when the l.t. fell to 1.3 volts. It was then decided to fit a DK96 and the appropriate modifications were made. This was a complete success and the set worked down to an l.t. of 1 volt.—R.E.J., Llanrwst.

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TV Disturbance Testing

DETAILS OF A SHORT-CUT METHOD TO SPEEDY TELEVISION FAULT ANALYSIS AND DIAGNOSIS

Part 3 by D. Wayne

THE same technique as outlined in Part 2 last month can be used to isolate a fault in the frame-scanning circuits. In this case there will be a visible indication on the screen of the cathode-ray tube, assuming that the line and e.h.t. circuits are in order. A single horizontal line will indicate the complete absence of frame-scan, which may be due to a fault in either the oscillator or output circuit. In order to determine whether any 50-cycle vertical saw-tooth is being generated, a simple signal tracer can be used. This consists of a 0.01 μF condenser (1,000V working) with the end leads extended, and having crocodile clips attached.

One clip is attached to the grid pin of the sound output valve (or alternatively, the "top" of the volume control), and the other clip can then be used as a probe, or may be attached to various points in the circuit under test. In this way, the audio-output stage of the receiver (assuming it is functioning normally) is being used as a signal tracer, the 0.01 μF condenser providing the necessary capacity coupling to the circuits under test.

Checking for Frame Saw-tooth

Using this method of audible signal tracing, the probe clip of the test lead should be attached to the anode pin of the frame output valve. If a loud coarse 50-cycle signal is heard, then saw-tooth is obviously present at this point, but is not reaching the frame deflection coils encircling the neck of the tube.

Appropriate checks should be made in this part of the circuit. As few components are involved, it should be a relatively easy matter to find the cause of the trouble. It is worth mentioning that while actual breakdown of the frame

scanning coils is relatively rare, trouble occasionally originates in dry-soldered joints on the deflection yoke, or soldered connections becoming strained through rotation of the yoke during servicing, replacement of the tube, etc.

Linearity components, comprising resistors and condensers, are also subject to failure (resistors going "high" and condensers going "short"), though this is more likely to happen in the line circuit than in the frame.

The absence of any audible saw-tooth at the anode of the frame output valve means that a further test will be required, this time at the grid of the same valve—thus working backwards through the whole of the frame circuit (as illustrated in Fig. 1). Saw-tooth at this point means that the frame oscillator stage is working, but that the output stage is dead.

The output valve may be checked at this point by substitution, and if this fails to produce a cure, then the associated components in the output stage should be tested with the aid of a meter.

The Frame Oscillator

If no saw-tooth is heard at the grid of the frame output valve, then it is necessary to trace backwards to the anode of the frame oscillator valve. A positive result here will indicate that the fault lies between this point and the preceding one (e.g., an open-circuit coupling condenser). On the other hand, a negative result means that the frame oscillator is not working, and meter tests should then be made to isolate the faulty component (having eliminated the valve by substitution).

Weak points in frame oscillator stages (Fig. 2) are: the blocking transformer—either the primary or secondary winding may go o/c or develop shorted turns. A meter should be used to check resistance readings against those specified by the manufacturer in the service manual; anode resistors—in certain types of circuit high-value anode resistors (of one megohm or more) are used, and these are liable to increase in value, causing raster distortion, and eventually becoming o/c, causing collapse of the frame-scan; grid resistors—here again high-value resistors are occasionally used (certain circuits using values of 10 megohms or more) and these may go high or o/c, upsetting valve biasing conditions and causing oscillation to stop; cathode resistors together with cathode by-pass condensers are also a frequent source of trouble, but can easily be checked by a simple meter reading; and anode-to-grid coupling condensers may show a leak, causing non-linearity of scan, or may even become o/c, causing loss of saw-tooth drive.

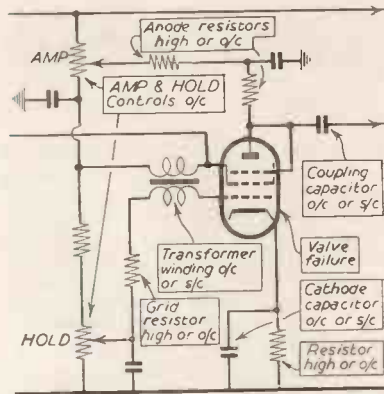


Fig. 2. Common faults in frame (or line) oscillator stage.

Moving parts are always suspect in any receiver, and potentiometers or variable resistors in the scanning circuits can go open-circuit through fair wear and tear. Such components include the line and frame hold, amplitude, and linearity controls. Trouble of this kind is soon located with a meter.

A quick check for high-value resistors that are suspected of being open-circuit is to place the thumb and forefinger across the wire ends, thus shunting the component in question with the skin resistance, and observing the result on the screen.

Needless to say, this test should only be carried out where the voltages involved are low, and would not be used for a resistor carrying the full potential of the h.t. supply. In the latter case, it would be almost as simple to shut another resistor across the offending component, using a pair of insulated pliers.

The Sound Receiver

If, on first switching-on the set, a normal raster or picture appears, but there is no audio output, then it is reasonable to diagnose a fault in the sound strip, which includes the speaker, output stage, a.f. and detector, and the r.f. or i.f. stages up to the point where the sound circuit is coupled into the vision strip near the "front end" of the receiver. Disturbance tests for audio stages are more or less standard and do not vary from those employed by engineers working on "blind" wireless sets.

Assuming that no audio output is being obtained from this circuit, and that the chassis has been removed from the cabinet so that all valves and components are accessible, a number of simple tests can be applied which will rapidly pin the fault down to one particular stage.

The first is to check for the presence of h.t. by the drastic but age-old and popular method of momentarily shorting an h.t. point to chassis with the blade of an insulated screwdriver. Good or bad, this device is standard practice among the great majority of service engineers, and is frequently used in commercial production-line testing. The short should only be for an instant, so as not to overload the rectifier and smoothing components. No spark will indicate no h.t.; a small spark—low h.t.; and a fat spark—normal h.t.

This is, of course, a rough and ready approximation. It is easy enough to measure the h.t. supply accurately with a testmeter, but here we are concerned with demonstrating whether or not h.t. is present in a simple and rapid manner.

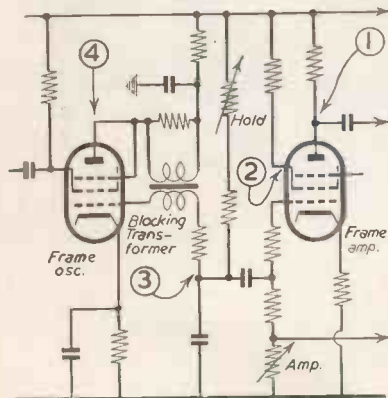


Fig. 1. Signal-tracer check points in typical frame-scan circuit: (1) output valve anode; (2) output valve grid; (3) output grid circuit at remote end of coupling condenser; (4) anode of oscillator.

For the squeamish, however, an equally rapid check is to touch a 0.1μF condenser between chassis and the h.t. line, discharging it immediately afterwards by connecting the wire ends together. A spark will indicate the presence of h.t.

If there is no h.t. present in the audio section of the receiver, then it will be necessary to trace the h.t. line back to the point where it connects to the common supply for the rest of the receiver. It will probably be found en route that a decoupling or h.t. dropping resistor has become o/c—in which case the fact should be fairly obvious since it will almost certainly be discoloured or even burned-out through overloading.

Obviously, any decoupling associated with such a resistor should be suspected of being short-circuited. A quick test is to clip the condenser at one end, short across the resistor with a length of wire held in a pair of insulated pliers, and test again for h.t.—the receiver being on all the time.

Alternatively, with the set switched off, an ohm-meter reading between h.t. line and chassis can be made, to find out if the condenser is s/c, or if there is a short elsewhere in the sound strip. The location of an h.t. short or failure should present no difficulties.

Hum Test

Assuming that h.t. is present—at least in the main h.t. line, if not at the anodes of all the sound valves—the next step is to find out whether the fault lies in the front half (the r.f. or i.f. stages) or the last half (detector, audio and

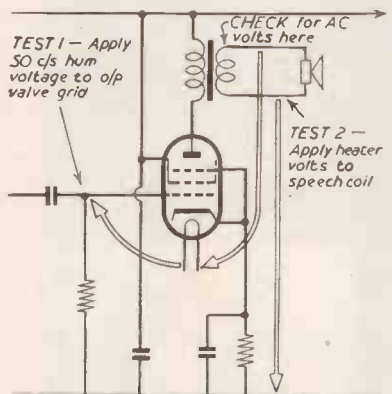


Fig. 3. Speaker transformer tests: (1) by coupling hum from heater to grid of output valve and checking for a.c. volts across speech coil; (2) by coupling hum from heater direct to speech coil. The condenser test lead should be used for both tests.

output stages) of the receiver. A small screwdriver, with the finger touching the metal blade, should be placed on on the "top" contact (or alternately the "wiper" contact) of the volume control.

If a loud 50-cycle hum is heard in the speaker, it can safely be assumed that all stages following the volume control are working normally, and the fault must lie in the preceding section of the receiver. On the other hand, if no sound is heard, there is trouble in the audio and output stages, and it is necessary to make further tests between the volume control and the speaker.

The meter may be used to check for h.t. at the anode of the output valve, or, alternately, the anode may be momentarily shorted to chassis, in which case, if h.t. is present, there will be a loud thump in the speaker. The 0.1μF condenser may be used instead: when touched between anode and chassis, the transient charging current will produce a click or a crackle in the speaker. If

nothing is heard, then the fault is isolated to two components—the speaker and the output transformer.

Obviously, h.t. on the anode plus no crackle places the fault in the transformer secondary or speaker, while no h.t. on the anode invariably means that the primary of the transformer is o/c. A meter test will uncover the fault in a few seconds.

It should be noted that the primary of a sound output transformer may be burned out due to the failure of the tone-correction condenser connected between anode and earth. This component should be checked before fitting a new transformer and testing.

Output Stage

The output valve can be checked under normal operating conditions by simply applying a 50-cycle hum voltage to the grid via the 0.01 condenser, one crocodile clip being attached to the valve grid pin, the other to a convenient heater point.

If no sound is heard tests as already described should be used to eliminate the valve itself and the primary of the sound output transformer, and if these are found to be o.k. then there is reason to suspect trouble in the transformer secondary circuit—either the secondary winding or the speech coil of the loudspeaker.

Still using the test lead to inject a hum signal into the output valve, an a.c. voltmeter should be connected across the speech coil. If no reading is obtained then the secondary winding is open; if the meter registers a.c. voltage then the speech coil must be open.

Alternatively, the test lead (or preferably, in this case, a length of wire) can be used to inject 50-cycle heater voltage directly into the output transformer secondary circuit (the crocodile clip is attached to one side of the speech coil, the other side being earthed to chassis). If no hum is heard, then the fault must be in the speech coil; or if hum is normal then the fault is almost certainly in the transformer secondary (Fig. 3).

In all these tests it is assumed that the speaker is of the permanent magnet type. The same principles will naturally apply to cranked speakers, though these are not commonly used in television receivers. Trouble suspected in the field winding can easily be checked with a test meter.

The Sound R.F.'s

The initial sound circuit test described previously (touching the "top" of the volume control with a metal screwdriver, finger on blade, to check for hum) indicates whether the trouble is pre- or post-detector. Supposing a loud hum is obtained, demonstrating that the audio and output stages are working normally, then the next step is to go

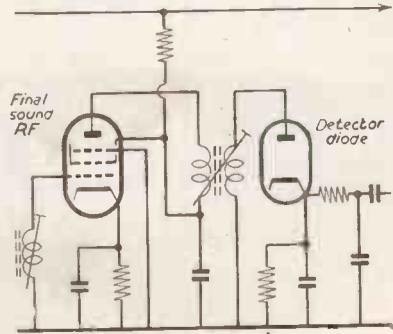


Fig. 4. Typical sound detector circuit employing single diode.

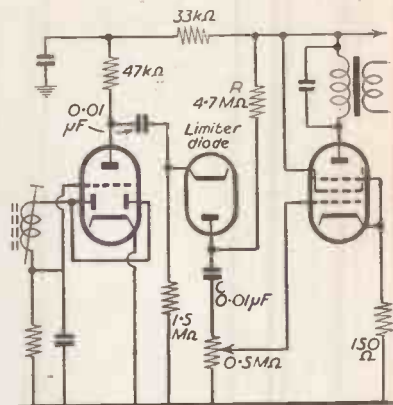


Fig. 5. Sound interference limiter circuit of the "envelope follower" type, as used in the H.M.V. Model 1808.

forward in the circuit to the grid of the r.f. valve (or i.f. in a superhet) immediately preceding the detector (Fig. 4). Here it is necessary to create an artificial signal in order to find out if this stage and the detector are functioning properly. This can be done in either of two ways.

The grid of the r.f. valve may be touched or scratched with a screwdriver—once again with the finger touching the blade. This creates transient voltages having radio-frequency components which constitute a test signal, the result in the speaker being noise in the form of crackling and clicks.

Alternatively, the test lead may be connected to the h.t. line via one crocodile clip, the other being touched on the valve grid pin. The transient charging current into the 0.01μF condenser will produce an audible click in the speaker, provided the following stages are working normally.

The absence of clicks with either of these disturbance tests will point to a fault between the grid of the final r.f. (or i.f.) valve and the top of the volume control. The anode of the detector diode may be treated in the same way. The reappearance of clicks at this point will indicate trouble between the last r.f. and the detector, and a test meter will quickly isolate the fault.

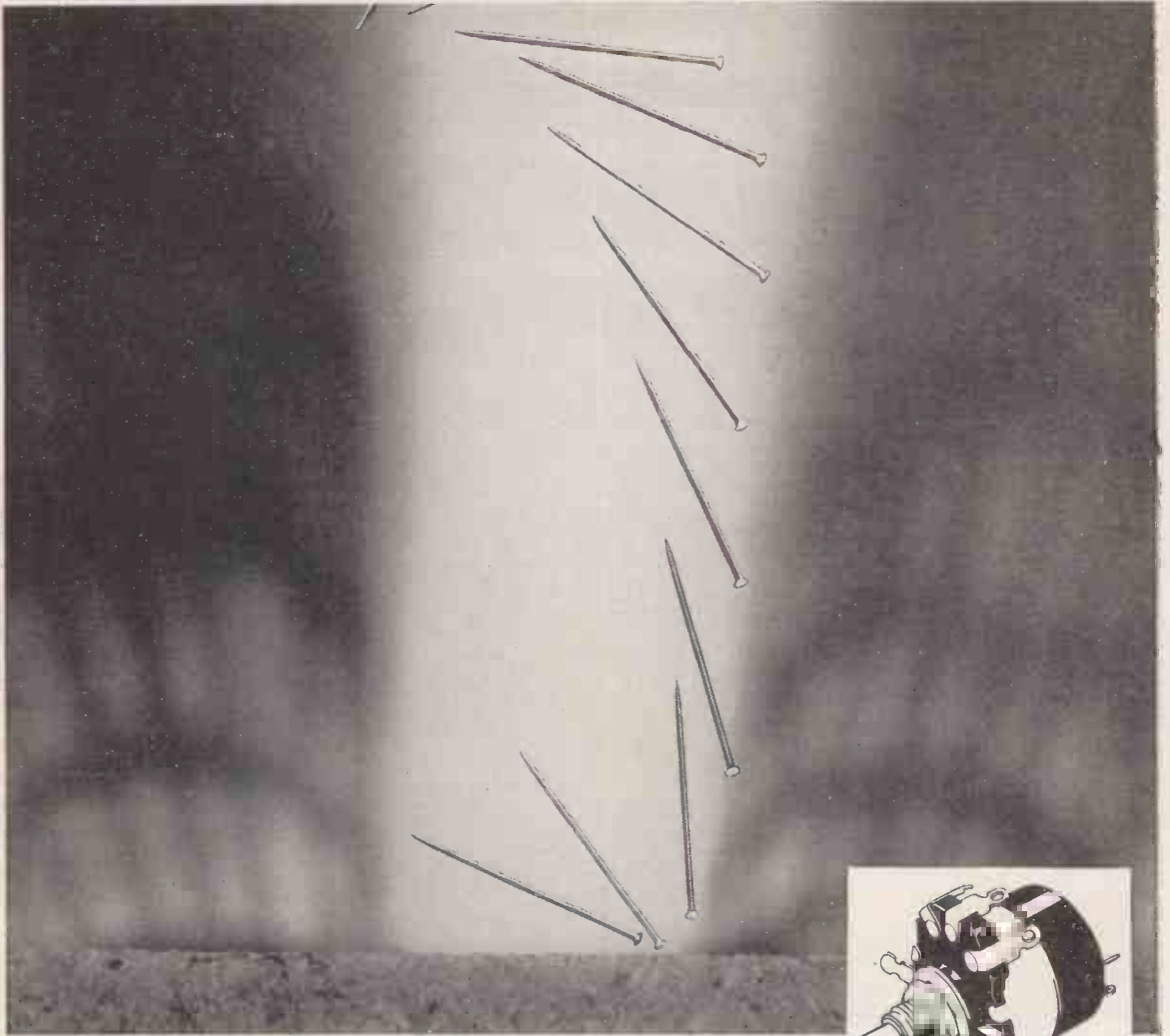
If, on the other hand, no clicks are heard at the detector anode, but hum is obtained from the detector cathode, the diode is almost certainly at fault. No hum from the cathode points to a component fault between this point and the point where hum was last heard—at the "top" of the volume control.

Since few components are involved, further fault-finding should be rapid and straightforward.

The Sound Limiter

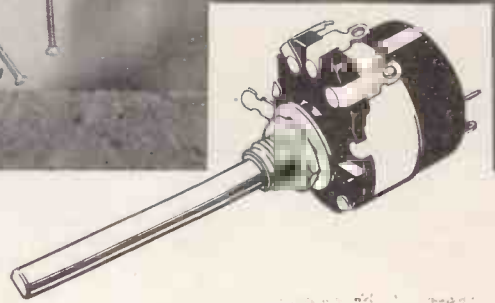
Most receivers incorporate a sound limiter circuit, which usually takes the form of an "envelope follower" (Fig. 5). The diode, in conjunction with the resistor and condenser (whose time constant is arranged to respond to the a.f. modulation waveform, but not to rapid peaky changes of amplitude characterised by ignition pulses), will normally not affect the modulation envelope after detection. But a fault in either the diode or its associated com-

(Continued on page 912)



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THE ambition of many service engineers is to go into business on their own account, handling service, not sales, as is the case in America. Establishing a shop or service premises is, however, easier said than done these days. There are many problems to overcome, so a little thought and planning is vital in such an enterprise.

Capital is a first requirement in order to purchase the necessary stock, equipment and transport. To start a service business only a minimum capital outlay of at least £500 will be needed so as to leave a float in the bank. This is absolutely essential as in the first few months the returns may not be enough to provide a weekly wage.

As much money as possible should be ploughed back into the business during the first few years. This makes for seemingly fruitless work, but is a good long-term policy and the only successful one.

The amount of capital required varies considerably in each individual case. If a retail shop is to be stocked at the outset, then, of course, a great deal more than £500 will be required. Radio and television sets are costly items to-day.

PREMISES

Premises of the right kind are most difficult to find even though many new shops are being built. In many cases rents are prohibitive; often a lease has to be purchased which ties up money which could be otherwise employed for buying valuable stock.

The prime consideration is to keep overheads as low as possible whilst at the same time obtaining premises which are in a good position easily available to the public; and not in direct opposition to an already established radio business.

It is sometimes more economical in the long run to buy a shop with living accommodation, if this is required, than to rent one over a long period. The only consideration then, is that a deposit is needed, so this proposition can only be entertained if the money is available.

When choosing shop premises, due consideration should be given to the amount of available space for a workshop and garage. If possible the workshop is best kept inside the main building for convenience purposes, also because outhouses tend to be damp and require a lot of heating in the winter months.

Once suitable premises have been obtained, shop fittings and workshop benches have to be installed. The best layout for these will depend largely on the shape of the rooms used, but

By D. E. Winter

in every case, a little pre-planning will ensure that all space is used to its best advantage.

A most important item is the telephone. Application to the G.P.O. should be made as soon as possible, for a business line with possibly an internal extension to the workshop. The extension saves much running about from one place to another, also service enquiries can be put through direct to the workshop, a great convenience when busy in the shop.

The acquisition of a small van will account for another portion of the initial capital. This is an indispensable item, so if possible a new or good second-hand vehicle is indicated—one which will give good service over the years. Large repair bills from the local garage are not welcome when first starting a business. The cost of running the van is, in itself, enough without extra overheads of that nature.

STOCK

A certain amount of stock is needed for the shop in the way of radio and television sets, electrical goods, batteries and other articles. It is best to try and acquire one or two agencies and keep to them for the first few years.

Once the business is on its feet, then is the time to think about expansion; trying to do too much at the start may well result in failure:

Valves, components and replacement parts for the workshop must be ordered, as large a stock as possible. The success of the venture may easily depend on the service work undertaken, and for efficient service work everything needed must be available on the shelf. If not, it must be quickly obtainable.

In this respect, credit accounts with wholesalers are valuable, for a phone message will usually ensure that the wanted goods are delivered the next day.

When buying stock of any kind, it is obviously logical to purchase the right type. Care should be taken in this respect, because it is so easy to tie up valuable capital in "dead" goods. As it is, enough money is rendered non-profitmaking by the purchase tax laws.

Some service equipment will be essential, so the most important items

will have to be purchased, but these may be kept to a minimum at first, as it is always possible for an enterprising man to manage initially without a lot of apparatus. When profits allow further purchases in this direction, then this is all to the good, as servicing will be facilitated and the assets of the business will increase.

Another thing to consider is the trading name employed. If the name of the owner is used, then no legal procedure is necessary, but any variations from this requires the business to be registered with the local council.

Once the name has been established, then headed letter paper and business cards can be printed. The cards can be distributed in the area together with some local advertising so that the public are informed of the new business.

The main object at the beginning will be to encourage customers into the shop, and then having made a sale, or carried out some service work, to ensure that they come back with their friends. Recommendation is by far the best way of making a business known, but is a long-term policy, so other means have to be employed as well.

BOOK-KEEPING

A certain amount of book work will be involved and must be carried out if the business is to be run efficiently. Apart from the fact of keeping accounts straight and knowing how trading is progressing from week to week, books have to be kept for income tax purposes.

In this respect, it is far better to contact an accountant and arrange to have all books audited yearly. For an annual sum, which is well worth while, the accountant will keep everything in order, deal with the income tax authorities and also give much helpful advice on the subject of book-keeping in general.

If a one business is contemplated, then all jobs will have to be systematically carried out; this calls for good organisation right from the start. It is a bad policy to keep changing from one system to another; the owner's time will be fully occupied with many other essential things. Competence and efficiency are the factors on which success of failure depend, together with many hours of hard work.

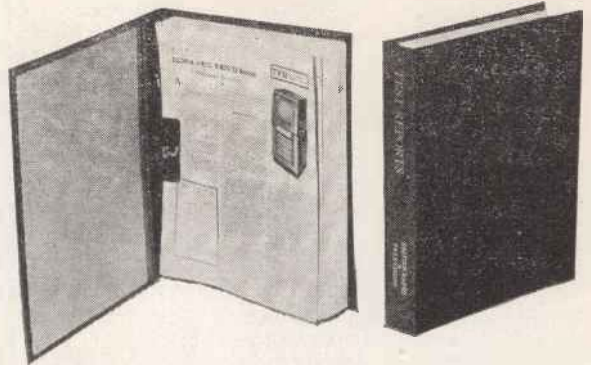
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 Pilot TM/CM54 Television Receiver (TV41, June, 53).
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 Pilot VS9 Console TV Receiver (TV34, Nov., 52).
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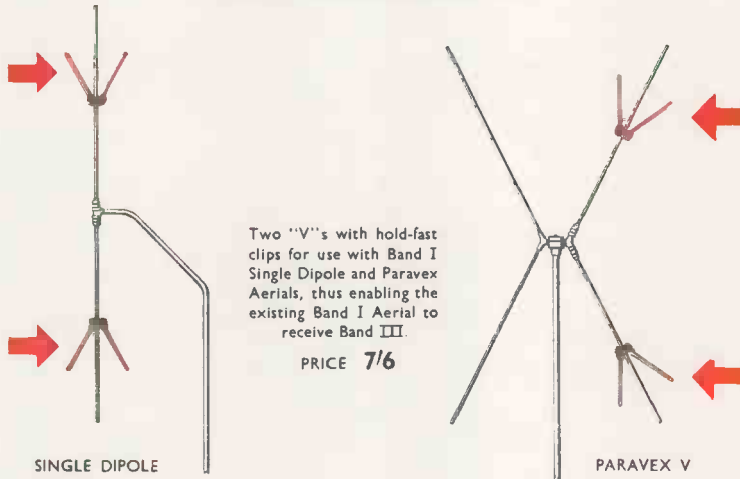
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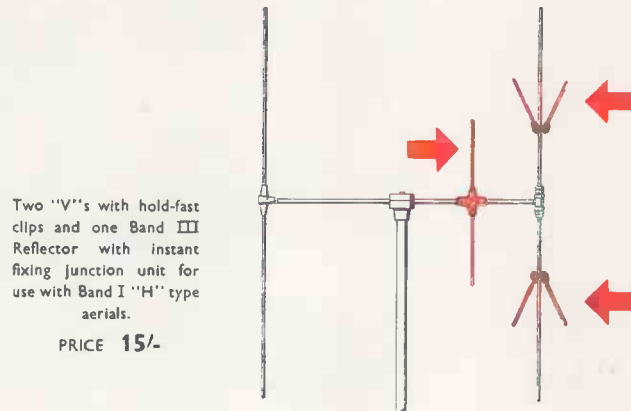
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COMPONENT SHOW PREVIEW

—continued

A range of Hunts hi-k ceramic capacitors in tubular form is now available and other types are in development. An important new development is the provision of ranges of special capacitors of all types for printed circuit applications.



Hunts W96 Midget Supermoldseal Metalloid Paper Capacitors

In addition to their range of silvered mica capacitors, Stability Radio Components, Ltd., are showing a range of ceramic tubular capacitors rated at 100°C. These are inexpensive, robust and fully insulated components which cannot be damaged by prolonged contact with the soldering iron. Capacitance values are from 0.5pF to 5,000pF in P100, N750 temperature co-efficient and high-k materials.

A new introduction for f.m. and Band III receivers is the "top coupling" range from 0.5pF to 1.5pF which is supplied at an economic price with a tolerance of ± 0.5 pF. Not long ago such a close tolerance could only be achieved in expensive precision components.

Two interesting new components will be shown by Welwyn Electrical Laboratories, Ltd., namely, the *Vitricon* capacitors and metal film resistors. The *Vitricon* capacitors have a dielectric material and a protective material consisting of vitreous glazes; they are thus capable of operation at very high temperatures, and will, in fact, maintain an insulation resistance in excess of 10,000 megohms in operating at an ambient temperature of 150°C. The vitreous enamel gives adequate protection against tropical conditions.



Wego multiple capacitor of 110 μ F in 1 μ F steps

They are suitable for application in equipment intended for use in supersonic aircraft where extremely high temperatures may be met.

The Wego Condenser Co. will be showing many capacitors manufactured to special design, in addition to their standard ranges. Examples of capacitors for delay lines and transmitters for replacement in American equipment will be included in the display. An interesting special type is the 110 μ F subdivided and switched capacitor (illustrated) which gives up to 110 μ F in steps of 1 μ F, and can be used for rapidly determining the correct capacity required for motors, etc.

A full range of transmitting and receiving condensers can be seen on the Stratton and Co. (*Eddystone*) stand. They include miniature and standard microcondensers in butterfly, split-stator, single-section and differential types. There is also a range of ceramic microcondensers with metal parts of silver-plated brass. Slow-motion and vernier dials of various types are available.

Jackson Brothers are displaying their range of variable condensers, complete drive assemblies and drive component parts, a range of stand-off insulators to suit most requirements, and, of particular interest, an insulated rotor ganged variable condenser and geared drive.

New additions to their ranges of metallised paper, polystyrene and American-styled capacitors will be displayed by the Telephone Manufacturing Co. Metallised paper capacitors in a number of specially designed "multiblocks" will also be shown.

Resistors

The Welwyn metal film resistors can operate at a high temperature. They are made in the conventional cylindrical form having axial wire terminals and consisting of a film of noble metal alloy deposited on glass. Their stability is equivalent to that of wire-wound resistors, but the resistance range of a given size is very considerably increased, e.g., in the component $1\frac{5}{16}$ in. long \times $\frac{1}{8}$ in. diameter, resistance values up to 1M Ω at a tolerance of 1 per cent. are available.

The company will also exhibit a range of heavy-duty resistors wound on ceramic tubes and supported by vitreous enamel.

A.B. Metal Products will be featuring the *Clarostat* range of rotary and preset potentiometers incorporating the *Clarostat* "stabilised element" which is claimed to give stability and long working life. A full range of *Clarostat* wire-wound controls will also be displayed. In the power-resistor class the *Clarostat* series KS (*Standee*) range are designed for ease of mounting and give trouble-free performance.



Salford Electrical Instruments Precision Potentiometer

Standard Telephones and Cables will be exhibiting a number of thermistors which are representative of the complete range available. They are suitable for use in temperature detection, current surge suppression, power measurement, etc. The exhibit includes examples of bead types (both directly and indirectly heated) and block types of various designs.

New products displayed by Salford Electrical Instruments, Ltd., include a range of precision potentiometers with metal housings. Available in both linear and functional card winding types, these units employ an improved type of wiper assembly, in which the wiper, being horizontal, gives a more even tracking over the resistance winding. On the twin wiper arm type, the second arm is now capable of independent movement through 230°, whereas the standard units in the past were limited to a 90° or 180° movement.

The range of Electrothermal wire-wound high-stability resistors, the *Prestisor*, has been augmented to include special types with resistance values up to 3 megohms. These are required for computers, predictors, etc., where the highest accuracy is demanded. Any value, tapped or untapped is available as required. In addition to the high-stability range, a standard wire wound resistor in the usual values is now introduced.

Electronic Components are showing their ranges of miniature wire-wound resistors in lacquered and vitreous finishes, embodying non-hygroscopic ceramic formers specially selected for their insulation and mechanical characteristics. The terminating leads are of silver-clad copper wire.

Switches and Small Components

It would be impossible in the small available space to mention in detail the many hundreds of different items that go to make up the wide miscellaneous field of switches and small components such as pilot lampholders, clips, connectors, valveholders, valve retainers, etc. In the main, therefore, we shall concentrate on a represen-

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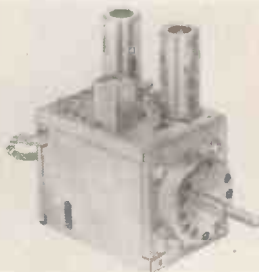
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tative selection of items which have a general interest value to members of the trade.

A number of new switch types will be featured on the A.B. Metal Products stand, among them the neat five-position push-button switch incorporating a "piano-key" action (illustrated). A complete range of *Clarostat* controls suitable for incorporation in printed circuits will be shown, also a new rotary multi-way switch. The A.B. *Minibank* rotary switch is claimed to be the smallest multi-way switch in the world.

Of particular interest to engineers and designers is the A.B. switch construction set which can be used for making up prototype switches for experimental or pre-production development work.

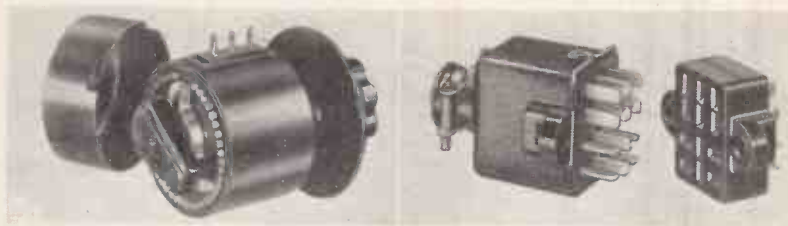


N.S.F. cascade 13-channel TV tuner unit employing Oak-type switch.

A topical exhibit incorporating the well-known *Oak*-type switches will be displayed by N.S.F., Ltd. It consists of a cascade television tuner in two versions: (i) type 12K13 covering five channels in Band I and eight channels in Band III; (ii) type 12K14, with an additional switching position which will enable it to be easily converted to u.h.f. working. These tuners are supplied fully-aligned and tested and minor modifications may be made to meet customers' individual requirements.

The N.S.F. *Oak* rotary, push-button and slider switches are shown in various forms, and also Cutler-Hammer appliance switches and a working exhibit of the *Ledex* circuit selector.

Bulgin are, as usual, showing a large range of products including many new additions in various lines. Many of the products are, or can be, specially made with materials and finishes to individual specifications. Among the switches the newest introductions include all-moulded thermo-setting-insulation press-switches and lever toggle switches, one-hole fixing, with tags or terminals, rated at 6-250V, 50 c/s, 3A. There are also a number of new cupboard-door or cabinet-lid operated switches of 1A, 250V rating.



Two items from the range of components shown by Electronic Components, Ltd. Left—Elcom multibank rotary switch, and right—Elcom miniature interlocking plug and socket.

Latest model in the Bulgin range of microsensitive switches is a sub-miniature open structure item rated at 1.5A, 250V a.c., and so small that nearly a dozen will fit inside a match-box.

New also, are further Bulgin *Poly-micro* Units, groups of 6 or 12 (or less or more) standard miniature microsensitive switches ganged between brackets, with rotary-can operation by shaft, and with or without indexing of positions, for manual or mechanical drive. These provide robust mains selector-switches of high-rating, small size, for a life of 1-million or more operations, reliably, and with flexible contacting.

In plugs and sockets many models are shown, including special polarised safety mains-inlet-to-appliance connectors with special or improved features, and also many new valve and connectors and connector-retainers, both screened and shrouded. For high-voltage uses, polythene-encased versions of standard and octal top-cap connectors are showing for the first time, also new anti-corona shrouds alone, for 6BA—and 4BA—connectors (stems, terminals, etc.). New shrouded and anti-corona valve top connectors are shown.

New types of moulded and insulated test prods, and with and without fuse, retractable point (or wide grip hook), or plain, are to be seen, in red or black, with new flexible-plastic cable entry cap. The twist-grip-prods are a useful innovation for the lab. and test bench. An extended range of terminals, covering 4 sizes from $\frac{5}{16}$ in. thread to 4BA thread, is also being shown.



The new push-button piano action switch unit introduced by A.B. Metal Products.

Radio frequency ceramics in fabricated small components will be shown by **Bullers**, whose range includes aerial insulators, bushes, capacitor bodies, coil formers, stand-off insulators, valve-holders, and electrode spacers and washers. Electro-ceramic insulators in a wide variety of designs for use in resistors, capacitors, valves, cathode-ray-tubes and other telecommunication equipment will be displayed by **Geo. Bray and Co., Ltd.**

Valve retainers for all types of valves are featured by **Electrothermal Engineering, Ltd.**, The selection of the appropriate style and size, which has in the past caused difficulty, is now facilitated by the *Electrothermal Valve Retainer and Valve Data Manual* recently published. Other items displayed by the company include an augmented range of top-cap connectors, thermal-delay switches, cut-outs and c.r.t. extractors.

Under the name of **Elcom**, the **Electronic Components** company are showing their ranges of plugs and sockets, single and multibank switches, rotary stud switches, and moulded knobs in addition to other products which are described elsewhere. The **Elcom** miniature plugs and sockets have a patent locking device which ensures that they remain fixed under most adverse conditions of vibration and stress.

A new introduction is the **Elcom** multibank rotary switch incorporating 30 positions per bank, single, double or three-pole per bank, with up to a maximum of six banks.

Simmonds Aerocessories, Ltd., are showing some recent interesting additions to the range of *Spire* parts, including a number of SCB type clips suitable for coaxial type knobs. The new *Spire* coil can fixing and improved coil former supports will be available for examination with samples for experimental purposes.

Other small metal component manufacturers include **Ross Courtenay and Stocko (Metal Works), Ltd.**

Featured this year on the **Standard Insulator Company's** stand is the first of a range of electrical battery charging and test clips complete with moulded

rubber insulators, manufactured under license from the Mueller Electric Co., U.S.A. It is of 25 ampere capacity known as Code No. 24A and is fitted with copper shunt. A new type also exhibited is the series 22 Mueller-Standard twin clip, unique in design with jaws at both ends. Pressure exerted in the centre opens both jaws at once—or similar pressure on either end opens one jaw without disturbing the grip of the other.

Among the many items to be seen on the Guest, Keen and Nettlefold's stand are moulded Nylon screws. The mouldings have an abrasive resistance even at high temperatures; the tensile strength is approximately 5 tons per square inch at room temperature and this strength increases until at -40°C . the tensile strength is approximately 7 tons. Because of the elasticity of Nylon great care must be taken in driving the screws otherwise the shanks will become elongated and the threads strip. Temperatures above 135°C . (275°F) should not be exceeded and at 250°C . (480°F) demoulding occurs.

McMurdo are showing examples of their latest developments of plugs and sockets, among which is the new miniature *Micronector* range. To meet the needs of printed circuit applications special valveholders and strip-type plugs and sockets have been designed. Holders for flying-lead B7G and B9A valves are in production and their methods of use are clearly shown.

The company's range of valve circuit supports, first introduced last year, has proved very popular and has now been extended to provide for the supply of completely assembled and potted circuits in this form. Other exhibits include valve retainers and screening cans, transistor and crystal sockets voltage adjustment panels and valve-holders to suit most applications.

McMurdo assembled and potted valve circuit support.



Wires and Cables

As usual there will be a wide range of all types of winding wires, connecting wires, resistance wires and cables, to cater for the widespread and various requirements of such conductors in the radio and electronics industries.

Connollys (Blackley) are again exhibiting a wide range of winding wires for the radio and light electrical engineering industries. Of special interest

are enamelled wires with various properties, including wires for quick-soldering, high temperature, high solvent resistances and self-bonding properties. The more conventional wires will also be shown with enamel, cotton, paper, silk and rayon insulation.

Vactite will be exhibiting their *Vacrom* (nickel-chrome) and *Eureka* (cupronickel) resistance wires and tapes, pure nickel wires and tapes, molybdenum rods, wires and tapes and special wires for the radio valve industry.

The London Electric Wire Co. will be showing *Lewcos* wires, including insulated winding wires, bare and insulated copper flexibles and braids, connecting wires, aerial wires and earth rods, Litz and insulated resistance wires. New products include two self-fluxing enamelled winding wires. *Lewcosol* can be soldered rapidly with an iron without prior removal of the enamel film. *Lewtinex* (a modified form of *Lewnex*) can be dip-tinned in molten solder at 475°C . Also on show will be the heat-resisting wires *Lewco-glass*, *Lewbestos*, *Lewmexglas* and *Lewisilicon*, and P.T.F.E. and *Terylene* covered wires.

A wide range of polythene and p.v.c. insulated wires and cables with solid, flexible and stranded conductors, and television coaxial downleads will be shown by *Duratube & Wire, Ltd.* On the same stand will be seen multi-colour extruded insulations on connecting wires and flexibles. This new development is of interest since the colours are extruded direct on to the wire and are not colour printed, thus giving permanency.

Another comprehensive wire display will be shown by F. D. Sims, Ltd., including the *Formvar*-based *Simvar* and *Singold* coverings which are the result of developments to produce a covering cheaper than *Formvar* but yet retaining the better features and combining with a high heat resistance. Also shown will be a quick-soldering enamel and glass covered wires which can be bonded with a high temperature varnish.

The Telegraph Construction and Maintenance Co. are to show their range of Telcon products including cables giving a greatly improved non-microphonic characteristic. Other exhibits will be helical membrane aluminium sheathed coaxial cables, screened quad cables for television relay systems and a range of t.v. downlead cables with expanded polythene dielectric. Telcon products *Mumetal*, *Radiometal*, *Rhometal*, *H. C. R. Permendur* and R2799 are to be shown in various forms of interest to designers and manufacturers.

Tevtile-covered winding wires, with both single and bunched conductors,

with special emphasis on wires for wave-winding will be seen on the stand of *Fine Wires, Ltd.*

British Insulated Callender's Cables, Ltd., will again display r.f. cables, miniature multiway cables, polypole couplers and TV downleads with cellular polythene insulation. The exhibit will also include winding wires, enamelled wires, etc.

Materials

A range of flexible electrical insulating materials will be shown by H. D. Symons & Co., Ltd., with special emphasis on their *Symel* silicone elastomer products such as the *Symel* impregnated glass cloth, glass braided.



Telcon magnetic E-core designed for 3-phase operation.

sleeving and an impregnated glass braid sleeving still being developed. It is also hoped to exhibit something on the Nylon extrusion in both sleeving and strip form which is at present being developed.

Glass fibre laminates are the speciality of *Thermo-Plastics, Ltd.*, and they will show materials of greatly increased chemical, electrical and heat resistant properties, featuring examples of materials of both sheet and tube glass fibre laminates. Additionally, the stand will contain examples of components made from all types of plastic materials including perspex, polythene, polystyrene, cellulose acetate, urea formaldehyde, rigid p.v.c. and bakelite. It is hoped to show examples of silicone laminates including curved structures.

Faradex H, a high permittivity ceramic in widespread use, is featured on the stand of *Steatite & Porcelain Products Ltd.*, who are also showing *Frequentite S*, a ceramic of extremely low dielectric loss with mechanical properties and freedom from porosity which render it suitable for vacuum applications. In the representative selection of insulators and insulating parts to be seen, there will be many examples of the adaption of machining techniques to ceramics, including a range of precision, thread-ground coil formers.

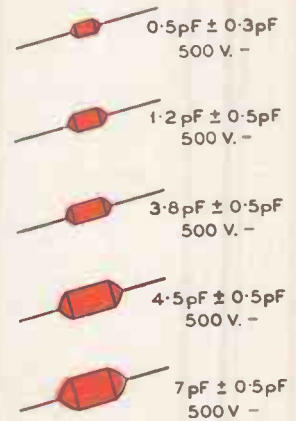
A new form of inter-laminar insulation known as D.R.N.S. is being shown by *Joseph Sankey & Sons, Ltd.*, Advantages of this new insulation include the fact that it is water-proof and is capable

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- Closer tolerances
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- High stability
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- More values to choose



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Rd	0.246"	0.197"	0.4	1.0	1.2	2.0	3.2
	0.197"	0.197"	0.5	1.2	1.5	2.5	3.8
	0.158"	0.197"	0.6	1.4	1.7	3.1	4.6
	0.138"	0.197"	0.7	1.6	2.0	3.8	5.4
	0.118"	0.197"	0.8	1.8	2.3	4.5	6.3
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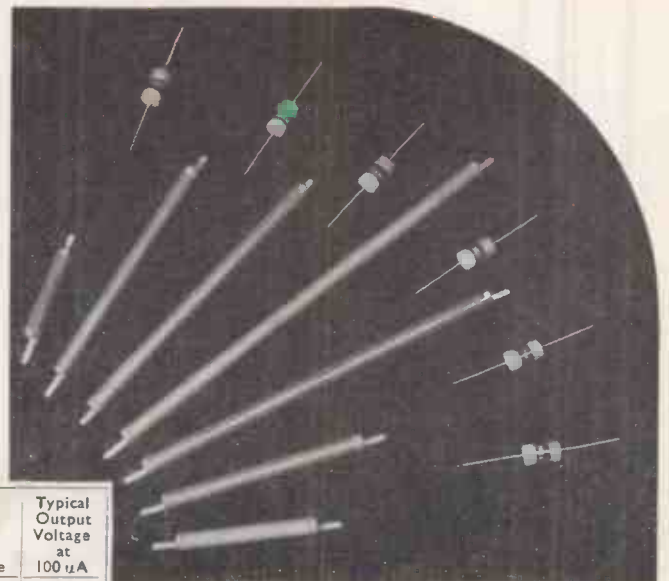
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Developed for use in very high voltage-low current circuits, these rectifiers give approx. 600 volts output for each inch of length. The highly insulated tubular construction and the end tags for soldering enable them to be wired directly into circuit, whilst providing adequate insulation is present, there is no limit to the number that may be connected in series. Below are tabulated some of the many types available in this range of:



RECTIFIERS TYPE 36EHT & 36K

Type No.	Peak Inverse Voltage	RMS Input Voltage	Output Voltage		Peak Pulse Input Voltage	Typical Output Voltage at 100 μA
			100 μA	2 mA		
36K1	85	27	35	30	—	—
36K6	510	162	210	185	—	—
36K14	1190	378	490	440	—	—
36EHT25	2125	675	875	820	1810	1640
36EHT70	5950	1890	2450	2320	5080	4580
36EHT100	8500	2700	3500	3250	7250	6550
36EHT130	11050	3520	4550	4300	9420	8500
36EHT240	20400	6480	8400	7900	17400	15700

For further information on EHT rectifiers, write for Data Sheet No. 60 to:

Dept. B.R.T. 4. Westinghouse Brake & Signal Co Ltd

82 York Way, King's Cross, London, N.1

Telephone: TERminus 6432

of withstanding reannealing temperatures up to 800°C. This insulation will shortly replace *Insuline* and all Sankey single-sided laminations will be treated with D.R.N.S.

Thermo-plastic extrusions and mouldings, including refrigerator parts and small radio components, will be exhibited by National Plastics Ltd., in ureas, polythene, cellulose acetate, reinforced glass fibre resin, bitumen asbestos compound and hard rubber. Older materials are also to be featured, an example being a large and substantial phenol-formaldehyde moulding for a 3-way fuse carrier.

A new glass bonded insulating material *Mycalon* will be shown by *Mycalex* and T.I.M., Ltd., and is a material evolved to meet service requirements under tropical and arctic conditions. It can be injected or transfer moulded into any required shape and to fine tolerances because it does not shrink or distort after moulding. The mechanical strength compares favourably with existing grades of *Mycalex*. After subjection to six humidity cycles in the standard chamber to RCS11, the material recovers to its full resistivity value within one hour.

The *Micanite* and *Insulators Co., Ltd.*, will show a comprehensive range of materials and in addition to sheet plastics and fabrications will exhibit a complete range of *Empire* varnished cloths, silks, woven glass, *Terylene* and paper. Extruded p.v.c. sleeving, samples of *Durasleeve*, *Durastrip* and *Durajoint*, together with examples of silicone bonded glass laminates, tubes, silicone varnished glass tapes, etc., are other items which will be on show.

Creators, Ltd., specialists in the technical application of plastics, will be



Whiteley Electrical C-core moulded in Aroldite and fitted with waterproof plugs and sockets.

showing p.v.c. sleeving of all sizes, colour and wall thickness, coiled bobbins, colour indication buttons, junction sleeves and similar items.

A wide and improved range of *Delaron* laminated plastic insulating boards are amongst the exhibits to be shown by *Thomas De La Rue & Co.* Of special interest is the new grade of laminate, *Delaron Copper Clad*, which is now being used in the manufacture of printed circuits, with the circuit drawing transferred to the copper clad by litho, silk screen or photo-engraving techniques. Also showing will be *Delaron* glass fibre laminates and a selection of *Traffolyte* sheets for engraving purposes.

Bakelite, Ltd., are showing copper-faced *Bakelite* laminated sheet for the production of printed circuits and glass laminates based on melamine, silicone phenolic resins for improved electrical characteristics combined with strength and heat resistance. Also featured will be the *Vybak* range of p.v.c. resins and compounds (including extrusions), thermosetting resins for insulating varnishes, valve-capping, etc., and polyester resins for the protective potting of delicate components.

Examples of the application of the versatile *Araldite* resins will be shown by *Aero Research, Ltd.*, including the recent improved *Araldite* foam, flexible resins and high temperature materials which retain their mechanical and electrical properties up to 200°C. *Redux* metal adhesives, *Aerolite* wood glues and metal honeycomb assemblies will also be featured.

A comprehensive selection of modern permanent magnets will be exhibited by *Swift Levick and Sons, Ltd.*, featuring the high-energy anisotropic alloys *Alcomax* and *Columax* and miniature magnets of *Alcomax* and *Alnico*.

On the *Murex* stand will be another display of sintered permanent magnets of various shapes and sizes for use in the electronics and instrument industries. The range of *Sincomax* magnets, in which the soft-iron pole piece is sintered together with the magnetic alloy as an integral unit, now includes the smaller "centre pole" type of magnet.

Miscellaneous

Working models on the *Telephone Manufacturing Company's* stand will show *Carpenter* polarised relays operating from a thermo-couple junction and a photo-electric cell.

New ideas in solder and soldering will be featured on the *Multicore Solders* stand. In addition to a display of *Ersin Multicore* solder in various alloys and gauges (including one grade containing silver for use on silver-plated ceramics), a new type will be shown, also containing five cores of the



Marrison and Gatherall TV focusing unit using Alcomax lightweight magnets.

extra fast non-corrosive type 362 flux, known as *Savbit* alloy and containing approximately 2 per cent. copper; it is claimed to increase the useful life of a soldering bit by 10 times. This special alloy is already in production and can be supplied in nominal tin content alloys of 60, 50, and 40 per cent. There is no appreciable difference in melting points between *Savbit* alloys and conventional tin lead alloys.

The *Bib* recording tape splicer which is being shown for the first time at an exhibition, enables recording tapes to be jointed and edited professionally. The splicer, which is most attractively packed, is made from nickel-plated brass. A razor cutter is included which fits conveniently underneath.

On the *Enthoven* stand a working soldering demonstration unit designed to enable visitors to try their own hand at soldering will be featured. The particular unit is so arranged that various metal strips appearing in "windows" on the soldering box can be soldered on by anyone, with the respective solders and soldering irons conveniently arranged and displayed for easy use by any interested party.

The *Enthoven* exhibit will include a comprehensive display of soldering materials selected for their usefulness to the radio and electronic engineer. Interesting new developments include aluminium-cored solder and dip soldering materials for printed circuit techniques.

T.C.C. will also be demonstrating the applications and uses of printed circuits in the radio, TV and electronics industries, and, in addition, will be showing various types of electrolytic and paper condensers suitable for assembly in printed circuit panels.

On show at the *Garrard* stand will be the latest unit, Model 301 transcription motor, a high-quality motor designed for the high-fidelity market. An addition to the range of replacement styli is the *Garrard GC2/1* and *GC2/3* diamond styli. Also showing for the first time is a new 3-speed spring gramophone motor.

A. K. Fans, Ltd., are showing for the first time a new miniature 1 in. diameter *Airmax* high-efficiency axial flow electric fan, which is claimed to be the smallest fan in the world. It operates on 6, 12, or 24V d.c. Hitherto the smallest fan in the *Airmax* range was 1½ in. in diameter, available for d.c. 400 cycles. Several versions of the 1½ in. diameter fan are also on exhibition, one of them being in nylon.

Ferranti will be showing a new range of *Pentland* series resin cast 3-phase transformers in addition to a full display of single-phase transformers, chokes and delay networks employing the resin-case technique. T.R. cells

which will be displayed include 3 cm. tuneable and broad-band types together with a range of 10 c.m. cells. An integrated microwave test bench designed for use in the 3 cm band and incorporating the milled block technique of waveguide manufacture will be shown.

The Zenith exhibit includes a wide range of *Variac* transformers, the original continuously adjustable transformer now equipped with *Duratrak* non-oxidising plated contact tracks, including new models and special types for operation in high periodicity circuits.

Pye Industrial Electronics, Ltd., are making their first appearance at this exhibition and are showing a number of types of junction transistors which are intended primarily for hearing aid and low-powered audio frequency application and are all hermetically sealed.

Cathodeon Crystals, Ltd. are exhibiting a range of quartz crystals for frequency control. All are hermetically sealed and in general adhere to requirements of the inter-services specification, from 2,000 to 20,000 kc/s. Of particular interest is the range of crystals in evacuated glass bottles, fitted with B7G type bases.

On the Westinghouse stand a comprehensive display of *Westalite* rectifier units will include a number of new



Ferranti transformers designed for 3-phase (left) and 6-phase (right) rectifier systems.

miniature assemblies in various types of sealed housings. All of the new miniature rectifiers contain either double- or quadruple voltage elements capable of withstanding peak inverse voltages of 42 and 85 volts respectively. Although many of these midget rectifiers were developed primarily for Service and Ministry requirements, they have also found a ready commercial market.

Parmeko are exhibiting a new series of transformers specifically designed for photo-printed circuit techniques, including examples of mains transformers, chokes and output transformers. A special display will feature the Parmeko *Saturn* series of trans-

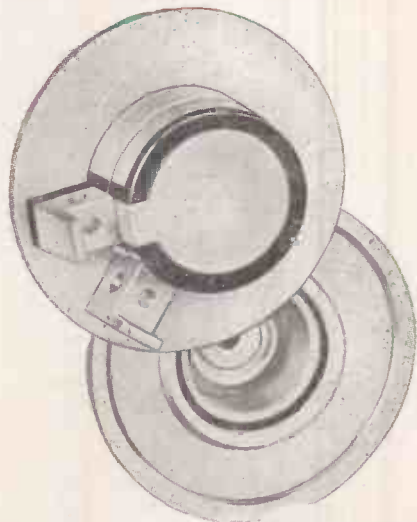


Three typical transducers from the standard range developed by Parmeko.

Puzzle Picture?

Our photograph shows two views of a component which comprises two metal diecastings joined together and yet completely insulated from each other by a plastics moulding. No seeping of moisture can be tolerated and the placing of the inner component must be extremely accurate.

This tricky problem solved by our technicians, the resulting assemblies go to play their part in an electro acoustic instrument of great intricacy. National Plastics development engineers and product designers are ready at all times to collaborate with potential users of moulded plastics. The list of new applications developed and put into production in recent months is most impressive.



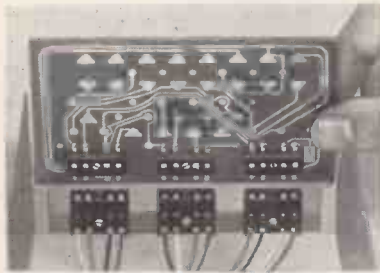
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Avenue Works, Walthamstow Avenue, London, E4. LARKSWOOD 2323



ductors for magnetic amplifier applications, comprising auto-excited transducers of the push-pull input and single and 3-phase output types. The standard range, together with special transducer designs, has applications which include high-speed sensitive relays, voltage and frequency regulators, high power gain amplifiers, circuit protection devices, and d.c. amplifiers giving a linear output from a 0-10 μ A unit.

Of particular interest to the trade on the Marrison and Catherall stand are the loudspeaker centre pole and ring magnets, instrument magnets and TV focus and linearity control biasing magnets. Ion-trap magnets of three different field strengths are shown. A special feature of the magnet display is a new type of TV focussing unit developed by this company. This



Belling-Lee printed circuit connectors shown fitted to typical printed circuit.

unit overcomes many disadvantages of older types; it minimises astigmatism and, using correctly designed *Alcomax* 111 magnets, is light in weight. Encased in bakelite it incorporates an adequate picture shift device and a focus adjustment which may be accessible external to the receiver. The range of field strength is sufficient for all known types of tubes.

The Electronics Department of Ferranti, Ltd., will display examples from a wide range of valves and cathode-ray tubes for radio and television receivers. Valves for domestic use include B7G and B9A miniatures, octal and loctal based types. Television cathode-ray tubes are produced in all the popular sizes, up to 21in. rectangular.

Sheet metal instrument housings will be featured on the Imhof stand. Among the new units are a totally enclosed rack with inset panel mounting frame, available in any multiple of units. The inset panel is mounted 3in. back from the front door and is a standard 19 $\frac{1}{2}$ in. frame taking 19in. panels. The depth from inset to rear frame is 19in. and takes standard 19in. chassis runners and telescopic runners.

Control consoles can be supplied in double or single pedestal (the single with tubular leg, either left or right

hand). The pedestal frames are drilled front and back to take standard 19in. panels and an inset frame is provided mounted either 19in. from the back or front so that standard chassis runners and telescopic runners may be fitted. Consoles are available with two types of superstructure, consisting of a full length 3-bank unit taking either 10 $\frac{1}{2}$ in. or 15 $\frac{1}{2}$ in. standard 19in. rack panels inclined at 13° to the vertical. The Console top is of grey linette formica.

Other companies exhibiting cabinets and instrument mountings and cases are Hallam, Sleigh and Cheston, Ltd., and Hassett and Harper, Ltd.

Apart from their well-known range of *Cydon* variables and mica compression trimmers, Sydney S. Bird & Sons, Ltd., are to demonstrate an improved type turret *Teletuner* incorporating f.m. channels. The exhibit will also include high voltage trimmers for large screen TV applications, tubular and air-spaced trimmers for f.m. circuitry and a new car radio push-button inductance tuner.

In addition to a display of established lines, Belling & Lee are showing printed circuit connectors and improved Units. The connectors, designed for versatility, economy and reliability, can be mounted singly or in groups, direct to plates, printed or otherwise, and are suitable for mounting on ceramic and laminate plastic printed circuits. Another new item will be the fuse link L1055, now manufactured by a new technique which bonds caps, glass and filament into one unit. Caps are held so securely that they will not come off unless the glass is broken.



One of the Imhof range of rack and panel instrument or equipment cases, manufactured to standard dimensions.



Electro Acoustic Industries Elac Duomagnette focaliser for TV picture tube focusing.

Electro Acoustic Industries will show *Elac* focalisers and ion-trap magnet assemblies, including the *Duomog* which incorporates two coaxially mounted ring magnets and is adjusted by varying the gap thus providing a double-lens system, which enables a symmetrical external magnetic field to be achieved. As the magnet material has an extremely high resistivity, the unit may be placed close to deflector coils without detrimental effects. Designed for use with wide angle deflection systems, it is particularly suitable for tubes with a 38 mm. neck diameter.

Radio jacks, for use with tape recorders or audio amplifiers, are to be shown by Truvox. Metal housed, these units embody switch controlled high-Q coils, tuning by switched preset capacitors, and germanium diode rectification. Factory preset for m.w. Home and Light programmes, the range of the trimmers are from 200-500 metres. A simple aerial is required. The Senior radio jack provides three preset positions, two m.w. and one l.w.

Valves on show on the Ediswan stand will include new types for high frequency heating equipment—ES1001 is a radiation cooled triode and the ESA1002 is a forced air cooled triode, both with thoriated tungsten filaments. Valves suitable for f.m. applications are the 6L34 grounded grid triode, the 10L1 (a series run version of the 6L34) and the 6D2 double diode suitable for ratio detector. There will also be a full range of c.r.t.'s, including rectangular types, a new beam tetrode of d.c. control type for use in control applications in stabilised power supplies.

Note: At the time of going to press only a few details had been received of new valve cathode-ray tube types to be exhibited, and for this reason no independent preview has been included.

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E. FORBES

M. J. G. LANG

D. MACADIE

J. S. CLARK

T. D. CONWAY



T. D. Conway, B.Sc. (Eng.), A.C.G.I., A.M.I.E.E., has resigned from his post as chief engineer of Grundig (Gt. Britain), Ltd., to take up an appointment with an associated company, Smart and Brown Machine Tools, Ltd. Production matters at Grundig at Kidbrooke now are controlled by H. Spring.

At a general meeting of the Technical Publications Association held in London recently C. E. Cunliffe, manager of the Publicity and Publications Department of A. C. Cossor, Ltd., was elected chairman of the new council.

E. K. Cole, Ltd., announce the appointment of E. Forbes as manager of the Ekco Scottish Service Depot, 26 India Street, Glasgow, C.2. Mr. Forbes entered the industry in 1929 and since that date has held various service appointments with the E.M.I. Group of companies.



The Philip Weisberg cup—awarded annually by the Display Producers and Screen Printers Association for the best example of exhibition stand submitted by a member company—has been won by Ace Associated Woodwork Co., Ltd., for the second year running. The winning entry for both years was the Mullard Valve stand at the last two R.E.C.M.F. Exhibitions. R. Ingles, M.S.I.A., designed both stands. Here seen celebrating this double victory are (left to right) R. Ingles, M.S.I.A., H. Chapman, Ace Associates, and Clive Barwell, General Publicity Manager of Mullard, Ltd.

G.E.C., Ltd., announce that R. N. Millar, lately Chief Mechanical Engineer to The British General Electric Co. (Pty.), Ltd., Australia, has been appointed to take charge of its newly-formed Industrial Atomic Energy Section. The new organisation, located at the company's Erith works under the direction of Arnold Lindley, will develop designs of plant for the utilisation of atomic energy in power station generating equipment. G.E.C. plan to provide most of the equipment for atomic power stations from within their own manufacturing organisation.

Robert Boast has been appointed assistant manager of the H.M.V. showrooms in Oxford Street, London, W.1.



G. Lewis (managing director) and E. W. Durant (technical director) of Telerection, Ltd., again competed in the R.A.C. Rally last month. This year they entered a TR2.

F. D. Perkins, Eastern Counties representative of the TV and Radio Division of Philips Electrical, Ltd., is taking up a head office appointment. He is succeeded by M. J. G. Lang who has been a member of the Philips organisation for the past four years.

Wilfred A. Hardy, A.C.I.S., has been appointed company secretary to Winston Electronics, Ltd., Hampton Hill, Middlesex.

The inventor of the Avometer, Donald Macadie, died recently at the age of 84. Throughout his career he invented numerous devices now in common use in the Post Office and industry, including automatic coil winding machines, telephone and telegraph apparatus, and what is believed to be the first multirange meter for measuring voltage, current and resistance which later became known as the Avometer. In 1932 he was awarded the M.B.E.

(Continued on page 938)

J. S. Clark left Southampton aboard the *Queen Mary* recently to tour the two Americas, including visits to Cossor Group companies: Beam Instruments Corporation in New York, of which he is president, and Cossor (Canada), Ltd., in Halifax. He is also visiting Chicago, Ottawa, Bermuda, Jamaica, Mexico, Venezuela and Trinidad where he has business appointments. Mr. Clark is joint managing director of A. C. Cossor, Ltd., chairman of Sterling Cable Co., Ltd., and vice-chairman of B.R.E.M.A.

Stella Radio and Television Co., Ltd., announce that A. A. Berkovitch is appointed their representative in the South of England.



H. J. Saar has been appointed Baird Television representative for North London and Norfolk areas.

H. Ibbotson managing director, White-Ibbotson, Ltd., reports that during 1954 his many journeys involved seventy-two frontier crossings. Firm orders or contracts for White-Ibbotson projection television receivers were secured with Scandinavia, France and French Protectorate (including Morocco), Luxembourg, Switzerland, Germany, Belgium, Italy and Japan. He states that enquiries have been received from many other parts of the world, including Australia and Canada.

R. F. G. Whitehouse, formerly with the *Plessey Co., Ltd.*, has joined the sales staff of *A.B. Metal Products, Ltd.*

Headed by W. M. York, executive director of E. K. Cole's publicity, senior members of the Ekco publicity department recently visited the *Daily Express*. During their comprehensive tour they studied the many intricate operations involved in the production of a national newspaper and watched the first editions of Saturday's paper being run off.

Radio Retailing as a Limited Company

MOST RADIO BUSINESSES OPERATE AS A LIMITED COMPANY SOONER OR LATER. IN THIS SHORT ARTICLE THE AUTHOR DEALS WITH SOME OF THE ADVANTAGES OF "CONVERTING TO LTD."

by S. Elliott James

MANY new radio businesses start life as a private limited company. Many business partnerships of two or more radio retailers are sooner or later converted into a private limited company. Obviously there is a good reason for business enterprises acquiring a "Ltd" after their name, and the reason is easier to appreciate if a comparison is made between trading as a partnership and as a limited company.

Some of the disadvantages of trading as a partnership are:

(i) Each partner is liable for the debts of the partnership to the full extent of his personal estate both in and outside the business, if this should be required to satisfy creditors' claims.

In a limited company, however, the directors are only likely to lose what they have invested in the company. Thus, if a director holds 1,000 ordinary shares of £1, fully paid up, that is the amount he would lose if the worst happened. If only 10s. were paid on each share, the director would be liable for a further 10s. on each—£500 in all. The same conditions apply to shareholders.

(ii) The debts of the partnership are not separate debts from those of the partners in the business. Although the partners may have debts of their own and the partnership may also have debts of its own, all are the debts of the partners.

It is interesting to note that a partnership is not a separate person at law (as distinct from the partners who own it) except in Scotland. On the other hand, a limited company is a separate legal person at law, quite apart from the persons who are shareholders or directors in it. Directors contract in the name of the limited company and are only its agents; the Law of Agency applies to all such contracts.

(iii) In the event of the death of a partner, the partnership is usually dissolved; but if special provision is made in the articles of partnership the business can be carried on. In any case, the deceased partner's executor will ask for that partner's share to be paid out to the dependants, i.e., the partnership debt due for payment at the time of death.

On the death of a director, however, the limited company carries on as before; his shares can be transferred to others and the transfer noted in the register of the company. New certificates are made out in the name or names of the transferees and the old certificates are deposited with the company.

(iv) It is always rather difficult to persuade an executor to carry on with the business until the deceased partner's share is fully paid out. This is because, in certain cases, he may be made responsible for some of the partnership debts while operating with it and the

other partners. For the executor it means two jobs instead of one.

There is no risk of this kind with limited companies.

Few Advantages

If there are any advantages in partnership trading, they are few in number. Here are two advantages, with modifying comments.

(i) Partnerships are easy to form, but full articles should be drawn up as a sound basis of agreement. In forming a limited company there is a great deal more formality.

(ii) Because the liability for the partnership debts is unlimited for each partner, it is often assumed that the partners are thereby stimulated to greater efforts to make the business pay.

Such an advantage is less real than is supposed, however; whether as a partnership or as a limited company, the partners in the first and the directors in the second type of business are invariably anxious to make the enterprise a success. As most retailers know, business success is not something that depends upon being a partnership or a limited company—it is much more than the mere question of definition.

Bankruptcy

If a limited company cannot pay its debts, it can be wound up and the directors will be put out of business in just the same way as partners may be put out of business by a bankruptcy. But bankruptcy does not individually

touch the directors of a limited company—it is the company that is wound up.

Converting to "Ltd."

If a business is entirely of a service nature, no stocks of receivers, either radio or television, will be carried. The only purchases are normally for test equipment, components parts for replacement, and consumable materials such as solder, wire, sleeving, etc. Such a business is normally of a professional nature and it makes little difference whether it is carried on as a partnership or as a limited company.

There has always been an element of uncertainty in radio retailing due to the rapidity with which technical development takes place. Unless some kind of sale-or-return scheme exists between dealer and manufacturer, some sets, (television in particular) may become obsolete, or at least dated, in less time than dealers would wish. Stock can, therefore, lose its value—quite apart from losses incurred through change of taxation.

For this reason the retailer might think it desirable to convert the business to one having limited liability, or deem it advisable to start as a limited liability company. In this way the partners become directors and they have so many £1 shares in the company instead of a massed amount of capital as in a partnership.

Company News

If the old partnership or firm name was Grainger and Todd, then its company name would be Grainger and Todd, Ltd. Or it could be something else, e.g., The Grainger-Todd Radio Service, Ltd. Long names have disadvantages, and it has been the fashion for many limited companies to shorten their names in the last few years.

That little word "limited" at the end of the name makes all the difference. It must appear in the sign above the shop or in prominent letters on the

(Continued on page 946)

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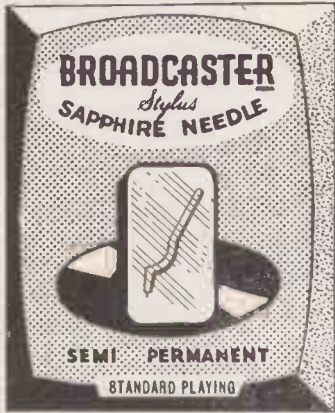
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Specimen of typical letterhead bearing the necessary information required for a limited company

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Playing



For B.S.R. HGP
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Radio and Television Servicing Examinations

EXAMINERS' REPORT FOR 1955

The radio and television servicing certificate examinations held annually by the R.T.E.B. and the City and Guilds of London Institute are becoming recognised as a necessary qualification for service engineers. As a guide to engineers contemplating taking these examinations, we publish below last year's question papers with examiners' comments.

THE results of the 1954 series of radio and television servicing certificate examinations conducted by the Radio Trades Examination Board in conjunction with the City and Guilds of London Institute show that a larger percentage of TV candidates passed than in the previous year, while the percentage of passes in the final radio paper showed a falling off. The comparative figures for 1954 and 1953 are shown in the tables below and on page 938.

The R.T.E.B. comprises a number of constituent bodies, including the Radio Industry Council, the British Institution of Radio Engineers, the Radio and Television Retailers' Association, and the Scottish Radio Retailers' Association. The examinations are facilitated by the radio industry, who lend receivers to the Board for practical tests.

The question papers of the radio and television servicing certificate papers, with examiners' comments, are reproduced below.

RADIO SERVICING CERTIFICATE (Written Examinations)

In the Radio Servicing Certificate examination 144 candidates passed out of a total of 370, 96 being referred in the practical test. The remainder, 130, failed. The examiners report that the paper appeared to present little difficulty to the majority of candidates. The standard of the scripts was much better than in previous years although candidates still made their answers too brief. Illustrations were, in general, poor.

Final Radio Servicing					
	1954		1953		
		%		%	
Candidates	370	100.0	309	100.0	
Passed	144	38.9	126	40.8	
Referred					
Practical	96	25.7	87	35.5	
Failed	130	35.4	96	23.7	

First Paper

Not more than six questions are to be attempted. The maximum number of marks obtainable is the same for each question. Questions may be attempted in any order, but the answers must be clearly numbered.

1. (a) On the squared paper provided, and from the data below, construct a valve characteristic curve:—

Anode Voltage = 250.
(b) State the probable function of the type of valve indicated by your curve.

(c) Give a typical commercial type number of such a valve.

Attempted by most candidates. Some excellent curves were submitted and the tailing characteristic was identified by the majority as that of a variable-mu type of valve. Consequently, parts (b) and (c) of the question were correctly answered.

2. (a) Explain the essential difference between amplitude modulation and frequency modulation. Illustrate your answer with diagrams.

(b) State one advantage and one disadvantage of each of the above two methods of modulation.

(c) What is meant by 30 per cent. amplitude modulation?
Approximately half the candidates attempted this question, obviously because they were fairly confident of their ability to deal with it as some very good answers were returned. Sketches were rather crude but sufficiently clear to illustrate the test in most cases.

3. (a) State the approximate frequency ranges covered by the following terms:—(i) Audio-frequency. (ii) Radio-frequency. (iii) Short wave. (iv) Very high frequency. (v) Long wave. (vi) Electricity supply mains. (vii) Medium wave. (viii) High frequency and low frequency.

(b) Describe the purpose and principle of operation of a beat-frequency oscillator.

Most candidates made an attempt at this question and many quoted accurately the acknowledged international frequency range of the various terms in part (a).

In answer to part (b) approximately half the candidates chose to describe the oscillator circuit of a superheterodyne receiver and half the circuit of an audio B.F.O. There were many good descriptions of both these applications.

4. (a) Give approximate test data for a lead-acid accumulator when (i) fully charged. (ii) completely discharged.

(b) Why should not a dry h.t. battery be left in a small "personal" receiver after it is discharged?

(c) If a customer enquires, when purchasing a new h.t. battery: "How long should it last?" what would be your answer? What factors would you take into consideration when framing your reply?

Not many candidates attempted this question but those who did were no doubt familiar with battery powered equipment and their answers reflected commercial experience. Especially was this the case in regard to parts (b) and (c) where corrosion and bursting cells were mentioned under (b) and type of receiver circuit, hours of use, etc., in part (c). In the latter case, some quite humorous but correct imaginary dialogues were originated as taking place between customer and dealer.

5 (a) Draw a map of the magnetic lines of force surrounding two 6-in. permanent-bar magnets lying in line with each other with their

N poles separated by a distance of approximately 1in. Your drawing need not be to scale.

(b) Sketch the lines of force in a magnetic gap having an N pole above an S pole. Show a cross-section of a conductor lying in the middle of the field. Assuming the current in the conductor to be flowing from you and downwards through the paper indicate by an arrow the direction in which the conductor will move. Describe how you have reached this conclusion.

Many candidates chose to answer this question but surprisingly few returned really good text or sketches and a large proportion failed to gain pass marks. In part (a), many sketches showed the magnets parallel and not in line, and for part (b) candidates were equally divided as to whether Flemings left-hand rule for motors or his right-hand rule for generators applied. Quite a number used positive and minus signs for N and S and argued their case in terms of electro-statics.

6. State the principal differences between:—(i) a moving-iron meter, (ii) a moving-coil meter, (iii) an electrostatic meter. Illustrate your answer with simple sketches. Give the advantages and disadvantages of each type, and suggest the type of measurement for which it is best suited.

Well done by most candidates but many gave incorrect examples of an electrostatic meter (part iii) by describing hot-wire ammeters or valve-voltmeters (electronic).

7. (a) Name three dielectrics commonly used in commercial capacitors. State under what circuit conditions each type of capacitor would be used.

(b) What determines the capacitance of a capacitor? What consideration, other than that of capacitance, determines the suitability of a replacement capacitor?

Nearly all candidates attempted this question and answers were satisfactory but not good. Part (a) gave most trouble and many did not appear to appreciate that in an electrolytic capacitor the gas film is the dielectric and not the "Borax" or "electrolyte" as stated by them. Part (b) was obviously easy to most because of practical experience and correct reasons for choosing replacement capacitors such as working voltage, size, etc., were given.

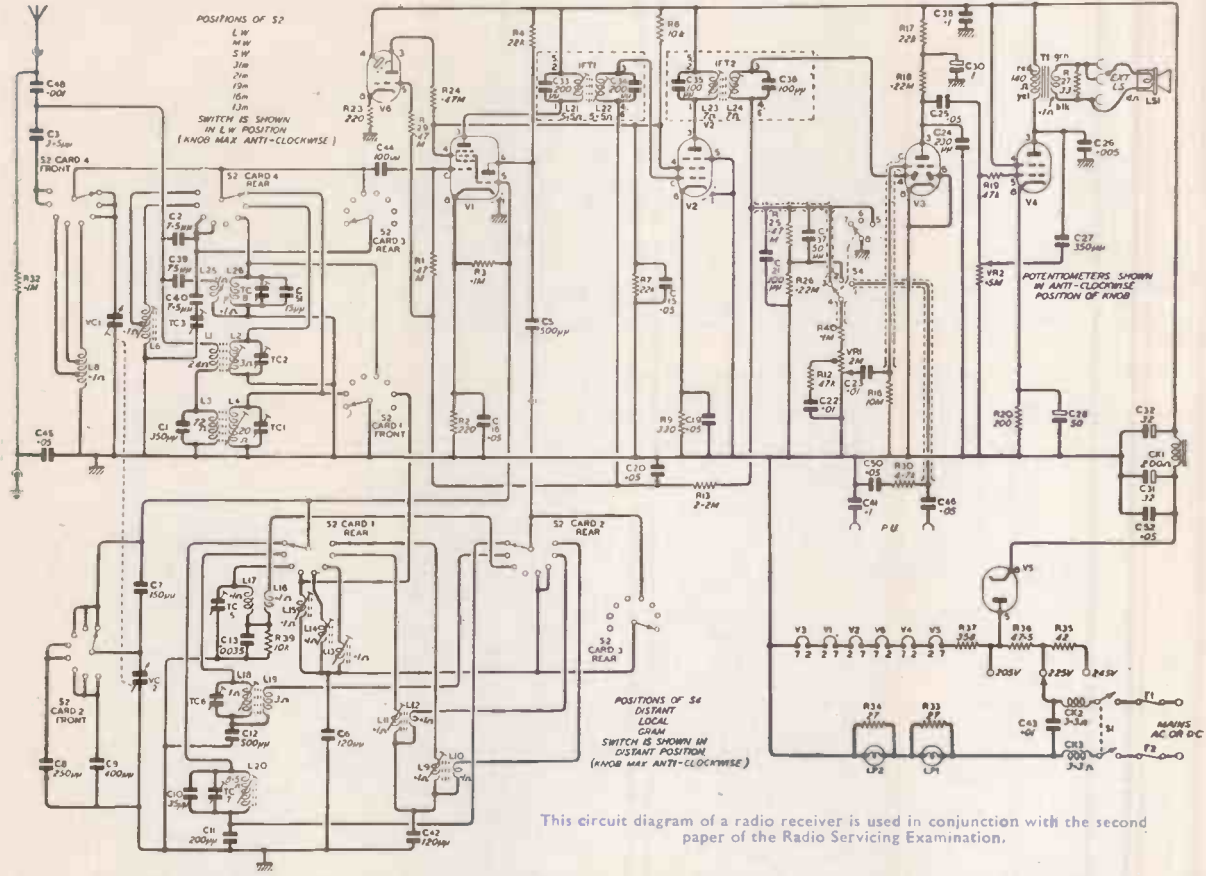
8. (a) What do you understand by the following terms:—(i) Skip distance. (ii) Ground wave. (iii) Refraction. (iv) Fading?

(b) State very briefly arrangements in common use to alleviate fading and man-made static.

Not answered so well as would have been expected. In part (a) quite a number of candidates

Grid Volts:	0	-2	-4	-6	-8	-10	-12	-14	-16
Anode current (milliamps)	17	13	10	7	5	4	3	2.1	1.8
Grid Volts:	-18	-20	-22	-24	-26	-28	-30	-35	-45
Anode current (milliamps)	1.5	1.0	0.9	0.7	0.6	0.5	0.45	0.4	0

4348.1.8	0	7.12.30.40.0	11.11.2	51	0	44	42	16	5	33	54	20	15	35.40	21	36	57	27	23	30.41	54	25	24	40.50	43	17	20.40	32.13.2
R 12	8	0	25	17.34.0	10.17.18.19.20.15	14.13	11	12	0	2	21	22	7	0.0	13	25	20	40	12	54	10	50.17.18	33	37	19	20	30	27.35
Misc	S2 CARD 5 48.2.VC1	VC2	TC3	TC 0.8.5	S2 CARD 4	TC 0.8.2.8.1	S2 CARD 1	VC5	S2 CARD 3	VC6	IF T1	S2 CARD 2	VC7	VC8	VC9	VC10	VC11	VC12	VC13	VC14	VC15	VC16	VC17	VC18	VC19	VC20	VC21	VC22



This circuit diagram of a radio receiver is used in conjunction with the second paper of the Radio Servicing Examination.

confused "Refraction" with "Rarefaction" (concerning air waves and loudspeakers) despite the obvious general trend of the question. In part (b) many gave details of mains filters, suppressors, etc., but very few mentioned anti-static aerials.

Second Paper

(Set in conjunction with the circuit diagram reproduced above)

Not more than six questions are to be attempted. The maximum number of marks obtainable is the same for each question. Questions may be attempted in any order.

1. (a) A customer states that he obtains certain local stations not only at their correct setting on the wave-scale but also at other points, in some cases on other wavebands; what could be the cause of this and how would you verify your diagnosis?

(b) A complaint is registered that instead of "coming on gradually" after switching on as has been normal, the receiver now consistently remains silent for a long period and then bursts suddenly into full volume. State the most probable cause of this change of operating conditions.

Deal with adequately by most candidates with logical diagnosis such as harmonics and images for part (a) and low emission on cathode fault in frequency changer valve, intermittent connections, etc., for part (b) of the question.

2. State the functions of the following com-

ponents:—C26, R18, C7, L8, L19, TC5, R32, C24. Good marks earned by most candidates for this question. (See remarks concerning question 4 and 5).

3. (a) Why are the valve heaters connected in series and not in parallel in this receiver?

(b) For what reason are the valve heaters connected in the sequence shown in the circuit diagram?

(c) Give two reasons for the incorporation of R33 and R34.

(d) Why are CK2, CK3 and C43 included in this type of receiver but seldom in a.c. receivers using a mains transformer?

A.c.-d.c. techniques still cause trouble for candidates and many failed this question. Parts (a) and (b) provided many really absurd answers, e.g. "because there is no mains transformer" or "valve heaters taking most current come first in the heater chain," and so on in the case of part (a) and a repetition of the answer to part (a) slightly changed to answer part (b). Obviously the word "sequence" was not understood by many who confused its meaning with "series."

4. (a) Describe fully the action of S4 in the DISTANT and LOCAL positions.

(b) How is the change-over to GRAM effected by S4? How is radio suppressed when S4 is switched to GRAM?

(c) What are the functions of R12 and C22?

5. Which components constitute the following? (a) Pickup isolating capacitors. (b) Signal diode i.f. filtering. (c) H.t. line r.f. by-pass. (d) Variable tone control. (e) L.w. oscillator feed-back

coupling. (f) S.w. aerial coil. (g) Heater voltage drooping resistor. (h) V2 cathode decoupling capacitor.

Practically all candidates attempted these questions and most of them answered very well. This indicates good appreciation of modern design and ability to read circuit diagrams. In question 4(c) "base" still persists for "bass".

6. (a) The receiver has bandspread tuning on the five s.w. bands—13m., 16m., 19m., 21m., 31m. What do you understand by this statement?

(b) Enumerate all the components in the r.f. and oscillator tuning stages in use on the 19m. waveband.

(c) State two essential requirements that must be satisfied before attempting r.f. alignment on the bandspread ranges.

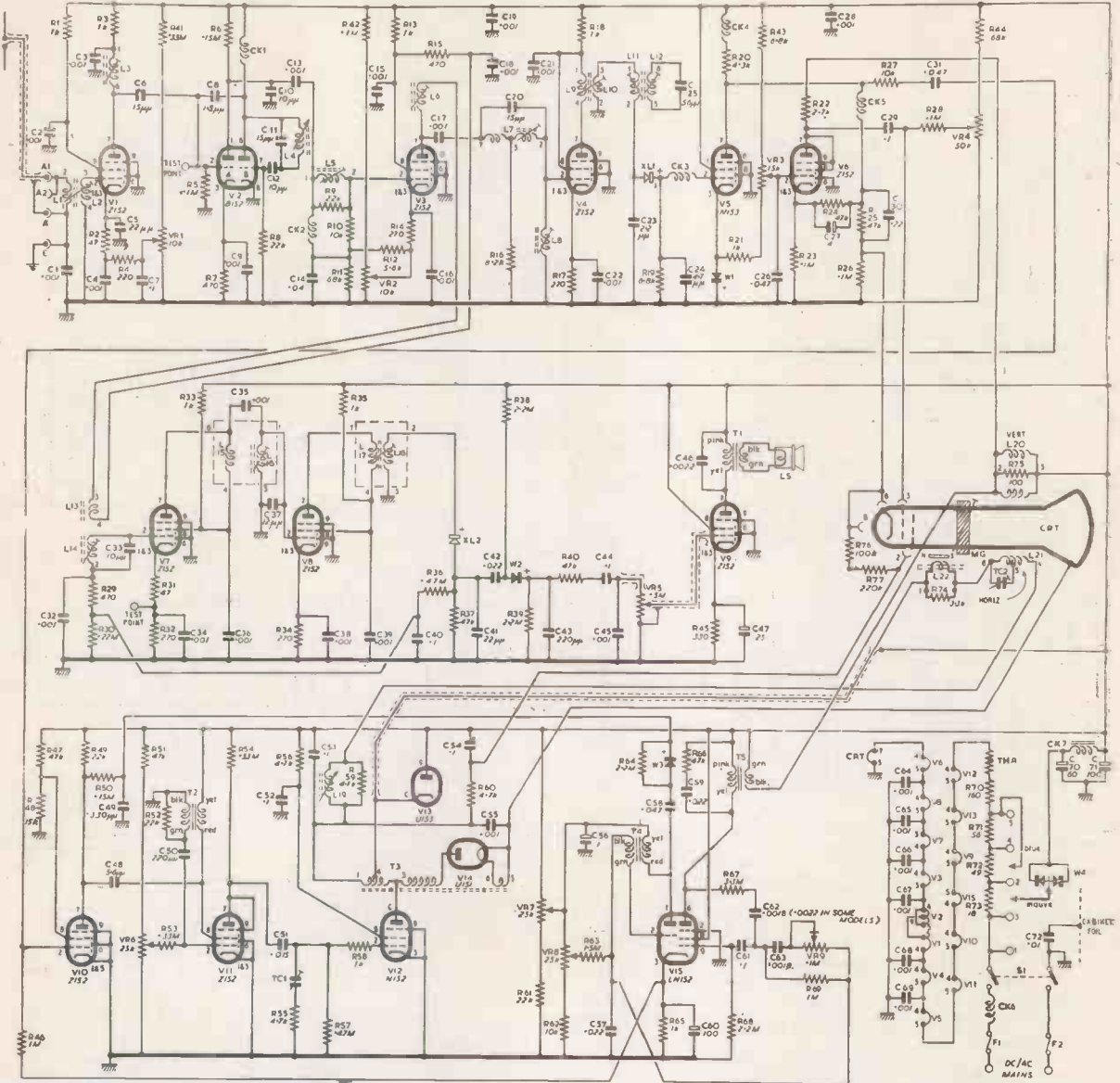
Approximately half the candidates attempted this question and not many good answers were turned in but the majority just gained sufficient marks for a pass. Part (b) was scamped by most, only the major components being mentioned and not all as requested. Part (c) mystified some but most mentioned warming up period for receiver and signal generator, calibration, etc.

7. (a) What is V6? Why is it incorporated in this type of receiver?

(b) Give a sketch of the internal construction of V6 and explain fully how it functions.

This was answered by only a few candidates and of these many failed. Part (a) was satisfactorily dealt with, but for part (b) many very hazy answers were given and some very poor sketches. Confusion with C.R.T. operation was evident and the explan-

C	2	1	3	4	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100						
R	49	48	47	46	45	44	43	42	41	40	39	38	37	36	35	34	33	32	31	30	29	28	27	26	25	24	23	22	21	20	19	18	17	16	15	14	13	12	11	10	9	8	7	6	5	4	3	2	1	100	99	98	97	96	95	94	93	92	91	90	89	88	87	86	85	84	83	82	81	80	79	78	77	76	75	74	73	72	71	70	69	68	67	66	65	64	63	62	61	60	59	58	57	56	55	54	53	52	51	50
V	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
W	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100



This television circuit is used in conjunction with the second paper of the TV Servicing exam.

TELEVISION SERVICING CERTIFICATE (Written Examination)

ations were "in reverse" in some cases, i.e. a greater signal input providing "a better image."

8. (a) There are three capacitors associated with the anode circuit of V3. Enumerate them, state the functions of each, and explain why each has the value of capacitance indicated on the circuit diagram.

(b) Describe fully the function and operation of VR2.

Quite well answered by all candidates attempting it.

In the Television Servicing Certificate examination 55 candidates passed out of a total of 104, 20 being referred in the practical test, and 20 failing. The examiners say: Considering that this examination is the final of the servicing series, the standard of the candidates

work was not very high. Many questions were answered with very little detail, and there often appeared to be a complete lack of knowledge on certain aspects of television.

First Paper

All six questions must be answered. The maximum number of marks obtainable is the

(Continued on page 938)

TELEVISION TRADING SIMPLIFIED

Are you ready for I.T.A.?

New record system
Cuts staff! Cuts time!
Cuts costs!

Independent Television, coming hard on the heels of H.P. freedom means, of course, that you are expecting a boom.

And how right you are.

But it can also mean a tremendous increase in the paper work necessary to control customers' accounts, to ensure that maintenance contracts are executed to time and correctly costed, that stocks of receivers and replacement parts are properly controlled.

THERE IS A METHOD THAT WILL DO ALL THESE THINGS and more—WITH LESS CLERICAL EFFORT and with A LOT LESS WORRY THAN EVER BEFORE.

HOW?

Briefly the method is to make out a specially designed card holding comprehensive details of your dealings with each customer.

The cards are then housed in a Shannovue 'book' or cabinet—it depends on the number of cards you have (i.e., 60-10,000). When clipped in, each record shows a visible edge. This edge holds main details such as name, address, number, etc., and a dated strip.

The dated strip is used to signal (by means of little coloured signals) date of next instalment due—overdue payments—date overhauled, etc.

Over the whole card folds an 'auxiliary' sheet on which to note H.P. payments (paid and overdue) and details of reminders sent.

If you would like full details of this very compact little system (the saving in clerical effort is really surprising) just jot 'TV RECORDS' on your bill-head and post to us. Full details, plus a specimen of the actual record, will be with you by return.



VISIBLY BETTER RECORDS

The Shannon Ltd.,

51 Shannon Corner, New Malden, Surrey

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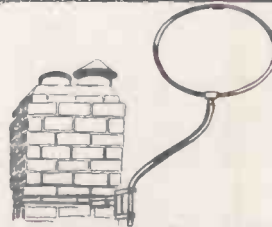
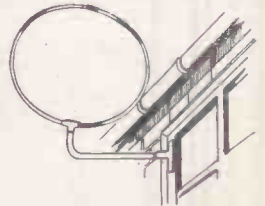
The T.V.9 Portable Aerial, 39/6 retail.
The "Teleglow" fits on the TV9 obviating eye-strain, compact and good to look at. Quick sales at 21/- retail (including Purchase Tax).
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The T.V.12 loft type aerial 27/6 retail. Easy 2-point fixing.



The "Tuneflex" ribbon element aerial, 19/6d. retail. Inductively tuned. Supplied complete with 18ft. cream co-ax cable, trimmer screws and pins for fixing.
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The T.V.14 outdoor aerial, 37/6 retail. Complete with 3ft. upswept stand-off arm, and fixing plate. Designed for wall, eaves or window frame mounting.



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Dealers in all parts of the country are finding it very profitable to stock these quick selling lines. Send for fully illustrated literature to-day.

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RADIO AND TV SERVICING EXAMS

—continued

same for each question. Questions may be attempted in any order, but the answers must be clearly numbered.

1. List, in their correct order, all the adjustments necessary to a superheterodyne television receiver upon installation. What other steps should be taken to ensure the customer's satisfaction?

Fairly well done on the whole, though some papers were notable for serious omissions in the list, particularly the mains voltage adjustment. Candidates powers of expression and ability to marshal all the relevant facts were severely restrained in many cases.

2. State the tests that can be made satisfactorily on a television receiver during a transmission of Test Card "C."

Most candidates were aware of the main uses of Test Card "C," but few appear to be able to make full use of it.

3. Draw a circuit diagram of a complete line time base, including flyback e.h.t., suitable for a universal type of receiver. What defects in this circuit could cause the picture to be:—(a) too narrow, (b) dull and poorly focused, (c) cramped on left-hand side, (d) completely absent?

Diagrams were not too good on the whole. There still seems to be some confusion over the action and hence the correct circuitry of the efficiency diode. Parts (b) and (c) gave the most trouble.

4. What types of television aerials are suitable for:—(a) indoor mounting in high field-strength areas, (b) use in medium strength areas with high interference levels, (c) use in fringe areas? Describe in detail the siting and orientation in each case.

Some very good answers, but many candidates seemed to dismiss the question in such a very few words that vital information was omitted.

5. Describe the synchronisation of a picture in a domestic receiver.

Many candidates seemed satisfied with the crudest of circuits, not even suggesting that sometimes more elaborate circuits are desirable and necessary. Very few pointed out the need for preventing line sync pulses reaching the frame circuit.

6. Describe the effects which might be observed when a mismatch occurs in the aerial-feeder-attenuation-receiver chain. What steps could be taken to correct the defect? Specify the components you would use to make a 3-1 attenuator for use with 70 ohm coaxial cable.

Very hazy ideas were often apparent as to what constitutes a mismatch, and even hazier ideas as regards correction of the faults. The second part of the question was also a stumbling block to many candidates.

Second Paper

(Set in conjunction with the circuit diagram reproduced on page 936)

All six questions must be answered. The maximum number of marks obtainable is the same for each question. Questions may be attempted in any order, but the answers must be clearly numbered.

1. Describe in detail the functions of:—V2, V5, V13, V15.

Most candidates were able to give the bare function of each valve, but usually with complete lack of detail. V13 was dealt with very badly.

2. Give a title to each of the variable resistors VR1 to VR9. Also describe the functions of L19 and L22.

On the whole this question was answered satisfactorily, although some candidates had mixed ideas on VR8, VR9, and L19, L22.

3. Describe briefly the functions of the following components:—W1, W2, W3. Suggest a simple method of testing these, if they were suspect.

Television Servicing				
	1954		1953	
		%		%
Candidates Passed	104	100.0	135	100.0
Referred	55	52.9	64	47.4
Practical Failed	20	19.2	36	26.6
	29	27.9	35	26.0

This question was not answered very well. Few candidates were able to give a reasonable description of the functions of all three rectifiers. W1 and W2 gave the most trouble. More important still, a large number of candidates appear to have little idea how to check a rectifier, apart from substitution.

4. Give a detailed description of the line time base. How does V12 obtain grid bias? What is the purpose of TC1?

From the answers given it was obvious that many candidates do not fully appreciate the operation of this type of circuit. This is rather important as it is now used extensively by most manufacturers, and damage to components can easily occur if the controls are not correctly adjusted.

5. What are the functions of V6 and its associated components? Describe the operation of this part of the receiver in detail.

The majority of candidates stated correctly that the valve operates as a vision noise suppressor. Few gave a detailed description of its operation and less than a dozen mentioned that it also provides frame fly-back suppression.

6. Give a brief description of the effect of each of the following faults on the receiver operation:—(a) R38 increased to 10 megohms, (b) C36 open-circuit, (c) C49 short-circuit, (d) R54 open-circuit, (e) C40 open-circuit.

Most candidates answered this question satisfactorily, sections (a) (b) and (c) gave the most trouble.

RADIO AND TV PRACTICAL TESTS

On the Practical Examination for both radio and TV, which involved faultfinding on a receiver chassis, the examiners report as follows:

The most important factor in the practical

test is for the candidate to carry out and record a logical sequence of diagnosis, test and repair, commencing with cold tests.

Regarding workmanship, a serious view is taken by the examiners of the use of corrosive fluxes, and where they are seen on the bench a note is made by the invigilator on the report form. Students should be warned against using such flux and they should also be warned not to scratch the cabinet of the receiver on which they are working.

Many candidates are not careful about the damage caused to other components and sleeving by the heat of the iron, and they do not always dress their leads neatly. They should perform their work at the examination exactly as they would expect to do for a customer, and the result is judged accordingly.

The practical examiners would like to see more attention paid to the report form throughout the examination. They realise that the candidate may be working under some tension, but it is important that he records his progress continuously in order to be assured of fair marking.

The practical test report is divided into two columns: "Symptoms Observed" and "Tests Applied and Action Taken." In the first column candidates should enter the existing state of the receiver, i.e. what symptoms are observed. Candidates should then record in the second column each test they apply and any action taken. After clearing one fault they should state the new symptoms which are observed and continue as before.

It is important that students are instructed in the full meaning of the word "Symptoms."

Although the examiners require much information, they want it in the minimum number of words, and any recognized abbreviations may be used. The last thing they require is that candidates should spend all their time writing. The candidates should be warned against hurrying through a series of stages of work and then writing it up afterwards; in this way intermediate stages are often omitted. Marks are awarded for the standard of reporting, as in the commercial field the accuracy of technical reports is of vital importance.

Candidates should always complete their practical tests by checking and reporting the calibration and performance of the receiver on all wavelengths.

People in the Picture

CONTINUED FROM PAGE 931

Since his retirement from the Post Office, Mr. Macadie devoted a considerable part of his time to the Automatic Coil Winder and Electrical Equipment Co., Ltd., which he had helped to form in 1923 to manufacture two of his major inventions.

Pye Telecommunications announce the appointment of F. H. Foster, as area sales manager for Derbyshire, Nottinghamshire, Lincoln and Lindsey, and Sheffield. He will be operating from Sheffield and his address is 348 St. James's Chambers, 56 Church Street, Sheffield.

M. C. Cleminson announces that he is no longer trading under his own name, but now has a controlling interest in Cleminson's Agencies, Ltd., a firm acting as manufacturers' agents, importers, and distributors. Address of the company is 36 Clifton Gardens, London, N.W.11.

Three members of the export organisation of the Ever Ready Co. (Gt. Britain), Ltd.—known as *Berec*—left England recently on business tours abroad. George White (export sales director of the Ever Ready Co.) visited the Caribbean and Central American countries, and was accompanied by P. S. Roberts (area field representative) who later visited South America. A. C. Evans (area field representative) is touring Belgian Congo, Rhodesia and Nyasaland, and East Africa. M. C. Elliott is covering West Africa, including the Gold Coast, Liberia, Sierra Leone and Gambia.

Visiting the Malmesbury Division of E. K. Cole, Ltd., recently, E. K. Cole, chairman and managing director of the company, presented the Higher National and Ordinary National Certificates gained by Malmesbury apprentices in 1954.

Easy to demonstrate



Simple to sell

● Supplies of this folder and other publicity material on application.

● The MONARCH Autochanger is Nationally Advertised.

● B.S.R. Pick-up Styli replacement showcards, Monarch display cards and consumer folders, freely available.

● The advertisement below appeared in *Radio Times* and all advertisements tell readers "Ask your dealer for a demonstration."

Place a record on the Monarch Autochanger turntable (load up with 9 more if required) and adjust the turnover cartridge. Set speed knob and operate switch (explain to the customer it's a simple combined control). Watch his reaction to the precision operation. See how he smiles as all the details of the recording are beautifully reproduced. Guess (right) that you can clinch the sale when the autostop works without attention. (Yes) the Monarch is fitted in leading radiograms and players, so it's easy to please everyone.



The
MONARCH
AUTOCHANGER

Easily makes their favourite choice



BIRMINGHAM SOUND REPRODUCERS LTD., OLD HILL, STAFFS.

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CHANNEL BAND 3 CONVERTORS

ANNOUNCING

OUR NEW IMPROVED TWO-PROGRAMME BAND 3 TV CONVERTOR TYPE C.1.

This redesigned new-look model incorporates several exclusive features, including

- ★ Attractive streamlined case
- ★ Front knob gain control
- ★ Quick-change programme knob
- ★ Hidden easy-access tuning trimmers

The C.1. provides instant choice of your B.B.C. Band 1 programme, or any one Band 3 programme.



THE CHANNEL FOUR-PROGRAMME BAND 3 T.V. CONVERTOR TYPE C.2

This is the ONLY Band 3 converter on the market providing

**INSTANT CHOICE OF
4 TELEVISION PROGRAMMES
(B.B.C. plus three in Band 3)**

In the C.2 the Channel design staff have covered all possible future programme requirements in any T.V. area.

PRICE **9 GNS.** RETAIL

subject full trade discounts
Now in quantity production.
Deliveries in strict rotation.

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Now in quantity production.
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of the

CHANNEL DUAL-BAND TELEVISION PRE-AMPLIFIER **TYPE P.13**

Providing pre-amplification of Band 1 or Band 3 programmes

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GAIN CONTROL — HIGH-GAIN LOW-NOISE CIRCUIT — MAINS SWITCH

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Phone : 3167

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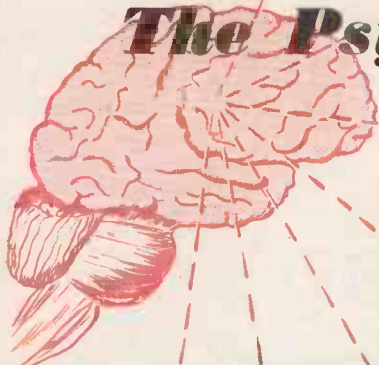
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The Psychology of Selling

Part 2 — ATTENTION

Attention is a selective function, says H. J. Campbell, and it is the salesman's job to make sure that the customer selects his selling message from the mass of sense data presented for his attention. How this can be done is indicated in this entertaining and instructive article.

by H. J. Campbell



LAST time, we dealt with the senses. The great thing about the senses is that they react to the world around us. Whether we like it or not our eyes see, our ears hear and our skin feels. Messages are "coming in" all the time. Whether we are aware of those messages depends upon whether we are attending. Try as we might, we cannot be aware of *all* the incoming messages—try looking at two things at once; you can *see* them both, but you can't *look* at them both.

So we can pay attention to only a limited amount of sense data. Your job as a radio salesman is to be sure that your customers pay attention to the sense data you are offering. So you had better know something about what makes and breaks attention.

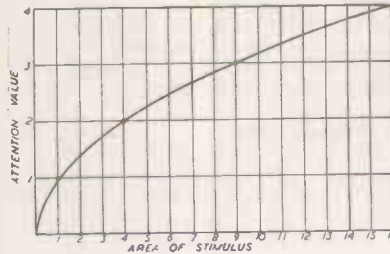
In the words of the famous American psychologist, J. P. Guildford: "He who would control the actions and the development of others, must first of all get all their attention, whether he be teacher, salesman, advertiser or preacher."

We can define attention as the process of selecting what one is going to observe. Right now you are reading this page; you have selected a small region of optical sense data for consideration. But when the corn on your toe begins to speak for itself, your selection will change and the region of sense data you consider will be way down in your shoe.

COMPETITION

Thus, as you probably know already, different types of sense data compete with each other in our minds for attention. Sometimes we attend to one, sometimes to another. It may well be that those of us who lead the most successful lives have a knack of paying attention to just those things that help us on, whereas the less successful pay attention to any old thing.

You are reading this article in the fond hope that it will do you some good. I'm sure it will! But not if you attend only to the size of the type or the width of the column or the thickness of the page. Those things are irrelevant to your purpose and any attention you bestow on them will be wasted.



"The larger a thing is, the more attention it gets..."
Graph showing how the attention value varies as the square root of the area of display or stimulus.

So it is no use just getting your customer's attention. You make him attend to a specific region of sense data that is going to sell one of your lines.

GETTING ATTENTION

How, first of all, do you get your customer's attention? Psychologists are agreed that man is so habitually eye-minded and ear-minded that visual and auditory sense data almost always take right of way over all others. That is why your window and your sales talk are so important.

Nothing draws attention so much as a really well-designed layout of goods in the window, backed up by judicious use of cards and notices. The psychologists say that orange and yellow are the strongest attention-getting colours—contrary to the popular belief that red has this role.

Of course, this does not mean that you should splash orange *all over* your window, for attention is obtained by *contrast*. It does mean that if you are plugging a particular line, you should

surround it in your window with orange or yellow.

A tenet of psychology is that, everything else being equal, the more intense the sense data, the greater their attention value. You don't want to take this too far. I passed a radio shop in South London the other day, the owner of which seemed to think that he was doing himself some good by having a radio blare out so loudly it could be heard, really, over two hundred yards away. He certainly drew attention to his shop by the intensity of his sense data—but *what* attention!

Sense data can be so intense that they hurt, not physically, necessarily. But we are dealing with the mind, and the mind can be hurt very easily. So, watch the intensity of your visual and auditory stimuli. Make the intensity optimum—as high as possible without hurting.

SQUARE LAW FUNCTION

Another psychological principle is that, other things being equal, the larger a thing is, the more attention it gets. There's nothing academic about this for down-to-earth advertising research has shown that the attention value of an advertisement is directly proportional to the square root of its area.

But don't let this make you indulge in an orgy of advertising spending on large spaces. The mathematical function quoted above means that, with a given layout, a full-page advertisement has only twice the attention getting and holding power of a quarter-page advertisement.

Similarly, a sound that is four times as loud as another, gets only about twice the attention—unless it has got into the "hurt" range. The same kind of thing applies to lights; you may burn, and pay for, four times as much current by having a really brilliant window, but you'll still draw only about twice as much attention.

REPETITION

The duration of the stimulus is very important. The longer a stimulus lasts, the more we become adapted to it and

the less attention we pay to it. That is why the best composers introduce their significant ideas in recurring patterns; and that is why the best orators use alliteration and repetitive catch phrases. But you can get monotony of repetition too, and if the same thing turns up identically each time it has a deadening effect on attention.

You'll have noticed that composers and orators introduce slight variations on their repetitive phrases. These are principles you can apply to your window design, shop layout, mail order letters, sales talk—and indeed, everything connected with selling radio ware. Have constant change, but repeat the main theme with variations. In a word, make your sales technique a symphony!

Position of the stimulus has importance only in connection with visual sense data. Even so, it may be well to bear in mind that exhaustive study has shown that the upper half of magazine and newspaper pages get more attention than the lower; the left side gets more than the right. However, in the case of billboards, such as those you have dotted about your window, it is the lower part that gets most attention.

This does not mean, in either case, that the non-attentive parts should be left blank. It does mean that the most important part of the message should occupy these attention getting areas.

Sense data tend to gain in attention-getting power as they are isolated from other sense data. I've said several times in various articles that those dealers who clutter up their windows with masses of goods are wasting their exhibition space. Now I can give you some experimental evidence in support of clean, clear, uncluttered windows.

Some research was done by American advertisers to discover the effect of blank space in advertisements. They published quarter-page advertisements. Then they took the selfsame advertisement and displayed it on a half-page with all the extra space left blank. There was an overall gain of 30 per cent. in response.

The lesson is clear: don't try to plug everything at once; select two or three lines and give them each their own isolated display.

TYPES OF ATTENTION

Once you have got your customer's attention, you need to keep it. But before considering this, let's have a quick look at the types of attention you might get. First of all there is involuntary attention. This occurs where the person, without willing it, attends to something. It is found mostly in young children, but it also occurs in adults when they are presented with something novel.

You would get it, for example, by showing your customer some new gadget for remote control of his television set. It is the easiest type of attention to get—once you've got the novelty.

Then there is voluntary attention. Here the subject "forces" himself to attend. He does not naturally want to; something "inside him" makes him do it. You do it yourself when you make up your income tax accounts! This kind of attention you will meet most clearly in the man whose wife is insisting that they buy some device he cannot afford.

The third type of attention—the type that you should pray to get—is the non-voluntary form. Here the person is so genuinely interested in the sense data that he attends without any effort, even though the sense data do not involve novelty.

Naturally, these three divisions shade off into each other and cannot be divided by sharp lines. The importance of the classification from the sales point of view is that you want to try to estimate what sort of attention you have got in each customer, so that you'll know how much trouble you must take to keep his attention.

DISTRACTION

The subject of holding attention is, of course, the same as that of distraction. It is a law of psychology that

if you have got attention, you will keep it if no distracting influence intrude. Theoretically, distracting influences lose their effectiveness after a time, *i.e.*, although they are still present, they fail to distract.

That may be all right under the conditions where it was observed—among factory workers—but it does not apply to the short time in which you have to sell a tape-recorder or television. During that small period distracting influences may make all the difference between success or failure.

Obviously, if you are talking to the prospective buyer, anything that takes his attention off your talk is a distraction. If you are showing him something (which includes his looking in your window), then anything that makes him look elsewhere is a distraction.

One of the most frequent sources of distraction is movement. We all of us have an instinctive fear of moving things, and although as we grow up we don't go silly about them, moving things still draw our attention with great ease.

This is one of the reasons why, on previous occasions, I have suggested that you have a little cubicle in the shop where the customer can sit down. He will not be distracted by the assistants moving about or by the whirling blades of the electric fan or the dozen or so other things that are always on the move.

MOVEMENT OUT

Movement should be kept out of the window. Despite the prevalence of those fancy little gadgets that twist and turn and revolve and sparkle, there is no sense in having them. The customer may have his attention drawn, pause and stare. But he is staring at the gadget, not at your goods. And when he has finished looking at the gadget he will move off. You've done nothing except add to the confusion of his life by making him wonder how the thing works.

Flashing lights are good—because the lights themselves can be a sales message—but moving objects should be right out. Heresy, maybe, but true.

Apart from moving objects, there are a few general rules which come in handy when trying to avoid distraction. It has been found that sounds tend to distract more than other stimuli. It has also been shown that distractions are more potent when in the same sense as the attention. That is, a light is more distracting when the person is looking than when he is, say, listening.

Interrupted stimuli, such as the buzzing of an electric fan, are stronger distractors than continuous stimuli. Interest in the distractor is a contributing factor. Your customer will be less distracted by the electric fan than by your assistants telling each other jokes!



Distraction is the involuntary transference of attention to an extraneous stimulus. Interest in the distractor is a contributing factor.

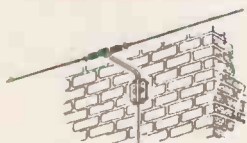
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AERIALS**



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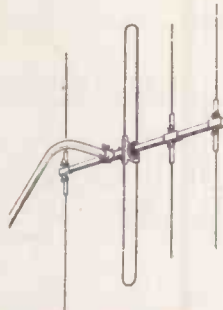
FM/HL. "H" type with 4ft. 6in. cranked arm, die-cast bracket, and chimney lashing. LIST **77/6**



FM/Y4. 4-element Yagi for F.M. reception. With 4ft. 6in. cranked arm, die-cast bracket and chimney lashing. LIST **97/6**

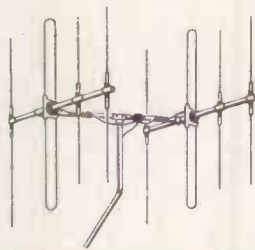
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BAND III and F.M.**

You can order Wolsey Band III aerials with confidence that they will give satisfactory reception in the areas for which they have been designed. They are the result of research, development and exhaustive field tests carried out since early last year, combined with our experience in the manufacture of Yagi arrays for export. There is no need to stock several types of Band III aerials, the two Wolsey Yagi types illustrated below provide for all areas within the anticipated range of Band III transmissions.



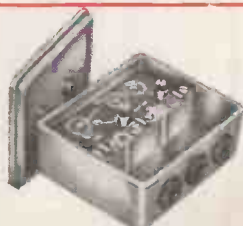
BAND III 4-ELEMENT YAGI

Type Ref. Y4. This Yagi is designed for use in the primary service area and fringe areas. By installing this model you can be sure of eliminating ghosting in the primary service area, and it will provide adequate signal pick-up in the fringe areas. Complete with 4ft. 6in. cranked arm, die-cast bracket, and single lashing equipment. For use with 70-80 ohms co-axial cable only. LIST **77/6**



BAND III BROADSIDE ARRAY

Type Ref. BA/4. For extremely difficult areas where ghosting is particularly severe or the signal strength is exceptionally low, we very strongly recommend the Broadside Array consisting of two Y4 aerials in parallel with matching lines and splitter box. Complete with cranked arm, die-cast bracket and chimney lashing equipment. For use with 70-80 ohms co-axial cable only. LIST **£7 15s.**



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1957A. For mast mounting only. 17/6

**★ BAND 111 TYPES
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ATTACHMENT TO
EXISTING AERIALS**

Wolsey have designed an adjustable Clamp for securing the above types to the mast or support arm of existing Band I aerials. These clamps cover masts or arms of 3/4in.-1 1/4in. and 1 1/4in.-2in. diam. Full particulars on request.

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Assembling Valves under Dust-Free Conditions

**NEW TECHNIQUES IN
THE ASSEMBLY OF RADIO
VALVES GIVE GREATER
RELIABILITY**

Two operators at work
in one of the dust-free
special valve assembly
rooms at G.E.C. Re-
search Laboratories.



IN certain industrial manufacturing processes the presence of dust in the atmosphere seriously affects the quality of the product and may even add to the difficulties of production. This is particularly the case in the assembly of special radio receiving valves, which have been in increasing demand in recent years.

Certain of these valves contain grids wound with about 500 turns per inch and have interelectrode clearances of about one thousandth of an inch. Particles of dust, cloth fibres and other airborne impurities, generally known as "lint," would, under normal working conditions, enter these valves during assembly. They cannot be removed during subsequent processing and some would eventually settle on the electrodes, causing premature failure of the valves during operation.

The high degree of reliability now required of these valves has led to the recent construction of specially designed "dust-free" rooms at the Research Laboratories of The General Electric Co. Ltd. where the valves are assembled. The space used measures 11 x 20 x 8 ft. high and is divided by hardboard partitions containing large sheets of plate glass. The resulting arrangement, shown in Fig. 1, gives a large "L"

shaped room, an additional rectangular room, and a small air lock which serves as a robing room.

The materials and colour schemes were selected with considerable forethought in collaboration with the Building Centre and the Building Research Station. The rooms receive little natural light, and every attempt has been made to make them pleasant to work in, within the limitations which dust-free conditions impose.

The eggshell blue walls and white ceiling are given semi-watt finishes to avoid excessive disturbing reflections from the overhead fluorescent lighting, while wooden doors and partitions are covered with high-gloss cream paint. The floor covering is of highly polished dark red linoleum.

Minimum of Dust

Benches, faced with green scratch-resisting Waverite, tool cupboards and hot cupboards, were carefully designed to produce the minimum of dust during

use. Where possible, apparatus is enclosed in smooth metal boxes, and exposed metal parts such as vices and welding sets are electroplated or painted for ease of cleaning.

The ventilating system, housed in a gallery above the assembly rooms, draws in air from outside the building, filters out particles of dust more than 5 microns in diameter (1 micron x 0.001mm.), and delivers 1,000 cu. ft. per minute of clean air to the two workrooms below. This results in a complete change of air in the "L" shaped room every 2½ minutes.

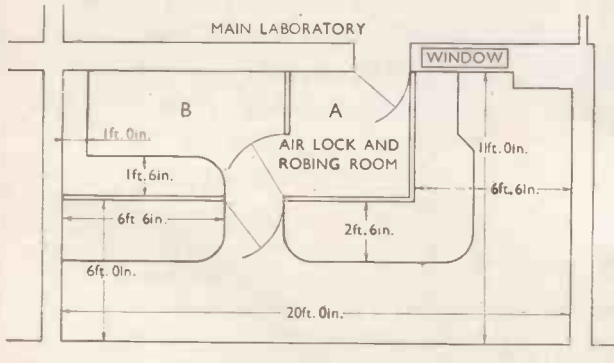
The temperature of the air entering is regulated by a thermostatically controlled 10 kW electric air heater mounted in the duct. Air leaves the rooms through non-return louvres built into each of the doors, and escapes into the main laboratory via the air lock.

Special Uniform

Having supplied the rooms with clean, filtered air, it is equally important to prevent dust and "lint" entering from other sources such as operators' clothing. This is accomplished by keeping traffic in and out of the rooms to a minimum and by providing all operators with special overalls free from loose fibres.

The operators themselves are carefully selected for this assembly work and the maintenance of a high standard of cleanliness in the rooms depends on them to a great extent. They wear nylon overalls, buttoning at the neck, wrists and ankles, and fitted with a zip-fastener at the front. A nylon cap to cover the hair and leather slippers in place of shoes are also supplied.

Although the existing system is adequate for the present purpose, future requirements may impose even more stringent conditions of cleanliness. Provision has been made for the installation of additional filtration plant for the removal of dust particles down to 0.2 microns in diameter. Since the rooms have been in operation, however, there has been a marked improvement in the reliability of the product.



Plan of the dust-free rooms where special valves are assembled at the G.E.C. Research Laboratories.

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*Continued
from page
390*

**Wide-range Valve Voltmeters
E7555/2 and E7555/3**

These instruments differ only in the range of voltages which they can measure. The E7555/3 covers the range 100mV to 500V d.c. or peak a.c., while the E7555/2 has additional ranges up to 15,000V. An input of 0.5V peak a.c. and d.c. gives full-scale deflection on the most sensitive range, and stabilities of zero setting and calibration are exceptionally good. Both positive and negative direct voltages can be measured with respect to earth or other reference potentials, up to a maximum of 500V.

For a.c. measurements, a probe is provided which incorporates a double diode valve. One diode is used as a peak rectifier, while the other balances out the effects of contact potential and residual diode current. Careful design ensures a frequency response which is level between 30 c/s and 100 Mc/s.

The probe input resistance (a.c.) is 3.5 megohms at frequencies up to 50 kc/s, falling to 8.5 kilohms at 45 Mc/s. The capacitance is constant at 9pF.

The d.c. circuit of the voltmeters takes the form of a balanced four-valve amplifier. Two EF86 pentodes connected as a "long-tailed pair" are directly coupled to balanced cathode followers. The output of the cathode followers is connected back to the grids of the long-tailed pair, providing virtually 100 per cent. negative feedback. This arrangement results in a high input impedance (10 megohms on the 0.5V d.c. range) and exceptional stability. Variations of mains voltage and ageing of valves have very little effect on accuracy.

The meter, which has a 5in. mirror scale, is connected between the cathodes of the cathode followers.

High-sensitivity Voltmeter E7556

This instrument measures alternating voltages between 0.5 millivolt and 300V in the frequency range 20 c/s to 1 Mc/s with a total error of less than 4 per cent.

The circuit consists of an input cathode follower feeding into a three stage wide band amplifier with negative feedback. The amplifier output is rectified by a diode and displayed on a 5in. mirror scale meter. The frequency response is flat within 2 per cent. over the range 20 c/s to 1 Mc/s.

The input resistance on the lowest range (10mV f.s.d.) is 1.5 megohms at 20 kc/s and 0.7 megohms at 1 Mc/s, the input capacitance being 15pF. On ranges of 3V f.s.d. and over, the corresponding values are 1.9 megohms, 0.7 megohm, and 6pF.



Mullard high-sensitivity voltmeter type E7556.



Mullard wide-range valve voltmeter E7555.

A lamp bridge circuit provides an accurate calibrating voltage of 10mV at mains frequency.

Dual Trace Oscilloscope

Another new introduction is a high grade general purpose oscilloscope type L101 which incorporates a dual-trace facility, and features wide-band amplifiers, sweep expansion, and stabilised h.t. and e.h.t. supplies. A tubular steel movable floor stand and an oscilloscope camera are available as accessories. The instrument should be of great value for the comparison and measurement of complex waveforms.

Dual-Trace Working

The dual trace facility is provided on a conventional 5½ in. tube by means of two identical Y amplifiers and an electronic switch. Each amplifier is switched through to the cathode-ray tube on alternate sweeps, the electronic switch being operated during flyback. There is no interaction between the channels, each of which has a frequency response from 10 c/s (1db down) to 4 Mc/s (3db down). The rise time of the amplifier is 0.1 microsecond.

Identical attenuators embodying close tolerance high stability components are provided for each channel. These permit the sensitivity to be adjusted from 0.02V peak-peak/centimetre to 100V peak-peak/centimetre in twelve steps. The frequency response of the amplifier channels remains constant for all attenuator settings. Voltages can be measured within 5 per cent.

The dual-trace facility can be switched out when not required.

Time-base

The Miller time-base can be free-running, synchronised or triggered. Sweep velocity is variable between 10 cm/microsecond and 0.1 cm/millisecond. The sweep length may be expanded in three switched steps to 10 cm., 20 cm., and 50 cm.

Velocity adjustments have negligible effect on sweep length. Time can be measured with an accuracy of ± 10 per cent. The time-base output stage can also be used as an X amplifier with a sensitivity of 0.7V/cm and a bandwidth of 2 c/s to 300 kc/s.

**£1 STARTING
NEXT MONTH**

As from the May issue the annual subscriptions for B.R.T. will be increased to £1. For full details see page 875.

NEW BOOKS

Television Circuit Refinements

SO rapidly has television developed during the post-war years, with each manufacturer continually striving to produce better and more efficient circuits, that engineers have long recognised the need for a book which explains and illustrates the various circuit improvements that have taken place. In other words, what is required is an "anthology" of new circuit techniques so that the servicing man can keep abreast of receiver developments without having to abstract the information for himself from the manufacturer's service manual (when—and sometimes if—available).

Television Circuit Refinements fulfils this function admirably; it contains a selection of nearly 100 circuits, old and new, used to improve the performance and reliability of television receivers, and as such forms a useful reference book for the engineer. The subject matter is classified into chapters, each covering a specific section of the television receiver: *Aerial Circuits, Sound Rejection, Automatic Gain Control, Reflex Circuits, Black Level Stabilising, Interference Limiters, C.R.T. Circuits, Power Supplies, etc.*

The book is well illustrated with line diagrams of circuits from actual commercial receivers, and the text explains in non-mathematical language how each circuit operates.

This book should sell well among dealers and servicing men.—K.L.L.

Television Circuit Refinements, by C. H. Bantorpe. Published by Norman Price (Publishers) Ltd., 283 City Road, London, E.C.1. Size: 8½ in. x 5½ in.; 32 pages; well illustrated. Price, 5s.

**RADIO RETAILING AS
A LIMITED CO.**

(Continued from page 932)

doorway, and it must appear on all contracts made by the company, for these contracts are made "for and on behalf of" the company by the directors. It follows that all cheques should be signed thus:

For and on behalf of Grainger and Todd, Limited.

..... Director
..... Director and Secretary

All correspondence should be signed in a similar manner, but by one director or the other depending on the part of the business he is responsible for. All orders will be signed in the same way.

The full name of the company should also appear on all brochures, folders or tariff cards for services showing prices to be charged for standard work, and the word "Limited" must be included in every case—on advertisements as well as on notices in shop windows.

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With this issue of *British Radio and Television* volume 9 comes to an end. Twelve copies of B.R.T., from May 1954 to April 1955 are now ready for filling in permanent form so that the technical articles and features can be referred to as and when necessary. This is the time to order your Annual Binder, and convert a year of B.R.T. into an invaluable 956-page reference book for your Technical Library.

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Financial News

It is pointed out that winding-up proceedings and liquidations are frequently rendered necessary for the purpose of reconstruction, extension of capital, transfer of business, etc., quite unconnected with any financial embarrassment, and the fact that companies appear in this list, therefore, must not be taken as necessarily indicating any want of solvency.

NEW COMPANIES

Brimetrix, Ltd. Capital £2,000. Objects: To carry on the business of agents for the sale of and wholesale and retail dealers in and repairers of artificial lighting apparatus, electrical plant, machinery, wireless and television sets and accessories, etc. Subscribers: Edwd. R. Watkins and Douglas J. Bryant. The first directors are not named. Solicitors: Jones & Middleton, Chesterfield.

Bristol Channel Production Co., Ltd. Capital £2,000. Objects: To carry on the business of mechanical, general and electrical engineers, engineering contractors, wireless and television engineers, etc. Subscribers: Joseph A. Cave and Marjorie Evans. John Whittaker is first director. Secretary: Miss Marjorie Evans. Solicitors: Hugh-Jones Cava & Lougher, Cardiff. Registered office: 1 Museum Place, Cardiff.

Bruce Mitchell (Sales), Ltd. Capital £2,000. Objects: To carry on the business of hire purchase financiers, etc. Directors: Bruce H. Mitchell and Alva Mitchell. Secretary: Lillian Wilson. Solicitors: Horsley & Birstow, Halifax. Registered office: Fountain Chambers, Fountain Street, Halifax.

Burkill's for Wireless, Ltd. Capital £1,000. Objects: To acquire the business of radio and electrical engineers and contractors now carried on by the administratrix of the estate of Claude W. Burkill (deceased) at 93 Carlton Street, Castleford, Yorks, as "Burkill's for Wireless." Directors: Mabel Burkill (permanent), Phyllis C. Morgan, and Mildred Bailey-Smith. Secretary: G. Teet. Solicitors: A. Maurice Smith, Castleford. Registered office: 93 Carlton Street, Castleford, Yorks.

Caledonian Broadcasting Services, Ltd. Capital £100. Objects: To carry on the business of renters, owners, managers and operators of sound and television studios and stations, etc. Directors: Robert Wotherspoon, Iain Tennant, Robert Clark and Sir Alexander B. King. Secretaries: Macandrew & Jenkins. Registered office: Royal Bank Buildings, Inverness.

C. A. Moreton, Ltd. Capital £500. Objects: To acquire the business of wireless, television, electrical, motor and refrigeration engineer now carried on by Chas. A. Moreton at Gt. Yarmouth, as "C. A. Moreton." Directors: Chas. A. Moreton, Mrs. Joyce E. Moreton, and Chas. R. Moreton. Secretary: Chas. A. Moreton. Solicitors: Ruddock & Middleton, Great Yarmouth. Registered office: 94 Northgate Street, Gt. Yarmouth.

Cape Electronics, Ltd. Capital £1,000. Objects: To carry on the business of manufacturers of and dealers in electronic, electro-phonic, musical and mechanical apparatus and instruments, etc. The directors are: Horace L. York, Thos. L. Horton, and Neville L. Hearne. Secretary: T. L. Horton. Solicitors: York & Hearne, Bournemouth. Registered office: 43/5 High Street, Shirley, Southampton.

Carew Finance Co. Ltd. Capital £100. Objects: To carry on the business of financiers of hire purchase agreements, etc. Directors: Kenneth D. Berwick, Berwick's Toy Co., Ltd., and Jas. W. G. T. Raynes, director of Rayburn Cars, Ltd. Secretary: J. W. G. T. Raynes. Registered office: 183 Hammersmith Road, W.6.

Carlin & Horne, Ltd. Capital £100. Objects: To carry on the business of manufacturers, importers and exporters of and dealers in wireless apparatus, cabinets, loudspeakers, etc. Directors: Dennis P. J. Carlin and Percy N. Carlin. Secretary: Ula Carlin. Registered office: 1 Eastmead Road, S.E.2.

Carlow Manufacturing Co., Ltd. Capital £100. Objects: To carry on the business of manufacturers of and dealers in and repairers and hirers out of electrical and mechanical apparatus, accessories and components of all

kinds, in particular wireless and television sets, etc. Directors: Philip H. Carlow, Albert A. Jones, and George D. Morton. Solicitors: Webber & Williams, Amptill, Beds. Registered office: 14 St. Mary's Street, Bedford.

Carlow Rentals, Ltd. Capital £100. Objects: To carry on the business of hirers out of electrical and mechanical apparatus and accessories and components, in particular wireless and television sets, etc. Directors: Philip H. Carlow and Albert A. Jones. Solicitors: Webber & Williams, Amptill, Beds. Registered office: 14 St. Mary's Street, Bedford.

Cavendish Hire Purchase, Ltd. Capital £100. Directors: Sarah Muslin, director of Granta Publications, Ltd., and Mrs. Iris M. Hutton. Secretary: Sarah Muslin. Solicitors: Carr Sandelson & Co., 19a Cavendish Square, W.1. Registered office: 19a Cavendish Square, W.1.

Central Wireless Co., Ltd. Capital £25,000. Objects: To acquire the business of a television and radio specialist carried on by John Tilley at Wigan as "Central Wireless Company," etc. Permanent directors: John Tilley (governing director and chairman) and Mrs. Ethel Tilley. Secretary: D. W. Magrath. Registered office: 52 Standishgate, Wigan.

Chanctonbury Finance Co., Ltd. Capital £5,000. Objects: To carry on the business of industrial finance and hire purchase consultants, etc. Directors: John C. Garratt and Mrs. Majorie E. Garratt. Secretary: E. W. Watts. Solicitors: Griffith, Smith & Co., Brighton, 1. Registered office: 33 Howlands Road, Worthing.

Chas. R. Rae & Son, Ltd. Capital £100. Objects: To carry on the business of electrical, radio, television and refrigeration engineers, etc. Directors: Charles R. Rae, Mrs. Florence A. Rae, and Kenneth C. Rae. Secretary: C. R. Rae. Registered office: 125 Blackstock Road, N.4.

Contraco, Ltd. Capital £100. Objects: To carry on the business of dealers in wireless goods, gramophones, records, etc. Directors: Ivo P. Tonder, and Marjorie M. E. Abrams. Secretary: I. P. Tonder. Registered office: 3 Cork Street Bond Street, W.1.

Cossor Service, Ltd. Capital £100. Objects: To carry on the business of rendering services to owners, dealers, manufacturers, users or others in connection with the installation, repair and maintenance of electrical and electronic devices and apparatus, etc. Directors: Henry Chisholme, B.A., A.C.A., F.I.I.A., Jas. S. Clark (directors of Sterling Cable Co., Ltd., etc.), and Harry T. Shepherd. Secretary: N. Sadler. Solicitors: Linklaters & Paines, 6 Austin Friars, E.C.2. Registered office: Cossor House, Highbury Grove, N.5.

County Rentals (Tunbridge Wells), Ltd. Capital £1,500. Objects: To carry on the business of radio and television engineers, etc. Directors: Fredk. H. Balls, Mrs. Winifred E. M. Tucker, Wm. S. Howes and Maurice E. Martin. Secretary: Maurice E. Martin. Solicitors: Berry & Berry, Tunbridge Wells. Registered office: 47 St. Johns Road, Tunbridge Wells.

Craystone Finance Co., Ltd. Capital £100. Objects: To carry on the business of hire purchase financiers, etc. Subscribers: Jean Herbert and Claire Moor. The first directors are to be appointed by the subscribers. Secretary: T. A. Herbert.

Crenway Finance Co., Ltd. Capital £100. Objects: To carry on the business of hire purchase financiers, etc. Subscribers: Jean Herbert and Claire Moor. Secretary: T. A. Herbert. The first directors are to be appointed by the subscribers.

C. A. Andberg & Son, Ltd. Capital £10,000. Objects: To carry on the business of factors of and dealers in electrical equipment, apparatus and appliances, etc. Directors: Chas. Sandberg and Ralph Sandberg. Secretary: R. Sandberg. Registered office: Hulland Street, Leeds, 10.

Daveley, Ltd. Capital £100. Objects: To finance hire purchase agreements, etc. Directors: Jas. Clifford Laycock (permanent managing director) and Margaret Laycock. Secretary: Margaret Laycock. Solicitors: Campbell Pasquill & Bullough, Wigan. Registered office: 73 Greenough Street, Wigan.

Davis Tele-Radio Services, Ltd. Capital £1,000. Directors: Alfred V. W. Davis and Patricia Davis. Secretary: Patricia Davis. Registered office: 45 Church Street, Eastbourne, Sussex.

Denbigh & Son, Ltd. Capital £1,000. Objects: To acquire the business of radio, television and electrical dealer and repairer carried on by H. Denbigh at 131 Accrington Road, Burnley, and 18 Bank Street, Padiham. Directors: Hilton Denbigh and Mrs. Mary M. Denbigh. Secretary: Mary M. Denbigh. Solicitors: Oddie & Roebuck, Blackburn & Padiham. Registered office: 18 Bank Street, Padiham.

Dialex, Ltd. Capital £1,000. Objects: To carry on the business of manufacturers of and dealers in sound recording and reproducing apparatus, etc. Directors: Gordon Trevor-Johnstone and Joan W. Trevor-Johnstone. Secretary: Joan W. Trevor-Johnstone. Registered office: 35 Brompton Road, S.W.3.

Direct TV Windings, Ltd. Capital £1,000. Objects: To carry on the business of manufacturers of and dealers in radio, radar, television, electronic and electrical components, windings and coils, etc. Directors: Alfred Rose Ethel Rose, and Leslie Hartless. Secretary: Ethel Rose. Registered office: 134/6 Lewisham Way, New Cross, S.E.14.

Dixon-Leslye, Ltd. Capital £1,500. Objects: To carry on the business of manufacturers and repairers of and dealers in electronic, medical and electrical equipment and instruments, plant, machinery, fittings and accessories, machine and other tools, etc. Directors: John G. Dixon and Mrs. Isabel Dixon. Secretary: Isabel Dixon. Registered office: 23 St. Marys Place, Newcastle-on-Tyne, 1.

Dobermans Loans, Ltd. Capital £5,000. Objects: To carry on the business of money-lenders, industrial finance and hire purchase consultants, etc. Directors: Jacob Deberman and Mrs. Eileen Deberman. Secretary: Eileen Deberman. Registered office: 145/7 Newport Road, Middlesbrough.

D. O. H. Coles, Ltd. Capital £4,000. Objects: To carry on the business of manufacturers of and dealers in wireless and television sets and electrical goods of all kinds, etc. Directors: David O. H. Coles and Mrs. Gladys M. Coles. Secretary: Gladys M. Coles. Solicitors: Tozers, 10 St. Pauls Road, Newton Abbot. Registered office: 18 Courtenay Street, Newton Abbot.

Dragon Finance, Ltd. Capital £1,000. Objects: To carry on the business of hire purchase contractors, etc. Directors: Margaret D. Williams, Michael P. H. Williams, Ivor H. Williams, and Leonard A. Watson. Secretary: Margaret D. Williams. Registered office: 2 Thames House, Queen Street Place, E.C.4.

D. Townsend & Co., Ltd. Capital £500. Objects: To carry on the business of electrical, radio, television and mechanical engineers and contractors, etc. Directors: Derek B. Townsend and Ernest Jeffery. Secretary: J. B. Dowling. Registered office: 51/3 Rochester Street, Brighton.

Duigman & Hall, Ltd. Capital £100. Objects: To carry on the business of importers and exporters of and dealers in electrical washing and cleaning machines and electrical apparatus and appliances of all kinds, etc. Directors: John R. Duigman and Thos. J. Hall. Secretary: Thomas J. Hall. Solicitors: Sloper, Potter & Chapman, 2 Putney Hill, S.W.15. Registered office: 136 North Hill Drive, Harold Hill, Romford.

D. Woolfman, Ltd. Capital £1,000. Objects: To carry on the business of manufacturers of and dealers in electrical and mechanical apparatus and accessories, in particular wireless sets, radio sets and valves, gramophones, television sets, etc. Directors: David Woolfman and John R. Woolfman. Solicitors: A. Banks & Co., 12 Bow Lane, E.C.4.

E. and A. Perkins (Gosport), Ltd. Capital £250. Objects: To acquire the business of electrical engineers and contractors carried on

(Continued on page 951)

CLASSIFIED ADVERTISEMENTS

Rates: 4d. per word (Minimum 18 words) per insertion. Box Numbers 6d. extra. Series rate on application. Copy and remittance should be sent to the Classified Advertisement Manager, British Radio and Television, 92 Fleet Street, E.C.4, before the 10th of each month preceding publication. Classified advertisements must be prepaid.

SITUATIONS VACANT

Engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour or Scheduled Employment Agency if the applicant is a man aged 18-64 inclusive or a woman aged 18-59 inclusive unless otherwise excepted from the provisions of the Notification of Vacancies Order 1952.

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DEALERS wishing to develop Hire Purchase and Credit Sales business apply for facilities and advice to British & F. E. Co., Ltd., 37-40 Cheapside, London, E.C.2.

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A NEW TV Replacement and Rewind Handbook is now available, it contains many technical hints and illustrations, send Trade Heading and 1s. for new trade terms and handbook to: "DIRECT TV REPLACEMENTS" 134-136 Lewisham Way, New Cross, S.E.14. TIDeway 3696-2330.

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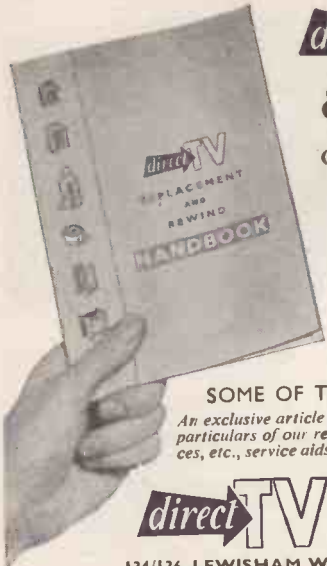
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FREE! Brochure giving details of Home Study Training in Radio, Television, and all branches of Electronics. Courses for the Hobby Enthusiast or for those aiming at the A.M.Brit.I.R.E., City and Guilds, R.T.E.B., and other Professional examinations. Train with the college operated by Britain's largest Electronics organisation. Moderate fees. Write to E.M.I. INSTITUTES, Dept. BRT28, London, W.4.

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Financial News

—continued

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Edona, Ltd. Capital £1,000. Objects: To carry on the business of manufacturers of and dealers in electrical apparatus, appliances and fittings, radio and television apparatus, cycles, gramophones and records, etc. Directors: Albert G. Lever and Alan L. Larkworthy. Secretary: Albert G. Lever. Registered office: 94 Arthur Road, Wimbledon, S.W.19.

E. Duckworth (Preston), Ltd. Capital £100. Objects: To carry on the business of electrical engineers, general electrical installation contractors, lighting specialists and contractors, wireless and television engineers, etc. Directors: Eugene Duckworth and Mary E. Duckworth. Secretary: Mary E. Duckworth. Solicitors: Dennis Birchall, 2 Cross Street, Preston. Registered office: 106 Layland Road, Penwortham, nr. Preston, Lancs.

E. J. Goodall & Co., Ltd. Capital £1,000. Objects: To carry on the business of manufacturers of and dealers in and repairers and hirers of electrical and mechanical apparatus and accessories and in particular wireless and television sets, etc. Directors: Ernest J. Goodall and Mary Goodall. Secretary: Mary Goodall. Registered office: 111 Chiltern Drive, Surbiton, Surrey.

Elby Radio and Television, Ltd. Capital £3,000. Objects: To carry on the business of radio and television engineers, etc. Directors: Lipman Bruskin and Mrs. Edith Bruskin. Secretary: Edith Bruskin. Registered office: Bishopsgate House, 80 Bishopsgate, E.C.2.

Electronic Switchgear (London), Ltd. Capital £7,000. Objects: To carry on the business of designers and manufacturers of and dealers in electro-mechanical and radio active recording, controlling and communication devices adaptable to agricultural, industrial, mechanical, medical, chemical and electrical purposes, etc. Directors: Geo. H. Symonds, Bernard R. Symonds, and Robt. A. Sproule. Secretary: E. H. McNulty. Solicitors: Hamlin, Grammer & Hamlin, 4 New Square, W.C.2. Registered office: 47 Victoria Street, S.W.1.

Electronics (Lincolnshire), Ltd. Capital 1100. Objects: To carry on the business of manufacturers of precision electronic equipment for communications, industrial and domestic purposes, etc. Directors: John A. Porter, John B. Leigh, and Fredk. C. Drury. Secretary: Edith M. Porter. Registered office: 106 Cleethorpe Road, Grimsby.

LEGAL NOTICE

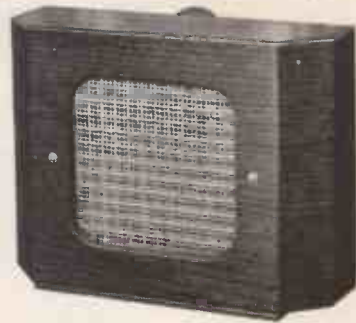
IN certain proceedings in the High Court of Justice before Mr. Justice Danckwerts wherein Mr. Maurice Winnick, radio and television producer, was Plaintiff and Mr. Harry Alan Towers and Messrs. Towers of London, Ltd., were Defendants, the Defendants acknowledged and accepted that Mr. Maurice Winnick was and is solely entitled to broadcast and perform shows under the title *Twenty Questions*, and the Court restrained by Injunction the Defendants from being concerned in any way with any show under the title *Twenty Questions*.

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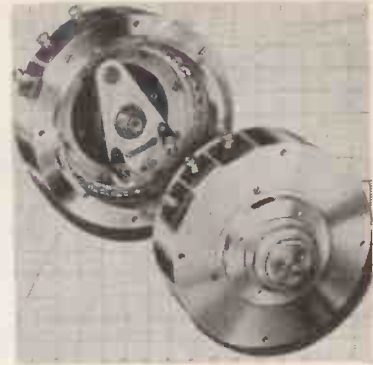
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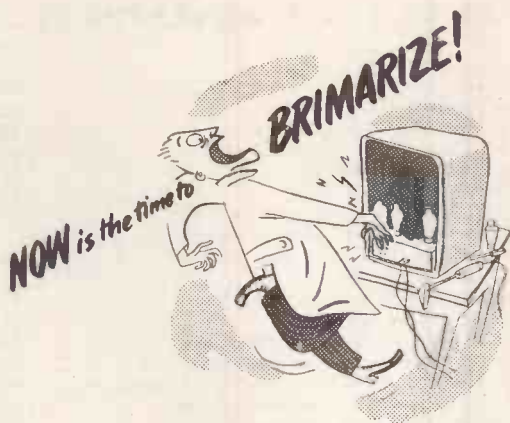
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FOOTscray 3333

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