

JUNE 1957

*Hardie*

TWO SHILLINGS

# Wireless World

**ELECTRONICS**

**Radio · Television**



**FORTY-SEVENTH YEAR OF PUBLICATION**

**A****BICC***development***P.T.F.E.***(POLYTETRAFLUOROETHYLENE)***EQUIPMENT WIRES****FOR OPERATION UP TO 240°C***Unaffected by fuels  
oils and solvents**Complying with  
M.O.S. requirements**Flexible**Coloured for easy  
identification**Thin radial  
coverings**Non-inflammable*

Further information on BICC  
P.T.F.E. Equipment Wires is  
contained in Publication No. 384,  
available on request.

**BRITISH INSULATED CALLENDER'S CABLES LIMITED, 21 BLOOMSBURY STREET, LONDON, W.C.1**

# Wireless World

ELECTRONICS, RADIO, TELEVISION

Managing Editor : HUGH S. POCKOCK, M.I.E.E.  
Editor : F. L. DEVEREUX, B.Sc.  
Editorial Consultant : H. F. SMITH

JUNE 1957

## ***In This Issue***

- VOLUME 63 No. 6  
PRICE: TWO SHILLINGS  
FORTY-SEVENTH YEAR  
OF PUBLICATION
- ◆ ◆ ◆ ◆ ◆ ◆
- Offices: Dorset House,  
Stamford Street, London,  
S.E.1
- Please address to Editor,  
Advertisement Manager or  
Publisher, as appropriate.
- Telephone :  
WATERloo 3333 (60 lines)
- Telegraphic Address :  
"Ethaworld, Sedist, London".
- |     |  |                           |
|-----|--|---------------------------|
| 253 | Editorial Comment                                |                           |
| 254 | High Definition on 405 Lines                     |                           |
| 256 | World of Wireless                                |                           |
| 258 | Personalities                                    |                           |
| 259 | Audio Fair, 1957                                 |                           |
| 262 | Television Interference from Sea Reflections     | By <i>J. K. S. Jowett</i> |
| 266 | Wideband Communications Systems                  |                           |
| 267 | Components Exhibition                            |                           |
| 273 | Letters to the Editor                            |                           |
| 275 | Limiters and Discriminators for F.M. Receivers—4 | By <i>G. G. Johnstone</i> |
| 281 | Manufacturers' Products                          |                           |
| 282 | Valves and Semi-Conductors                       |                           |
| 283 | C.R. Tubes and Photoelectric Devices             |                           |
| 284 | Short-wave Conditions                            |                           |
| 285 | The Blocking Oscillator                          | By "Cathode Ray"          |
| 290 | Limiting Factors in Gramophone Reproduction—2    | By <i>D. A. Barlow</i>    |
| 295 | Technical Notebook                               |                           |
| 297 | National Gramophone Conference                   |                           |
| 298 | News from the Industry                           |                           |
| 300 | Random Radiations                                | By "Diallist"             |
| 302 | Unbiased   | By "Free Grid"            |

PUBLISHED MONTHLY (4th Tuesday of preceding month) by ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1. Telephone: Waterloo 3333 (60 lines). Telegrams: "Iliffepres, Sedist, London." Annual Subscription: Home and Overseas, £1 12s. 6d. U.S.A. and Canada \$5.00. BRANCH OFFICES: BIRMINGHAM: King Edward House, New Street, 2. Telephone: Midland 7191. COVENTRY: 8-10, Corporation Street. Telephone: Coventry 5210. GLASGOW: 26B Renfield Street, C.2. Telephone: Central 1285. MANCHESTER: 260, Deansgate, 3. Telephone: Blackfriars 4412. OVERSEAS OFFICES: U.S.A.: 111, Broadway New York, 6, N.Y. Telephone: Digby 9-1197. CANADA: 67, Yonge Street, Toronto, 1, Ontario. Telephone: Empire 6-0873.

# Transistor

# Class B Push-Pull Output Stages

Symmetrical or single-ended Class B push-pull stages are generally used in transistor receivers and similar portable equipment because of their battery economy. At first sight it appears that the symmetrical circuit is superior, but on closer examination it is found that the single-ended arrangement is often preferable.

Comparison of the two circuits shows that the single-ended circuit in Fig. 2 can be derived from the symmetrical one in Fig. 1 by splitting it into two parts along the line of symmetry—after duplicating the battery and bias potentiometer—and then combining the halves so that the loads coincide and the batteries appear to be in series. The decoupling capacitor C prevents feedback from collector to base of Tr2 via the bias potentiometer.

The circuits of Fig. 1 and Fig. 2 are then exactly equivalent: each transistor still operates at the same voltage, the same quiescent current, and handles alternate half-cycles. The drive and peak collector currents are the same but the battery must have twice the voltage and about half the ampere-hour capacity for the same life. Therefore essentially a single-ended circuit working from 9 + 9V will behave in exactly the same way as a symmetrical circuit working from 9V—it will have the same currents, drive, distortion, stability and battery consumption for the same output.

A single-ended circuit working from 9V total will behave like a 4.5V symmetrical circuit and this, assuming equal electrical output from the transistors, will differ from the 9V symmetrical circuit in the following respects: The peak and mean collector currents, in the 4.5V symmetrical circuit, will be 2 times greater, the drive power requirements will be nearly 4 times greater and also the distortion (due to  $a'$  curvature) will be greater. However, the thermal stability will be easier to achieve, the load impedance will be  $\frac{1}{2}$  of the total load of the 9V symmetrical circuit and the battery consumption will be approximately the same.

So that except for the disadvantages of lower stability and higher load impedance the symmetrical circuit is preferable for obtaining a given electrical output with a given total battery voltage.

If the load is a loudspeaker the comparisons given above are valid only if a very efficient transformer is used in the symmetrical circuit. Two causes of reduced output must otherwise be considered—either the halved acoustic efficiency of a centre-tapped speaker, or the power loss in a practical transformer.

Normally, no transformer is needed in the single-ended circuit, so that no loss arises from that cause. Therefore, to obtain the same acoustic output from the symmetrical circuit, twice the electrical output is required when either a tapped speaker is used, or when the transformer used has an efficiency of 50%. This is a likely figure only for miniature trans-

formers. The use of a more efficient transformer is considered later.

Comparison of the two circuits for operation at the same battery voltage and equal sound output shows that the single-ended circuit is preferable because of battery power economy, lower transistor dissipation, ease of winding the speaker coil and of stabilisation.

The maximum acoustic output obtainable, which is limited by transistor dissipation, is twice as great. The only disadvantages are that an extra electrolytic capacitor (about 4 $\mu$ F)\*, 3 extra resistors R1', R2' and R1a, and a tap on the battery (or twin batteries) are required.

The advantages and disadvantages of the two versions are much more evenly balanced if an output transformer or tapped choke with an efficiency much exceeding 50% is used in the symmetrical circuit. However, this method is more expensive.

The main characteristics of the single-ended and symmetrical

push-pull circuits may be summarised as follows:

1. The single-ended Class B push-pull circuit is exactly equivalent to a symmetrical circuit with half the total battery voltage.

2. When a given electrical output is required from the transistors with a fixed total battery voltage, the symmetrical circuit is preferable on the grounds of lower

drive and lower distortion, although the single-ended circuit scores on ease of stabilisation and more convenient impedance matching for direct speaker loading.

3. However, when the inefficiency of tapped speakers or the losses in a 50% efficient small output transformer are considered, the single-ended circuit is seen to be preferable. As speakers can readily be wound to the impedance required, the speaker and transformer losses are avoided and the electrical power required for equal sound output is only about half. Under these circumstances the single-ended circuit gives almost a 50% battery saving, is comparable in sensitivity and distortion and much easier to stabilise thermally. The maximum sound output obtainable with a directly-fed speaker is twice that of the symmetrical circuit.

4. When using a transformer or choke with an efficiency considerably greater than 50% in the symmetrical circuit, the results obtained lie between those of (2) and (3). The advantages of the two circuits then tend to balance. Whereas the single-ended circuit is cheaper and shows some battery saving, the symmetrical circuit is intrinsically more sensitive and gives less distortion at large signals. Its greater sensitivity may however be largely

offset by the effect of the extra stabilisation it requires. \*When a small measure of negative feedback in the output stage is acceptable, this capacitor can be omitted. The top end of R1' must then be connected to point X instead of to the battery tap.

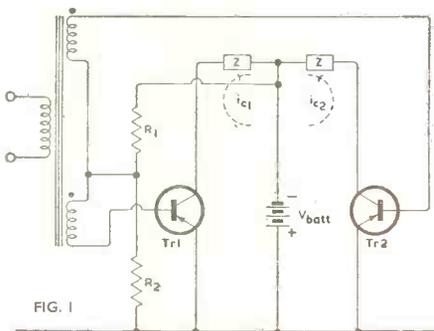


FIG. 1

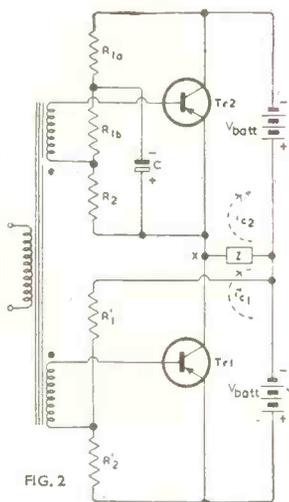


FIG. 2



## Off the Record

LISTENING to music for recreation through the medium of gramophone records is as prevalent among professional radio and electronics engineers as it is in other sections of the community. Indeed, we are sometimes persuaded that the incidence is higher, and that the dissatisfactions which set in as the result of acquiring too great a knowledge of the processes of sound reproduction may ultimately exceed those of the layman who is assailed by doubts as to whether his present equipment is capable of the "high-fidelity" which he feels may be necessary to his full enjoyment.

We do not deny the value of this discontent which more than ten years ago gave rise to the *cri de cœur* in this journal that we "... get our music by scraping a steel point carrying tons of weight per square inch over what is virtually a refined macadamized roadway." It has since given us plastic records with lower surface noise and has forced pickup designers to abandon their early and too facile conception of what constitutes a "lightweight" pickup.

Yet even today, conditions in the microcosm bounded by the perimeter of the stylus-groove contact are such as might well have taxed the imaginative and descriptive powers of Dante, with accelerations more than a thousand times higher than that due to gravity, temperatures which *burn* off any asperities and pressures which produce plastic flow in the material under the record surface.

Reproduction of the sound image impressed on the record has long been known to be difficult; from what we now read of recent and even more searching investigations into the problem it would seem to be virtually impossible! Certainly one can never hope to reproduce with a spherical stylus tip all that can be recorded with a flat-faced cutter.

All this has generated in some quarters a pessimism which we believe to be unjustified. Just as the bumble-bee goes about its business in ignorance of the pronouncements of aerodynamicists that its flight is impossible, so we shall continue to be delighted by many if not all of

the products of our recording studios and record factories.

The truth is that the content of the record is not always driving the reproducing equipment to the limits where distortion is produced. Even when distortion can be proved by measurement to be present, it does not necessarily follow that it will be noticed. A performance may have qualities of emotion or musicianship which hold the attention to the exclusion even of gross amounts of harmonic distortion.

The ultimate criterion of the success of a particular sound reproduction is not that the measured distortion is less than some arbitrary figure but that it is not high enough to introduce any incongruity which will distract the attention of the listener and so mar his enjoyment of the things that really matter. An objective assessment of overall performance cannot be made without including the temperament and experience of the listener and the nature of the programme material—which is tantamount to saying that an *objective* assessment cannot be made.

## Information Engineering

IT will soon become possible to get an M.Sc. degree in Information Engineering (see page 257). This recognition by Birmingham University that information, in the non-semantic sense, is the basic commodity of several related branches of technology (communications, computers, control systems, etc.), and therefore represents a good approach for studying these subjects, is altogether praiseworthy. At the same time, it is hard to see how a mere 12 months' course of this nature can do much more than broaden the student's outlook—for a while. One cannot be just an Information Engineer for long, and each of the new M.Sc.s will be claimed by a particular specialization in the end—and then really begin to learn his subject. However, there is no doubt that the Birmingham University course will provide a much better background for specialists in these fields than has existed so far.

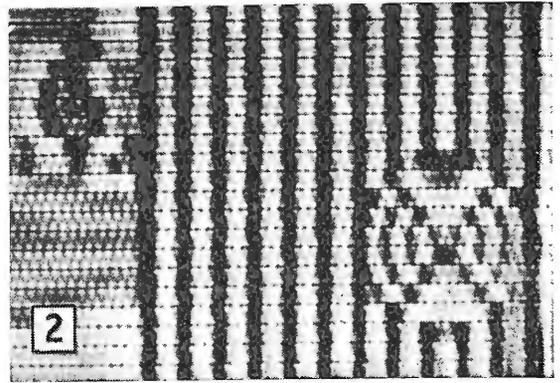
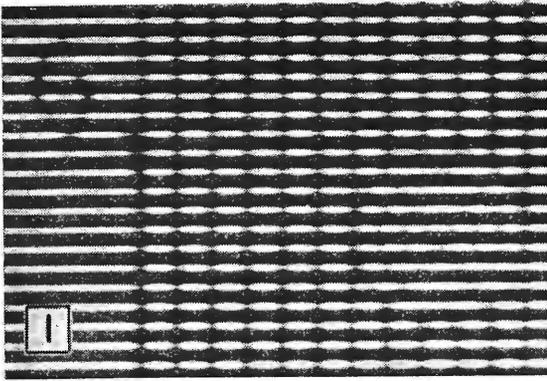


Fig. 1 shows a section of a test chart on one frame of a 405-line picture (202½ lines) without spot wobble. Fig. 2 is the same section with ordinary spot wobble applied to the c.r.t., while Fig.3 (on opposite page) shows the improvement effected by synchronous spot wobble on both c.r.t. and camera tube. A complete interlaced picture with s.s.w. is even better.

# High Definition on 405 Lines

BETTER RESOLUTION GIVEN BY SYNCHRONOUS SPOT WOBBLE

**I**N discussions on British colour television standards it has often been suggested that a high-definition picture might be transmitted in Bands IV or V and that standards conversion might be used to obtain a 405-line version for transmission to the existing 7 million monochrome sets. Ruling out the "brute force" method of standards conversion (a camera "looking" at a monitor tube) on grounds of picture degradation, the direct electronic system proposed by H. A. Fairhurst\* comes to mind. This, and most other proposals, tacitly assume that the high-definition picture will have a greater number of lines than the 405-line standard. There is, however, the interesting possibility that the high-definition picture might itself be 405 lines, but with increased resolution and bandwidth. The normal-definition 405-line picture could then readily be extracted from it by sampling at a rate appropriate to a 3-Mc/s bandwidth.

This suggestion emerged from a lecture on a new

\* *Wireless World*, February 1955, p. 53.

system of television recording given recently to the British Kinematograph Society by A. E. Sarson and P. B. Stock, with an historical introduction by L. C. Jesty. The new system is based on the well-known suppressed-frame method of recording on film, but it avoids the loss of picture information normally associated with using only alternate television frames by starting off with a 405-line picture of high definition. The 202½-line television frames recorded on successive film frames then contain much more information than they would with the normal definition, and when subsequently the film is scanned for transmission a much better picture is obtained. Of course, since the camera chain giving the high-definition picture for recording is also the means of producing the "live" programme, a 405-line picture of normal definition has to be extracted for transmission, and this is where the sampling process is used.

The increase of definition without extra lines is obtained by a technique known as synchronous spot wobble. With ordinary spot wobble the idea is simply to fill in the spaces between the lines, and this is particularly necessary on suppressed-frame recording where each film frame records only 202½ lines and there is no subsequent interlacing. As an example, Fig. 1 shows a section of a 202½-line frame and Fig. 2 how it is improved when ordinary spot wobble is applied to the c.r.t. The main drawback of ordinary spot wobble, however, is that it displaces picture information which should appear at only one point on the screen so that it also appears at other points. This produces among

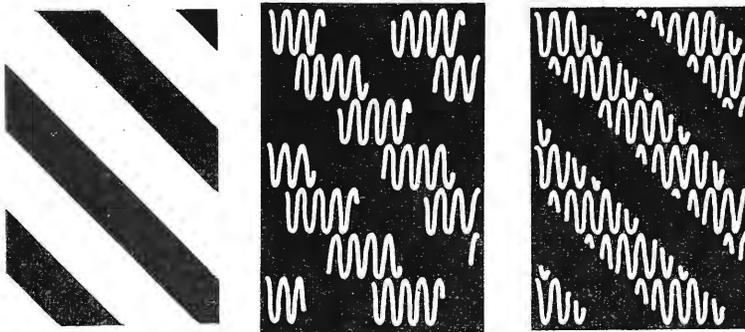
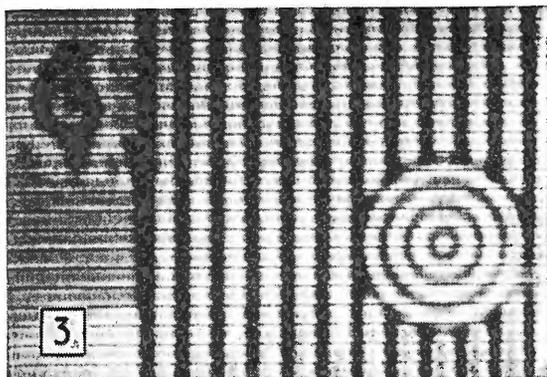


Fig. 4. When scanning diagonal bars (left) ordinary spot wobble gives a stepped effect (centre) but synchronous spot wobble fills in the spaces with genuine picture information (right).



other things a stepped effect when diagonal or curved lines are scanned, as shown in Figs. 2 and 4, with consequent deterioration of picture quality.

With synchronous spot wobble, however, these effects are avoided. The alternating wobble voltage is applied to the camera pick-up tube as well as to the monitor c.r. tube, and is synchronized in frequency and phase at both ends. The result is that the scanning spot has an increased path length and covers a greater area of picture detail than normal during the period of one line. Because of this higher scanning speed, information is transmitted through the closed-circuit system at a higher rate than normal, so that a larger bandwidth is required. In addition to filling in the spaces between the lines, the synchronous spot wobble gives a vertical "exploratory" component to the horizontal scan, with the result that the vertical resolution of the complete picture is increased. Actually the spot-wobble scanning is such that the improved definition is shared between the vertical and horizontal directions.

Fig. 4 (right) shows diagrammatically how the scanning of diagonal bars is improved by the use of synchronous spot wobble, while Fig. 3 demonstrates it on an actual screen picture of the section of chart in Figs. 1 and 2. Instead of just filling in the gaps between lines with spurious picture information, as with ordinary spot wobble, the new system adds genuine information which was previously missing. Of course, the price to be paid for the improvement is the increased bandwidth, but this does not matter in the closed-circuit system used for recording purposes. A spot-wobble frequency of 6 Mc/s has been found satisfactory, and this demands a video bandwidth of at least 6 Mc/s and preferably 9 Mc/s. In practice the spot-wobble scan produces the effect of a 6-Mc/s sub-carrier on the video signal, which is modulated by the line sync waveform and the picture information to form sidebands extending up to 3 Mc/s on either side.

To extract the "live" television picture from the high-definition closed circuit for transmission at normal 3-Mc/s definition, a sampling p.r.f. of 6 Mc/s is required (according to the well-known Hartley law). If the samples are of sufficiently short duration, and they are smoothed afterwards by passage through a 3-Mc/s low-pass filter, the "contaminating" effect of the vertical component in the synchronous spot wobble is removed and the resulting picture is practically indistinguishable from one generated in the normal way.

Of course, if the high definition 405-line picture were actually transmitted in a wideband public ser-

vice, instead of just being confined to a recording closed circuit, some means would have to be adopted for synchronizing the spot wobble in the domestic receivers with that at the studio camera. Probably this could be achieved by transmitting a "burst" of several cycles of spot-wobble frequency as a phasing signal on the back porch of the existing line sync pulse—as is already done in the N.T.S.C. colour television system. (In fact the "burst" might easily serve a double purpose in a 405-line high-definition colour service.)

A picture composed of two interlaced frames with synchronous spot wobble is, of course, a good deal better than the single frame in Fig. 3, and *Wireless World* has seen several excellent examples.

## CLYDE SHIP-TO-SHORE TELEPHONE

SHIPS in the Firth of Clyde can now be connected by radio to the public telephone system as a result of a new service opened by the Post Office last month. The radio system, which is on v.h.f. and uses frequency modulation, conforms to recent international agreements for this type of service, and corresponds to other systems already established in various parts of the world. The shore station is at Piper Hall on the Isle of Bute near Rothesay, from where a land line goes to Greenock telephone exchange—the official number being "Clyde Radio—Greenock 22255."

By the courtesy of Pye Marine, who built the shore station and have introduced shipborne transmitter/receivers for the service, *Wireless World* witnessed the opening ceremony from a launch in the Clyde estuary, when calls were put through to Liverpool, Cambridge and New York Harbour (via the transatlantic cable.) In all cases the clarity of speech and freedom from interference were quite outstanding. The shore station has an output power of 100 watts with a range of about 40 miles down the Firth, extending up river to around Gourcock. This and the shipborne equipment is based on the f.m. version of the Pye "Ranger" series of mobile radiotelephones. Transmitters with powers of 3 watts, 10 watts and 20 watts (see illustration) are available for the mobile equipment.

Further v.h.f. services of this kind are being planned by the Post Office for operation from existing coastal radio stations at Land's End, Niton (Isle of Wight), North Foreland and Humber (Mablethorpe).



# WORLD OF WIRELESS

## Mobile Radio Channelling

AS was recommended in the Mobile Radio Committee's 2nd Report (see page 464 October issue) trials are to be undertaken by the Post Office of v.h.f. mobile radio equipment using 25-kc/s channelling instead of the present 50 kc/s. This is announced in a letter to the Radio Communication and Electronic Engineering Association which had asked the Post Office for clarification of the position. The trials are expected to begin in the early autumn.

The Committee's recommended reduction from 100 to 50-kc/s channelling in the 165 to 174-Mc/s band (as in the 71.5 to 88-Mc/s band) was introduced in January.

## RCA and Colour TV

IN last month's *Wireless World* it was suggested that the Radio Corporation of America, which has hitherto been the main driving force behind colour television in the U.S.A., is losing its enthusiasm for colour. That view is not borne out by a joint statement from the chairman and president which has reached this country since the last issue went to press.

According to the statement, the number of regular colour programmes is, in fact, being increased in 1957, which should result in more colour receivers being sold. Colour television, the statement continues, is proving that it can supply a greater and more interesting service to the public and develop into a profitable business for all sections of the industry. Apart from its application to broadcasting, it is also expected to expand in the industrial, medical and educational fields.

## Radio Exports

U.K. EXPORTS of radio and electronic equipment during the first quarter of this year were 17% higher than in the same period in 1956; £10.8M compared with £9.1M. As will be seen from the table the greatest increase was in sound reproducing equipment. Incidentally, the overseas sales of this type of equipment in the first quarter of this year were more than those for the whole of 1952.

	Jan.-Mar.	
	1957	1956
Capital goods (transmitters, navigation aids, etc.)	4.0	3.7
Components	2.5	2.0
Sound reproducing gear	2.4	1.7
Domestic receivers	0.9	1.0
Valves and c.r. tubes	1.0	0.7
	£10.8M	£9.1M

## Scottish Show

A CONSIDERABLE number of new models of domestic sound and television receivers are being shown at the Scottish Radio Show at Kelvin Hall, Glasgow, which closes on June 1st. Most of the major domestic receiver makers are among the sixty exhibitors at the Show, which is the first to be organized in Scotland by manufacturers since 1935.

## BREMA Report

THE ADOPTION of a standard television receiver i.f. by all its members and, as far as is known, by set manufacturers who are not members, is mentioned in the Annual Report of the British Radio Equipment Manufacturers' Association. It is, however, pointed out that in view of recent experiences of interference from ionospheric forward scatter transmissions around 35 Mc/s, "members may wish to reconsider the i.f. rejection characteristics of their receivers."

Plans are in hand for tests of colour systems other than the N.T.S.C. in Bands IV and V, but should these bands prove unsuitable then a compatible system in Bands I and III based on 405 lines would be the only practical one for the U.K.

The question of multi-path distortion in the v.h.f. sound service has been investigated on behalf of the members.

In an agreement reached between the Association and the G.P.O. regarding complaints of receiver interference, all cases where the receiver is found to be at fault will, in future, be reported to the maker of the set concerned.

Television licences in the United Kingdom must now exceed 7,000,000 for at the end of March they totalled 6,966,256 and the increase each month is approximately 100,000. Within the next few months the number of television licences will have exceeded that for sound only, which at the end of March was 7,558,843, including 306,053 for car radio.

**Have you heard *Mayflower II*?**—Although transmissions are restricted because of the need to conserve battery power *Mayflower II* is sending out a noon position each day and will transmit more frequently as she approaches the American coast. Her call is MXJW. Equipped with Marconi gear she operates on 'phone on 2009, 2198, 2301, 2381, 2406, 2527, 2534, 2738 and, of course, the international calling and distress frequency 2182 kc/s. She also operates on telegraphy in both the m.f. and h.f. bands.

**Television Society Council.**—Members elected to fill the vacancies on the Council of the Television Society are: J. E. Clark (Cathodeon), C. A. Marshall (*British Communications and Electronics*), A. A. Rowlands (Norwood Technical College), S. N. Watson (B.B.C.), and Dr. R. C. G. Williams (Philips).

**TV Premiums.**—At the Annual General Meeting of the Television Society the following premiums were awarded: E.M.I. Premium to A. H. Atherton (E.M.I.) for his paper "The secondary emission valve and its applications"; *Electronic Engineering* Premium to D. C. Birkinshaw (B.B.C.) for "Progress in American colour television"; Mervin Premium to H. A. Fairhurst (Murphy) for "The development of 21-inch colour television receivers"; Mullard Premium to Dr. R. L. Smith-Rose (D.S.I.R.) for "Properties and problems of Bands IV and V"; Pye Premium to R. A. Dilworth (G.P.O.) for "Interference with television reception: its causes and cures"; and *Wireless World* Premium to A. V. Lord (B.B.C.) for "Some problems in a band-sharing colour television system."

**British Wireless Dinner Club.**—The record number of 125 members attended the annual dinner, held on 26th April. Air Vice-Marshal E. B. Addison was elected president for the forthcoming year.

**Thailand** has ordered a complete television station, valued at £170,000, from Pye for erection in Bangkok. It will operate on the 525-line standard which is employed by the American-built transmitter already in operation at the capital.

A radio-telephone link between Ascension Island, in mid-South Atlantic, and its nearest neighbour, St. Helena, 800 miles away, has been introduced by Cable and Wireless. A radio-telephone service between Ascension Island and the U.K. has been in operation since November 1955.

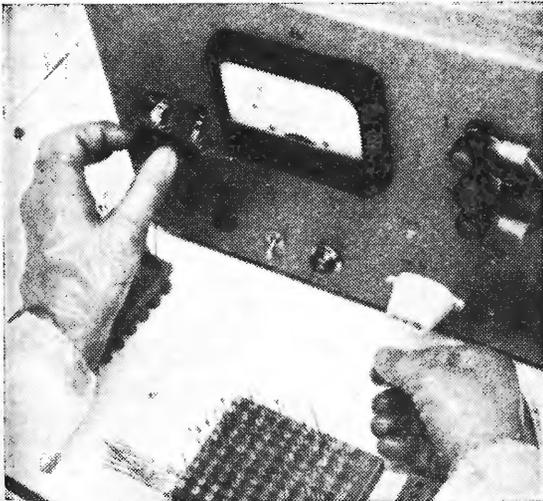
**Science Museum** (South Kensington, London, S.W.7) has arranged two special displays, one covering the International Geophysical Year, and the other electric power. An illustrated booklet (price 2s), being issued in conjunction with the I.G.Y. display, presents a general account of the phenomena to be studied and the observations to be made. The electric power display is introduced by a working reproduction of Faraday's apparatus of 1831 with which he demonstrated the continuous production of electric current.

**R.T.R.A.**—The new director of the Radio & Television Retailers' Association is M. Keegan, M.P., and the new secretary, J. E. Mountain. Both these positions were held by H. A. Curtis, who recently resigned. The Association has also appointed an assistant secretary, G. E. Ridgway. The president, F. C. Woodward, is continuing in office for a further year.

**Technical Authors.**—A committee is being set up by the City and Guilds to explore the problem of the training and qualification of technical authors, and if thought desirable and practicable to draft a scheme of syllabuses and examinations.

**Ekco Research.**—A four-storey extension to the Ekco works at Southend-on-Sea was recently opened as a research laboratory; most of the space is devoted to work in the nucleonic field. It will be remembered that Ekco Electronics recently shipped to Australia a set of instruments for the first atomic pile in that country.

**"Design of the Year."**—One of the certificates for 1957, awarded by the London Design Centre for 12 products chosen from some 3,500 shown at the Centre during the past year, was presented by Prince Philip to Pye for their CS17 television receiver.



**TRANSISTOR MANUFACTURE.**—This photograph, taken at the new Mullard Southampton works devoted entirely to semi-conductors, shows preliminary testing of a transistor before final enclosure. To prevent contamination, the test is made in a sealed "dry box."

**R.R.E.** now stands for Royal Radar Establishment. The Queen, during her recent visit to the Ministry of Supply's Radar Research Establishment, Malvern, granted the right to use the title, Royal. A large new laboratory for research in solid state physics is being built at Malvern.

**Briggs' Demonstration.**—Another concert of live and recorded music, this time in Liverpool, is being given by G. A. Briggs (Wharfedale) with the collaboration of P. J. Walker (Acoustical). It will be held in the Philharmonic Hall on July 2nd at 7.30. Tickets, price 3s 6d, will be obtainable from the Hall, dealers, or Wharfedale from June 1st.

## CONFERENCES

A three-day conference on "The Avoidance of Collision by Airborne and Shipborne Means" opens at the Royal Geographical Society, Kensington Gore, London, S.W.7, on June 5th. It is a joint meeting of the Institute of Navigation, the Institut Français de Navigation, and the Ausschuss für Funkortung, and is open to non-members (fee £1). Among those making contributions to the conference are Captain F. J. Wylie and Captain R. G. Swallow, of the Radio Advisory Service, A. L. P. Milwright (Admiralty Signal and Radar Establishment), and Wing Commander E. W. Anderson (Elliott Brothers).

**"Electronics in Automation."**—At the time of going to press over 300 delegates, including many from overseas, had registered to attend the forthcoming Brit.I.R.E. Convention at Cambridge (June 26th to July 1st).

An invitation is extended by the Institution of Radio Engineers Australia to any *Wireless World* reader visiting Australia in October to attend the I.R.E. Convention at Sydney (October 21st to 26th).

**Automation Conference.**—The Institution of Production Engineers is holding a conference on "Automatic production—change and control" at Harrogate from June 30th to July 3rd.

**Microwave Valves.**—It is announced in the Annual Report of the I.E.E. that the Institution is arranging a convention on microwave valves for May next year.

**U.H.F. Circuits and Aerials.**—An international conference covering this subject is to be held in Paris from October 21st to 26th. It is being organized by the Société des Radio-électriciens, 10, Avenue Pierre-Larousse, Malakoff (Seine), France, from whom further particulars are obtainable.

## COURSES

A **Course in Information Engineering**, lasting 12 months and leading by examination to the degree of M.Sc., is being offered to Honours graduates by Birmingham University.

**"High Quality Reproduction."**—A series of ten lectures on this subject began at the Northern Polytechnic, Holloway, London, N.7, on May 13th, and will be continued each Monday and Thursday (except during Whit-week) until June 20th. The lecturers in June include P. J. Walker (Acoustical), J. F. Doust (M.S.S.), F. H. Brittain (G.E.C.) and Percy Wilson (*The Gramophone*).

**Colour TV Course.**—Dr. G. N. Patchett began a course of six lectures on colour television at the Technical College, Bradford, on May 23rd. The lectures are being given each Thursday evening until June 27th (fee 10s).

**Aerial Lectures.**—A series of lectures on Band III aerials is being given by Antiference in Wales and the West Country in preparation for the opening of the I.T.A.'s transmitter at St. Hilary. They will be delivered in June in Exeter (18th), Bristol (19th) and Cardiff (20th).

# Personalities

**Sir Robert Watson-Watt, C.B., F.R.S.**, is on a two-months' visit to this country, and was among the guests at the 11th Annual Dinner of the Radar Association on May 10th. During a very amusing speech on the origins of radar, he greeted his "fellow radarians." He is here on behalf of his Canadian company of which there is a branch in this country (Adalia, Ltd., 12, Whitehall, London, S.W.1). Whilst here, he is reading the proofs of his autobiography to be published later in the year by Odhams.

**Paul Eisler, Dr. Ing., M.Brit.I.R.E.**, has been made an officer of the French "Order of Merit for Research and Invention" for his pioneering work on printed circuitry. Dr. Eisler, who was born in Vienna in 1907, came to London in 1936, at the invitation of Marconi's, to conclude an arrangement on a television patent. He started work on printed circuitry at about this time, but it was not until towards the end of the war that his ideas were put to practical use in proximity fuses. Dr. Eisler received the 1954 Marconi Premium from the Brit.I.R.E. for his paper, "Printed Circuits—Some General Principles and Applications of the Foil Technique."

**Dr. H. H. Beverage**, whose name is given to a long-wire type of receiving aerial and who was also co-inventor of the diversity system of reception, has been awarded the Lamme Gold Medal by the American Institute of Electrical Engineers for his "conception and application of principles basic to progress in national and worldwide radio communications." Dr. Beverage is vice-president of RCA Communications and also director of radio research at RCA Laboratories.

**A. D. Priestland, M.B.E., M.I.E.E.**, and **P. E. Trier, M.A., A.M.I.E.E.**, have been appointed directors of the Mullard Radio Valve Company. Mr. Priestland, who joined the Company as a technical assistant in 1935 and during the war was responsible for valve manufacture at the Company's factory at Blackburn, has been a director of Mullard Blackburn Works, Ltd., since its formation in 1951. Mr. Trier, who is manager of Mullard Research Laboratories which he joined in 1950 as head of the communications and radar division, graduated as a wrangler in the Mathematical Tripos at Cambridge. He was at the Admiralty Signal and Radar Establishment from 1941 to 1950, where he was for some time head of the v.h.f. communications group.

**C. L. Chapman**, chief development engineer, and **R. P. Mason**, commercial manager, of Venner Accumulators, Ltd., sole manufacturers of silver-zinc accumulators in Great Britain, have recently returned from the annual conference of the Yardney International Organization in New York. The conference was called to discuss methods of manufacture and design of the lightweight silver-zinc accumulator based on the André-Yardney system.

**J. W. Soulsby**, elected for the third term of office as chairman of the Radio Officers' Union, is chief radio officer in the British India Steam Navigation Company's *Uganda*. He joined Marconi Marine in 1918, and during the war was in the armed merchant cruiser *Canton*. He is 57. The new vice-chairman is **W. S. Armstrong**, who was on Marconi's seagoing staff until 1947 when he was appointed permanently to the Inspectors' and Technical Employees' Section of the Union.

**J. E. C. Bailey, C.B.E.**, the new chairman of the British Scientific Instrument Research Association, is chairman and managing director of Baird & Tatlock (London) Ltd. His term of office extends to July 1960. Mr. Bailey is also senior warden of the Guild of Scientific Instrument Makers formed last year.

**Air Commodore Thomas U. C. Shirley, C.B.E., M.I.E.E.**, recently appointed air officer commanding and commandant of the R.A.F. Technical College at Henlow, Beds., was for a short while during the war director of radio engineering at the Air Ministry and subsequently deputy director of signals. A signals specialist, Air Comdre. Shirley, who is 48, joined the R.A.F. in 1925.

**F. W. Perks** is the new chairman of the British Radio Equipment Manufacturers' Association in succession to M. M. Macqueen, of G.E.C. Mr. Perks has been in the radio industry for over 40 years, having joined Marconi's in 1914. He subsequently transferred to the Marconiphone Company and is now sales director of H.M.V. and Marconiphone. He has been chairman of the exhibition organizing committee of the Radio Industry Council since 1947. The new vice-chairman of B.R.E.M.A. is **A. L. Sutherland**, director of Philips Electrical. The only change in the membership of the council is that Radio & Allied Industries takes the place of Ferranti, who have resigned from the Association.



**T. S. Robson** is to be engineer-in-charge of the I.T.A. Scottish transmitter at Black Hill, Lanarkshire, which will begin transmissions in August. Before joining the I.T.A. he was for ten years on the staff of E.M.I.

**J. J. Bliss, B.Sc.(Eng.), Grad.I.E.E.**, is the first education officer to be appointed by Marconi Instruments, Ltd. A graduate of Nottingham University, he joined the technical literature section of Marconi Instruments in 1951 having served as a seagoing radio officer with Marconi Marine during the war. He has also had considerable experience in the educational field and was a member of the advisory committee in the Department of Physics at the Northern Polytechnic.

**J. K. S. Jowett, B.Sc.(Eng.), M.I.E.E.**, who gives in this issue an explanation of the Band I interference experienced in Cornwall (see March issue), has been in the Post Office Engineering Department since 1936. For the past seven years he has been in charge of a group of the branch concerned with propagation studies relating to the operation of Post Office radio links, and with propagation matters in relation to the sound and television broadcasting services.

**D. A. Barlow, M.Sc.**, whose article on record wear is concluded on page 290, is a metallurgist, his interest in sound reproduction being a spare-time activity. Since graduating at Birmingham University in 1943 he has worked in the research department of Aluminium Laboratories, Ltd., Banbury, Oxon, on the mechanical properties and plastic deformation of aluminium alloys.

## OBITUARY

**E. J. Emery, M.Brit.I.R.E.**, managing director of E.M.I. Sales & Service and a director of the parent company, died on May 10th at the age of 57. He joined the seagoing staff of Marconi's in 1916, and with the inception of sound broadcasting in 1922 transferred to the Marconiphone Company, now a member of the E.M.I. group. Mr. Emery played a leading part in fostering training schemes for technicians; he had been chairman of the City and Guilds Advisory Committee on Radio and Television since its formation before the war, and was also chairman of the Radio Trades Examination Board.

# Audio Fair, 1957

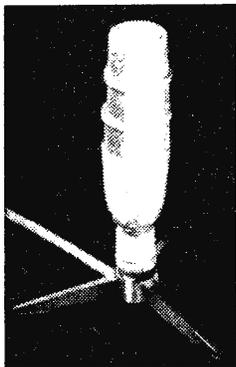
## REVIEW OF RECENT TRENDS IN AUDIO EQUIPMENT DESIGN

**T**HIS review considers the various types of apparatus in the order in which the audio signal passes through them. It includes "overflow" exhibits outside the Fair.

**Records and Tape.**—Connoisseur two-channel single-microgroove discs are approaching the production stage. The two channels are obtained by combined lateral and hill-and-dale recording in the same groove. In both the recording and reproducing pickups the two movements are mechanically coupled to a single stylus at a point where each has a null position. By this means a channel separation of the order of 25 dB has been obtained, and ordinary l.p.s. can be played without modification.

The new M.S.S. long-playing tape uses a thin PVC base, the coating being unchanged.

**Microphones.**—A new ribbon microphone (KTB1) introduced by Simon Sound has alternative output



Simon ribbon microphone.

impedances of 25  $\Omega$  or 50 k $\Omega$ . True pressure gradient response is obtained up to at least 10 kc/s, the overall response extending somewhat further. The ribbon is extremely thin (about 1 micron) and its large area gives a higher sensitivity than usual. Lustraphone introduced a very small (1 in  $\times$   $\frac{5}{8}$  in  $\times$   $\frac{1}{4}$  in) unit (DRA/62) using a differential-reed armature, and with an impedance of 1,000 ohms suitable for direct connection in transistor hearing aid circuits. It is also made up as a lapel microphone (LP/62), with an impedance of 30 ohms for normal requirements. The output peaks

around 2,000 c/s, thereafter being substantially flat to 5,000 c/s. The sensitivity is 84 dB below 1 V/dyne/cm<sup>2</sup> for the 30-ohm model. A new pencil ribbon microphone (VR64) was also shown by Lustraphone. A crystal microphone (Type 39-1) introduced by Acos has a typical response (when fitted with the 8ft of cable provided) which has a 5 dB peak around 8 kc/s and is 3 dB down at 13 kc/s. The sensitivity is 62 dB below 1 V/dyne/cm<sup>2</sup>.

**Tape Pre-amplifiers.**—Several manufacturers, including Sound Sales, Armstrong, Lowther and Rogers, have recently introduced units to enable tape decks to be used with their amplifiers and pre-amplifiers. These generally provide high-frequency bias and erase supplies which can be varied to suit particular heads; recording level indication is by meter or magic-eye, and compensation to enable an overall flat response to be obtained at various tape speeds and with various recording heads.

**Tape Decks and Recorders.**—A new deck used in their reproducer for tape records shown by Avantic uses two flywheels, the extra one being fitted to the take-up spool. These are roughly equivalent to the use of a single larger and more unwieldy flywheel on the capstan. By this means wow and flutter have been kept below 0.1%. The Brenell Mark IV deck incorporates a number of improvements, including the ability to change the tape speed by a simple change in capstan sleeving on top of the deck; the maximum usable reel size is increased to 8 $\frac{1}{4}$  in diameter. It can also, as is now the case with most tape decks, be fitted with a revolution counter. The new E.M.I. model (TR51) also allows the use of the larger 8 $\frac{1}{4}$  in reel. The Collaro Mark III deck now incorporates a pause control; and a safety device to prevent accidental erasure, which is actuated as soon as the recorder is stopped. A similar safety device is fitted to the Truvox Mark IV deck.

A Spectone recorder incorporating the Collaro tape deck was also introduced recently. Hum and noise is 45 dB (unweighted) below the 2% total harmonic distortion recording level. Low- and high-impedance

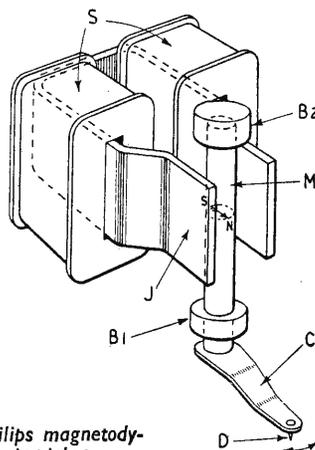
microphone inputs and 15-ohm (4 watts) and cathode follower outputs are provided. A variable bass cut for close microphone recording is also available.

**Stereophonic Decks and Recorders.**—A new stereophonic head for fitting to their Mark IV deck was shown by Truvox. The two heads are vertically in line and have gap widths of 0.00025 in. Crosstalk is better than minus 45 dB.

Ferrograph have introduced two new stereophonic recorders using vertically in line heads. In one of these (88) both recording and reproduction can be stereophonic; in the other (77) stereophonic reproduction, but only monaural recording is possible. Of course, in all stereophonic reproducers it is generally very simple to obtain monaural reproduction if desired.

**Pickups.**—By taking advantage of the long-wearing property of a diamond stylus, which does not need provision for easy replacement, Goldring have been able to obtain the very low dynamic impedance of 2 mgm referred to the stylus tip in their new variable reluctance turn-over cartridge (Type 600). The high-frequency resonance on vinyl records is thus at about 25 kc/s so the response is substantially linear to beyond 20 kc/s. The compliance is not less than 5  $\times$  10<sup>-6</sup> cm/dyne and the sensitivity 3.2 mV per cm/sec recorded velocity. A mu-metal shield is provided.

Philips were showing a new moving-magnet pickup (NG5400)



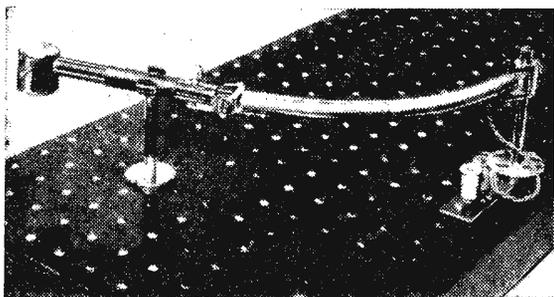
Philips magnetodynamic pickup.

described in *Philips Technical Review* Volume 18, Nos. 4, 5, 6. The design of this has been made possible by the use of the lightweight, high-coercive, material Ferroxdure, which, when in cylindrical form as in this application, can be magnetized in a direction at right angles to the cylinder axis. In the schematic illustration of the pickup shown, lateral movement of the stylus D is converted by means of the cantilever C and the bearings B<sub>1</sub>, B<sub>2</sub> into angular movement of the Ferroxdure magnet M. This induces an e.m.f. in the coils S wound on the magnetic material J in whose gap the magnet lies. In this design the effective mass

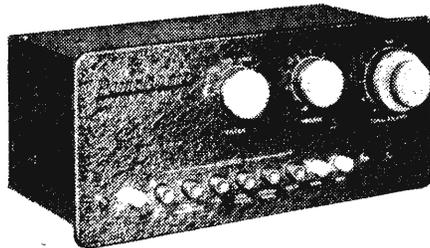
compliance about  $4 \times 10^{-6}$  cm/dyne.

**F.M. Tuners.**—A prototype f.m. tuner (TP100) shown by Thermionic Products has a tuned cascode r.f. stage, 3 i.f. stages, a biased crystal diode limiter followed by a saturated pentode limiter, and a broadband (1500 kc/s) ratio detector. It is claimed that by this arrangement the need for a tuning indicator and a.f.c. is avoided. The sensitivity is better than 5 mV for 30 dB a.m. rejection. Decca were also showing a prototype f.m. tuner with a wide-band ratio detector and a sensitivity of 4 mV for 20 dB quietening. A new a.m./f.m. tuner shown by Avantic had a.f.c. on the f.m. side with a Foster-

pre-amplifier. This also has a very comprehensive pickup matching arrangement whereby the input impedance can be continuously varied from 500 Ω to  $\frac{1}{2}$  MΩ independently of the sensitivity, which can also be continuously varied. Steep-cut treble controls (generally with three alternative cutting positions) are also now nearly universal, and four alternative record compensation characteristics (3LP,178) are also usually provided, though there are six on the Pamphonic 1002B. Inputs for low-level pickups are also now nearly the rule, and the sensitivity of the Armstrong A10 and W.B. 12 pre-amplifiers have been increased in keeping with this



Expert pickup.



Pamphonic 1002B pre-amplifier.

at the stylus tip is 3 mgm, the lateral compliance at least  $5 \times 10^{-6}$  cm/dyne and the output 4 mV per cm/sec recorded velocity. The frequency response is flat from 30 c/s to 15 kc/s, the high-frequency resonance being at about 25 kc/s on vinyl discs.

The Expert pickup (and amplifiers and loudspeakers) are not new but have not apparently been shown at audio exhibitions before. The pickup is of the moving coil type and the h.f. resonance is above 20 kc/s on l.p.s. The arm is pivoted some way along its length where a spring arrangement allows adjustment of the stylus pressure. By this means the extra rigidity and low inertia of a short arm are combined with the better tracking properties of a long arm. Acos showed two new crystal pickups with outputs of 0.16 and 1 volt per cm/sec; the high-frequency response (with a 3 dB peak) being 3 dB down at 11 kc/s and 7 kc/s respectively. The German Elac Miratwin MST2 cartridge is now being distributed in England by Thermionic Products. This is of the turnover variable reluctance type, but with two completely separate assemblies. The high output of about 6 mV per cm/sec recorded velocity is due to an efficient magnetic circuit. The high-frequency resonance is at about 18 kc/s on vinyl, and the

Seeley detector and a sensitivity of 10 mV for 20 dB quietening. The Armstrong FM61 is now fitted with a.f.c. which can be switched off if desired.

**Pre-amplifiers.**—Three transistor pre-amplifiers were introduced by Lowther. The input is 4-15 mV at 5-60 Ω impedance for each, and alternative voltage gains of 30 (general purpose with no feedback) or 50 are available. One of the pre-amplifiers with a gain of 50 has 24 dB uncorrected feedback, the other can be corrected to the R.I.A.A. or 78 ffr record reproducing characteristics, or to a flat, high gain characteristic for use with microphones.

A very comprehensive pre-amplifier was used by Acos for their demonstrations. On the bass and treble controls the turnover point and amount of alteration could be independently varied, and a continuously variable (3.5 kc/s-20 kc/s cut off) low pass filter was also provided.

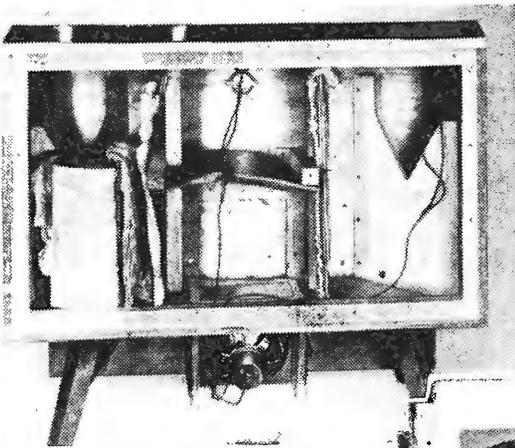
Several new valve pre-amplifiers were shown, "loudness" (tone-compensated volume) controls being increasingly fitted. These generally follow the Fletcher-Munson curves; but as Decca point out these curves apply only to sine waves, and so they have used somewhat different ones to provide the best compromise between speech and music in their prototype

trend. Pilot (who are newcomers to this field) have a useful addition to their pre-amplifier HFC12 in the form of a muting switch to desensitize the pre-amplifier (time constant 1 second) while changing records or input sources. Vortexion showed a pre-amplifier (TRG10) which can be fully loaded from Wearite tape heads.

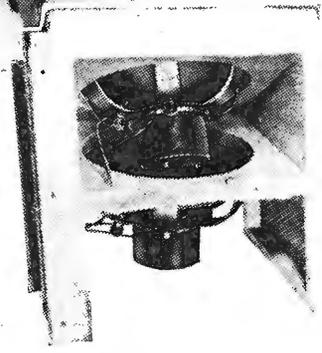
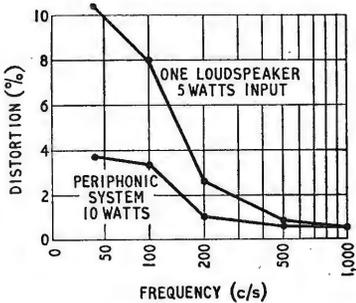
**Amplifiers.**—Philips were showing two transformerless amplifiers. These have been made possible by winding up to 800-ohm voice coils for their normal dual-cone loudspeakers. Two valves are used whose outputs add in the load but whose input is only single-ended. These amplifiers can deliver their full rated power at low frequencies and also have a wide, level frequency response. The separate amplifier and pre-amplifier gives 12 watts output for 0.1 per cent distortion at 100 c/s; a 4-watt transformerless amplifier is also used in their "Magic Box."

Lustraphone have introduced two portable P.A. transistor amplifiers giving 10 or 15 watts output for 5 mV low impedance microphone input, and with a substantially flat response from 100 to 10,000 c/s.

A considerable number of amplifiers are now stated to be stable for capacitive loads such as electrostatic loudspeakers. These include the



G.E.C. Periphonic cabinet and (inset) distortion canceling loudspeaker mounting. On the left is shown the reduction of distortion in this loudspeaker system.



seur and Avantic. These, of course, include an extra control for balancing the two inputs, and the Avantic also has a knob labelled 3D and stereo to enable a single channel output to be fed to two loudspeakers, thus giving a much wider apparent sound source.

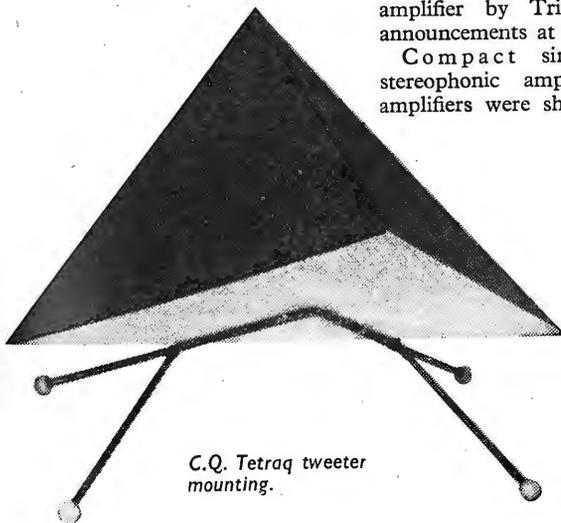
**Loudspeakers.**—A new method of mounting loudspeakers which greatly reduces the distortion at low frequencies was demonstrated in the G.E.C. Periphonic system. The loudspeakers are mounted front-to-back at a slight angle as close together as possible in a small V-shaped enclosure, as in the illustration. The slot in the enclosure is acoustically terminated in a rectangular bass reflex cabinet (42 in x 25 in x 15 in). The electrical inputs to the two loudspeakers are made out of phase. Because of the tight coupling between them the geometrical distortions of the loudspeaker cones are to a considerable extent cancelled out. These distortions are such that when the cone apex is moving towards its periphery the cone tends to open out, and when it is moving away it tends to collapse, much as a partially opened umbrella would. Very high air pressures are generated in the V-shaped enclosure, which possibly precludes its use to very strong cone loudspeakers such as the G.E.C. metal cone. This also necessitates considerable care in removing resonances from the reflex cabinet. Corrugated cardboard diaphragms are placed at suitable positions within the enclosure to break up any resonances of the air columns, and tapered slots are cut in the two vents to broaden the main air resonance. The diagram shows the reduction in the distortion achieved; it should be noted that the electrical input has been doubled to the two-speaker system. Three sets of the usual "presence-unit" tweeters are used in the complete system, placed at the front and the two sides of the cabinet. These are

Expert 10- and 20-watt (0.1% distortion), the Decca 25-watt (0.05% distortion) prototype (due to its tertiary feedback winding on the output transformer), and the Rogers Senior Mark II 15-watt (0.1% distortion) amplifiers. Some information was released by Quad on the amplifier conditions under which their electrostatic speaker should be operated. The ideal amplifier source impedance would be equivalent to a 1-2-ohm resistor in series with a 40- $\mu$ H inductance. The distortion should

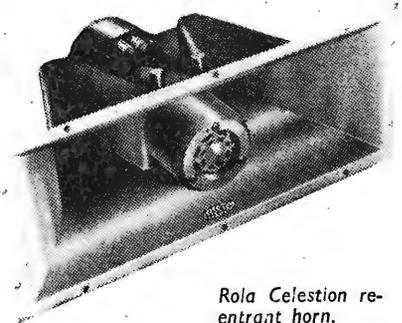
be low for resistive loads varying between 30 and 7 ohms, and on a 30-ohm load not more than 35 peak output volts should be available.

Although Gramplan were showing a 40-watt (1% distortion) amplifier using ultra-linearly operated KT88s, high powers do not yet seem to have invaded the British market. The two Leak power amplifiers have however been modified to give power outputs of 12 and 25 watts for 0.1% distortion. The Armstrong A10 Mark II can also now give 10 watts at 0.1% distortion. A 60-watt public address amplifier by Trix was used for announcements at the fair.

Compact single-unit 10-watt stereophonic amplifiers and pre-amplifiers were shown by Connois-



C.Q. Tetraq tweeter mounting.



Rola Celestion re-entrant horn.

arranged so that either the front, or the side, or both sets of tweeters can be switched on, compensation being applied to keep the overall response level in all cases. By this means the apparent sound source can be made very large with only the side tweeters on (perhaps for relaxed listening or large-scale works), somewhat smaller with the front tweeters switched on as well, or smaller still with only the front tweeters switched on (for speech).

Wharfedale were showing their new free-standing three-speaker sand-filled baffle system (SFB/3) which is 34 in × 31 in. They have found that with the additional reflecting surfaces such as occur in a room corner the normal response of a loudspeaker mounted in a baffle is modified and extends about an octave lower than usual, but with

the cut-off rate increased from 6 to 12 dB per octave. The two parallel low-frequency units (W12/SFB, 10-in Bronze/SFB) have a very low resonance frequency due to the use of the new foam rim-suspension which is now fitted to all Wharfedale speakers. This also reduces distortion at large amplitudes and smoothes the response generally. The tweeter in the SFB/3 is a standard super 3/FS.

Rola Celestion have introduced a new middle and upper frequency (crossover points at 750 and 5,000 c/s) two-speaker system (415). The middle speaker uses a re-entrant horn as in the illustration, the tweeter being placed in the centre. Some more information was given about the Goodmans electrostatic speaker (103): the impedance at 400 c/s is 15 ohms and substantially

resistive. C.Q. have added several alternative tweeters to their standard small (22 × 12 × 13 in) bass reflex cabinet with tunnel port. One of these is the Tetra, which consists of a tetrahedron containing two 4-in-diameter tweeters mounted on different faces. This rests on a stand in any position thus easily giving a wide control over the treble distribution. Other small speaker systems were shown by Pye and Simon.

New 4-in tweeters were shown by Rola and Plessey. Two miniature speakers 1½ in in diameter and 1½ in × 2½ in for use in transistor sets have been added to the W.B. range. One of the Expert range of speakers uses a simple four-foot acoustic column with the single speaker mounted at the top. By this means acceptable results are obtained in a very small floor space (1 ft square).

## Television Interference from Sea Reflections

By J. K. S. JOWETT,\* B.Sc.(Eng.), M.I.E.E.

### An Explanation of the Effects Observed at Kingsand and Cawsand

**A** PARTICULARLY interesting and troublesome case of beat interference to Band I television reception was reported in the March, 1957, issue of *Wireless World*. The predominant effect described was that of a fluctuating picture brightness which occurs rhythmically at a rate of between 35 and 50 per minute at reception points in Kingsand and Cawsand in Cornwall. These two places are heavily shielded by a local 400-ft hill from signals following the direct transmission path from the B.B.C. television transmitter at North Hessary Tor. When the beat effect is most pronounced it is accompanied by multiple ghost images of alternating polarity. Apart from a short period around sunset on summer days the phenomenon is present, to a greater or less extent, whenever television transmissions take place; no separate interference source which might have caused the trouble has been observed at times when North Hessary Tor was not transmitting.

This evidence strongly suggests that the interference is created by unwanted modes of propagation of the television signal, i.e., by reflections from some natural features or other obstacles which are not in the direct transmission path. The usual effect of such reflections is, of course, familiar to many viewers and takes the form of a permanent ghost or echo signal displaced from the main signal by an amount which is proportional to the time delay of

the ghost signal relative to the primary signal. The rhythmic variation of picture brightness which occurs at Kingsand and Cawsand, however, could only be caused by such means if the path delay were subject to a regular and systematic change. As is well known such an effect can, for a short space of time, be caused by a moving object such as an aircraft; but the permanent nature of the present reported interference rules out an explanation based on aircraft reflections.

It was stated that this type of interference has been noted elsewhere at a number of coastal areas shielded from North Hessary Tor, between Start Point and Looe; but nowhere is its effect so pronounced as it is at Kingsand and Cawsand.

The original report quoted the opinion of the B.B.C. that the beat is caused by a reflection from the surface of the sea. The present writer is convinced that this can be the only explanation and, furthermore, that the rhythmic beat effect is in all probability due to the regular motion of waves on the sea surface. It should be borne in mind in this connection that although a radio wave may be reflected at the sea surface with a high coefficient of specular reflection—perhaps of the order of 0.8 or 0.9 or even more—there is inevitably some degree

\* Post Office Engineering Department, Radio Planning and Provision Branch

of scattered reflection taking place. The sea acts, in fact, as a re-radiator of energy; by far the greatest part of the incident energy is re-radiated in an extremely narrow lobe in the forward direction but a very small amount of energy is scattered in all directions. There may be small side lobes of re-radiation in directions favoured by the corrugation of the sea surface and, where a large area of sea is "illuminated" by a strong incident field, the cumulative total of energy thus scattered may be far from negligible.

The same type of interference is, of course, met in the form of sea-clutter on centimetric radar displays. In this case the echoes forming the clutter are due to direct back scatter from the sea. Such back-scattering phenomena, both from sea and land, have also been conclusively demonstrated in recent research on the transmission of h.f. waves. It is this form of back-scattered reflection which no doubt generally accounts for the television beat interference at coastal areas where the reception site is badly shielded from the transmitter and where, also, the sea is in direct view of both the reception site and the television transmitter. In the special case of Kingsand and Cawsand, however, it would appear that the interference is largely due to "sideways" scatter from areas of water in Plymouth Sound rather than to back scatter from the English Channel.

Why should the problem be so pronounced at Kingsand and Cawsand? The primary condition that the direct path signal is severely attenuated by local high ground is, of course, fully met, but so it

is in many other places. The real aggravation of the problem here lies in the fact that Plymouth Sound and much of Cawsand Bay are in no way shielded from North Hessary Tor; they are, in fact, illuminated with radio fields that are at least 20-30 dB greater than the direct-path field set up at Kingsand. Moreover, this stretch of water lies in front of or to the side of the receiving aerial; not, as in the case of usual coastal sites, to the back of the receiving aerial. It is therefore less easy to provide discrimination by means of aerial directivity. The glancing angle at which the radio waves strike the water surface is also quite high—of the order of  $1.5^\circ$  to  $2^\circ$ —and as will later be seen this considerably assists the extent to which scattering takes place.

### Possible Reflection Modes

It is useful to distinguish between three possible separate modes of sea reflections in this particular case, these are:—

- (a) Quasi-specular reflection at oblique incidence from wave fronts in Plymouth Sound.
- (b) Similar, but less oblique, reflections from rollers out to sea, and
- (c) Scattered reflections from a wide area of the bay similar to the usual form of sea-clutter met in radar.

The first mode may well predominate at times and is therefore described here in some detail; it also illustrates very simply the way in which sea-wave motion can cause picture fluctuations. These oblique-incidence reflections from sea waves may be assumed to take place from region A marked on the map (Fig. 1), perhaps particularly from wave fronts advancing in a generally north-west direction, since such wave fronts are likely to give maximum reflections in the direction of Kingsand and Cawsand†. If we look at the situation in plan view, we see that reflection at the wave fronts is relatively oblique in this region; it is, therefore, more nearly specular and of larger amplitude than ordinary back scatter. Since, in addition, the reflected signal would arrive at Kingsand only  $30^\circ$  or so off the direct-path bearing it is likely that this mode of reflection is always effective. In so far as the mode is one of quasi-specular reflection from the advancing fronts of waves and breakers it is probable that the general area of reflection will depend on the height of the receiving aerial. If this height is only 50 feet above sea-level, effective reflections may be taking place little more than  $\frac{1}{2}$  mile away, whereas, with aerials 100-200 feet above sea-level, the area of most effective reflections may be one or two miles away from the receiving point. The delay of these reflected signals relative to the direct-path signals would be of the order of 1-2 microseconds only, and, while a diffuse form of ghost image might be seen, the main result would be to cause a fluctuation of picture brightness as the following reasoning shows.

Let us consider reflections from a single wave front advancing towards the coast to the north-east of Kingsand. At some point in the travel of this wave the reflected signals reaching Kingsand would augment the direct-path signal; a short time later, when the excess path length has decreased by just

† It is worth noting that, near the coast, sea waves travel faster in deep water; this causes wave-fronts approaching a coast-line, from whatever direction, to swing round so that they roughly follow the contours of the sea-bed and make their final approach in a direction parallel to the shore.

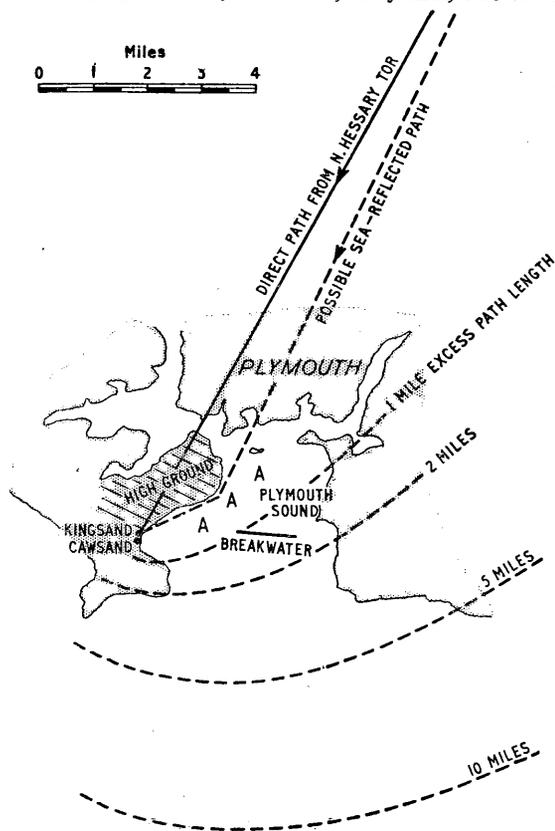


Fig. 1. Plan of the affected area and its environs, showing ellipses through reflection points giving various path differences.

one half-wavelength of the radio waves, the reflected signals would be in phase opposition to the direct-path signal, thus reducing the picture signal level. Simultaneous reflections from a number of such sea waves would undoubtedly take place. They could not, of course, all be expected to be in phase with one another but neither would they all cancel out; there would virtually always be a substantial resultant causing a fluctuation of the total received signal.

## Sea Wave Velocity

In support of this general contention it is possible, quite simply, to relate the picture fluctuation rate to the velocity of the sea waves causing the beating effect. The lowest observed picture fluctuation rate is 35 per minute or about 0.6 per second. In other words the excess path length of the reflected signals must be decreasing by  $0.6\lambda$  per second or approximately 3.5 metres per second since the vision wavelength of North Hessary Tor is very nearly 6 metres. If we now refer to Fig. 2 we see that this excess path length, P, is given by:

$$\begin{aligned} P &= AC - DC \\ &= AC(1 - \cos 2\theta) \\ &= n \operatorname{cosec} \theta (1 - \cos 2\theta), \text{ since } AC=BC \operatorname{cosec} \theta \\ &= n \operatorname{cosec} \theta \end{aligned}$$

i.e.  $P = 2n \sin \theta$ , a very simple result.

Differentiating,

$$\frac{dP}{dt} = 2 \sin \theta \cdot \frac{dn}{dt}$$

and since the angle  $2\theta$  is close to  $30^\circ$  for much of the region we are now considering,  $\sin \theta \approx 0.25$ , and

$$\frac{dP}{dt} = 0.5 \frac{dn}{dt}$$

In simple terms this means that the rate of change of excess path length (minimum value about 3.5 metres per second as deduced above) is just about one-half of the velocity of the advancing waves when these are approaching in the correct direction to give maximum reflections. Thus, in order to explain the reported rates of picture fluctuations, the minimum sea-wave velocity in and around region A must be about 7 metres per second (or 14 knots) while the maximum sea-wave velocity in this correct direction must be perhaps 9 or 10 metres per second (or 18 to 20 knots). The striking thing is that these velocities are very close to what would normally be expected in fairly shallow water. At low tide the water depth of region A is certainly below 5 fathoms (30 feet); let us assume an average low-water depth of around 15 feet, for which various authorities quote a wave speed of 13 knots. At high tide this depth would be roughly doubled and this would approximately increase the wave velocity by a factor of  $\sqrt{2}$  to some 19 knots, either more or less, depending upon the strength and direction of the wind and other factors. An assumption that the average water depth was either 10 or 20 feet instead of 15 feet would have altered these results by less than 20%. It can therefore be said that the observed phenomena are consistent with the theory of wave-front reflections from this particular region. It would certainly be of interest to know whether the observed rate of fluctuation is generally a maximum around high tide, particularly under conditions when modes (b) and (c) might be less important than mode (a).

The possible effects in region A have been described in some detail. But it is clear that other areas of water do affect reception on occasions if not all the time; for example, multiple fluctuating ghosts are reported with such long delays that the corresponding excess path lengths must be of the order of several miles or more. In Fig. 1 are drawn parts of the ellipses joining points from which reflections would give excess path lengths of various values from 1 to 10 miles; this latter range corresponds to a time delay of about 54 microseconds or just over one-half of a line scan. It is clear that if sea reflections are to give the multiple long-delay ghosts which are reported they must come from the English Channel and the southern half of the bay.

There seems no reason to doubt that such reflections can take place, particularly when there is a heavy swell or sea occurs. But the fact that separate ghosts are visible would suggest that such reflections are "grouped" so as to give echo signals which are delayed by at least one or two microseconds from one another. For this to be the case it would seem that conspicuous reflections do not necessarily take place from all waves, but only from those which are spaced by perhaps as much as  $\frac{1}{4}$  mile or  $\frac{1}{2}$  mile apart. This is by no means improbable in fairly high seas and it is an observed fact that sometimes a number of rollers advance as a group very close to one another and leave behind a long gap before any further substantial waves are met. This inference is supported by radar observations which occasionally show sea-clutter divided out into striations or ridges of echoes with intervening dark gaps representing distances of hundreds of yards between effective wave-scatterers. The velocity of such large waves or rollers at the entrance to the bay probably exceeds 20 knots. From Fig. 1 we should expect the distant waves to advance in a direction roughly normal to the delay ellipses, and for this reason separate fairly distinct echoes from a close group of waves might be expected. The effect might be particularly pronounced with winds between south and east and the polarity of these long-delay ghosts would alternate at a rate considerably faster than the reported picture fluctuations. The ghosts would not, of course, beat exactly in phase with one another and at any one instant some would appear white, others black, while the remainder would be in the process of changing their polarity. They would move steadily towards the primary image but at too slow a rate to be observed, especially in view of their constantly changing polarity.

## Scattered Reflections

There remains to be considered the third mode, that of sea-clutter which, of course, could be taken to include the first two modes. Scattered reflections or "clutter" from nearly all parts of the bay must take place at all times to some degree. The effect would, one might expect, be especially marked in choppy seas but may be sufficient at nearly all times to give some of the observed effects. Some help on the present problem may be gained by studying the findings of radar research on sea-clutter, although in this case only back-scattered reflections from the sea's surface are involved.

Sea-clutter on centimetric radar screens is regularly observed out to ranges of several miles, and



may be more localized and also more readily dealt with by the greater aerial directivity discrimination achievable at these frequencies.

These remarks, however, scarcely help the unfortunate viewers of Kingsand and Cawsand. If the explanations here advanced are correct it would appear that the best prospects of minimizing their difficulties lie in, so far as possible, avoiding sites which give a very open view of the bay. Aerials

which are designed to give really effective discrimination against signals some 30°-40° off the true bearing may be of some help, but would not necessarily assist when moderate- or long-delay echoes are predominant.

The views expressed in this article are the personal ones of the author, who wishes, however, to acknowledge the helpful suggestions of a number of his colleagues in the Post Office.

## Wideband Communications Systems

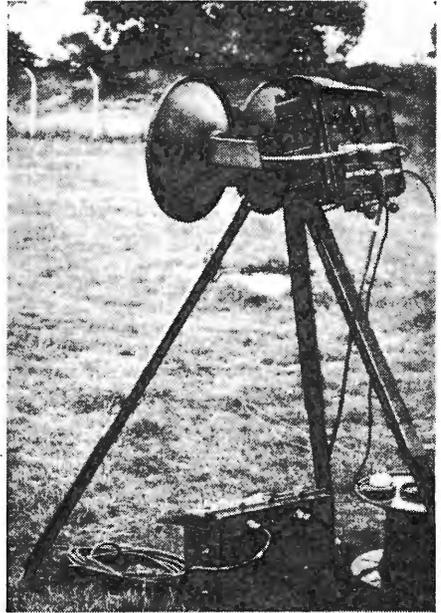
### Travelling-wave Tubes Contribute to Simplification of Equipment

AN exhibition and demonstration of wideband metre and centimetre communications equipments was held recently by Marconi's Wireless Telegraph Company in association with certain other companies. Among these were the Automatic Telephone and Electric Company, the British Insulated Callender's Construction Company, the English Electric Valve Company, Siemens Bros. and the Telephone Manufacturing Company.

These equipments have been developed primarily for multi-channel telephony. Frequency modulation is used throughout and one of the equipments, the HM200/250 working in the 2,000 Mc/s band, has a potential capacity of 600 normal-width speech channels, or one high-definition television channel.

A special feature of the HM200 (terminal) and HM250 (repeater) equipments is the use throughout of some new types of travelling-wave tubes made by the English Electric Valve Company. These tubes are designed especially to meet the exacting requirements of wide bandwidth, linearity, freedom from phase distortion and high amplification at ultra-high frequencies. The last-mentioned characteristic has enabled the repeater stations to operate without demodulating the incoming signal prior to amplification. Signals are amplified at the working frequency of about 2,000 Mc/s, the frequency is changed slightly and after further amplification in a 3-stage travelling-wave tube amplifier is re-radiated at a power of about 10 W. Parabolic aerials are used with receiver and transmitter sharing a common aerial by means of diplexers. Distances of 2,000 miles or more may be covered by this equipment using suitably disposed unattended repeaters. All travelling-wave tubes used in these equipments are tested for linear operation over the frequency band of 1,700 to 2,300 Mc/s.

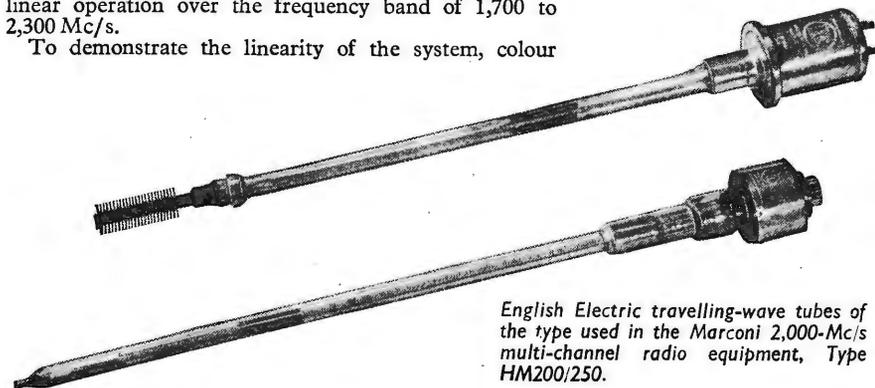
To demonstrate the linearity of the system, colour



Marconi Type HP311 6.5-cm portable multi-channel communications equipment.

television pictures were sent over a 30-mile radio path, comprising one two-way repeater and a turn-round station. Direct comparison between the pictures before and after traversing the radio path, failed to reveal any loss in picture quality.

The various equipments displayed embraced a frequency range of 60 Mc/s to 5,000 Mc/s and for the higher order frequencies there was shown (and demonstrated) the Type HP311, a portable multi-channel system working in the band 4,580 to 4,860 Mc/s (6.5 cm) with a transmitter power of about 200 mW. This is intended to be a temporary or semi-permanent point-to-point communications system and, in conjunction with carrier-telephony equipment, will handle up to 12 speech channels. Distances of 20 miles or more, according to nature of the intervening terrain, can be covered in a single hop and the HP311 is usable as a repeater by locating two sets back-to-back with appropriate ancillary equipment.



English Electric travelling-wave tubes of the type used in the Marconi 2,000-Mc/s multi-channel radio equipment, Type HM200/250.

# Components Exhibition

REVIEW OF TRENDS AT THIS  
YEAR'S R.E.C.M.F. SHOW

This report covers most of the exhibits at the Exhibition held in London from April 8th-11th by the Radio and Electronic Component Manufacturers' Federation. Valves and allied devices at the show are dealt with under a separate heading in the present issue, while test and measuring gear shown at this and other recent exhibitions will be described in the July "Wireless World"

**Resistors.**—A few new resistors made their appearance this year but generally speaking the main changes have been directed towards adapting existing ranges for printed circuits and for automatic assembly.

Dubilier had a new range of "BT" insulated resistors in  $\frac{1}{2}$ - and 1-W sizes. The  $\frac{1}{2}$ -W (BTS) measures only  $\frac{1}{8}$  in in diameter and  $\frac{3}{8}$  in long and is available from 390  $\Omega$  to 10 M $\Omega$ . The 1-W size (BTA) is somewhat larger.

A modified form of vitreous wire-wound resistor, in which the axial wires do not impose any strain at all on the fine resistance wire, was shown by Welwyn.

This firm were showing also a new type of potentiometer designed for use in flywheel sync circuits. Its particular feature is the embodiment of an on/off switch which is brought into operation by pushing in the control spindle. The potentiometer can then be rotated in the usual way, still maintaining the switch contacts closed.

A control, offering the same facilities but of quite different design, is the "Claro-stat" model shown by A.B. Metal Products. In this design the switch, a single-pole change-over type, is directly connected to a small insulated knob; on pressing in the

knob a dog-clutch engages with its counterpart on a potentiometer spindle and the control can be rotated as usual.

Television influence was seen in the design of small pre-set potentiometers intended for factory or dealer adjustment only. They are very compact and of inexpensive design and examples were shown by Welwyn and by Egen. The latter had three distinct types; for independent mounting, for printed circuits and for suspending in the wiring. They are rated at  $\frac{1}{10}$  W and made in values of from 4.7 k $\Omega$  to 2.2 M $\Omega$ .

Some ingenious brackets have been evolved for fixing the smaller types of volume control potentiometers to printed circuit boards. Special contacting tags replace the customary ones and examples were seen on the stands of A.B. Metal Products, Egen, Plessey and several other firms.

In addition to the familiar button-type potentiometers with rim control, introduced originally for hearing aids, the orthodox pattern with spindles are now produced in miniature form for transistor equipment and wherever space is restricted. The Dubilier Type "Y" is a good example and Plessey have introduced a new one which is only  $\frac{3}{32}$  in in

diameter. Known as the Type MH2, it embodies a moulded resistance element rated at  $\frac{1}{4}$  W. It is made in values of from 5 k $\Omega$  to 1 M $\Omega$  with a log law and 1 k $\Omega$  to 2 M $\Omega$  with linear law. It complies with Services' Specification RCS122 and is a high-grade component.

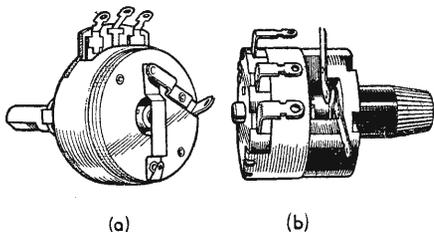
**Manufacturers\*:** A.B. Metal Prod. (VC), British Electric Res. (W), Bulgin (W), Colvern (VC, W), Dubilier (C, HS, VC, W), Egen (VC, W), Electronic Comp. (W), Electrothermal (W), Erg (HS, W), Erie (C, HS, W), Morganite (C, VC), N.S.F. (VC), Painton (HS, VC, W), Plessey (VC, W), Salford (W), Welwyn (C, HS, VC, W), Zenith (W).

\*Abbreviations: C=composition, HS=high stability and carbon film, VC=volume control, W=wirewound.

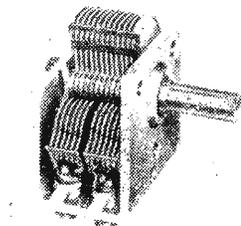
**Capacitors.**—During the past year or so the design of fixed capacitors has been significantly influenced by the requirements of printed circuits and transistor equipment. This year sees these influences reflected in the design of ganged tuning capacitors. Jackson Bros. have introduced a midget twin gang, the Type "00", measuring only  $1\frac{1}{2} \times 1\frac{1}{8} \times 1\frac{1}{2}$  in and having a single bank of moving plates instead of the usual two. The fixed plates are in two sections, but not divided by a screening partition as usual. They have unequal capacitances, the rear, or oscillator section, being 176 pF and the front 208 pF maximum.

A midget Type "W" twin gang capacitor of similar form was included in the Plessey exhibit. It, also, has a single rotor section and unscreened stator sections, in this case of 111 pF and 229 pF respectively. Some tiny twin gangs were found on the Polar stand (Wingrove and Rogers), but in these both sections are of the same capacitance.

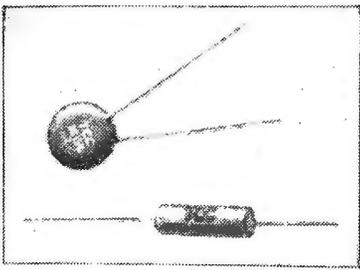
New fixed capacitors were reasonably plentiful and everywhere reflected the influence of the printed circuit. It has led Plessey to introduce a new moulded base for their



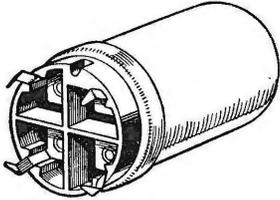
Potentiometers with press switch for flywheel sync circuits, (a) Welwyn "clutch" potentiometer and (b) A.B. Metal Products "Claro-stat."



Miniature Type "00" gang capacitor made by Jackson Bros.



Aerial isolating and "Ceramisal" tubular capacitors made by T.C.C.



New moulded base for Plessey printed-circuit electrolytic capacitors.

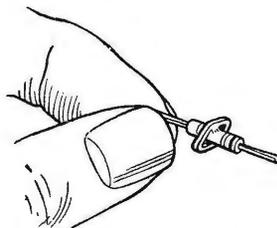
larger type electrolytic capacitors to enable replacement, should it be necessary, to be effected in a reasonably simple way. Normally all base tags, or wires, have to be heated simultaneously to melt the solder before the unit can be removed. The new base has springy tags which fit in rectangular slots in the printed circuit board, the slots being of such a size as to enable the spring lugs to be unsoldered separately and disengaged from the printed wiring.

Plessey were also showing some new paper-dielectric capacitors of small physical size for the capacitances achieved. There were three ranges known as "Plesmin", "Pleswax" and "Ple seal" respectively.

Dubilier have added some further models to their already extensive range of interference suppressors and they now include some 96 different types. One, a u.h.f. feed-through suppressor for power leads, has the "through" conductor sleeved with ferrite to provide a series impedance at u.h.f.

A tiny polystyrene capacitor, principally for use in miniature i.f. transformers, was shown by Suflex. It is only 7 mm long and 3 mm in diameter. Nevertheless capacitances of 100 pF at 350 V d.c. working and 50 pF at 500 V have been achieved.

Among the new capacitors recently introduced by T.C.C. is a small ceramic disc with radial wires which is intended for isolating the aerial in a.c./d.c. sets. It conforms with the safety requirements in



Erie miniature lead-through capacitor.

BS415-1957 and is made in five sizes with capacitances of from 470 pF to 20 kpF. The latter is for earth leads only. Another "aerial isolator", but of tubular ceramic form with side-entry wires, was shown by Stability Capacitors. It measures 0.7 in long, 0.2 in in diameter and conforms also with BS415. Normal values are 470 pF, 1 kpF and 1.8 kpF.

Some new temperature compensating capacitors made their appearance this year. T.C.C. had a range known as "Ceramisals" in which some models with capacitances ranging from 2 to 600 pF are available with a wide variety of temperature coefficients ( $-750 \pm 80 \times 10^{-6}$  deg C to  $100 \pm 60 \times 10^{-6}$  deg C). These are enclosed in ceramic tubes with sealed ends and axial wires. Stability Capacitors had a new range of temperature compensating ceramic capacitors. Nine varieties are available, ranging from P100 (positive) to N750 (negative) and in capacitance of 1 pF upward. Erie also had a number of models of this type.

Erie was showing as well a new miniature feed-through capacitor designed to withstand the effects of considerable heat without disintegrating, as might well happen when soldering it in position. It is made of very high "k" ceramic and so far is available in a 1-kpF size only, as its present application is in television and v.h.f. sets. A capacitor of a somewhat similar kind, and equally as small, was shown by L.E.M.

A novel Erie capacitor, unlike anything seen elsewhere and designed especially for printed circuit applications, takes the form of a small, thin, wedge-shaped plate of ceramic silvered on both sides. It is intended to be inserted into an appropriately shaped slot in the printed circuit plate and soldered in position. It is known as a "Spade Ceramicon" and is available at present only in a 1-kpF size.

Adaptation to modern techniques was the highlight of Hunt's exhibit. Printed circuit capacitors were well in evidence and there was a bandolier strip assembly of capacitors of

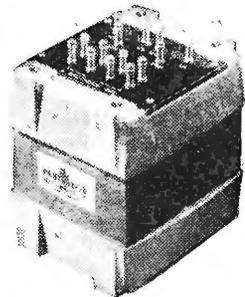
the kind used in automatic component assembly machines.

**Manufacturers:**\* Bulglin (T, V), Daly (E), Dubilier (C, E, F, M, P, T), Erie (C), Hunt (C, E, F, M, P), J.B. (T, V), L.E.M. (C, M), Mullard (T, V), Plessey (C, E, F, M, P, T, V), Stability Capacitor (C, M), Static Cond. (P), Standard Telephones (M,P), Stratton (V), Suflex (F), Telegraph Cond. (C, E, F, M, P, T), Telephone Manuf. (F, M, P), Wego (M, P), Walter Instr. (T), Polar (T, V).

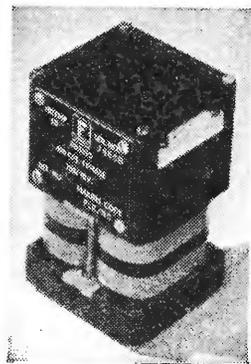
**\*Abbreviations:** C=ceramic, E=electrolytic, F=plastic-film and polystyrene, M=mica and silvered mica, P=paper and metallized paper, T=trimmers, V=variable and tuning capacitors.

**Coils and Transformers.**—As in other fields, new developments in wire-wound components have been influenced by the demand for miniaturization, for operation at higher temperatures, or both.

Transformers, even when of the miniature type, are the heaviest components which have to be inserted in printed circuit panels, and present problems of handling in the stages of production prior to dip soldering. Plessey have devised a system of "snap in" connecting tags of crimped spring material which holds the transformer securely without the necessity of bending over the tags at the back. A further advantage is that in the event of breakdown the connections can be unsoldered, one tag at a time, and the component replaced with no tools other than a soldering iron.



Partridge P5000 audio output transformer.



Ferranti "Hitemp" single-phase power transformer.

Transformers, and the transducers used in conjunction with servomechanisms, must be capable of operating at high temperatures in supersonic aircraft. The principal differences from conventional practice in transformers for these applications lie in the insulating materials and in the mechanical construction which is arranged to minimize internal thermal gradients. The Ferranti "Hitemp" series of transformers exemplifies this trend and is based on a maximum winding temperature of 250 deg C. This is the sum of the effects of ambient temperature and transformer loss and if the ambient temperature is not excessive advantage can be taken of the available balance to reduce weight and size in any application in which regulation is of secondary importance.

Wide-band, audio-frequency output transformers of the highest quality have generally been constructed with "C" cores, though the less expensive stacked laminations of the so-called "waste-free" grain-oriented type can be made to give a comparable performance. Partridge Transformers have introduced a series (P5000) with cores of the latter type in which the difference in performance has been still further reduced.

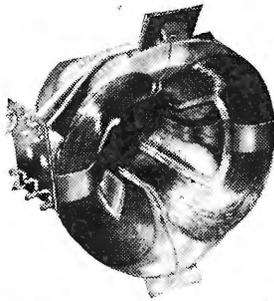
Toroidal cores in "Supermetal" are now being produced by Telcon with a guarantee performance in terms of inductance per 1000 turns. They are supplied, ready for winding, in hermetically sealed nylon cases containing a silicone grease to protect the metal from mechanical shock or vibration.

**Manufacturers\*:** Richard Allan (AF, M); Sidney S. Bird (IF); Electro Acoustic Industries (AF); Electro Methods (TD); Ferranti (M, TD); Fortiphone (CH, AF, TD); Goodmans (CH, AF, M); Gresham (CH, AF, M, TD); Haddon (CH, AF, M); Parmeko (CH, AF, M, TD); Partridge (CH, AF, M, TD); Plessey (CH, RF, IF, AF, M); Reproducers and Amplifiers (CH, AF); Rola Celestion (CH, AF); Salford Electrical (TD); Standard Telephones (CH); Weymouth Radio (CH, RF, IF, AF, M); Whiteley Electrical (CH, RF, IF, AF, M); Woden Transformer (CH, AF, M, TD); Wright and Weaire (CH, RF, IF, AF, M); Wireless Telephone Co. (RF, IF); Zenith Electric (M).

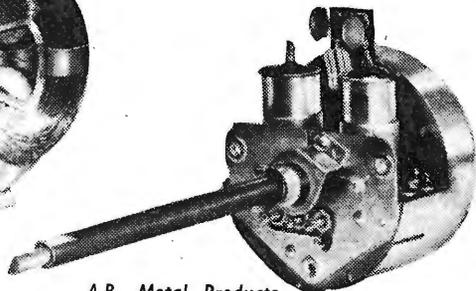
\*Abbreviations: CH, a.f. chokes; AF, audio transformers; M, mains transformers; TD, transducers; RF, radio-frequency coils; IF, intermediate-frequency transformers.

**Television Components.**—Now that the 21-inch c.r. tube with 90° deflection angle has obviously come to stay, considerable improvements have been made in scanning components for this wide-angle operation. The larger scanning power required calls for high efficiency in the magnetic deflection system, and this is particu-

larly difficult to obtain at the lower frame frequency. Hitherto, the toroidal type of frame deflection coil has been used, but coupling between the coils has prevented the use of high-inductance windings. Now, Plessey have introduced an improved 90° deflection coil assembly with a castellated type of core for the frame coil, which has the high inductance of 128mH. This gives a better coupling between the winding and the core, while the high impedance of



Plessey 90° scanning coil assembly.



A.B. Metal Products television tuner.

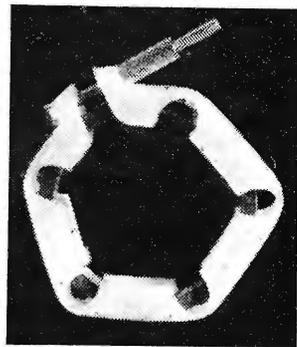
the coil permits a more efficient frame transformer to be used. Moreover, the core (made of "Caslam") locates the line and frame coils accurately and thereby ensures good consistency in picture shape. Improved focusing is also obtained. Any cross-talk between coils can be eliminated by damping resistors.

A new line output transformer for 90° scanning was also shown by Plessey. It has a wave-wound e.h.t. winding giving up to 18kV, a bracket for mounting the e.h.t. rectifier, and width and linearity controls incorporated in the base assembly. Another line output transformer, for 70° deflection and 14kV e.h.t., was intended for portable television sets.

Included in the range of focusing, ion-trap and picture-shift magnets shown by James Neill was a ring type of ion-trap magnet with a circular mounting clamp made of high-density polythene. This is designed to give improved locking on to the neck of the c.r. tube so that the magnet cannot move during transit. An aluminium version of the clamp is also available.

**Manufacturers\*:** British Moulded Plastics (M); Electro Acoustic Industries (D, F); Goodmans (F); Long and Hambly (M); James Neill (F); Plessey (W, F, ST, D); Standard Insulator (M); Thermo-Plastics (M); Weymouth (W, ST); Whiteley (W, F, ST, D).

\*Abbreviations: D, deflector coils; F, focus units and ion-trap magnets; M, screen masks; ST, scan transformers; W, width and linearity controls.



James Neill ion-trap magnet.

**Tuners.**—A prototype television tuner notable for its small size and compactness was shown by A.B. Metal Products. Built in cylindrical form, it is only 2 inches deep and 3½ inches in diameter. The small depth of the cylinder is obtained by using a flat switch plate instead of the usual coil turret. A further simplification is the use of a neutralized earthed-cathode single triode (2BN4) for the r.f. stage instead of the familiar double-triode cascode circuit. The other valve is a triode-pentode (5CG8) operating as a combined oscillator and mixer stage. Both of these valves have double base connections to the cathode to eliminate a common return path in the input and output circuits.

The "Teletuner" made by Sydney S. Bird has been modernized and now offers the additional facility of f.m. sound frequencies on Band II.

**Manufacturers\*:** A.B. Metal Products (TT); Sydney S. Bird (TT, TC, PS); Brayhead (TT, TC); N.S.F. (TT); Plessey (TT, TC); Weymouth (FM).

\*Abbreviations: FM, a.m./f.m. tuners; PS permeability sound radio tuners; TC, television converters; TT, television tuners.

**Aerials.**—Improvements in aerials this year are mainly confined to the mechanical details. As an example, Wolsey have introduced two new fixing devices of more than passing interest. One is a clamp for adding a Band-III aerial to the stand-off arm of an existing Band-I aerial.

It allows the high-band aerial to be separately orientated through a full 360° and it can be fixed to cranked or straight arms. The other is a universal-type wall bracket, for indoor or outdoor use, and its special feature is that the bracket can be fixed to a surface of any angle; it allows the aerial support arm to be pointed in any direction. It is known as the "Turret" wall bracket.

Time-saving designs, which cut the cost of erecting a v.h.f. aerial, were well in evidence this year and most of the leading makers had a number of examples under various names. For instance, Antiference call their design of collapsible aerials "Clik-Mec" models. The basic idea is the same throughout and consists of assembling the aerial at the factory, but collapsing and folding it into a conveniently sized package for dispatch. On the site it has only to be opened out and the elements snapped into position.

Aerial accessories were well in evidence again this year and Egen had two of more than usual interest. One was an adjustable attenuator only a little longer than an orthodox coaxial plug. It embodies a "pi" resistance network with the series arm adjustable in six steps, giving attenuation of from 6dB to 36dB. A number, indicating which of the six adjustments is in use, shows through a small window in the side of the attenuator case.

The other Egen accessory, a Bands I, II and III triplexer, is for feeding signals from the three aerials to a common feeder. Alternatively it can

be used in reverse to separate the signals at the receiving end from a feeder common to three aerials.

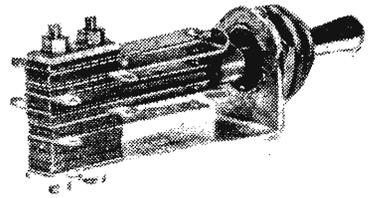
Among the examples of printed circuits shown by T.C.C. were several aerial combining units; one, the "Trimatch Coupler," for Bands I, II and III aerials and a single feeder.

Coaxial plugs and sockets remain much as before except that Plessey have introduced some new miniature and sub-miniature types. The "MB" series has a bayonet-type fitting giving quick attachment and release and secure mating of plug and socket. The sub-miniature type is only  $\frac{3}{16}$  in in diameter and has PTFE insulation. It is so small that a special coaxial cable has had to be made for it as no existing type is suitable.

**Manufacturers\*:** Antiference (A, AS), Belling-Lee (A, AS, C), B.I.C.C. (C), Egen (AS), Henley (C), J-Beam (A), Permanoid (A, C), Plessey (AS), Power Controls (AS), T.C.C. (AS), Telcon (C), Wandleside (C), Wolsey (A, AS).

**\*Abbreviations:** A=aerials, AS=plugs, sockets and accessories, C=feeder cables.

**Switches.**—Printed circuits have not produced any marked change in the design of switches except to make the tags into long thin fingers which can be readily soldered on to the copper conductors. Plessey had a whole range of switches—rotary, slider, push-button and piano-key—which could be supplied with either standard or printed-circuit contacts. One of the rotary segmented types had its printed-circuit contacts extended to form a straight row like the teeth of a comb, thereby allowing



Bulgin key-type switch.

the switch to be mounted with its spindle parallel to the circuit board. Miniature piano-key switches, about half of the normal size, were also shown by this firm, and it was noticeable that in these a "push-push" action could be provided—the first key depression locking the mechanism and the second one, on the same key, releasing it.

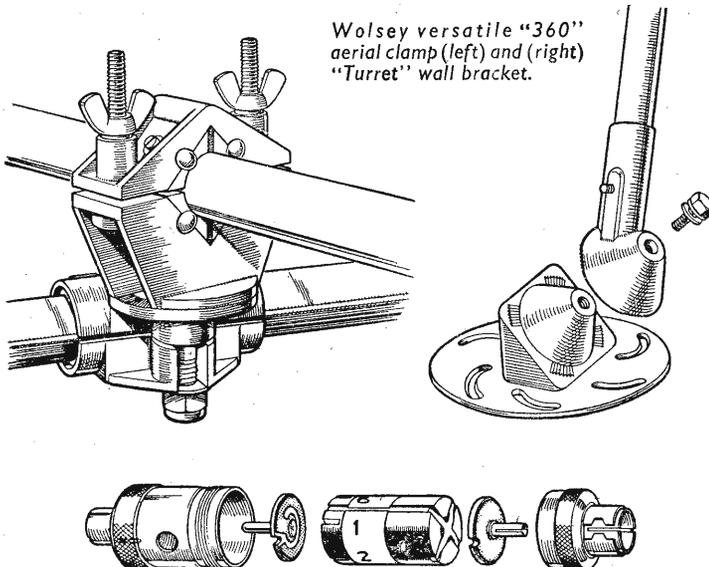
A new type of switch, with an action similar to a key type but in other ways resembling a toggle switch, was shown by Bulgin. The operating dolly has three positions, and it either locks firmly on the outside ones or returns to centre under bias, according to the model concerned. Pure silver contacts are used and the maximum load is 50W. This firm also had a new open-blade microswitch with an operating pressure of 1-2oz and initial travel of  $\frac{5}{32}$  inch. It is available with various contact arrangements, biased and non-biased, and will carry a.c. up to 6 amps.

Film Industries were showing a tubular form of microphone switch designed for mounting between the microphone and its stand. It has three-pin plug-and-socket terminations at the ends, so that the microphone can be unplugged and the switch inserted very easily. The contact system uses gold-plated ball bearings and loading springs in a self-cleaning rotary action.

**Manufacturers\*:** A.B. Metal Products (K, T, P, R, SL); B.E.R.C.O. (R, ST); Bulgin (K, T, M, P, R, SL, ST); Diamond H (T, R); Egen (R); Electronic Components (P, R, ST); N.S.F. (T, P, R, SL); Painton (T, P, R, ST); Plessey (K, T, P, R, SL, ST); Walter (T, P, R, SL); Wright and Weaire (R).

**\*Abbreviations:** K, key; T, lever or toggle; P, push-button; M, micro; R, rotary; SL, slide; ST, stud.

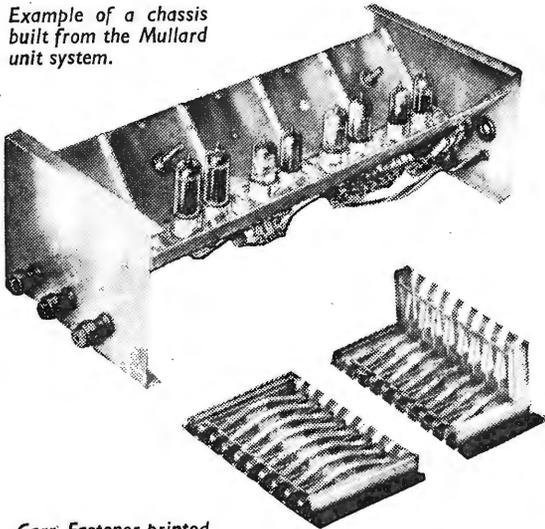
**Chassis fittings.**—Some of the more recent applications of printed circuits require connections to be made between circuit boards arranged at right-angles to each other, and several new connectors have been introduced for this purpose. One shown by Carr Fastener consists of a row of right-angled clips mounted on an insulator. The printed-circuit boards act as plugs at their edges



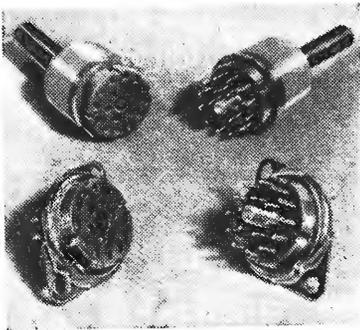
Wolsey versatile "360" aerial clamp (left) and (right) "Turret" wall bracket.

Egen six-step aerial attenuator in exploded form.

Example of a chassis built from the Mullard unit system.



Carr Fastener printed-circuit connectors.



McMurdo new 18-way radial type connector.

and are pushed into the clips. Another right-angled connector on the N.S.F. stand made use of the "Varicon" type of contacts described in last year's report. Here the contact blades are actually mounted on the two circuit boards (on their blank sides) in such a way that the blades themselves mate at right-angles. Both of these firms showed corresponding connectors for boards in the same plane.

For equipment manufacturers who do not favour using the printed-circuit edge as a plug, Painton had a 10-pole connector which includes a plug part for fixing to the board (the socket part being free). The gold-plated contacts are staggered to prevent wrong-way-round insertion.

Amongst other connectors, McMurdo displayed a new 18-way radial type based on a B9A valveholder moulding (see illustration). It is light and inexpensive and is at present supplied with the customer's cables directly moulded in. This firm also showed a new octal

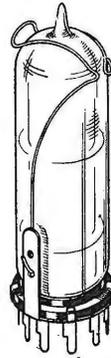
Electro-Methods sub-miniature 7-way connector.

printed-circuit valveholder, while Spear Engineering had a very simple valve retainer for printed-circuit valveholders (see sketch).

An interesting form of chassis construction, based on the "Meccano" principle, has been introduced by Mullard for "breadboard" experiments in development laboratories and training establishments. The basic unit is bridge-shaped chassis to which various valve mounting plates can be bolted (B7G, B9A or B8-O). The sloping sides are drilled to accept 10-way tag strips or terminal blocks for mounting components, and also have  $\frac{3}{8}$ -in diameter holes for potentiometers, switches, coaxial sockets, etc. End supporting plates can be used for lifting the chassis clear of the bench. The system permits of a good many variations, and, incidentally, can be fitted to a standard 19-inch rack.

Coaxial plugs and sockets for carrying e.h.t. voltages up to 30kV were shown by Lion Electronic Developments. They are moulded

in polythene on to standard coaxial cables and are sealed against dampness.



Spear valve retainer for printed-circuit holders.

**Manufacturers\*:** Antiference (CPS); Ash-downs (DL, P); Bakelite (P); Belling-Lee (CPS, T, F, J, V); B.E.R.C.O. (DL, K); Brayhead (EFC); British Moulded Plastics (CR, CPS, ES, T, K); Bulgin (V, EFC, CR, DL, ES, T, F, J, K); Carr Fastener (EFC, CPS, T, F, V); H. Clarke (T); Colvern (CPS); Cosmocord (K); Creators (EFC, G, T); Ediswan (CPS, T, V); Egen (CPS); Electro Methods (CPS, T); Electronic Components (CPS, DL); Fortiphone (CPS); Goodmans (CR); Hallam, Sleigh and Cheston (CR); Harwin (EFC, CPS, T); Hasset and Harper (CR, EFC, ES); Hellermann (EFC, G, T, K); Imhof (CR); Insulating Components (DL, P, T, V); Jackson (DL, DR); K.L.G. (T); Long and Hambly (G); Lustraphone (EFC); McMurdo (V, CPS); Mica and Micanite (EFC, T, V); Morganite (CPS); Mullard (CR); N.S.F. (CPS); Painton (CPS, DL, T, K); Perma-noid (CPS); Plessey (CR, CPS, DR, T, P, F, K, V); Power Controls (CPS, T); Geo. Salter (EFC); Simmonds (EFC); Spear (EFC, CPS); Standard Insulator (EFC, G); Stocko (EFC, T); Stratton (CR, CPS, DL, DR, K); Suffix (ES); T.C.C. (P); Telcon (CPS); Thermo-Plastics (CR, DL, ES, T); Thorn (P); T.M.C. (J); Geo. Tucker (EFC, G); Tufnol (T); Walter (P); Weymouth (DL, T, K); Whiteley (CR, CPS, T, K, V); Wimbledon (CR, EFC, DL, ES); Wingrove and Rogers (DR, T); Wolsey (CPS); Wright and Weaire (J, CPS).

**\*Abbreviations:** CPS, connectors, plugs and sockets; CR, cabinets, racks and chassis; DL, dials; DR, drives; EFC, eyelets, fasteners and clips; ES, escutcheons; F, fuseholders; G, grommets; J, jacks; K, knobs; P, printed circuits; T, terminals and tag boards; V, valveholders.

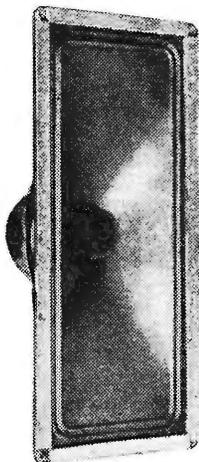
### Sound Reproducing Equipment.—

Most of this was also shown at the Audio Fair and is discussed in our report on that exhibition. Some loudspeakers made for set manufacturers were, however, only shown at the R.E.C.M.F. This year, apart from improvements in materials and manufacturing techniques, several new trends were apparent in this field. For example, several manufacturers, such as Rola Celestion and Elac, now offer small-diameter (generally 4-inch) speakers for use as "tweeters." By this simple size reduction a high-frequency response up to about 15 kc/s is readily obtained. The increasing use of transistors offers good possibilities of doing without an output transformer. For use in this kind of circuit R. and A. were offering centre-tapped voice coils of impedances up to 60 + 60 ohms in their 7 x 4-inch loudspeaker. Plessey were also showing a high-impedance (80 + 80 ohms) centre-tapped loudspeaker of 3-inch diameter.

For use in cases where it is important to save space Plessey were showing some "inverted" speakers with the magnet inside the cone angle. In some cases the magnetic flux return path was through the speaker chassis and ribbed structure in front of the cone. The same company were also showing a 9 x 4-inch loudspeaker with a rectangular cone.

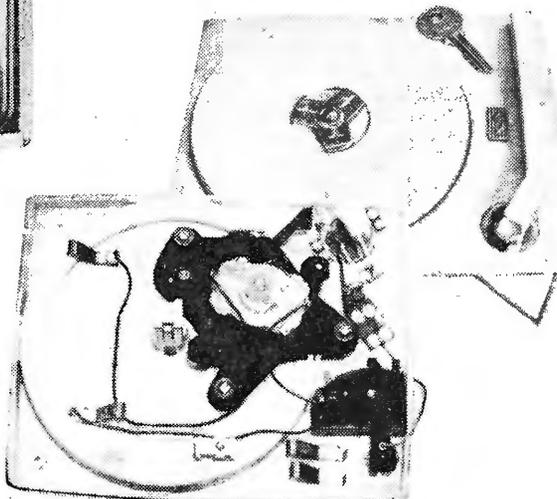
The cone area, and thus low-frequency reproducing power, are equivalent to that of an elliptical speaker of, say, 8 by 5 in. A new pressure unit for P.A. work (type LS9) which can be completely sealed against moisture was shown by Film Industries.

A very stylish-looking record changer with the usual facilities was shown by Staar Electronics. An experimental transistorized transmitter and receiver (which actuated a relay) gave remote-control rejection or repetition on this changer up to 25 feet away. The same company showed a small ( $7\frac{1}{2} \times 6$ -in baseboard) battery-operated 45-r.p.m. single record player. The current consumption is only 27 mA and a centrifugal governor ensures a constant turntable speed within 2% for supplies of between 6.2 and 3.5 volts. The pick-up is protected when not in use. Manual movement of the protecting shell cleans the sapphire stylus by means of a built-in brush and engages the motor idling pulley. Collaro were showing a new 4-speed record changer (the Challenger) where the crystal pick-up measures the diameter of the record before it is dropped and adjusts its lowering position accordingly. The mechanical construction has been considerably simplified.



Above: Plessey rectangular loudspeaker

Right: Staar 45 r.p.m. battery record player and (inset) underneath view



"Scotch Boy" were showing a new instrumentation tape and also a strong PVC-base tape with the normal brown oxide coating. A new barium titanate turnover pickup cartridge was shown by Sonotone. The tracking weight is 9 grams and the compliance  $0.8 \times 10^{-6}$  cm/dyne. The output is 0.13 volts at 1 kc/s on Decca test record LXT269.

**Manufacturers:**

Loudspeakers:—Richard Allan, Elac, Film Industries, Goodmans, Plessey, R. and A., Rola Celestion, Truvox, Vitavox, W.B. Magnetic Tape:—Scotch Boy. Pickups and Microphones:—Collaro, Cosmocord, Film Industries, Garrard, Goldring, Lustraphone, Simon, Technical Ceramics, Vitavox, Walter, W.B. Tape Recorders:—Collaro, Simon, Truvox, Walter, Wearite. Turntables:—Collaro, Garrard, Staar.

**Materials.**—Insulators and dielectrics for operation at temperatures of 500°C or higher have been investigated by S.R.D.E. (Ministry of Supply) and one of the most promising is boron nitride, which is a talc-like material normally available as a powder. It can be aggregated by hot pressing and the resultant mass has good mechanical strength, though this is anisotropic and the transverse strength perpendicular to the direction of pressing is less than the strength parallel to it. The dielectric loss ( $\tan \delta$ ) decreases with frequency; at room temperature it is 0.0006 at 1 kc/s and 0.0001 at 100 Mc/s in a vacuum-dried specimen, though without special preparation it may be an order higher. There is an increase of about 10 in the loss at 500°C compared with room temperature. The permittivity is of the order of 4.7.

A co-polymer of styrene known as Styrene DVB was also shown by the Ministry of Supply. It has r.f. properties similar to polystyrene but greater resistance to solvents and a

softening point at 130°C compared with 102°C for the normal polymer.

Copper-clad, resin-bonded glass fibre sheeting now made by Thomas De La Rue (Delaron) for printed circuits has exceptional solder resistance and can be dipped for periods up to 2 minutes at 260°C.

Epoxy resins are being used more widely than ever, not only for encapsulation by gravity casting, but for coating by dipping. To save the time and cost of successive coatings Aero Research have developed a grade which will give the necessary thickness by a single immersion. An exceptionally long "pot life" is claimed for this new mix.

Ferrite magnetic materials, once virtually a monopoly, are now being produced by a number of firms. Ferranti have developed a manganese-magnesium ferrite (type F5X) for use in X-band waveguide isolators and switches. Its properties are: specific rotation 30°/cm; microwave loss 0.09 dB/cm; figure of merit 330°/dB; permittivity 12.

Permanent magnets of barium ferrite ( $\text{BaO} \cdot 6\text{Fe}_2\text{O}_3$ ) are being produced by both Darwins and Swift Levick under the name "Feroba." The latter firm make two grades with remanence of 2000 or 3500 gauss coercivity of 1600 or 1400 oersteds and  $(\text{BH})_{\text{max}}$  of 0.8 or 2.5 mega-gauss-oersteds. Principal advantages of these ceramic magnets are their resistance to demagnetization, light weight (5gm/c.c) and the fact that they are electrical insulators.

**Manufacturers\*:** Aerialite (C, IS, W); Aero Research (IM); Anglo-American Vulcanized Fibre (IM); Associated Technical Manufacturers (C, IM, W); Bakelite (IM); Geo. Bray (CE); B.I. Callenders (C, S, W); British Moulded Plastics (IM); Bullers (CE); Clarke (IM, IS); Connollys (C, IM, W); Cosmocord (CF); Creators (IM); Darwins (M); De La Rue (IM); Duratube and Wire (C, W); Ediswan (IM); English Electric (L); Enthoven (S); Ferranti (F); Fine Wires (W); Fortiphone (C); Hellerman (IM); Henley's (C, IM, W); Insulating Components and Materials, Ltd. (IM); Langley London (IM); Linton and Hurst (L); Lion Electronic Developments (IM); London Electric Wire and Smiths (W); Long and Hambly (IM, RP); Magnetic and Electrical Alloys (L, M); Marrison and Catherall (M, L); Mica and Micanite Supplies (IM); Micanite and Insulators (IM); Minnesota Mining (IM); Mullard (DC, F, M); Multicore (S); Murex (RM, M); Mycalex (IM); James Neill (M); Permanoid (C, IM, W); Salford (DC, M); Geo. L. Scott (L); Shell Chemical (IM); F. D. Sims (C, W); Standard Insulator (RP); S.T.C. (M); Steatite (CE); Suflex (IM, W); Swift Levick (M); H. D. Symons (IM); Technical Ceramics (PC); Telcon (C, DC, IM, L, M., RM, W); Telephone Manufacturing Co. (DC); Thermo Plastics (IM); Tufnol (IM); United Insulator (CE, IM); Vactite Wire (RM, W); Wandleside Cable Works (C, W); Whiteley Electrical (M); Henry Wiggin (RM).

\*Abbreviations: C, cables; CE, ceramics; DC, dust cores; F, ferrites; IM, insulating materials; L, core laminations and strip; M, magnets and magnetic alloys; PC, piezoelectric ceramics; RM, refractory metals; RP, rubber products; S, solder; W, bare or covered wires.

# LETTERS TO THE EDITOR

The Editor does not necessarily endorse the opinions expressed by his correspondents

## Audio Fair

AS I fought my way round this year's Audio Fair I wondered increasingly how much valid judgment was possible on these occasions. With increasing perfection any weak link in the reproducing chain produces a greater effect, and the variability of recordings is also more apparent.

Thus, to give some examples, A's loudspeaker which you have every reason to expect should sound very similar to B's does not sound as good. But is the reproduction somewhat muffled because A has a smaller room than B? C's loudspeaker sounds rather boomy. But perhaps the boom is in the type of recording C likes, or has he been careless about recording compensation at the lowest frequencies? D's loudspeaker seems to have some distortion in the treble. Is this because he is using a slightly inferior pickup or has adjusted the tracking weight too low? E's new amplifier does not sound very good, but then one feels he is not using very good speakers.

It should be possible to settle on an amplifier and pre-amplifier good enough to please everyone. In that case we only need to test loudspeakers and pickups in the same large room, using the same records, the same pickup for testing loudspeakers and vice versa, with the same sound levels and the same position for each speaker. Allowance must also be made for the fact that, quite apart from auditory fatigue which may also occur, one's sensitivity to high notes varies at different times.

Edgware.

D. J. KIDD.

## Quam Ridiculum Hoc Est

SOME of your light-hearted readers may be interested in my new definition of "j" which reads as follows:—

"The numerical value in ohms of a resistor which, when wired in series with a 1Ω resistor, provides twice the resistance of that resulting when these resistors are wired in parallel."

Proof:—

$$\frac{2R_1R_2}{R_1 + R_2} = R_1 + R_2$$

Then by substituting the values of 1 for  $R_1$  and  $j$  for  $R_2$

$$\frac{2j}{1+j} = 1+j$$

$$1 + 2j + j^2 = 2j$$

$$1 + j^2 = 0$$

$$\text{Hence } j^2 = -1$$

$$\text{and } j = \sqrt{-1}$$

with which no student will disagree.

Reading.

W. CLARKE RIDDIFORD.

## Television Coverage

THE B.B.C. Blaen Plwy television/v.h.f. sound transmitter, which has just started operations, serves a population of 72,000 at a cost of £250,000. Good luck to Wales, but we of the city of Sheffield could wish the B.B.C. would spend but a fraction of this amount to give a worthwhile service to a very large proportion of our half-million population.

Situated at 18 miles from the main transmitter at Holme Moss, we have 107,000 TV licence holders for which at the new rate we shall pay £428,000 per annum. Our problem is multi-path reception owing to the topography of our terrain, and figures issued by the Post

Office reveal that 55 per cent have satisfactory reception, 4 per cent have no reception and 41 per cent have need of directional aerials. These latter range from three-element to the double H, of which we have masses. A simple reckoning will show that at £10 extra for each aerial of 41 per cent of 107,000 and our city has met an excess capital outlay for aerials alone of over £½ million; further, it is no cure, but only makes the "ghosting" more bearable.

The 41 per cent mentioned are contained in three main areas and are sited favourably for coverage by a satellite transmitter with a five-mile radius. That seems the most economical solution of the problem, but perhaps your readers can think of something better.

Sheffield, 6.

T. PAYNE.

## Symbols and Nomenclature

THE recent inconclusive correspondence on the subject of symbols for equivalent current generators prompts me to make the following suggestions:—

The normal symbol for an alternating voltage source

is  OR . The surrounding circle suggests

the zero output impedance of the source. I suggest, by analogy that, for an alternating current source, the

symbol  OR  should be adopted. This has

the advantages of (i) indicating the open-circuit nature of the source, (ii) being similar in character to the a.v. symbols, and (iii) being very simple. The sine wave could, of course, be set horizontal, but my suggestion has the advantages of keeping the two symbols more distinct, and also of not being far removed, at least in my handwriting, from the italic letters *v* and *i*, which are widely used as the corresponding algebraic symbols. The symbols I would suggest for direct voltage and

current sources are then  AND , which are

even more obvious in their derivation.

Cambridge.

B. M. HARDISTY.

DISCUSSION about nomenclature in the field of transistor physics and engineering cannot be too long at this stage. As an experiment a small survey has been conducted to decide what is understood by transformer "turns ratio."

The question posed was:—

What do you understand by a turns ratio of (a) 1:3, in terms of number of turns, in the following cases?

*Example 1.*—A transformer designed to be fed from a single-phase supply and to provide h.t., a.c. supply to a bi-phase rectifier, e.g., the type of transformer generally found in radio mains supply units.

*Example 2.*—A transformer designed for phase-splitting between l.f. sections of an amplifier having a push-pull output stage.

And (b), what is understood by a turns ratio of 18:1

(in the same terms), in a transformer designed to match a push-pull stage to its load?

The replies showed that the expression of turns ratio simply as 1:3 or 18:1 was not sufficiently explicit. If the ratios had been expressed as 1:3+3, 1:3+3 and 9+9:1 respectively, and if this type of nomenclature had been in use since the innovation of the term "turns-ratio," probably the differences between replies would not have existed.

The simple example given shows that careful attention to the choice of nomenclature is of the utmost importance in the initial stages of development of new ideas. It also infers that, in some cases, even when techniques have been established for quite a long time, there is room for improvement in terminology.

Evesham.

JOHN R. GREENWOOD.

### The Short-circuited Screen

IN an article on the short-circuited turn in the March issue of *Wireless World* I suggested that there was something wrong with equation (87) on page 71 of Terman's "Radio Engineers' Handbook." Mr. E. A. W. Hoff of Welwyn Garden City has pointed out that by the use of two other equations given by Terman the error can be exposed.

On page 55 (*loc. cit.*), Terman gives for the low-frequency inductance of a single-layer coil an expression due to Wheeler:—

$$L = r^2 n^2 / (9r + 10l) \text{ microhenrys} \quad \dots (37)$$

Where  $r$  is the radius and  $l$  the length, in inches.

On page 71 (*loc. cit.*) Terman gives an expression for the mutual inductance between two solenoids:—

$$M = 0.0501 \frac{a^2 n_1 n_2}{g} \left( 1 + \frac{A^2 a^2}{8g^4} \left( 3 - 4 \frac{l^2}{a^2} \right) \right) \mu\text{H} \dots (86)$$

Fig. 43 (*loc. cit.*), which shows the meaning of the various symbols, is slightly ambiguous because it looks as though  $l/a = x/A$ .  $g^2 = A^2 + x^2$ . In this expression the length is  $2l$ .

Mr. Hoff suggests that we take  $a = l$ ,  $A = x$  and  $a = pA$ , so that

$$\begin{aligned} M &= 0.05 \cdot \frac{a^2 n_1 n_2}{a p \sqrt{2}} \left( 1 + \frac{p^2 a^4}{16 p^4 a^4} (3-4) \right) \\ &= 0.05 \cdot \frac{a n_1 n_2}{p \sqrt{2}} \left( 1 - \frac{1}{16 p^2} \right) \end{aligned}$$

$$\begin{aligned} \text{Now we also have } L_a &= a^2 n_1^2 / 29a = a n_1^2 / 29, \\ \text{and } L_A &= A n_2^2 / 29. \end{aligned}$$

The coefficient of coupling,  $k$ , is given by

$k^2 = M^2 / L_a L_A$ , and if we neglect the second term in the bracket for  $M$ :—

$$\begin{aligned} k^2 &= \left( \frac{1}{20} \right)^2 \cdot \frac{a^2 n_1^2 n_2^2}{2p^2} \cdot \frac{(29)^2}{a n_1^2 \cdot A n_2^2} = \left( \frac{29}{20} \right)^2 \cdot \frac{1}{2p^3} \\ &= 1.05 \cdot \frac{1}{p^3} \end{aligned}$$

Terman's equation (87) is given as  $k = a^2 / A^2 x (= 1/p^3)$ . It seems pretty clear, therefore, that, as we suspected, it should read  $k^2$ .

THOMAS RODDAM

## COMMERCIAL LITERATURE

**Rectifier/Stabilizer** for mains/battery portables using miniature valves with 25-mA filaments. Consists of two small selenium rectifiers on same insulated spindle, the first for obtaining 1t. from the mains transformer, the second acting as a filament voltage stabilizer. Two ratings are available. Booklet of 20 pages, giving characteristics and circuit design procedure with many curves, from Standard Telephones and Cables, Edinburgh Way, Harlow, Essex. Also a booklet on 10-mA tubular rectifiers.

**Communal Aerial System** for blocks of flats, hotels, etc., covering Bands I, II and III. The output of the master aerial array is fed through wide-band pre-amplifiers and cross-over filter units to distribution boxes, from which it is distributed to various coaxial outlets. Descriptive leaflet from Aerialite, Castle Works, Stalybridge, Cheshire.

**Ex-Government Equipment** of all kinds and radio control gear. An illustrated catalogue of 480 items for mail orders from Arthur Sallis, Radio Control, 93 North Road, Brighton, Sussex, price 2s including postage.

**Materials Research Service** offered by independent laboratories under conditions of secrecy. Activities cover electrical ceramics, ferrites, piezoelectric materials, ferroelectric crystals, scintillation screens, vacuum techniques, glass-to-metal bonding, hermetic sealing, resin encapsulating, capacitors, resistors, printed circuits and many others. Leaflet from G. V. Planer, Windmill Road, Sunbury-on-Thames, Middlesex.

**Signal Strength Meter**, covering Bands I, II and III, with meter indication in  $\mu\text{V}$  and  $\text{mV}$  up to 100mV. Uses a standard turret tuner, with 34-38Mc/s output, which can be used as a substitute for testing suspected tuners in receivers. Leaflet from Lab-Craft, 71 Netley Road, Newbury Park, Essex.

**Servomechanism Equipment**, comprising synchro transmitters, receivers and resolvers, tachometer-generators and induction motors. Performance figures and installation diagrams in an illustrated brochure from Ketay, Eddes House, Eastern Avenue West, Romford, Essex.

**Air-Powered Drill**, 6in long and weighing under 25oz. Is fitted with  $\frac{1}{4}$ -in Jacob's chuck and has built-in oiler. Runs on ball bearings at 3,000 or 5,000 r.p.m. (according to type). Descriptive leaflet from Consolidated Pneumatic Tool Co., 232 Dawes Road, London, S.W.6.

**Radio and Electrical Books**, also general physics, sound, light, mathematics and statistics. An Autumn, 1956, catalogue from Cleaver-Hume Press, 31 Wright's Lane, Kensington, London, W.8. Publications of Philips Technical Library are also included.

**Bench Storage Trays** for components used in assembly. Interlocking square types and new large polythene types illustrated in a leaflet from Precision Components (Barnet), 13 Byng Road, Barnet, Herts.

**Plastics in Electronics** is among the subjects dealt with in a booklet "Plastics Review" issued by Bakelite, Ltd., 12 Hobart Place, London, S.W.1.

**Recording Oscillograph**, primarily designed for seismic applications but with many other uses in the fields of vibration study and civil engineering, described in a leaflet from Seismic Instruments, Ltd., Granta Works, Cambridge. The firm is working in collaboration with Electro-Tech of Houston, Texas, whose seismic detectors are described in a separate pamphlet.

**"Inexpensive Pre-amplifier."**—A correction: In Fig. 3 the only earth connection between the playing desk and the pre-amplifier should be via the coaxial cable sheathing, and there should be a break in the heavy "earth" line at the bottom of the diagram; otherwise a loop is formed which may result in hum pick-up.

### IN OUR NEXT ISSUE

The July *Wireless World* will contain reports on exhibits at the Instruments, Electronics and Automation Exhibition, and a survey of test and measuring apparatus shown at several recent shows.

The second instalment of the article "Portable Transistor Receiver," unavoidably held over from this issue, and details of a pre-amplifier designed for use with the "88-50" power amplifier (April issue) will also appear in the July number

# Limiters and Discriminators for F.M. Receivers

By G. G. JOHNSTONE,\* B.Sc.

## 4.—SOME LESSER-KNOWN DISCRIMINATOR CIRCUITS

THE discriminators most commonly employed in f.m. receivers, the Foster-Seeley circuit and the ratio detector, were discussed in earlier parts of this series. In the present article it is proposed to discuss some of the lesser-known types of discriminator. The chief of these is the gated-beam discriminator. Whilst it is not widely used in f.m. receivers, it is, however, used extensively in television receivers in the U.S. for the demodulation of the frequency-modulated sound carrier.

**Gated-Beam Discriminator.**—This class of discriminator relies for its action upon the phase relationships between the voltages developed across two loosely coupled circuits. The circuit is given

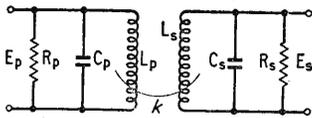
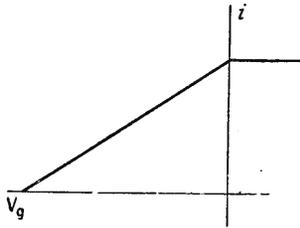


Fig. 1. Two coupled circuits; coupling coefficient  $k$ .

Fig. 2. Anode-current/grid-voltage curve of idealized valve.



in Fig. 1, and it was shown in the Appendix to Part 2 that the primary and secondary voltages are related by the expression

$$E_s = \frac{-jkQ_s \sqrt{L_s/L_p}}{1 + jQ_s y} \cdot E_p$$

where  $y = 2\delta f/f_o$ ,  $f_o$  is the resonance frequency of the secondary circuit, and  $\delta f$  is the difference between the frequency of the applied signal and the resonant frequency. This relationship is true whether the primary circuit is tuned or not.

At the resonance frequency the secondary voltage lags on the primary voltage by  $90^\circ$ . At a signal frequency displaced by  $\delta f$  from resonance the phase shift increases to  $90^\circ$  plus an angle given by  $\tan^{-1} Q_s y$ . This suggests that if it is possible to produce a signal with a magnitude dependent upon the phase angle between the two signals, a detector for f.m. signals will result. This is the principle embodied in the gated-beam discriminator. There is an additional complication in that both voltages tend to vary in amplitude with  $\delta f$ , so the detector must be insensitive to such variations. If this condition is met, the detector is similarly insensitive to a.m.

of the original signal and no separate limiter stage will be required.

The properties required in the detector can be realized by utilizing two input electrodes of a multi-element valve, such as a pentode. Ideally, such a pentode should have a control grid and a suppressor grid which have characteristics of the type shown in Fig. 2. The grid base should be short, and in the positive region the anode current should not vary with the bias; additionally, grid current should be small, to minimize damping of the input circuit. In an ideal pentode, the control grid determines the space current (anode and screen) through the valve, whilst the suppressor grid controls the ratio in which this space current divides between anode and screen. As the suppressor grid is biased negatively, a retarding field is set up in front of the anode, and an increasing proportion of the space current is reflected to the screen grid. When the suppressor grid is driven positive, the anode current does not increase appreciably above its value for zero suppressor bias, because all the electrons which pass the screen grid mesh must travel to the anode; the total current is not affected since this is determined solely by the control-grid and screen-grid potentials. Thus the ideal characteristic is approached fairly closely by a practical anode-current/suppressor-bias characteristic. The ideal characteristic is difficult to realize at the control grid because of the grid current which flows when the grid is driven positive. To obtain the desired performance a special form of construction has to be adopted, as in the valve type 6BN6.

An alternative way of avoiding this difficulty is to employ a multi-electrode valve with two "suppressor" grids, neither of which is immediately adjacent to the cathode. Such a valve is the nonode type EQ80, which has nine electrodes, as shown in Fig. 3.

In addition to the control grid proper, there are

\*B.B.C. Engineering Training Department.

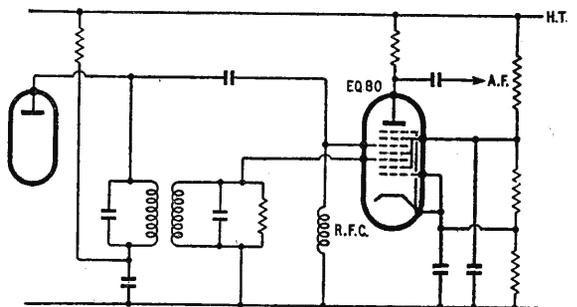


Fig. 3. Circuit for use with nonode discriminator.

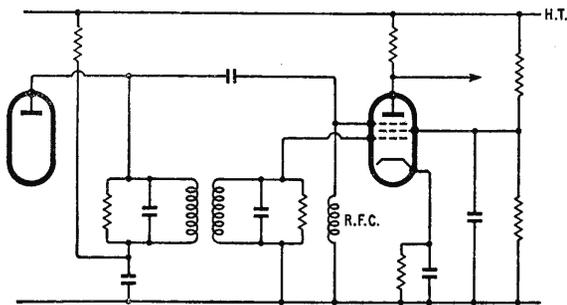


Fig. 4. Circuit for use with gated-beam discriminator.

two short-base grids, to which the input signals are applied. There are also three "screen" grids which serve to maintain the potential gradient through the valve and screen the input circuits from one another. The control grid may be biased to set the quiescent current through the valve.

The simple circuit employing an "ideal" pentode will serve to illustrate the method of operation of this type of detector; the circuit arrangement is as shown in Fig. 4. The quiescent bias at each grid is adjusted so that each is at the mid-point of its characteristic. The anode current of the valve is then one-quarter of the maximum value, which occurs when both grids are simultaneously at zero bias. The input signals applied to the two grids are taken from the primary and secondary circuits of the coupled pair. The coupling factor ( $kQ$ ) is usually in the region of unity, so that approximately equal primary and secondary voltages exist at resonance. If the signal voltages are sufficiently large, both grids are heavily overdriven. Consider now an input applied to one grid alone; anode current will flow in pulses, having a mark/space ratio of unity, as shown in Fig. 5. However, with an input to both grids, anode current can flow only when the signal at each grid is within the grid base. This is shown in Fig. 6, which shows the effect of applying each signal separately and together. The period of anode current flow is proportional to the overlap of the two sets of pulses. The amplitude of each resultant pulse is constant and hence independent of the input signal magnitude, so long as the condition of overdriving at each grid is maintained. The period of overlap of the pulses is proportional to the phase angle between the two sine waves giving rise to the pulses. At resonance, the phase difference is  $90^\circ$ , i.e., one-quarter of the wave period. Hence the mean anode current is one-quarter of the maximum current, i.e., it is equal to the anode current in the absence of input signals.

When the frequency of the input signal changes, the period of overlap changes, and hence the mean anode current varies with the signal frequency. Thus the audio output is directly proportional to the departure of the phase angle between the two input signals from the  $90^\circ$ -degree condition at resonance. It was shown earlier that this phase change is equal to  $\tan^{-1} -Q_s y$ , where  $y = 2\delta f/f_o$ . The graph of audio output plotted against frequency shift thus has the form shown in Fig. 7. In practice, the curve has turnover points, due to the selectivity of the tuned circuits, which reduces the drive to the grids. Typical turnover points are shown dotted in Fig. 7. From Fig. 7 it will be seen that the input

signal frequency shift/output characteristic is not truly linear anywhere, but offers a fair approximation to linearity in the region near the centre frequency. For a fixed frequency deviation, improved linearity can be obtained if the value of  $Q_s$  is lowered. However, this process cannot be carried too far, or difficulties arise in obtaining sufficient input signal for satisfactory limiting.

The expression for the audio output may be expanded as a power series as follows.

$$E \propto \frac{-Q_s}{f_o} \delta f + \frac{1}{3} \left( \frac{Q_s}{f_o} \right)^3 \delta f^3 \dots$$

With the EQ80 type of gated-beam discriminator an input of some 8 volts r.m.s. is required at each grid for satisfactory limiting to commence. This somewhat low sensitivity is probably one of the major reasons why this type of valve has not been more widely used. The audio output is of the order of 10 volts r.m.s. for a deviation of 75 kc/s; this is usually sufficient to drive an output stage directly without an intervening audio amplifying stage. The a.m. suppression ratio is between 25 and 30 dB, and this falls below the desirable limit of 35-40 dB. (The a.m. suppression ratio was defined in Part 3 as the ratio of the audio outputs due to the f.m. and a.m. components of an input signal simultaneously modulated by a.m. and f.m. to a modulation depth of 30 or 40 per cent.)

The 6BN6 gated-beam discriminator was discussed in detail in *Wireless World* (January 1957) by Lawrence W. Johnson, and reference should be made to this article for circuit details, operating conditions, etc. The a.f. output obtainable from this valve is of the order of 15 volts r.m.s. for a deviation of 75 kc/s. The input signal amplitude required at the control grid for limiting is 2 to 3 volts r.m.s. The a.m. suppression ratio is between 25 and 30 dB. This is below the desirable limit, and it would appear that the 6BN6 should be preceded by a further limiter. This reduces the attractiveness of the circuit, since its chief merit lies in its simplicity and cheapness.

The harmonic distortion can be evaluated approximately by means of the expansion for the a.f. output given previously. If the modulating signal is  $f_d \cos \omega t$ , the output is given by

$$E \propto \frac{-Q_s}{f_o} f_d \cos \omega t + \frac{1}{3} \left( \frac{Q_s}{f_o} \right)^3 f_d^3 \cos^3 \omega t$$

$\cos^3 \omega t$  may be expanded in terms of  $\cos \omega t$  and

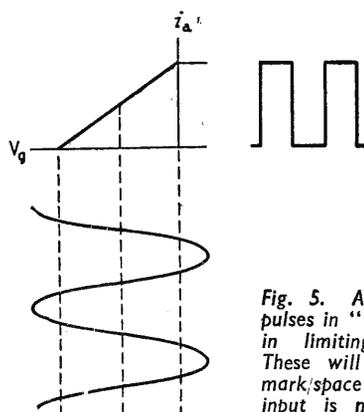


Fig. 5. Anode current pulses in "ideal" valve in limiting condition. These will have unity mark/space ratio if the input is much greater than is shown here.

Fig. 6. (a) Anode current pulses due to input at control grid alone. (b) Anode current pulses due to input at suppressor grid alone. (c) Anode current pulses with inputs at both control and suppressor grids.

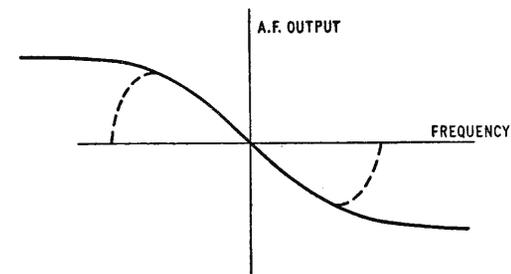
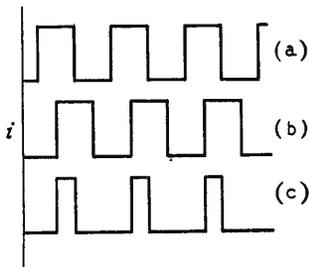


Fig. 7. A.F. output against frequency for gated-beam discriminator, assuming limiting at all frequencies. The dotted curve is that obtained in practice due to falling-off of signal amplitude with circuit selectivity.

$\cos 3\omega t$ , and the percentage of third harmonic distortion shown to be

$$\frac{1}{12} \left( \frac{Q_s f_a}{f_o} \right)^2 \cdot 100$$

With  $Q_s = 35$ ,  $f_a = 75$  kc/s and  $f_o = 10.7$  Mc/s, the third harmonic distortion is approximately 2 per cent.

There is one feature of the 6BN6 circuit given by L. W. Johnson which is not immediately apparent: this is the mechanism of coupling between the primary and secondary circuits. The circuit arrangement is as shown in Fig. 8, and at first sight there is apparently no coupling between the two circuits. In fact, there is the equivalent of top-end capacitance coupling, with the somewhat unusual feature that the coupling capacitor is a negative capacitor, i.e., it has positive reactance, like an inductor, but the magnitude of the reactance decreases with increasing frequency, as with a capacitor.

The mechanism of coupling is as follows. The input "primary" circuit voltage controls the total electron stream through the valve, and hence the anode current flowing past the suppressor grid is modulated at the input signal frequency. Now if an electric charge is brought near a conductor connected to earth, there is a movement of charge to the face of the conductor tending to neutralize the field of the approaching charge. This is a familiar phenomenon in electrostatics. A positive change of grid potential increases the number of electrons flowing through the valve, and hence increases the number of electrons in the vicinity of the suppressor grid. There is then an increase of the positive charge on the suppressor grid, which is the conductor past which the electron stream is flowing; and there is a movement of electrons from the suppressor grid through the external circuit.

If a change of grid voltage  $dv$  produces a change of

the charge  $dq$ , in the neighbourhood of the suppressor grid, we may write

$$dq = -a \cdot dv$$

where  $a$  is a positive constant.

The reason for the negative sign is that a positive increment  $dv$  increases the number of electrons in the vicinity of the suppressor grid, and since these are negatively charged there is a negative increment of charge. The increase of the charge near the suppressor grid induces a proportional charge  $dq'$  flowing out of the suppressor grid, and we may thus write

$$dq' = b \cdot dq$$

where  $b$  is a positive constant.

Thus

$$dq' = -a \cdot b \cdot dv$$

This may be compared with the relationship for a capacitor  $Q = CV$ .

From this it appears that the electron stream coupling is equivalent to a negative capacitor of magnitude  $a \cdot b$  connected directly between control grid and suppressor grid. This form of coupling occurs in all multi-electrode valves. In particular its effect has long been recognized in frequency changers where on short wavebands it may induce "pulling" of the local oscillator frequency. In this application neutralizing is effected by means of a small (positive) capacitor connected externally between the electrodes.

The degree of coupling obtained by this means is insufficient in the 6BN6 to produce adequate voltage drive at the suppressor grid, and is supplemented by means of the uncoupled anode lead resistor  $R$ , shown in Fig. 8. This resistor is of low value, usually a few hundred ohms. Under working conditions,

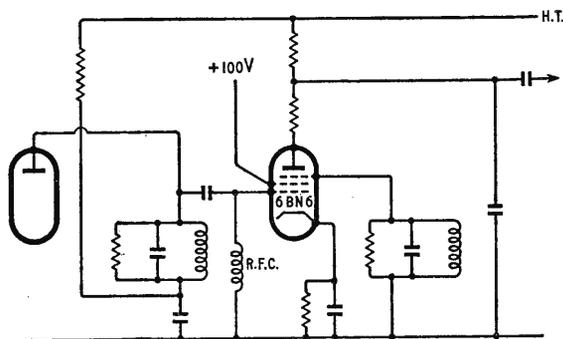


Fig. 8. Circuit used with 6BN6 gated-beam discriminator.

a voltage is produced across it which is in anti-phase with the control-grid voltage. We may write this anode voltage as

$$E_a = -c \cdot dv$$

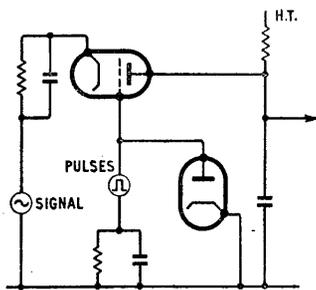
where  $c$  is the working gain of the valve at r.f. There is a physical capacitance which we may designate  $C_{a-su}$  between the anode and the suppressor grid, and hence current is fed through this capacitor to the "secondary" circuit. If the impedance of this circuit is  $Z$ , then the current  $i$  is given by

$$i = -c \cdot dv / (Z + 1/j\omega C_{a-su})$$

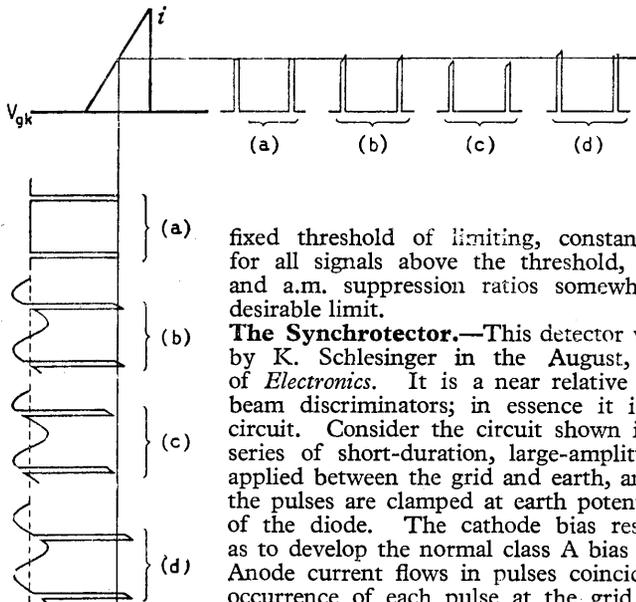
If the reactance of the capacitor is appreciably greater than  $Z$ , we may use the approximation

$$i = -c \cdot dv \cdot j\omega C_{a-su} = c \cdot dv \cdot j\omega (-C_{a-su})$$

i.e. this coupling also behaves like a negative capacitor connected directly between control and suppressor grids, and hence supplements the equivalent capacitance existing already.



Above: Fig. 9. Basic circuit of the synchrotector.



Right: Fig. 10. Showing how a.f. output from the synchrotector varies with phase angle between applied signal and sampling pulses; (a) no input signal (b) 90-degree phase shift (c) phase shift greater than 90 degrees (d) phase shift less than 90 degrees.

fixed threshold of limiting, constant a.f. output for all signals above the threshold, fair linearity, and a.m. suppression ratios somewhat below the desirable limit.

**The Synchrotector.**—This detector was described by K. Schlesinger in the August, 1956, issue of *Electronics*. It is a near relative of the gated-beam discriminators; in essence it is a sampling circuit. Consider the circuit shown in Fig. 9. A series of short-duration, large-amplitude pulses is applied between the grid and earth, and the tips of the pulses are clamped at earth potential by means of the diode. The cathode bias resistor is such as to develop the normal class A bias for the valve. Anode current flows in pulses coincident with the occurrence of each pulse at the grid as shown in Fig. 10(a). Consider now an input signal applied to the cathode, the frequency of the signal being the same as that of the grid pulses. The mean anode current will now vary according to the phase relationships between the applied pulses and the signal.

If the pulses occur at the instants when the signal amplitude is passing through zero, the anode current pulse is of the same amplitude as it is in the absence of the signal, as shown in Fig. 10(b). If the pulses occur when the signal is positive with respect to earth, the anode current pulses will be smaller in amplitude, because this condition is equivalent to a negative signal in the grid circuit, as shown in Fig. 10(c). Conversely, if the pulses occur when the signal is negative with respect to earth, the anode current pulses will be larger in amplitude, as shown in Fig. 10(d). Thus it is possible to construct a discriminator if the phase angle between the pulses and the applied signal can be varied with the signal frequency. A suitable circuit arrangement is that shown in Fig. 11. The grid pulses are now sine waves generated across a tuned circuit, fed by a small top-end capacitance from the applied signal source. As shown earlier, the phase relationship between the "secondary" circuit signal and the applied signal varies with the signal frequency, being  $90^\circ$  at a frequency near the secondary circuit resonance frequency. This can be shown simply for the top-end capacitor coupling circuit by Thévenin's theorem. The circuit of Fig. 12(a) is equivalent to that of Fig. 12(b), and it can be seen that the "secondary" voltage  $E_s$  is at  $90^\circ$  with respect to the "primary" voltage  $E_p$  when the secondary inductance is resonant with the capacitors  $C_s$  and  $C_t$  in parallel, i.e., at a frequency slightly below the resonance frequency of  $L_s$  and  $C_s$  alone.

In the practical circuit the voltage at the grid is about 3 to 4 times that at the cathode, so that the periods when the valve is conducting are relatively short. By assuming the pulses to be very short, it is possible to derive an approximation for the variation of anode current with signal frequency. The amplitude of the anode current pulses is pro-

An important distinction exists between two circuits coupled together physically, and the two circuits coupled together by the electron stream of a valve, as in the 6BN6. In the former case, the energy in the secondary circuit is supplied from the primary circuit, and consequently the shape of the resonance curve of the primary circuit is affected by the coupling to the secondary circuit. The response exhibits "rabbit's ears" similar to those obtained across the secondary circuit when the coupling factor ( $kQ$ ) exceeds the critical value. However, the primary circuit "rabbit's ears" are more widely spaced in frequency, and more pronounced. When the coupling is via the valve electron stream, the energy in the "secondary" circuit is supplied by the electron stream, and consequently the "primary" circuit resonance curve is unaffected by the presence of the "secondary" circuit. As a corollary of this, the resonance curve of the secondary does not develop "rabbit's ears" as the coupling factor increases, but remains single-peaked.

An interesting variant of the 6BN6 has recently appeared in the U.S. This valve is the 6DT6. This has sufficient internal coupling via the electron stream to produce adequate drive at the suppressor grid. At low input signal levels there is a gain from control grid to suppressor grid, and this fact is utilized to make the circuit self-oscillating at small signal inputs. The physical capacitance between the control and suppressor grids is made sufficiently large to maintain oscillation in the absence of an input signal, the suppressor grid functioning as an "anode." The oscillator is then of the tuned-anode, tuned-grid type. With a small input signal, the detector functions as a locked-oscillator limiter, as well as a detector. This action lowers the threshold value of input signal with which the detector will work; the 6BN6 requires an input of the order of 1 to 2 volts, whilst the 6DT6 requires an input of only 0.3 to 0.5 volts.

The properties of the gated-beam discriminators as a class may be summarized as good sensitivity,

portional to the sine of the angle between the zero value of the applied signal and peak value of the sampling pulse. Using  $y = 2\delta f/f_o$ , where  $\delta f$  is the difference between the signal frequency and the resonance frequency of the secondary circuit, this angle  $\theta$  is given by

$$\theta = \tan^{-1} - Q_s y$$

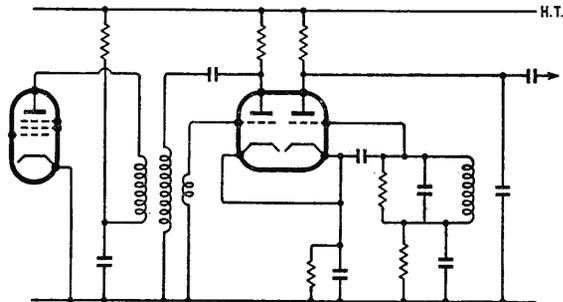
Hence the amplitude of the anode current pulses is proportional to  $\sin(\tan^{-1} - Q_s y) = -Q_s y / (1 + Q_s^2 y^2)^{1/2}$ . Provided that  $Q_s$  is small, the anode current is approximately linearly related to the signal frequency shift in a small region near the resonance frequency of the secondary circuit.

There is some degree of limiting action, since an increase of signal amplitude produces an increased amplitude of the "sampling" pulses. This results in the conduction period being shortened, which tends to reduce the increase of anode current which would otherwise occur. The circuit described by Schlesinger is shown in Fig. 13. The discriminator proper is driven from a locked-oscillator limiter. The circuit was designed for use with the U.S. television inter-carrier sound system, which employs a deviation of 25 kc/s at a carrier frequency of 4.5 Mc/s. The circuit is stated to give an audio output of 25 volts peak-to-peak, for an r.f. input to the driver stage of 6 millivolts. This represents a high conversion efficiency, being better than a comparable ratio detector circuit employing a driver stage and a double-diode-triode, the latter valve providing the detector diodes and a.f. amplifier. The circuit is claimed to have an a.m. suppression ratio greater than 40 dB.

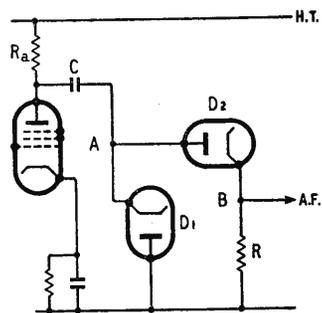
**Counter Circuit.**—If the incoming signal can be converted to a train of constant-amplitude pulses, demodulation can be effected by means of a "counter" circuit, which gives an output proportional to the repetition rate of the pulses. This type of circuit was discussed in some detail in the April, 1956, issue of *Wireless World* by M. G. Scroggie. The basic circuit considered by Scroggie is shown in Fig. 14. The incoming signal is heterodyned to produce an intermediate frequency signal at 200 kc/s approximately. After amplification, the signal is applied to a limiter stage, which gives a square wave

output. The pulses are then applied to the diodes D1 and D2.

Consider first the quiescent condition with the limiter stage cut-off. The anode potential is that of h.t., and there is no voltage across either diode, or the diode load resistor R. If now the limiter anode potential falls as its grid is driven positively, diode D1 conducts; diode D2 remains cut-off. Because of the high ratio of the resistance  $R_a$  to that ( $R_{di}$ ) of the diode D1 when conducting, the cathode of D1 is not driven appreciably negative with respect to earth,



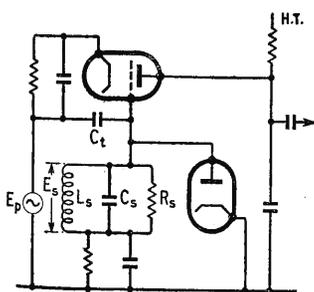
Above: Fig. 13. Practical circuit of synchro-trotor preceded by locked-oscillator limiter.



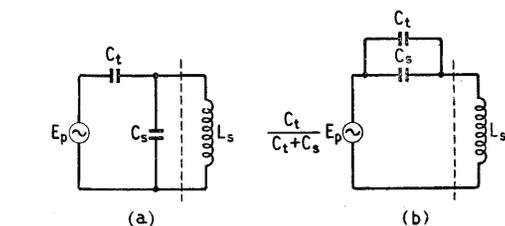
Right: Fig. 14. Basic "counter" circuit.

and capacitor C discharges through  $R_a$  and diode D1 is series until the cathode of D1 returns to earth potential. This is shown in Fig. 15(a). The discharging curve is exponential, and thus an infinite time is required theoretically for the cathode of D1 to reach earth potential; in practice the time constant  $(R_a + R_{di})C$  is sufficiently small for the potential of D1 cathode to be indistinguishable from earth before the next part of the cycle. After a period equal to half the signal period, the anode of the limiter is driven positive, as its grid is driven negative to beyond cut-off. The anode potential then commences to rise to h.t. potential, and current flows through  $R_a$ , C, D2 and R in series; the voltage across R is shown in Fig. 15(b). The time constant of the combination is such that the voltage pulse developed across R has virtually disappeared before the next change of limiter anode potential occurs, when the cycle is repeated. There is thus a train of pulses developed across R, the area (volt-secs) of which is independent of the magnitude and frequency of the input pulses. However, the mean voltage output is equal to the area of these pulses multiplied by the rate at which they occur, and this rate is, of course, equal to the input signal frequency. Thus the output voltage is apparently linearly related to the input signal frequency.

The linearity is, however, not perfect because the capacitor C cannot charge completely through R and



Left: Fig. 11. Circuit of synchro-trotor with sampling pulses derived from input signal.



Below: Fig. 12. Thévenin's theorem applied to circuit (a) to give circuit (b).

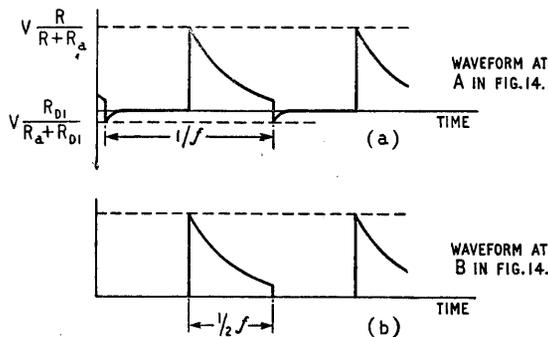


Fig. 15. Waveforms at points A and B of Fig. 14.

$R_a$  in the half-cycle period, as required. If the time constant is made very short to approach this condition of perfection, the area of the pulses becomes smaller and the a.f. output decreases. In a practical circuit, the component values adopted must be a compromise between the requirements of good linearity and sensitivity. In addition, in the circuit described by Scroggie, there is a limitation placed upon the value of  $R_a$  by the limiter requirements.

The degree of non-linearity can be calculated as follows. If the signal frequency is  $f$ , then the time of one pulse cycle is  $1/f$ . The combination of  $R_a$ ,  $C$  and  $R$  is thus charging for a period  $1/2f$ . If the amplitude of the voltage step at the limiter anode is  $V$  volts, then if the diode forward resistance is negligible, the voltage across  $R$  at the beginning of the charging period is  $VR/(R + R_a)$ . At the end of the period this voltage has fallen to

$$\frac{VR e^{-1/2fCR'}}{R + R_a}$$

where  $R' = R + R_a$

The area of the pulse is given by

$$\frac{VR}{R + R_a} \int_0^{1/2f} e^{-1/CR't} dt$$

which is equal to

$$VCR(1 - e^{-1/2fCR'})$$

The a.f. output is equal to the product of this area and the signal frequency, i.e.,  $VCRf(1 - e^{-1/2fCR'})$ . This may be compared with the "ideal" output,  $VCRf$ , obtained if the time constant  $CR'$  is very small. Thus the second term within the bracket represents the departure from linearity. It is minimized if  $f$ ,  $C$  and  $R'$  are small. However, the expression for the output voltage shows that if  $V$ ,  $C$ ,  $R$  and  $f$  are reduced to minimize non-linearity, the a.f. output will fall. Thus a compromise is required. The minimum value is further determined by the consideration that the signal frequency should not be allowed within the a.f. spectrum; thus with a deviation of 75 kc/s, the centre operating frequency must be above 90 kc/s, and preferably higher, to allow some margin for mistuning, drift, etc. Thus a centre signal frequency of 150–200 kc/s is usually employed. The use of a low-value intermediate frequency such as this brings other difficulties in its train, notably those of obtaining adequate i.f. selectivity, and the maintenance of second channel protection, since the second channel is only 300–

400 kc/s removed from the wanted carrier frequency. The circuit response curve is markedly unsymmetrical, having a comparatively large linear portion in the direction of increasing frequency, and a comparatively small linear portion in the direction of decreasing frequency.

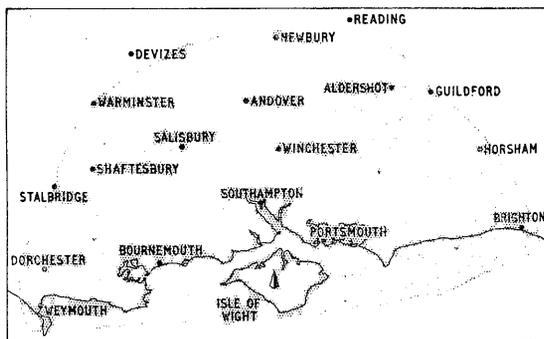
In the circuit described by Scroggie, the value of  $R_a = R = 4.7 \text{ k}\Omega$ ,  $C = 50 \text{ pF}$  and  $V = 60 \text{ volts}$ . The centre frequency is 150 kc/s. With these values, the r.m.s. a.f. output for 75 kc/s deviation is 0.8 volt. Scroggie also plotted the departure from linearity against frequency; the curve obtained agrees well with the curve obtained from the calculation given previously. The distortion, computed by Scroggie, was about 0.5 per cent second harmonic at maximum deviation.

The degree of a.m. rejection cannot be specified, since it is a function of the limiter performance; in general, it should be possible to realize a satisfactory performance in this respect. With regard to sensitivity, the circuit compares closely with the Foster-Seeley circuit, requiring about 2 volts input at the limiter grid for an output of about 1 volt. It has a fixed threshold of limiting, and constant audio output for all input signals above this threshold. As with the Foster-Seeley circuit, the maximum degree of "downward" a.m. handling capacity is dependent upon the margin by which the signal at the limiter grid exceeds the limiter threshold.

## REFERENCES

- "The Gated Beam Valve," by Lawrence W. Johnson, *Wireless World*, January 1957.
- "A Locked-oscillator Quadrature-grid F.M. Sound Detector," by J. Avins and Thomas Brady, *RCA Review*, December 1955.
- "Sampling Detector for Intercarrier TV Sound," by K. Schlesinger, *Electronics*, August 1956.
- "Low-distortion F.M. Discriminator," by M. G. Scroggie, *Wireless World*, April 1956.

## Southern I.T.A. Station



APPROXIMATE service area of the I.T.A.'s seventh transmitter, to be built at Chillerton Down, Isle of Wight, is shown shaded on this sketch map. It will probably come into service in the late spring of next year. No announcement has yet been made by the Post Office regarding the channel in which the station will operate. It is unlikely to use one of the three channels so far allocated to the I.T.A. owing to its geographical position in relation to the stations already operating in them.

# Manufacturers' Products

## NEW ELECTRONIC EQUIPMENT AND ACCESSORIES

### Improved "X" Aerial

FITTED with a new centre insulator and completely assembled in the factory, but collapsed for packing and transport, the new "Unex" Band I television aerial has only to be opened out into the familiar "X" form on the site before erecting. The four elements are finally locked in position by captive wing nuts.

Electrically its characteristics are similar to the earlier models, namely 3 dB forward gain and 25 dB back-to-front ratio. The acceptance angle is 176 deg.

The makers are Aerialite, Ltd., Castle Works, Stalybridge, Cheshire, and the price is £2 for the aerial alone or £6 15s complete with 10ft mast and double chimney lashings. Shorter masts, cranked arms and single lashings are also available.

### Miniature Micro-gap Toggle Switch

A NEW single-pole, on-off toggle switch of small dimensions for its rating (10 A at 250 V a.c.) has been introduced by Arcolectric (Switches) Ltd., Central Avenue, West Molesey, Surrey, and should find many applications in the larger types of electronic equipment.

Silver contacts are fitted and the design ensures a low contact resistance despite the very light operating pressure and micro-gap movement. It is well finished, and has a long pear-shaped dolly. The fixing bush is the customary toggle-switch pattern and requires a  $\frac{1}{2}$ -in diameter hole. An "on-off" marked plate is fitted. The single-pole switch costs 4s; a double-pole version will be available shortly.

### Constant-heat Soldering Iron

THERMOSTATIC control to prevent overheating when not in use is a very practical way of prolonging the life of a soldering iron. The Ceco iron, made by the Cardross Engineering Co., Ltd., Woodyard Road, Dumbarton, embodies a device of this kind. Normal

adjustment provides a working temperature of 230 to 250°C, which allows a comfortable margin over the melting point of 60/40 solder.

To alter the setting of the thermostat it is necessary to remove three screws and slide the wooden handle over the metal sleeve housing the heating element. The use of a solder thermometer, or its equivalent, is advised when changing the original setting.

The iron weighs  $4\frac{1}{2}$  oz, is quick heating and embodies a 70-W element. The price is 85s.

### Transistor Communications Receiver

SHOWN in the illustration is a transistor communications receiver designed especially for use in small sea-going craft, such as fishing vessels and private yachts, requiring a robust, compact and weather-proof set for receiving coastal and Consol beacons, weather forecasts and broadcast.

Known as the "Homer" it is a t.r.f. set covering 150 to 420 kc/s and 650 to 1,550 kc/s in three bands. There are two r.f. stages, a diode detector, a.f. amplifiers, BFO and push-pull output. Four 1.4-V Mallory cells give 500 hrs operation with telephones and 250 hrs with a loudspeaker.

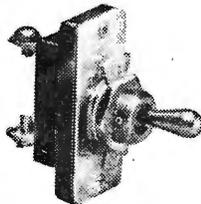
Provision is made for taking bearings on beacons using the "Heron" combined hand compass and ferrite-cored direction-finding aerial. This weighs only 17 oz and covers the beacon frequencies of 290 to 310 kc/s. For general reception an elevated aerial 20 to 60 ft long should be used.

The "Homer" receiver is hermetically sealed in a seawater-resistant light-alloy case measuring  $8 \times 4\frac{7}{8} \times 2\frac{7}{8}$  in overall. Components are to Services specification with sealed control shafts. A desiccating material is included in the case and the battery compartment is accessible without breaking the main seal.

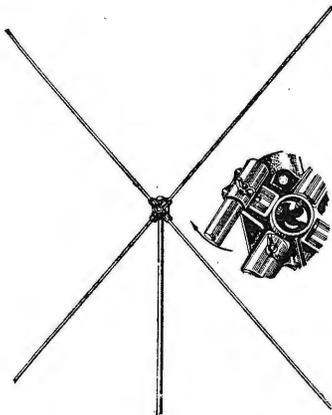
The makers are Brooks and Gatehouse, Ltd., Lymington, Hants. The set alone costs £37, and with "Heron" DF aerial £48.



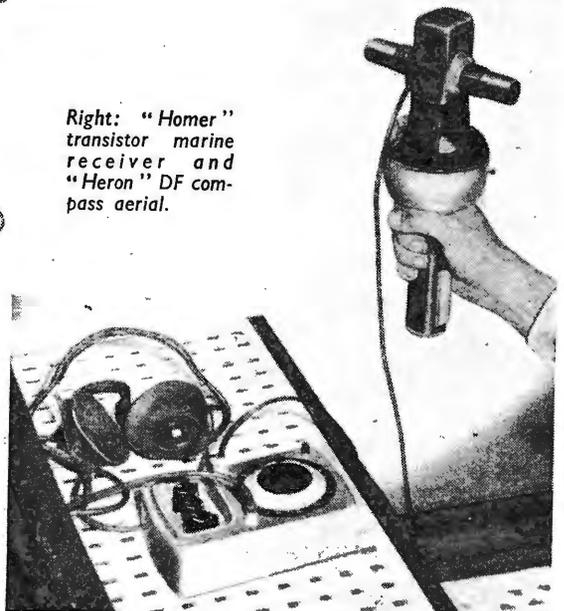
Ceco thermostatically controlled soldering iron.



Arcolectric miniature micro-gap toggle switch.



Left: Aerialite new "Unex" Band I television aerial showing (enlarged) how elements collapse for transport.



Right: "Homer" transistor marine receiver and "Heron" DF compass aerial.

# Valves and Semi-Conductors

DEVICES ON SHOW AT THE R.E.C.M.F. AND PHYSICAL SOCIETY'S EXHIBITIONS

**Receiving-type Valves.**—The idea of using valves for the r.f. stages of a receiver and transistors for the audio stages has been given practical support by both Brimar and Mullard, who have introduced new valves which will operate with only 12 volts on the anode (see April issue, p. 179). Of course, these valves can also be used for car radio. Brimar have the 12AC6 variable- $\mu$  r.f. pentode, 12AD6 heptode frequency changer, 12AE6 double-diode triode and the 12K5 audio driver tetrode. Mullard were showing the EBF83 double-diode variable- $\mu$  r.f. pentode, the ECH83 triode-heptode frequency changer and the EF98 audio driver pentode.

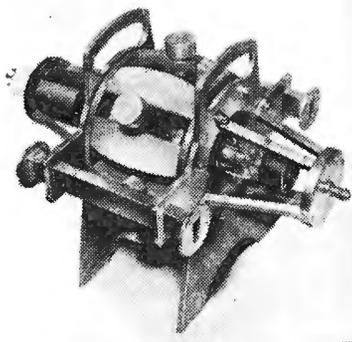
For wide-band r.f. amplifiers, S.T.C. have introduced the 5A/170K beam tetrode, which is notable for its high initial conductance of 16.5 mA/V and is said to have almost twice the gain-bandwidth product of conventional high-gain pentodes. It is mounted on the B9A base and has gold-plated pins. This firm also had a new miniature voltage stabilizer tube, G55/1K, with the low maintaining voltage of 55 V for its striking voltage of 90 V. The current can vary between 2 and 30 mA, and the regulation over the range is 3 V.

A miniature tuning indicator, EM840, shown by Brimar, has the luminous target deposited as a vertical strip on the glass envelope itself.

Each end of the strip luminesces, and on application of a control voltage the luminous areas extend inwards towards the centre. The indicator has a variable- $\mu$  characteristic and is therefore sensitive to weak signals. Brimar also had a miniature double triode, 5965, for digital computer circuits. It has a sharp cut-off characteristic and an ability to maintain its emission after long periods of cut-off operation.

**Transmitting Valves.**—A magnetron capable of producing the exceptionally high peak power of 1 megawatt under pulsed conditions was shown by Ferranti. Operating in the range 9,000-9,500 Mc/s at mean power levels up to 1 kW, it uses an electro-magnet and has a water-cooled anode with integral pole-pieces. The high mean power is made possible by a thorium-activated tungsten cathode which is heated to about 2,000°C by bombardment with an electron beam. An electron gun mounted in one of the pole-pieces provides this bombardment, and a beam current of 30 mA is required to obtain the correct temperature.

New travelling-wave tubes were shown by both English Electric and Mullard. The English Electric tubes range from 2 kMc/s to 4 kMc/s in operating frequency, while the latest Mullard type is for the 11-18 kMc/s band, over which it has a gain of 20 dB. Backward-wave tubes are re-



Mullard five-cavity klystron

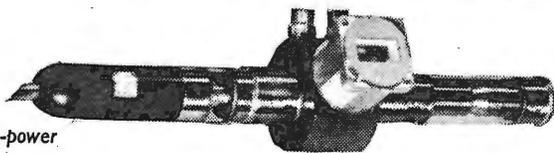
lated devices, but here the electron beam interacts with an electromagnetic wave travelling in the opposite direction. A wide frequency variation can be obtained in oscillators simply by altering the beam accelerating voltage. Two such backward-wave oscillators for the 1-5 kMc/s band were displayed by G.E.C. This firm also had a miniature magnetron on a B7G base, intended as a pulse test source.

Mullard were showing an unusual klystron (development model) incorporating five successive tunable cavities. The gain is equivalent to four separate two-cavity klystrons. It works in the 3-cm band, giving outputs of up to 5 watts. Normally the cavities are all tuned to the same frequency, and here the gain is 70 dB for a 2.5-Mc/s bandwidth. They can, however, be tuned to give a broad band of 25 Mc/s, at which the gain is reduced to 30 dB.

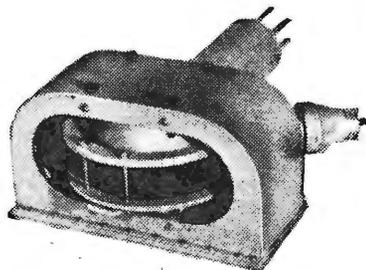
**Noise Generating Tubes** are often used in microwave superhet receivers as standards against which the receiver noise can be compared in order to measure the noise factor. A version introduced by Ferranti, the TE10, is a gas discharge tube which strikes at 1,150 V and maintains at 50 V, 35 mA. Intended for noise measurement in the "X" band, it is supplied with a waveguide mount which is normally tuned to a centre frequency of 9.375 kMc/s, but can be varied from 8.5 to 10.5 kMc/s. Diodes are also used as noise sources, and G.E.C. had a coaxial type, CV2341, intended for use up to 1,000 Mc/s.

**Power Transistors** are limited in output by their power dissipation

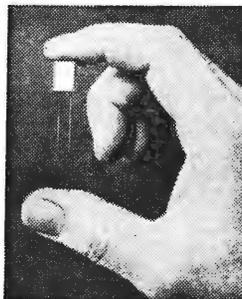
WIRELESS WORLD, JUNE 1957



Ferranti high-power magnetron



G.E.C. backward-wave oscillator



Cathodeon miniature quartz crystal

ratings and hence by their ability to conduct heat away. Much attention is therefore being paid to the design of structures with low thermal resistance. One of the latest types, produced by Sylvania-Thorn, has a total dissipation of 5 watts. Intended for servo-mechanisms and other industrial purposes, it will operate with a collector current of 5 amps at 25 volts, the alpha cut-off frequency being 400 kc/s. The GET8 and GET9 are comparable types made by G.E.C. Working respectively at supply voltages of 12V and 24V, they are mainly intended for use in class-B audio output stages, and a pair in push-pull will give output powers up to 20 watts. The GET7, working at 6V under similar conditions, will give 10 watts output from a push-pull pair. All these transistors depend on having good thermal connections to chassis or "heat sinks."

**Audio and R.F. Transistors.**—Two new additions to the Mullard range are the OC65 and OC66, which are special sub-miniature types for hear-

ing aids. They have common-emitter current gains of 30 and 50 respectively. The OC73, OC76 and OC77 are new types comparable with audio transistors but designed for switching and industrial applications. Improvements have been made in the ratings of the well-known OC70 and OC71, which will now dissipate 50 mW instead of 25 mW and operate with a maximum collector voltage of 15 V (30 V peak) instead of 5 V (10 V peak). In r.f. transistors, Mullard have added to their OC45 the OC44, which has the much higher alpha cut-off of 15 Mc/s and is intended for use in mixer/oscillator circuits (the OC45 is for i.f. amplifiers).

**Rectifiers.**—Selenium rectifiers are now undergoing considerable development, the most recent introduction being resin-encapsulated types (Salford and Westinghouse), and types for operation at high temperatures up to 125°C (Westinghouse). Germanium junction rectifiers are, however, supplanting metal rectifiers in many applications because of their

high rectification efficiency. As an example, Sylvania-Thorn were showing an hermetically-sealed type, XGR511, capable of passing 100 A mean d.c. with a maximum peak inverse voltage of 50 V. Another one, the XGR411, could pass 10 A with a maximum p.i.v. of 50 V, and four of these were shown in a full-wave bridge circuit giving 20 A at 30 V. This firm also had a small wire-ended silicon junction rectifier giving 35 mA mean d.c. with the low reverse current of 1 μA at 100 V.

**Quartz Crystals** are being made to operate at higher and higher frequencies by the use of overtones; S.T.C., for example, had production models going up to 5.2 Mc/s and laboratory samples to 100 Mc/s. Usually the third or fifth overtone of the fundamental frequency is used. For v.h.f. applications where space is limited, Cathodeon have introduced an overtone model for frequencies between 20 Mc/s and 60 Mc/s which measures only 0.52 in × 0.42 in × 0.17 in. It is primarily for "packaged" and transistorized circuits.

## C.R. Tubes and Photoelectric Devices

R.E.C.M.F. AND PHYSICAL SOCIETY EXHIBITS

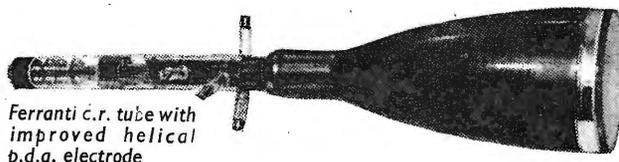
**Oscilloscope Tubes.**—When high-speed transient phenomena or u.h.f. signals are to be displayed, the main limiting factor is the time taken by the electron beam to traverse the Y deflection system. For example, in the Ferranti 5/62GM tube the Y-plate transit time of 2 millimicroseconds gives a response which cuts off above 1000 Mc/s and is 3 dB down at 400 Mc/s. A most unusual way of overcoming this transit-time effect was to be seen in the VCRX410 tube shown by G.E.C., which has a travelling-wave Y deflection system fed by a 70-Ω coaxial cable. The electron beam passes between the outside of a helix, as in a travelling-wave valve, and the inner surface of an enclosing cylinder. Thus the high speed transient, which would normally be too fast for the beam electrons in a conventional system, is made to travel as a wave alongside the electrons so that it can perform its deflecting function on them effectively.

This tube, intended for displaying pulse rise times of the order of a

millimicrosecond, uses post-deflection acceleration (30 kV) to obtain adequate brightness with the extremely high writing speed. Recently a continuous helical ring of resistive material, with a high voltage applied across it, has come into fashion for the p.d.a. electrode. It gives a potential gradient increasing evenly towards the screen and so avoids the lens effect which occurs between separate rings and also the

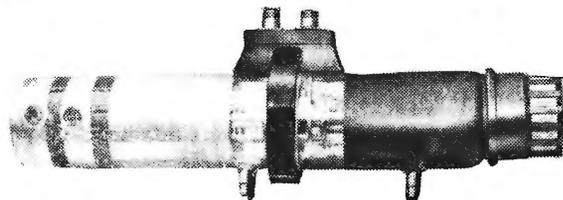
need for separate voltages. Examples were to be seen in tubes by Ferranti, G.E.C., Sylvania-Thorn and 20th Century.

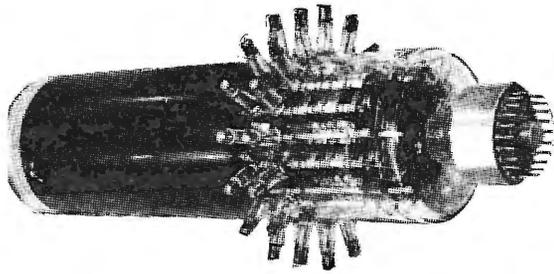
In one of the Ferranti tubes, a helical accelerator of novel design, becoming coarser in pitch towards the screen, gives a high deflection sensitivity which is substantially independent of the final anode voltage. Even with the high anode voltage of 7 kV a sensitivity 1 mm/V can be



*Ferranti c.r. tube with improved helical p.d.a. electrode*

*G.E.C. travelling-wave-deflection c.r. tube*





E.M.I. photoconductive camera tube

20th Century eight-gun c.r. tube



obtained, and with 0.75 kV on the anode the remarkable figure of 1 cm/V is achieved. Frequencies to over 500 Mc/s can be handled.

20th Century Electronics, who have specialized in multi-gun tubes for some time, have now produced a 5-inch tube containing as many as eight guns. The deflection systems are independent and each gun gives full coverage of the screen. Operating with 4 kV on the final anode, it has a deflection sensitivity of 0.23 mm/V. The face is optically finished, while the numerous deflector-plate connections are brought out to side caps.

**Photoconductive Devices.**—Cadmium sulphide photo-cells are notable for their high sensitivity compared with selenium cells. Two types shown

by G.E.C. had an efficiency of about 1 amp/lumen with an illumination of 2-3ft candles, the maximum ratio of photo to dark current being  $10^6$ . A powder-layer type can be made to pass photo-currents in excess of 1 amp. The cells are slow in response compared with photoemissive types but can be made to operate relays directly. Selenium cells available in potted form were displayed by Megatron, while S.T.C. had some new and extremely small germanium junction photocells, intended for scanning punched cards and tape, with a diameter of only 0.08in.

The photoconductive pick-up tube is now being used extensively in industrial television equipments, and E.M.I. were showing a 1-inch-diameter type which is physically

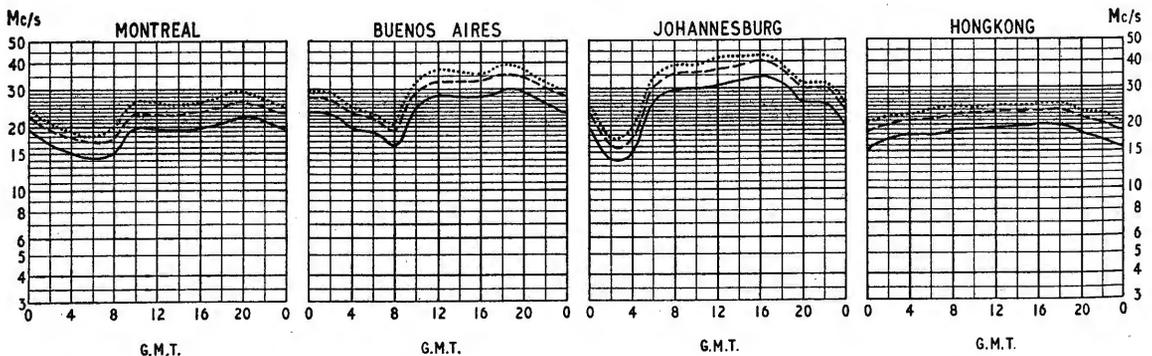
interchangeable with the well-known Vidicon. It has a resolution in the centre of at least 1,000 lines and 600 lines at the corners, while the possible contrast range is 100:1. The sensitivity is high, as with all photoconductive tubes, and a high-light brightness on the scene as low as 21 ft-lamberts will give a minimum signal current of  $0.2 \mu\text{A}$  with a lens aperture of  $f1.9$ .

**Electroluminescent Cells**, as described in our March issue, were demonstrated in principle by both B.T.-H. and G.E.C., while Thorn had some actual models in commercial form intended for use in a digital computer. These were mounted five in a row on small strips of insulating material and could be switched on and off individually by application of a 250-V, 2-kc/s supply obtained from a transistor oscillator. Examples of electroluminescent signs and indicators were also on view. The G.E.C. exhibit, incidentally, showed an electroluminescent cell used in conjunction with a cadmium sulphide photoconductive cell to form a light amplifier—not an image amplifier but one of the very small units intended as a two-state element in binary computing circuits (see p. 132, March issue).

**Stroboscopic Light Sources** based on c.r. tubes were shown by Ferranti. Short single flashes or flashes at high repetition rates can be produced with durations limited only by the phosphor decay time.

## SHORT-WAVE CONDITIONS

### Predictions for June



THE full curves given here indicate the highest frequencies likely to be usable at any time of the day or night for reliable communications over four long-distance paths from this country during June.

Broken-line curves give the highest frequencies that will sustain a partial service throughout the same period.

- ..... FREQUENCY BELOW WHICH COMMUNICATION SHOULD BE POSSIBLE FOR 25% OF THE TOTAL TIME
- PREDICTED AVERAGE MAXIMUM USABLE FREQUENCY
- FREQUENCY BELOW WHICH COMMUNICATION SHOULD BE POSSIBLE ON ALL UNDISTURBED DAYS

# The Blocking Oscillator

A Bird That Needs a Separate Stone ?

By "CATHODE RAY"

**B**LOCKING oscillators are responsible for at least half the scanning in most television receivers. They perform equally essential duties in radar. Their place in the great new transistor empire already seems secure. Yet the authors of elementary—and even the not so elementary—books seldom have much to say about them. And what they do say isn't always quite as right as it should be.

For the blocking oscillator is one of those things that look simpler than they are. In a recent book, the author—one of the soundest authorities—confesses that in the previous edition his explanation of it was on the wrong lines. Other books I have consulted declare that the action of a blocking oscillator is so complex that a comprehensive analysis has never yet been made. Lately a whole book on it has appeared, but except for the warning that the usual explanation is inadequate I found it unsatisfying.

Before being too hard on technical writers for the present unsatisfactory information service on the subject, let's ask ourselves what we would do. Would we (1) explain it correctly and, therefore, complicatedly; (2) explain it simply and, therefore, incorrectly; or (3) not explain it at all. So far as I am concerned, having written the title at the head of the page, (3) is no longer open. Which of the other two I have gone in for, you will have to judge at the end; I hope the result will not be a hitherto unlisted combination—complicated and incorrect.

Fig. 1, subject to minor variations, is the circuit. We can see at once that it is simple. And so far as one can see from the diagram it is exactly the same as an ordinary "reaction coil" oscillator. With the addition of a variable capacitor for tuning, Fig. 1 could be used in almost any superhet. As regards both its simplicity and its resemblance to an ordinary continuous-wave oscillator, however, the circuit diagram is deceptive.

One of the principles of teaching is to make any one explanation cover as many things as possible. This spares both teacher and taught. Whichever of these roles I happen to be filling at any given moment, I entirely agree with the principle—provided it is correctly applied. The blocking oscillator, having essentially the same circuit diagram as an ordinary oscillator, clearly asks to be regarded as a special case of it. Such treatment is so very plausible.

It goes something like this. "When the coils  $L_1$  and  $L_2$  in Fig. 1 are inductively coupled in the appropriate direction, positive feedback causes continuous oscillation to be set up." Here follow a page or two, or even more, explaining this in detail. (The circuit diagram used will certainly show a capacitance across one of the coils, for the oscillations must have capacitance as well as inductance in which to circulate; but it is only fair to point out that a circuit made up as in Fig. 1 would nevertheless work, because of the existence of stray capacitance, not

actually shown.) Next follows at least a long paragraph explaining the role of C and R and how they automatically cause an appropriate negative bias to be applied to the grid, directly oscillation begins. At that point, if the author has room to spare and feels in a chatty mood, he is likely to go on to mention that if the coupling between  $L_1$  and  $L_2$  is too close, and especially if at the same time R is rather high, the amount of bias developed at the start of oscillation may prove too great to allow oscillation to continue, so it stops until the charge on C has leaked off through R sufficiently to allow it to start again, whereupon the whole sequence repeats indefinitely, and instead of Fig. 2(a) one gets (b), and one says that the oscillator is squegging.

Then, if the author remembers that there are such things as radar and television, so that sooner or later he will have to say something about blocking oscillators, he may see a golden opportunity to kill this third bird with the same stone, in accordance with the teaching principle just mentioned. So he goes on to say that if the coupling is tightened still more a cut-off grid bias will be developed by the very first half-cycle of oscillation, and grid-current damping is so great that no more than this half-cycle remains

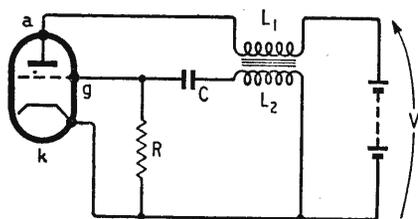


Fig. 1. Blocking oscillator circuit.

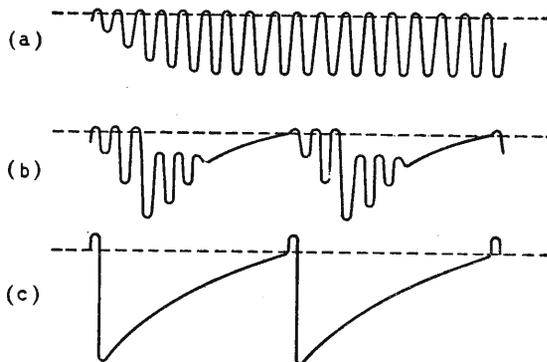


Fig. 2. (a) Start of oscillations in sine-wave oscillator in circuit very similar to Fig. 1 except for closeness of coupling. (b) Squegging condition obtained by increasing the coupling slightly. (c) Alleged result of tightening coupling to the limit.

per burst of oscillation; result, Fig. 2(c). "This saw-tooth shaped waveform finds application in oscilloscope time bases, radar, and—oh, yes!—in a little thing commonly called TV."

That—minus the lead-up on oscillators and squegging, which was taken as read—was more or less how the "pulse generator" was explained to me on the first "R.D.F." course in those hectic days of 1939. I remember being a shade doubtful even then about the "single half-cycle followed by heavy damping" theory; but there was no time to go into refinements, and any reasonably plausible explanation was reckoned to be better than none. The main thing was to have something that worked; if a convincing theory could be thought up to account for it, so much the better.

This is just one example of a big ethical problem in teaching. Is one justified in pitching a tale known to be inaccurate, because the best knowledge on the subject would be far above the head? Even if

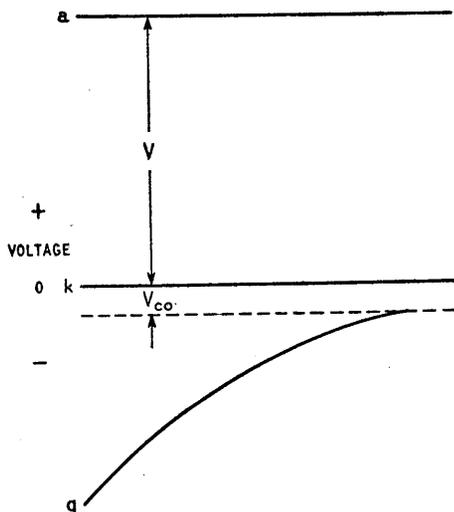


Fig. 3. Electrode potentials of valve in Fig. 1 during discharge phase of blocking oscillator cycle. The dotted line marks the minimum cut-off grid bias,  $V_{co}$ , when the anode is at  $+V$  volts.

one knows that the Fig. 2 theory of the blocking oscillator doesn't hold water at every point, it is at least roughly true and capable of satisfying almost all except the specialists who design blocking oscillators (if, in fact, they ever are really designed!). So ought one not to give it, rather than a more academically correct theory that is generally agreed to be difficult and, therefore, only likely to confuse?

Well, it's not for me to pronounce on the general principle, but the object of this series is to look rather more closely into things than there is space for in the average book or teaching course, so let us try to find an approach that is not too far removed from truth on the one hand nor too complicated to follow on the other.

Now although the circuit of a blocking oscillator (Fig. 1) looks the same as that of a sine-wave oscillator, and although the derivation of one from the other along the lines of Fig. 2 has obvious attractions as regards plausibility and economy of effort, the explanation of continuous oscillation in the Fig. 2(a) case will not—if it was anything like a correct and adequate one—be found to fit very well when

applied directly to the Fig. 2(c) case. In other words, acceptance of the statement that (c) shows half a cycle of the oscillations seen earlier at (a) is rather like accepting a conjuror's box containing a rabbit as the same box as the one we saw him pouring a jugful of water into a moment or two earlier.

One inconsistency is that sine-wave oscillation in Fig. 1 depends essentially on capacitance as part of the oscillatory circuit, whether it is provided by an actual capacitor or exists only as "stray"; whereas although stray capacitance inevitably exists and plays a part in a blocking oscillator, it is only a subsidiary part. A blocking oscillator, both in operation and in the nature of its waveform, really belongs to a different class; it is a relaxation oscillator\*. So let us regard any resemblance between it and the sine-wave sort as purely coincidental and start afresh.

It was at this point I began gathering together the basic principles that govern relaxation circuits—the results of switching combinations of resistance and capacitance or resistance and inductance—and found that the review expanded into a full instalment, which was published last month. There was the well-known charge and discharge of a capacitor, leading to the definition of time constant; and the not quite so well known "charge" and "discharge" of an inductor, especially one provided with two close-coupled windings. I hope this review is at hand for reference, because there will not be room even to summarize it all. I will only re-emphasize that just as the voltage across a capacitor cannot change abruptly, but only as a result of current flowing into or out of it for a time, so the current through an inductor cannot change abruptly, but only as a result of voltage across it for a time. And that any change of current through it induces a voltage proportional to the rate of change and to the amount of inductance; and that where there are two or more close-coupled windings this change refers to the resultant of them all.

The only other thing we need is a very elementary knowledge of the behaviour of a valve at extremes of grid voltage. We can pretty well cover it by saying that when there is a large negative bias on the grid the valve is "cut off," so that there is no circuit through the valve from either grid or anode; but when a positive voltage is applied to grid as well as anode, both conduct freely to cathode.

We are now all set to consider Fig. 1 as a blocking oscillator, for in that role it is essential for the coils to be coupled tightly by means of an iron core, and it is quite usual for them to have equal numbers of turns (as conveniently assumed in our theory last month). Inequality of turns complicates the reckoning but in no way affects the general principle, so for that our simple preparations will do.

With a process that goes round and round in a circle, without any beginning or end, the first problem is to decide where to join in. The blocking oscillator cycle consists broadly of two phases: one of them is usually a small fraction of the whole and has lots of things happening very quickly, so doesn't make the easiest introduction. The preferred procedure is to start with the longer and slower phase, which we have already studied under the heading of discharge of a capacitor.

C in Fig. 1 is the capacitor, and it has previously

\* April 1954 issue, p. 193.

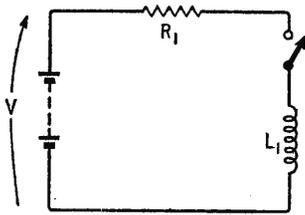


Fig. 4. The start of anode current at the end of Fig. 3 is equivalent to closing the switch in this simple circuit, discussed fully last month.

been charged, in what manner we shall see later, in such a way that the plate connected to the grid is negative. It is discharging through  $R$ , and because  $R$  is quite high—say  $100k\Omega$ —it damps out any tendency for  $C$  to form an oscillatory circuit with  $L_2$ . It is also large enough for nearly all of the voltage of  $C$  to appear across it, and therefore as negative bias for the valve. The amount of this voltage at the start of the discharge phase was far more than enough to cut the valve off completely. So the valve (and  $L_1$ ) can be ignored during this phase. The only addition to the simple CR discharge circuit is  $L_2$ , and it is insufficient in comparison with the large  $R$  to make any vital difference. So we can copy our discharge exponential curve, upside down to represent the fact that the voltage is negative from the valve grid's point of view. Because there is no anode current, and since we are neglecting any voltage induced in  $L_1$  by the slow rate of change of current through  $L_2$ , we can show the anode voltage as constant at  $+V$ . Fig. 3 tells the story. The dotted line marks the minimum negative bias (call it  $V_{\infty}$ ) needed to cut off the valve at this anode voltage. Although  $C$  is not fully discharged by the time the negative bias it imparts to the valve has declined to the dotted level, we must regard it as the end of the phase, for directly it is reached things begin to happen—suddenly.

Seeing how gradually the grid potential eases towards the dotted line, and remembering how gradually anode current begins at its "bottom bend" even when the dotted line is reached, one might not expect sudden results. This, however, is the precise moment at which to bring on the second of the circuits we considered last month, repeated here as Fig. 4.  $V$  and  $L_1$  we already have in Fig. 1, and the combination of switch and  $R_1$  enables us to reproduce what the anode-to-cathode path is doing at this instant—changing over from infinite to finite resistance. It is true we don't know the value of  $R_1$ , and certainly can't assume it is constant, but our ignorance on these points doesn't affect the fact that at the moment of transition from one state to the other the whole voltage  $V$  appears across  $L_1$ .

Because  $L_2$  has the same number of turns and is 100 per cent coupled to  $L_1$ , the same voltage necessarily appears across  $L_2$ . If the coils have been

correctly connected as shown in Fig. 1 (so that the coil windings are in opposite rotation in the direction towards anode and grid) this secondary voltage equal to  $V$  makes the grid less negative, by that amount. Clearly this not only takes off the whole of the negative bias but makes the grid positive to the extent of  $V$  less only the cut-off bias  $V_{\infty}$ . This deduction is due to  $C$ , which at the instant being considered is charged negative-to-grid to that extent.

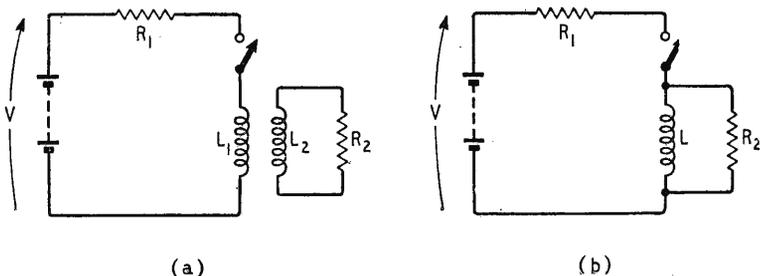
The effect of this positive grid is to make the valve conduct heavily from grid to cathode too. So (neglecting the relatively small counter-voltage of  $C$ ) we pass instantaneously from Fig. 4 to the next circuit we considered last month—Fig. 5(a). As we saw then, this can (on the equal turns 100 per cent coupled assumption) be simplified to (b).

The consequence of this second stage of the process seems to contradict the first. Since  $R_2$  is evidently of the same order as  $R_1$ , and may well be lower, it is clear from Fig. 5 that nothing like the whole of  $V$  can appear across  $L$  or  $L_1$ . This inconsistency arises because in the simple theoretical circuits it is possible for things to happen infinitely fast, but in any real circuit there are such complications as stray capacitances which restrict potentials everywhere to finite rates of change. For this reason the voltage across  $L_1$  has to grow, and directly it exceeds the cut-off bias  $R_2$  comes into existence. What happens then is that the values of  $R_1$  and  $R_2$  adjust themselves according to the characteristics of the particular valve, until a balance is reached more or less on the lines of Fig. 5. The difficulty (to say the least) of expressing the anode and grid characteristics of a valve over the whole range from below cut-off to highly positive grid as an equation is, I imagine, one of the reasons why making a comprehensive mathematical analysis of the blocking oscillator is not a popular occupation.

Since stray capacitances are normally only a few pF and the circuit resistances have now been brought down to the order of  $1k\Omega$ , the time constants of these strays are of the order of small fractions of a microsecond. So, compared with the leisurely progress of the relatively large  $C$  charging through the relatively large  $R$ , the switch-over to Fig. 5 conditions is very fast; so fast that with a time-base speed that gets the whole of Fig. 3 on to the screen of an oscilloscope the next parts of the grid and anode traces (one upwards and the other downwards) look quite vertical.

Because of this high speed of transition we need not worry unduly about what is happening during it to  $C$ . When the balloon went up, if you remember, its charge had dwindled to  $V_{\infty}$  volts. Then, without warning, its terminal joined to  $L_2$  gets a terrific kick positivewards. Even though at the same time the resistance in series with it is reduced from  $R$  to

Fig. 5. The start of anode current is instantly followed by the start of grid current, converting Fig. 4 into this equivalent, shown in two forms.



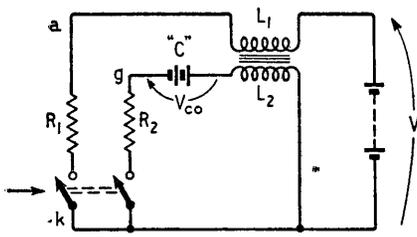


Fig. 6. The blocking oscillator circuit (Fig. 1) can be simulated quite well during its trigger phase by this working model, in which the valve is represented by  $R_1$ ,  $R_2$  and the two-pole switch.

perhaps a hundredth of that amount, its capacitance is normally so much larger than that of the strays that its response to this sudden charging voltage is comparatively slow. For the very brief duration of the switch-over, then, we can replace it approximately by a battery of  $V_{00}$  volts. Except that a lot of stray capacitances have to be imagined everywhere, Fig. 6 is a fairly good working model of Fig. 1 for this short period.

Relating it to Fig. 5, we see that the grid potential must shoot up by the same amount as the anode potential drops down. If  $R_1$  and  $R_2$  were equal, each would change by  $V/2$  volts, leaving the anode  $V_{00}$  volts more positive than the grid. The final balance may well be about here; if the voltage amplitude were much less, then  $R_1$  would be lower than  $R_2$ —the anode has a start of about  $V_{00}$  volts in the Conduction Handicap—and Fig. 5 shows that this would tend to increase the voltage pulse. If, on the other hand, it increased to much more than  $V/2$ , the grid would become more positive than the anode, increasing  $R_1$  relative to  $R_2$ , and so reversing the trend.

In any case we may expect the anode and grid currents to become very large with equal suddenness. That is obvious, whether one explains the action as I have done, or in the more conventional manner by supposing the start of anode current to induce a voltage in  $L_2$ , which reduces the negative bias a little, which makes the anode current grow more rapidly, which takes off the bias quicker, etc., *ad lib*. Students who have not taken the trouble to prepare themselves as thoroughly as we have, but who do remember that the voltage induced is equal to  $L$  times the rate of change of current, are apt to get into a flap when they see the almost vertical front of the current pulse through either coil—known to have quite a large inductance. Their problem is how it can change so fast without a stupendous voltage. We, however, remember also that the magnetic flux, which is what induces voltages, is the net result of the currents through both windings; and when, as in this case, they are in opposite rotation around the core, they can rise as fast as they like so long as they are equal.

Fig. 7 (which continues Fig. 3) shows the position to date, with the equal and opposite anode and grid voltage pulse fronts, and the commencement of anode and grid current, also equal and (from the magnetizing point of view) opposite. Although the difference between them, which is the net magnetizing current, must start from zero, it must be changing at the rate needed to induce the voltage pulses. This is a slower action than the almost vertical pulse rises, so we shall now have to take into account what

$C$  is doing. It is being charged by the positive voltage from  $L_2$ , and because the resistance  $R$  that discharged it is now shunted by the much lower resistance of the positive-grid-to-cathode path its rate of charge is much faster than the rate of discharge graphed in Fig. 3.

The difficulty is that we don't know yet what is going to happen to the induced voltage. Let us see where we get if we assume it remains constant until further notice. Then we have the simple charging  $C$  circuit once more, with  $L_2$  playing the part of the supply battery. Assuming in the meantime that the grid-to-cathode resistance also remains constant, we can tentatively sketch the next parts of the grid voltage and current as rapidly collapsing exponential curves (Fig. 8).

With typical components this rate of fall of grid current would by itself induce a higher pulse voltage than is necessary to keep everything else right, so the anode current must also fall off, but at a slower rate so as to provide sufficient growth of net current to keep up the assumed constant induced voltage. It would in any case decline, as a result of the falling grid voltage. The actual waveforms will, of course, have to be such that the various currents and voltages are at all times related in conformity with the characteristics of the valve, so we can do no more than forecast the general tendency.

When the grid potential reaches zero, the grid current does the same. Remember, it was the decline of grid current at a more rapid rate than anode current that has been keeping the voltage pulse going in  $L_1$  and  $L_2$ . The only thing that could keep it going now would be a reversal of the decline in anode current, and there is nothing to cause that, so inevitably the voltage pulse collapses. This is another trigger action, for directly the anode voltage tends to fall off at all it reduces the anode current, which induces a voltage in the opposite direction to the original pulse.

So we would expect the remaining anode current (which can be regarded as the net or magnetizing current that has accumulated during this charging phase, and whose steady growth has kept the voltage pulse going) to be suddenly cut off. This ought to be matched by an equal drop in grid current if there is not to be an enormous reverse voltage. But this time it looks as if that is impossible, for the grid current cannot go appreciably negative. What happens?

For the answer (and also to check the foregoing predictions) I had to go to the oscilloscope. It did corroborate Fig. 8 remarkably closely, and then went on to show that the collapse of the voltage pulse is indeed followed by a considerable reversal, but that it is preserved from being nearly infinite by an apparent drop in grid current nearly equal to the drop in anode current. I say "apparent" because it is pretty clear that in fact this current drop in  $L_2$  is due to the very large voltage reversal charging the stray capacitances of  $L_2$ ,  $C$ , grid, etc. It is therefore necessarily short-lived, being followed by a fairly rapid discharge (Fig. 9).

The large voltage change (which, of course, must be the same in both coils) brings the grid potential far below cut-off. The voltage induced in  $L_2$  returns quickly to zero as the stray charges leak off, but the charge on the much larger  $C$ , which now has only the high-resistance  $R$  to leak through, takes a long time to go. And that is where we came in.

We have, then, these steep-sided narrow pulses, whose width is determined chiefly by C and the positive-grid-to-cathode resistance, spaced apart by intervals determined chiefly by C and R. Because  $V_{co}$  is usually quite a small fraction of V, the spacing interval is of the order of two or three times the time constant, CR. And so we can roughly calculate the component values for a required frequency of oscillation. Note that we have come across nothing resembling ordinary LC oscillation.

In practice the waveforms may differ considerably from those we have built up by theory, and it is interesting to trace why. There is not room left to do so here in detail, but you may like to follow up some clues. We have already had to fall back on stray capacitances to account for things. Then there

are the resistances of the transformer coils, and their leakage inductances. These differences between the real transformer and our theoretical resistanceless 100%-coupled affair account for the most outstanding discrepancies—those between the theoretical and actual grid voltage pulses. Fig. 10 shows some typical oscillograms. Evidently the voltage actually induced in  $L_1$  and  $L_2$  is somewhere between the shapes observed at the terminals (and the internal resistive and inductive drops (due to the large current pulses) square the left shoulder of the  $L_1$  pulse and slope it off still more in the  $L_2$  pulse. This gradualness of rise allows C to charge considerably before the  $L_2$  voltage has reached anything like its full amplitude, and so the maximum voltage actually reaching the grid is considerably less than predicted.

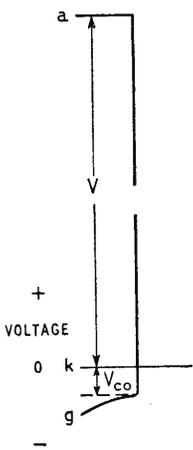


Fig. 7.

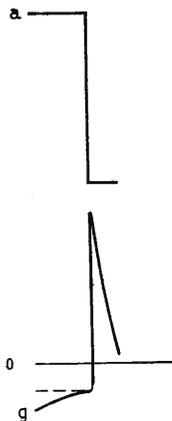


Fig. 8.

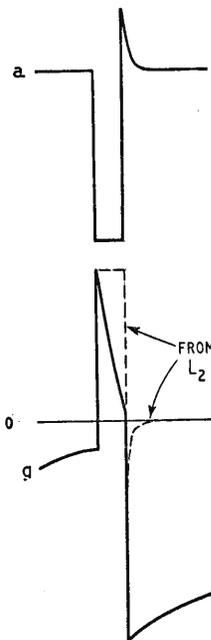


Fig. 9.

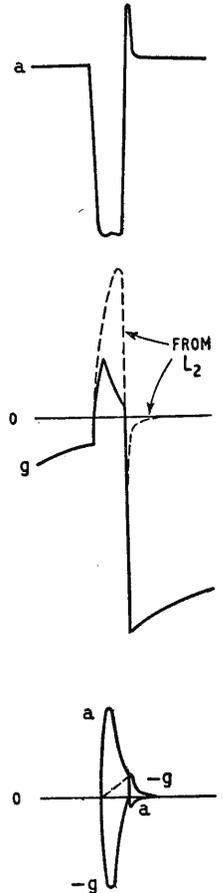


Fig. 10.

Fig. 7. First stage of the continuation of Fig. 3: the trigger action "on."

Fig. 8. The pulse stage, during which C is charged by grid current. The dotted line in the current diagram shows the difference between the anode and grid currents, which is the net magnetizing current.

Fig. 9. Trigger action "off," started by the magnetizing current being no longer able to increase. The dotted line in the voltage diagram shows the voltage generated in  $L_2$ , equal and opposite to that in  $L_1$ . The difference between it and the full line shows the voltage across C.

Fig. 10. Waveforms observed in an actual blocking oscillator, arranged for comparison with Fig. 9. The differences are due largely to transformer resistance and leakage conductance.

# Limiting Factors in Gramophone

## 2.—PICKUP DESIGN : CONTINUITY OF STYLUS-GROOVE CONTACT :

**H**AVING examined, in the first part of this article, the nature of record deformation and wear, we can consider the design of a suitable pickup. The limiting tracking weights are  $\frac{1}{2}$  gram for vinyl and  $2\frac{1}{2}$  grams for shellac. The lightest commercial pickups track at 2-3 grams for vinyl and 4-6 grams for shellac. It would be difficult to reduce the tracking weight to the desired value for vinyl, but it would be fairly easy to halve the tracking weight for shellac, as the design is in any case easier than for vinyl. If the desired low weight for tracking on vinyl could be achieved, the resultant pickup would doubtless be fragile, and have low output voltage, but before ruling out such a pickup as impossibly difficult and expensive, it should be remembered that only a few years ago pickup manufacturers considered that anything with a tracking weight of less than 30 grams was a fragile, expensive, specialists' instrument. With the advent of microgroove records, and the necessity of reducing tracking weights to about 8 grams, if reasonable record life was to be obtained, pickup manufacturers have produced, apparently without difficulty or complaint, pickups which not only operate at this weight but are fairly cheap and have a high output voltage; even record changers have been redesigned to treat records with more care.

**The Arm.**—This must have low friction and low inertia, particularly with warped records, and torsional resonance which will influence response must be avoided. A single vertical pivot bearing is at once the simplest and cheapest, is robust, has the lowest friction, and torsional resonance is avoided. If desired, an anti-vibration mounting can be used between head and arm to further reduce the effect of arm resonance. The only disadvantage of the single-point bearing is that very thin flexible leads must be used to reduce drag. To reduce the torque on the arm to a minimum, the armature should be positioned (at the correct angle for minimum tracking error) with the stylus on the axis of the arm (Fig. 4). To obtain

the correct tracking weight the arm may be counterbalanced either by a weight or by a spring—in the case of a single pivot, a weight only is possible. The weight is much more convenient and more easily adjusted, but it is sometimes argued that a spring is better in that it saves weight and hence inertia of the arm. However, although the saving of weight is considerable, the saving of inertia is very small. Thus if the head is of mass  $m$ , distant  $l$  from the pivot, its moment of inertia about the point is  $ml^2$ ; this must be counterbalanced by a mass of say  $5m$ , distant approximately  $\frac{1}{5}$  from the point, having a moment of inertia of  $5m \times (\frac{1}{5})^2 = \frac{ml^2}{5}$ , i.e., for the convenience of using a counterbalance as opposed to a spring, there is an increase of only 20% in the inertia. As the inertia of the tube forming the arm has been ignored the increase in the total inertia will be somewhat smaller. As the inertia of the arm will usually be only a fraction of that of the head, particularly if a magnetic head is used, there is no point in making the arm absurdly flimsy.

**The Head.**—The limiting weight of the head will depend on the degree of warping of the record to be played, the accuracy of the centre hole and the accuracy of the turntable. The inertia of a 60-gram head is not excessive at a tracking weight of 2 grams; it is thought, therefore, that at a tracking weight of  $\frac{1}{2}$  gram, a head weight of 15 grams would not be excessive. In a magnetic head it is doubtful whether this weight of magnet would give saturation in the size of gap likely to be used, but sufficient flux to give useful output should be obtainable. With shellac records, with the greater weight allowable, there should be no difficulty. Where a crystal movement is used there will be less difficulty in attaining a small head weight. The type of movement used is partly a matter of choice. The moving coil system is easily designed and has fewer objections than moving iron and crystal systems. The coil would preferably consist of several turns of fine wire giving a higher output voltage than a ribbon or single turn, so as to be well above the hum level picked up by the leads<sup>7, 8</sup>. The coil would preferably be a bifilar push-pull winding, feeding into a centre-tapped coupling transformer, thus reducing hum. A strain-gauge system in which the electrical resistance of a fine wire is varied by the strain it receives is attractive, as it is simple and can be made in small sizes. However, circuit arrangements are a little complex, and the signal level would almost certainly be so low that noise and hum would be serious problems. Carbon composition strain gauges would be unsatisfactory, due to self-generated noise. Other methods, such as magnetostriction and frequency modulation, would seem to offer no advantages. The recently

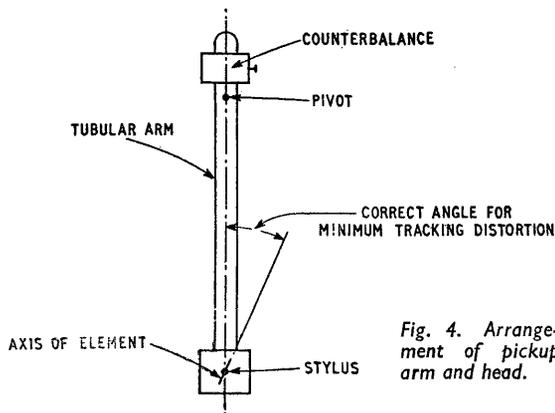


Fig. 4. Arrangement of pickup arm and head.

<sup>7</sup>Baxandall, P. J., Letter, *Wireless World*, Sept., 1950.  
<sup>8</sup>West, R. L., Letter, *Wireless World*, Sept., 1950.

# Reproduction

## TRACING DISTORTION

By D. A. BARLOW, M.Sc.

introduced magnetomotive system<sup>9</sup> consisting of a moving magnet with a stationary coil on a soft iron core is attractive, as the moving parts are simple and robust and high impedance with high output voltage is obtainable without a coupling transformer.

The tracking weight has been discussed by Mallett<sup>10</sup>. It is governed by three factors, the lateral stiffness, the lateral inertia and the vertical stiffness. The lateral stiffness is operative at low frequency so that the inner surface of the groove will take most of the load; at high frequencies the inertia of the moving parts is operative and the outer wall of the groove takes the load. In a complex waveform stiffness or inertia may be operative over different parts of the wave, but the full load will be taken at any instant by only one groove wall, so that stiffness and inertia loads are complementary. The maximum stiffness load is reached at maximum amplitude; the maximum inertia load may not always be reached at maximum amplitude, depending on the waveform; the maximum load due to vertical stiffness when vertical amplitude is greatest is at the mid-point of the wave. These three components of load, therefore, lateral stiffness, lateral inertia and vertical stiffness, are largely complementary rather than additive. Vertical inertia is not in itself important as will be shown later. Longitudinal movement of the stylus must be a minimum, otherwise distortion and rounding off the steep wave fronts will occur. Lack of longitudinal rigidity is the probable reason for needles trailing rather than being set vertically<sup>11</sup>. A vertically set needle will judder longitudinally if it is not rigid in that direction. The maximum angle of the groove to the direction making a tangent to the groove at the stylus contact must be less than the half angle of the groove (approx. 45°), otherwise the stylus will ride up the groove wall regardless of tracking weight. The angle of the trace in the 33½ r.p.m. extended play records appears to approach this limit as a result of the greater amplitudes employed.

**Lateral Stiffness.**—This must be such that the lateral load for the maximum recorded amplitude is not greater than the tracking weight, i.e., lateral compliances must be more than  $6 \times 10^{-6}$  cm/dyne for vinyl and  $4 \times 10^{-6}$  cm/dyne for shellac. This should not be difficult to arrange.

**Resonances.**—There will be a number of resonances due to the mass of the armature, head, etc., with the lateral, vertical, and longitudinal compliances of the suspension, and record-stylus. The armature should be sufficiently rigid longitudinally for resonances with this compliance to be ignored. The other resonances are examined below. Any damping

material must be added with caution, as it may cause intermodulation distortion<sup>12</sup>.

**Lateral Low-frequency Resonance.**—This is the resonance of the mass of the head and arm and the lateral stiffness of the movement, and the frequency is given by

$$f_1 = \frac{1}{2\pi\sqrt{M_p C_a}}$$

Where  $M_p$  is the lateral effective mass at the stylus

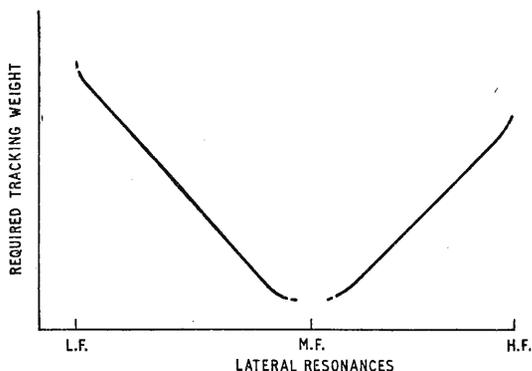


Fig. 5. Effect of lateral resonances on required tracking weight.

of the head and arm (gm)  $C_a$  is the lateral compliance of the movement (cm/dyne).

The effective mass at the stylus is:

$\frac{I}{l^2}$  where  $I$  is the moment of inertia about the particular axis, and  $l$  is distance of axis from stylus (cm).

This resonance has been used in cheap pickups to boost the bass; it should, of course, be below the recorded range in a high-quality pickup. For vinyl with a head weight of 15 grams, the resonance would be at about 17 c/s; for shellac with a 75-gram head, the resonance would be about 9 c/s.

**Lateral Mid-frequency Resonance.**—This is the resonance of the mass of the movement (coil or armature) with its own lateral stiffness (restoring force), and generally occurs at the mid-frequencies. Unlike most other resonances, it is not deleterious. It is a series resonance and at the resonance frequency the stylus point impedance tends to zero (Fig. 5.). It simply means that at this frequency no power is required to move the armature except that required by damping. The physical significance of this can be easily seen—the stylus will always try to move at this frequency so that at lower frequencies it tends to return to the mid-point faster than the trace allows, so that it is always pressing on the inner wall of the groove; at high frequencies

<sup>9</sup>Wittenburg, N., *Philips Tech. Rev.*, Vol. 18, Nos. 4/5 and 6, 1956/57.

<sup>10</sup>Mallett, E. S., *Electronic Eng.*, May, 1950.

<sup>11</sup>Rabinow, J., and Codier, E., *J. Acous. Soc. Amer.*, Vol. 24, No. 2, March, 1952.

<sup>12</sup>Roys, H. E., *Audio Eng.*, May, 1950.

it tends to return to the mid-point slower than the trace allows, so that it is always being forced back by the outer wall of the groove. This resonance is given by

$$f_2 = \frac{1}{2\pi\sqrt{M_a C_a}} \quad \text{where } M_a \text{ is lateral effective mass of element at stylus.}$$

**Lateral High-frequency Resonance.**—This is the resonance of the mass of the element with the compliance of the record and stylus. It is well known that if this frequency is in the audio range, excessive noise will result from shock excitation of this resonance, and there may be accompanying distortion, even if the resonance is thoroughly damped. This resonance is given by

$$f_3 = \frac{1}{2\pi\sqrt{M_a C_n}} \quad \text{where } C_n = \text{lateral compliance of stylus and record materials (cm/dyne).}$$

For this resonance to be above say 20 kc/s,  $M_a$  must be less than about 1 milligram for vinyl and 3 milligrams for shellac.

**Lateral Inertia.**—The maximum accelerations recorded are about 1500 *g* for microgroove records and 500 *g* for 78 r.p.m. records<sup>13</sup>. The corresponding limiting lateral effective mass at the stylus is 0.33 milligrams for vinyl, which would be hard to achieve, and 5 milligrams for shellac, which would be easy to achieve.

**Vertical Stiffness.**—The need for vertical movement is of course to allow for the pinch effect. The groove is cut with a chisel-edged stylus and traced with a spherical stylus, as a consequence of which the stylus of an ideal pickup must move vertically at twice the frequency of the trace. The maximum vertical amplitude is about 1/9th of the lateral for microgroove and 1/6th for 78 r.p.m. records. The vertical stiffness must therefore be not greater than 9 times and 6 times the lateral stiffness respectively, i.e., a compliance of  $0.67 \times 10^{-6}$  cm/dyne in each case.

**Vertical Resonances.**—Although the pickup may not generate any voltage for vertical movement, vertical resonances are best avoided in the recorded range, or, rather, at twice these frequencies, as the vertical movement takes place at twice the recorded frequency of the trace. Where the lateral loads are not shared equally by each groove wall, as is always the case except at zero amplitude, any vertical forces will cause movement of the stylus not vertically but at some angle—in extreme cases up and down the side of one of the groove walls, and will thus generate a signal, even though true vertical movement generates no signal. The normal vertical movement may therefore generate a signal, although it may be very small, but vertical resonances may be serious.

**Vertical Low-frequency Resonance.**—This is not the resonance of the mass of the head with the vertical compliance of the movement or cantilever, and should be below the recorded range. It will be about 50 c/s for vinyl and 22 c/s for shellac (corresponding to lateral recorded frequencies of 25 and 11 c/s) for the pickup considered here.

**Vertical High-frequency Resonance.**—This is the resonance of the vertical effective mass at the

stylus point with the compliance of stylus and record, and should be above the recorded range, i.e., above 40 kc/s (corresponding to 20 kc/s lateral). The vertical compliance of record and stylus is unknown, but will probably be about half the lateral, as the load is now taken by both walls of the groove. The limiting vertical effective mass at the stylus will thus be about 0.5 mgm for vinyl and 1.5 mgm for shellac.

The above two resonances will influence each other's frequencies slightly, but as they are a long way apart the interaction will be very small and can be ignored. With suitable design there will be no other vertical resonance, and the stylus will maintain contact with the groove at all times, except when severe tracing distortion occurs, due to over-modulation, when the trace radius approaches the stylus radius. When this occurs, and contact with the groove is not maintained, there will obviously be acoustic rattle or needle-talk, and the output may be affected. In addition, when the stylus point is free, there may be a further vertical resonance, falling in the mid-frequencies (see later). The vertical inertia of the system is not, in itself, of importance, as the high-frequency resonance is above the recorded range.

**Cantilever Movements.**—To achieve the above very small effective vertical masses in practice, a cantilever type of movement is essential, as only the cantilever and stylus contribute to the vertical mass, the axis of the generating element being vertical. In most other designs, the whole of the element must move vertically, and the total mass is limited to the allowable vertical mass. The cantilever movement has the added advantages that vertical movement is obtained with the minimum of longitudinal movement, and the system can be easily designed to minimize damage due to accidental dropping on the record. The use of a cantilever, however, introduces its own lateral, vertical and torsional resonances. The lateral resonance can probably be avoided, as the cantilever must be stiff laterally if appreciable signal loss is to be avoided. The torsional stiffness could be increased for a given cantilever mass by making it of tubular form, and its magnitude reduced by placing the stylus tip as near as possible to the axis of the cantilever. Vertical resonance of the cantilever will occur when the stylus is not in contact with the groove, and in any practical design this resonance will fall within the audio range. However, when the stylus tip is in contact with the groove, and provided the generating element itself has negligible vertical compliance, there will be no resonance in the audio range. Considering vertical movement only, the system has two degrees of freedom, Fig. 6(a), and the only resonances will be the low and high frequency ones already listed. If there is appreciable vertical compliance between armature and head, the system will have three degrees of freedom, Fig. 6(b), and there will be three resonances, the additional one of the mass of the armature with the cantilever compliance being within the recorded range. The armature vertical compliance can be made very small if the top end of the armature forms a cup-and-cone bearing with the head; in the case of a torsional crystal element it may be firmly fixed to the head.

The cantilever would best be made in a hard rigid

(Continued on page 293)

<sup>13</sup> Cosmocord Ltd., Private communication.

plastic, perhaps phenol-formaldehyde, as this would have the greatest stiffness/weight ratio of any practical material, this being proportional to modulus/(density)<sup>2</sup>. Sapphire and diamond would be too heavy for tips, at least for microgroove, so that a one-piece replaceable plastic moulding could be used for stylus plus cantilever.

**Soft Styli.**—In passing, it should be noted that the usual objections to soft needles will not apply here; as the yield stress and modulus of the stylus will be appreciably greater than those of the record material, there will be no serious deformation of the stylus, and fairly accurate tracing with reasonable life would be obtained. Conditions would bear no relation to those of the conventional thorn under, say, 40 gm playing weight, under which the point is deformed to contact almost the whole of the groove, with consequent distortion and top loss. The other conventional objections to thorn are the possible embedding of either sharpening or other dust with consequent abrasive wear of the grooves, the thorn acting as a lap. The possibility of dust from sharpening being embedded is much exaggerated; every day in industry, millions of sand-papery and grinding operations are carried out on all types of material and particles of abrasive are virtually never embedded in the work. It is possible to get embedding of abrasive, particularly with certain soft and ductile metals, but it occurs only with unsuitable grinding conditions, and virtually never occurs with the free-working non-metallic materials. Regarding the embedding of ordinary dust, if the record is cleaned sufficiently well each time for the noise due to dust to be inaudible, it is difficult to see how such dust as remains could become audible, and the rate of wear, if any, would be extremely small. Further, it is by no means certain that abrasive wear by such means actually occurs; for lapping to take place, the lap must normally be much softer than the material to be lapped. In the present case, the plastic will be harder than vinyl or (unfilled) shellac.

The relatively low modulus of soft styli, compared with sapphire or diamond, will increase the stylus-record compliance, which will lower the lateral and vertical high-frequency resonances. Again, a high-modulus plastic must be chosen, when the effect will probably be slight, but, if necessary, a further reduction in mass at the stylus point must be made.

**Tracing Distortion.**—This is by far the most serious form of distortion in record reproduction. It can be very distressing on shellac records, and is tolerable on vinyl only by reason of the elastic deflection of the groove walls, which reduces the tracing distortion but introduces a further type of distortion which is less serious. Severe record damage will result from overmodulated traces, however light the pickup. When the trace radius is equal to or less than the radius of the stylus at the point of contact with the walls, the stylus is required to change its direction instantaneously, which requires infinite deceleration and acceleration thus giving groove deformation and rattling. On 78 r.p.m. records an elliptical stylus is essential to reduce tracing distortion to tolerable limits. Thus a 3-mil bottom radius/1-mil lateral radius stylus can be used, reducing the tracing distortion by a factor of 6; the tracking weight must be reduced to about half

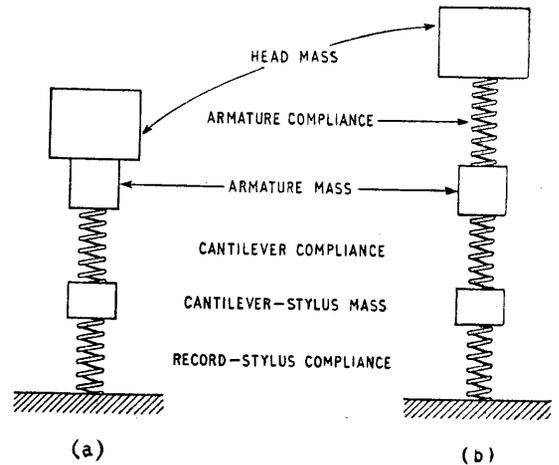


Fig. 6. Vertical systems with two and three degrees of freedom.

that for a 2.5-mil stylus. With microgroove records no such course is possible, and tracing distortion is more serious than on 78 r.p.m. records played with an elliptical stylus.

The high tracing distortion of microgroove records is due to the excessive high-frequency pre-emphasis used, as the de-emphasis in playback only partly offsets the distortion caused by pre-emphasis. The NAB characteristic, giving 16 dB rise at 10 kc/s is particularly bad—to quote Hunt, it “effectively guarantees excessive distortion.” As a result, the A.E.S. standard curve, giving 12 dB rise at 10 kc/s, was adopted. The purpose of the pre-emphasis is of course to reduce surface noise; as the noise of good vinyl records is barely audible, it seems that even the 12 dB rise could be reduced without surface noise becoming objectionable. The noise level is reduced by about 6 dB for the 12 dB boost; if this were reduced to 6 dB, there would be an increase of 3 dB in noise level, which would be barely noticeable, with a reduction in tracing distortion by some factor approaching 4, which would be a very noticeable improvement. If there were no pre-emphasis, the noise level would be 6 dB higher than the A.E.S. standard, which would still be very much lower than shellac, and tracing distortion would be drastically reduced. This point has been well made by Viol<sup>16</sup>.

An attractive alternative to dropping pre-emphasis would be 78 r.p.m. microgroove records—there would still be sufficient playing time per side that breaks would come between movements of symphonies, etc. The use of high-frequency pre-emphasis perhaps has more justification for shellac records where surface noise is high, but even here the gain may be largely offset by the increased tracing distortion. In any case, with a lightweight pickup, say less than 10-15 gm, there is no reason why 78 r.p.m. records should not be made in vinyl.

Dutton<sup>17</sup> has shown that for a given maximum level of tracing distortion, disc diameter, and average groove spacing, there is an optimum speed of rota-

<sup>14</sup>Watts, C. E., Reported in *Wireless World*, Dec., 1949.

<sup>15</sup>Pierce, J. A., and Hunt, F. V., *J. Acous. Soc. Amer.*, Vol. 10, No. 4, July, 1938.

<sup>16</sup>Viol, F. O., *Proc. I.R.E.*, Vol. 38, No. 3, March, 1950.

<sup>17</sup>Dutton, G. F., *Wireless World*, June, 1951.

tion of the turntable, giving the longest playing time. He states that at a groove speed of 16in/second, on standard 78 r.p.m. records, tracing distortion is apparent (this is rather an understatement), but that quality is not noticeably impaired at 22in/sec. The corresponding velocities for microgroove records (presumably allowing for high-frequency pre-emphasis, etc.) are stated to be lower by a factor of 1.6, i.e., 10in/sec and 13.75in/sec respectively; at this latter speed distortion is about 4% and it increases very rapidly to about 16% at 10in/sec. On the basis of a minimum speed of 10in/sec., a 12in disc gives a maximum playing time of 22 minutes at an optimum speed of about 33½ r.p.m. However, if we take the preferred minimum speed of 13.75in/sec., the maximum playing time is about 16 minutes at a speed of about 45 r.p.m.; 33½ r.p.m. gives a playing time of 15 minutes, and 78 r.p.m. gives 14 minutes. In other words, on the basis of work done by a well-known record manufacturer, if good quality is to be obtained, 15 minutes is about the limit of playing time, for a 12in disc, and the speed of rotation makes very little difference. In

minutes would be obtained on a 12in disc, run at 22 r.p.m.

On the subject of recording characteristics, it is interesting to note in passing that Hunt<sup>15</sup> has pointed out that the maximum output for both speech and music drops off at rather more than 6 dB per octave below 250-300 c/s, i.e., the usual bass cut in recording is unnecessary. The advantage of no bass cut is obvious—less equalization required, i.e., less waste of precious output volts from the pickup, with the elimination of hum and rumble problems. There is some doubt about published curves for maximum output, as it is possible that transients and organ notes reach higher levels; nevertheless it would be interesting to know if bass cut is really necessary to avoid overcutting, or whether it is simply a hang-over from the days of acoustic recording, when the recording equipment unavoidably gave such a cut. The suggested recording characteristics are given in Fig. 7.

Returning to the problem of tracing distortion, together with pinch effect and the need for vertical motion of the stylus, the whole difficulty would disappear if the original groove were impressed with a spherical stylus, a duplicate of the reproducing stylus, instead of being cut with a chisel. As the area of contact of the groove with the stylus would now be greatly increased, deformation and wear from existing pickups would be almost eliminated. The limiting tracking weight for an impressed groove is difficult to calculate but would be about 0.9 gm for vinyl for the elastic range. With a comparatively slight reduction in existing tracking weights of the best pickups, there would be no damage whatsoever to record grooves and frictional wear of both groove and stylus would be very low. It might be necessary to use very close tolerances on dimensions of both recording and reproducing styli, to avoid an oversize stylus being forced into the groove, or an undersized one from "skating," but this would be a very small price to pay, especially as the reproducing stylus would be virtually everlasting for normal users. Alternatively, a V-groove could be impressed with a conical stylus, which would give a greater contact area and hence even higher limiting tracking loads. By making the bottom radius of the reproducing stylus larger than that on the recording one, skating would be avoided and a universal stylus becomes possible.

An impressed type of groove would doubtless require considerably more power for recording than a cut groove, but this might be offset by recording at a high temperature, either by means of a heated stylus or by heating the blank. Thus the normal hard type of recording wax or lacquer could be impressed while hot and soft. There are doubtless other difficulties, but the advantages to the record user would be so great that every effort should be made to produce impressed-groove records.

The impressed type of groove, with the high tracking weights possible without serious groove damage, makes the acoustic gramophone once more possible as a high-quality reproducer. Although there may be many limitations on the quality obtainable, some improvement in design is doubtless possible, and it should be remembered that the best acoustic gramophones have a clarity of reproduction which is not matched by many commercial radiograms.

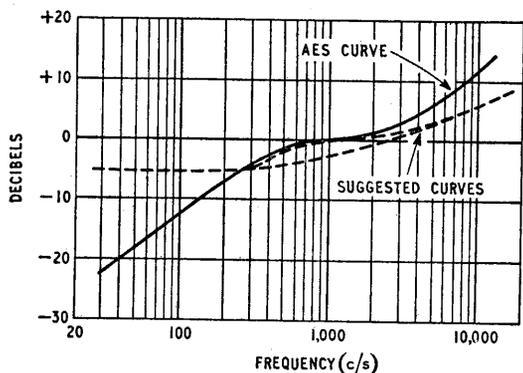
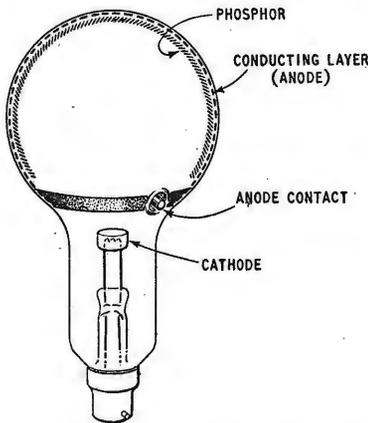


Fig. 7. Suggested revision of recording characteristics.

fact, the differences are so small that the trouble and expense of changing speeds and obtaining new turntables (usually more expensive than for 78 r.p.m., owing to the need to reduce rumble) was quite unjustified—the microgroove vinyl 78 r.p.m. record was the obvious choice, and speeds were doubtless changed only because the Americans had already done so. It has been argued that the slower speeds have the advantage of giving more margin for squeezing in an extra minute or so to enable the item to be completed; this is justified if the passage is a quiet one, but this does not often happen at the conclusion of a work. The fact that most 12in l.p. discs run for 20-25 minutes, and some for as much as 32 minutes, shows that this advantage is in fact a very serious disadvantage if high quality is to be obtained; with 78 r.p.m. microgroove discs, excessive squeezing in would be prevented by the label. There are even some gramophone enthusiasts who consider that on certain l.p.s, the musicians were persuaded to hurry through the work in order to squeeze it on to one side of a very long playing l.p. disc, when it would have been better to take two sides. If high-frequency pre-emphasis were not used on microgroove discs, it would be possible to go to a lower minimum groove speed, say 8½in/sec, for good quality, when a playing time of about 26

**Kilowatt Pulse Transistor** for switching purposes, developed by N. H. Fletcher, of the C.S.I.R.O. in Australia, is able to switch currents as high as 40 amps in times of the order of a microsecond. It can operate on voltages up to 30V. Normally, of course, switching transistors are restricted to low-current operation, while power transistors do not have the necessary frequency response. The requirements of high current gain at the operating current, low extrinsic base resistance and high alpha cut-off frequency have been obtained by an annular-ring construction of the emitter and base, with a covering collector. The well-known alloy process is used to form the junctions. Collector currents as high as 45A have been obtained with as little as 3A base current. Pulse rise times are fastest when a constant-current pulse is applied to the emitter in a common-base circuit. Mr. Fletcher has described the transistor and given references to earlier work in a letter in the April, 1957, issue of *Proc. I.R.E.*

**Cathodo-Luminescent Lamps.**—The old cartoon joke about people using the light of their television screens to read by will not be considered very funny by those who are developing electric light bulbs working on the very principle of the c.r. tube. Although this method of producing light is intrinsically efficient, the actual luminous efficiency obtained so far has been somewhat less than that of the tungsten lamp, and a great deal of work will be required to improve this at an acceptable anode voltage. The sketch shows

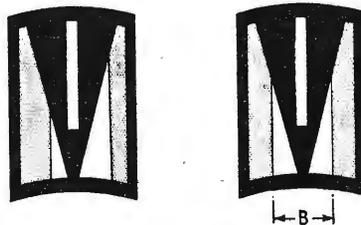


an experimental cathodo-luminescent lamp developed by L. S. Allard at the G.E.C. Research Laboratories. It was demonstrated to the Television Society at their 1957 Fleming Memorial Lecture.

**Differential "Magic Eye"** tube developed by Valvo of Hamburg has the important advantage when used

# Technical Notebook

as a null-indicator in bridge circuits that it will give the sign of the unbalance voltage. An electron beam of rectangular section produces a rectangular spot on a fluorescent screen on the inside of the valve envelope. The spot is deflected to left or right by two symmetrically mounted electrodes, to which the voltages to be compared are applied. When the bridge is balanced and the voltages are equal the spot is central. Unequal voltages cause a deflection to left or right according to the direction of the inequality, and this is made obvious to the eye by a black reference mask fitted on the outside of the tube as shown in the sketch.



At balance, the breadth of the spot, B (right), gives some indication of the mean value of the two voltages. Actually the two deflecting electrodes form the anodes of two built-in triodes which serve to amplify the applied deflecting voltages. The tube can be operated entirely from an a.c. supply, and various other masks can be used for different applications. A full description appeared in Vol. 18, No. 8, of *Philips Technical Review*.

**Magnetic-Core Analogue Computing** circuits have been devised by D. H. Schaeffer and R. L. Van Allen using square hysteresis loop magnetic cores in conjunction with switching transistors. The output is in the form of current or voltage pulses whose average values are a specific function of the input voltage. Many possible functions can be obtained, including square roots and other fractional powers, sines, arc sines and products of two inputs. Experimental data is given in D.S.I.R. unpublished report PB111900.

**Directional Junction Photocell** described by J. Torkel Wallmark in the April, 1957, issue of *Proc. I.R.E.*, is a semiconductor device based on a phenomenon known as the lateral

photoeffect. Light directed on to the cell produces a voltage *parallel* to the junction as well as the normal voltage across it, and this can be picked up by two electrodes, on the same side of the junction, with the light falling between them. A point source of light focused on the cell will give zero signal at the electrodes if it coincides with the symmetry axis of the device, but if it deviates by a small angle in one direction or the other a voltage of one polarity or the other is generated. Thus the direction of a light source can be measured by a null method with great accuracy—in fact, to within 0.1 second of arc. An interesting feature of the cell is that the application of a bias voltage will produce the same effect as turning the cell and focusing lens away from the light source. The sensitivity is about 200 $\mu$ A/lumen, while the frequency response is roughly the same as that of a transistor.

**Miniature Camera Tube** of the photoconductive type with a diameter of only  $\frac{1}{2}$  inch has been developed by R.C.A. for use in a small transistorized camera (see picture). Measuring only slightly longer than a cigarette, it operates with voltages up to 300V, which are derived from a transistor convertor working from a 15-V supply. For scanning, the tube requires only 20 ampere-turns of deflection field, enabling small, low-power a.f. transistors to be used for waveform generation. A signal current of



0.1 $\mu$ A from the tube is amplified by a video amplifier using high-frequency junction transistors and having a bandwidth of about 4Mc/s. Focusing is done by a permanent-magnet assembly. The camera shown measures only 4½in × 2½in × 1½in, and one of this type has been used with a portable 2,000-Mc/s transistorized television transmitter (known as a "Creepie Peepie") for reporting outside events.

**New Ferroelectric Ceramics** are being investigated as alternatives to the well-known barium titanate by M. Rose, G. T. Carter, C. G. Harmon and R. M. Gogolick. In particular, several compounds of sodium niobate have been found to be strongly ferroelectric (and piezoelectric after polarization). High dielectric constants have been noted, and electro-mechanical constants comparable with those of barium titanate. Studies are described in D.S.I.R. unpublished report PB117134.

**Colour TV Vectorscope** is an instrument developed by Marconi's for displaying and measuring the amplitude and phase of an N.T.S.C.-type colour signal on the screen of a c.r. tube. The N.T.S.C. colour signal is a sub-carrier modulated in amplitude to represent saturation and in phase to represent hue, so the vectorscope



indicates saturation by the radial distance of the c.r.t. spot from centre and hue as the angle subtended from a fixed phase reference on the screen. The signal to be tested is applied to a pair of quadrature demodulators, similar to those used in colour receivers, and the outputs of these, after suitable filtering and amplification, pass to the deflection plates of the c.r. tube. When used in conjunction with a colour-bar test signal, the vectorscope produces a pattern of bright dots corresponding to the tips of the various colour vectors and a pattern of lines corresponding to the tran-

sitions between the colours. Boxes indicating phase and amplitude tolerance limits are drawn on a transparent scale to provide a convenient indication of the quality of the signal—although these tolerances refer only to the sub-carrier information since the luminance information is removed first by a 1.3-3.3 Mc/s filter.

**Simple Gamma Monitor**, intended for measuring radiation in contaminated areas, has been designed by C. C. Klick, H. Rabin, J. J. Lambe, H. J. Peake and P. T. Cole. It comprises a cadmium sulphide crystal, a parallel combination of capacitor and neon flash lamp and a battery, and is sensitive over the range 0.1-1,000 Roentgens per hour—the neon flash rate being proportional to the gamma dose rate. Details in D.S.I.R. unpublished report PB111694.

**Individual Temperature Compensation** for components or sub-assemblies, rather than overall temperature control of equipment, is the idea behind a small "multi-purpose" oven, similar to a crystal oven, recently introduced by the Bulova Watch Company of New York. The manufacturers say that by eliminating costlier, less dependable and more complex temperature compensating equipment, a great deal of design effort can be saved; circuits can be



simplified, made more dependable and can have a far wider operating range. The oven is normally mounted on a standard octal base, weighs less than 7½oz, dissipates an average of 5 watts after warm-up and has the high stability of  $\pm 0.1^\circ\text{C}$ .

**Adhesive Copper Foil** is now available in this country for making the "copper clad" used for printed circuits. Manufactured by the Rubber and Asbestos Corporation of Bloomfield, New Jersey, U.S.A., it is known as Plymaster Type "C" and is intended for application to insulating bases made of epoxide resin reinforced by glass fibre. The resulting "copper clad" is said to have an outstanding performance during and

after exposure to silver and gold cyanide plating baths. The British agents are Omni (London), 35, Dover Street, London, W.1.

**Turntable Tape Recorder**, called the Selectophone T5, was one of the more interesting exhibits at the Photo Fair. Made in Germany by Standard, it is now being imported into this country by the Apparatus and Instrument Company. Magnetic tape 35mm wide is used, containing 70 tracks. The head moves automatically from one track to the next, giving a maximum of six hours' playing time at 3½in per second. Two other tape speeds of 4½in and 7½in per second are also provided. These non-standard speeds were chosen in order that a turntable attached to the capstan spindle should rotate at 78, 45 and 33½ r.p.m. The tape is supplied in cassette form, and positioning and selection of tracks is easy. Microphone and radio inputs with mixing facilities are provided, and the record being played can also be recorded. The audio output is three watts into an internal or external speaker.

**Intestinal Telemetering** has been demonstrated in the U.S.A. with the aid of a tiny f.m. transmitter in a plastic capsule measuring only 1.125in long and 0.4in in diameter. This "radio pill," as it is called, is swallowed by the patient and passes through the intestines, where changes in pressure are measured and transmitted by radio through the body to a nearby receiver. Designed by Dr. V. K. Zworykin of R.C.A., the "pill" contains an oscillator which is modulated in frequency according to the changes in pressure applied to the outside shell. The main components are a transistor, an inductor with a ferrite cup core and a battery, with a life of 15 hours, of a kind once used in anti-aircraft proximity fuses.

**Cruciform Slot Aerial**, with a pair of narrow slots crossed at right-angles, has been investigated by A. J. Simmons as a means of radiating and picking up circularly polarized waves. The cross is cut in the widest wall of a rectangular waveguide, to which it presents a very close impedance match. As a receiving aerial it can be used to discriminate between left-hand and right-hand circular polarization. Possible applications are suggested in D.S.I.R. unpublished report PB111904.

*Unpublished Reports mentioned above come from various sources but can be obtained from the Technical Information and Documents Unit of the Department of Scientific and Industrial Research, 15, Regent Street, London, S.W.1.*

# National Gramophone Conference

## VIEWS ON REPRODUCTION OF COMMERCIAL DISC RECORDINGS

A CONFERENCE organized by the National Federation of Gramophone Societies was held at High Leigh, Hoddesdon, from 5th-7th April. Seventeen talks or recitals on music or sound reproduction were given.

From the point of view of readers of this journal, perhaps the most interesting talk was given by Stanley Kelly. This dealt mainly with reproduction of commercial disc recordings. The overall picture which he drew of the ultimate quality obtainable was rather pessimistic.

The distortion due to pinch effect, which depends only on the geometrical factors of stylus and signal groove radius, can cause up to about 30 per cent third harmonic distortion at 10 kc/s on normal 33½ r.p.m. microgroove records, especially at the inner grooves. These harmonics are, of course, inaudible but the associated lower frequency intermodulation products will not be. This intermodulation is aggravated by the normal practice of pre-emphasizing the high frequencies on recording. The extra harmonic distortion thus introduced—since harmonics are necessarily at a higher frequency than the fundamental—is removed when the corresponding de-emphasis is applied in playback; but again this does not apply to lower frequency intermodulation products. This distortion provides some of the "brilliance" often associated with "hi-fi" systems. From this point of view recording at 78 r.p.m. with a constant velocity characteristic at high frequencies had much to recommend it, and such recordings were known to give very good results. Unfortunately, even if customers could be persuaded to accept once again the shorter available playing times, the expense of the vinyl discs makes such recording commercially unattractive.

In Mr. Kelly's opinion the lightest practical cantilever arrangement would have an equivalent mass referred to the needle point of at least 1 milligram. The stylus mass itself will weigh about half a milligram. It is clear then, that with the tracking weights at present in use (of the order of 5 grams) accelerations of approximately 10,000 g which can be recorded will not be accurately traced on playback. Experiments on an inertialess "light-beam" pick-up gave very noisy results. This was probably due to roughness in the recorded groove which would be smoothed out by inertia effects in a normal pick-up.

### Stylus Wear

Mr. Kelly stressed the importance of stylus wear—70 per cent of the complaints received by one pick-up manufacturer were found to be caused by worn styli. Dust is a very potent source of wear. Increases of sapphire lives of up to 30 times have been obtained by careful removal of residual dust by a brush accessory, by air conditioning, and by dispensing with coal fires! Intense local heat can be produced by the action of the stylus on groove asperities. Using a deliberately dirtied record

evidence has been obtained of actual welding of dust particles to the stylus. The resulting uneven shape will produce rapid record wear. The main advantage of using a diamond stylus may be simply that it has a higher melting point, so that such welding is less likely. Wear could perhaps be reduced by lubrication but, owing to surface tension effects it is difficult to get the lubricant properly into the groove.

### Faking Recordings

Mr. Lionel Salter gave a very interesting and profusely illustrated talk, mainly in support of the view that the recordings of certain works should, from artistic considerations, be deliberately "faked" so that they would not correspond to the recorded, or indeed to any actual performance. This view may be regarded as heresy, but Mr. Salter put it forward very persuasively.

One example is in the recording of concertos for instruments with a very weak tone, such as the harpsichord of fortepiano (a forerunner of the modern piano). If these instruments are played loud enough to balance the orchestra, they produce a very uninteresting sound. In Mr. Salter's view it was better for them to play at their normal level, and to amplify their sound using a separate microphone in recording. As a test piece for showing the difficulty of achieving a good recording balance he instanced Mozart's double concerto for fortepiano and harpsichord where the amplification necessary is different for each instrument.

Certain echo effects occasionally asked for by composers can be much more effectively produced by artificial reverberation. A very simple but convincing further case is where the choir is asked to fade away gradually singing a repeated phrase (such as at the end of "Neptune" in Holst's Planets Suite). This is very difficult to do perfectly naturally, but can be very simply produced artificially by gradually turning down the volume control to the recorder while the choir sings at the same level. The illustration was certainly better than your reporter has ever heard it sung at a concert.

Mr. Thurlow-Smith of Eroica Recording Services, Manchester, gave a very amusing yet instructive practical talk on "The uses and abuses of the domestic tape-recorder." The most important thing in tape recording was to label the tape! In Mr. Thurlow-Smith's opinion, for any serious recording, even with an ordinary tape recorder, it is necessary to use a good microphone.

### "88-50" PRE-AMPLIFIER

It is regretted that the article describing the pre-amplifier designed for use with the "88-50" power amplifier (April issue) is unavoidably held over until next month's issue.

# News from the Industry

**"Empress of England."**—Two entirely separate radar installations have been supplied by Marconi's for the new 25,000-ton Canadian Pacific liner, *Empress of England*. A special housing above the bridge accommodates the radar transmitting equipment. Two display units are fitted in the wheelhouse, and a smaller remote display in a radar plotting room. Marconi's are also supplying communication equipment and a direction finder. An echo sounder has been supplied by Kelvin & Hughes.

Marconi radio equipment has been ordered by B.O.A.C. for its fleet of long-range Bristol Britannias, some of which are expected to be in passenger service in a few months' time. Each aircraft will have a dual Marconi transmitter/receiver installation for multi-channel h.f. communication, a high discrimination receiver and a dual radio compass. The transmitter/receiver can be operated on any one of two hundred crystal-controlled channels, frequency changing being entirely automatic by self-tuning circuits. Similar equipment is also being installed in the new De Havilland Comets now on order for B.O.A.C. for its Australian, Far East and South African services. The Comet installations will include the selective calling system "Selcal" which relieves the pilot of the tedium of continuous listening. Marconi's are also fitting automatic direction finders in the Bristol Britannias to be brought into service by Hunting Clan Air Transport Ltd. next year.

**Servo-mechanism.**—To facilitate the translation of the servo designer's schematic into a working model, Vactric (Control Equipment), Ltd., have produced a slotted "bread-board" and a series of components for use with it.

**Lustraphone** transistor public-address equipment has been installed in a large number of patrol cars of the Lancashire Constabulary. The current consumption of the 12-volt amplifier is 200 mA quiescent and 1.5 A peak, and of the 28-volt model 100 mA and 750 mA, respectively.

**Electronic Products** (previously Electronic Production Company) recently took over additional premises at Lawrence House, Breakspear Road, Ruislip, Middlesex. Multiple coil-winding machines have now been installed, and random and layer winding of such items as relays and solenoids can be undertaken.

**Ekco** v.h.f. communication and d.f. gear and radar equipment is being installed at Fairwood Common Airport, Swansea.

**Colour Coding.**—Rejafix Ltd., of 81-83, Fulham High Street, London, S.W.6, manufacturers of industrial marking and printing machinery, have produced a machine which will in one operation put up to four different colour bands and one line of print on resistors, capacitors, fuses and similar components. It is available for hand or automatic operation. The separation between bands can be adjusted from  $\frac{1}{16}$  in to  $\frac{1}{2}$  in and the component can be up to  $\frac{1}{2}$  in diameter and 5 in long.

**Solartron** are to manufacture under licence in this country the gunnery trainer made by the Rheem manufacturing organization of New York. The trainer is in many respects similar to the Solartron radar simulator.

**Industrial television** by Marconi is being used experimentally by the National Coal Board at the Manvers Coal Preparation Plant at Wath-on-Dearne, Yorks. It provides the control engineer with a view of the coal conveyor system at a strategic point in this plant where the output of four collieries is processed.

The latest addition to the Aberdeen fishing fleet, the motor trawler *Clovella*, is equipped with a "Clipper" combined transmitter-receiver and direction-finder. It is made by Woodson's, marine radio manufacturers, of Tullos Radio Works, Greenbank Road, Aberdeen, who also produce a smaller version (the SS) for smaller craft. Both receivers incorporate the P.I.M. (position indicating meter) device for the visual reading of bearings and counting Consol signals.



**PRINTED CIRCUITRY** is used in this four-valve Roberts' battery portable housed in a leather case. Access to the control panel and the batteries is gained by two zip-fastened covers. The current consumption is h.t. 10.4 mA, l.t. 125 mA.

**High Definition Television, Ltd.**, are to supply twenty television receivers with 27-inch direct-viewing screens for installation in L.C.C. schools. Five similar models are also being installed in Edinburgh schools. Details of this receiver and a 21-inch model are given in a brochure "Television Receivers for Education" obtainable from 98, Highbury New Park, London, N.5.

**Airtech, Ltd.**, of Haddenham, Bucks, have supplied a mobile v.h.f. direction finder for use on Christmas Island during the proposed Pacific nuclear tests. The vehicle is equipped with a Standard Telephones and Cables automatic cathode-ray direction finder. The station provides for remote selection of up to ten v.h.f. channels and the monitoring of two channels at a time.

**Marconi Marine** now provide a service at their port depots whereby specially adapted television receivers can be fitted in merchant ships for short periods whilst in port or permanently.

**Kelvin & Hughes (Industrial) Ltd.** have appointed J. R. Taylor as area engineer for the west of England. His address is "Garth," Edward Road, Walton St. Mary, Clevedon, Somerset. (Tel.: Clevedon 3535.)

**Plastic Roller Shutter.**—Extruded unplasticized p.v.c. slats half-an-inch wide, which interlock to form a roll-type shutter, suitable, for instance, for television and gramophone cabinets, have been produced by National Plastics (Sales) Ltd.

**Vidor** have made arrangements with Direct TV Replacements, of 134-136 Lewisham Way, London, S.E.14, for them to supply replacement line output transformers and deflection coils for their older television receivers.

**New London headquarters** for Thorn Electrical Industries, manufacturers of Ferguson receivers and Thorn lighting equipment, to be built in Upper St. Martin's Lane, W.C.2, will be 180ft tall.

**Ambassador's** London office has been transferred to Camp Bird House, Dover Street, London, W.1, with the acquisition of the Hartley-Baird group of companies by Camp Bird, Ltd. Also with the take-over of the group, E. M. Gamble has been appointed to the Board of Photo Printed Circuits, of Brookwood, Surrey.

**Holiday & Hemmerdinger, Ltd.**, the wholesalers, have moved to 71, Ardwick Green North, Manchester, 12. (Tel.: Ardwick 6366.)

## NEW COMPANIES

**Semiconductors, Ltd.**, has been formed jointly by the Plessey Company, Ltd., of Ilford, Essex, and Philco Corp., of Pennsylvania, U.S.A., to manufacture in this country transistors and other semiconductors under Philco patents. Automatic equipment designed and manufactured by Philco will be used to begin the mass production of transistors early in 1958.

**Radio Telephone Aerial Systems, Ltd.**, has been formed in association with J-Beam Aerials, of Northampton, and Sky-Masts, of London, to make aerial equipment for v.h.f. radio-telephone systems. It will have offices and workshops at Redan Street, London, W.14. (Tel.: Shepherds Bush 6426.)

**Cossors** have formed a wholly-owned subsidiary, Cossor Radio & Television, Ltd., to handle the domestic sound and television receiver side of their business.

## OVERSEAS TRADE

**Television transmitters** for a further three stations in Denmark are being supplied by Marconi's, who have previously equipped three of the present four stations. The new stations, which will be at Aalborg, Vestjylland and Naestved, will each have 4-kW vision and 1-kW sound transmitters and a 16-stack aerial.

**Sound Reproducing Equipment.**—As a result of the North American tour undertaken by Harold J. Leak, chairman and managing director of H. J. Leak & Company, last autumn orders totalling over a quarter of a million dollars have been booked.

**Cyprus.**—The island's first television station, to be built near the sound broadcasting station of the Cyprus Broadcasting Service at Nicosia, will be equipped entirely by Marconi's. The equipment, valued at £38,000, will include 500-watt vision and 125-watt sound transmitters and studio equipment.

**Marine Equipment.**—The new Israeli luxury liner *Theodor Herzl*, built in Hamburg, has been fitted with Marconi Marine communication and public address equipment by Alhoutyam, Ltd., of Haifa.

**Washington Show.**—Automatic Telephone and Electric Co. was one of the few overseas exhibitors at the Armed Forces Communications and Electronics Association's annual exhibition in Washington (May 20th to 22nd).

**Italy.**—Equipment required for the next Olympic Games (Rome, 1960) includes sound reproducing gear, low-power transmitters and receivers. Particulars obtainable from Dott. Giovanni Poli, Comitato Olimpico Nazionale Italiano, Stadio Olimpico, Rome.

**Paris Air Show.**—Amongst the equipment being shown by British Communications Corporation, Ltd., at the 22nd Salon International de l'Aéronautique at Le Bourget (24th May-2nd June) is their multi-channel automatic recording system, which provides for the simultaneous recording of up to twenty channels on a single tape. They are also showing a variety of communications equipment.

**Surveillance Radar.**—Demonstrations of the mobile version of the high-power surveillance radar (CR21), recently introduced by Cossor Radar & Electronics, have been given during the past few weeks in Scandinavia. The equipment will also be seen at the Le Bourget International Air Show, after which the unit will tour Western Europe.

**Airport Communications.**—A contract for the supply of communications equipment for 39 airports has been awarded to Pye Telecommunications, Ltd., in a programme of modernization being undertaken by the Indian Department of Civil Aviation.

**South African Agents.**—Pye Telecommunications, Ltd., have appointed S.M.D. Telecommunications (Pty.), Ltd., P.O. Box 10013, Johannesburg, as sole distributors of Pye radio-communication equipment in the Union of South Africa, Bechuanaland, Swaziland and Basutoland, and Mozambique south of the Save River.

**North American Market.**—J. P. Coleman and J. W. Perkins, of Gresham Transformers, Ltd., are undertaking an eight-week tour of Canada and the United States to set up an organization to handle the North American business of the company and its associates, Lion Electronic Developments, Ltd., and Data Recording Instrument Co., Ltd.

**Latin American Distributors,** of 410 Cigali Building, New Orleans 12, Louisiana, are interested in receiving quotations and literature from United Kingdom manufacturers of 17-in and 21-in, 525-line, television receivers and also mains/battery sound receivers.

**U.S.A.**—The Standard Radio & Record Co., of 1028 E 65th Street, Seattle 15, wish to get in touch with United Kingdom manufacturers of amplifiers, loudspeakers, tone arms, turntables and pickup cartridges. They have hitherto handled U.K. equipment through New York agents, but now wish to import directly. Quotations should show both f.o.b. and c.i.f. prices in dollars.

**Finland.**—Elektriska Ab Heden-gren, Fredriksgatan 65, Helsingfors, are interested in getting in touch with British manufacturers of tape recorders, including, if possible, a pocket battery-operated type.



## sound equipment serves the world

The latest result of the continual improvement in the standards of our range of Sound Reproducing Equipment is the new **T664 60-watt power amplifier**. This incorporates four output valves (6L34) in parallel push-pull with less than 1% distortion at full rated output. Output regulation is exceptionally stable. The T664 is suitable for rack-mounting and has an audio output indicator on the front panel.

*Send for full details of this outstanding new amplifier.*

a product of

**THE TRIX ELECTRICAL CO. LTD.**

1-5, MAPLE PLACE, TOTTENHAM COURT RD.,  
LONDON, W.1

Tel.: MUJ 5817. Grams: TRIXradio Wasdo London.

# RANDOM RADIATIONS

By "DIALLIST"

## When, Oh When?

ALTHOUGH the Norwich television station has been using its permanent aerial since Christmas, East Anglians are still awaiting the inauguration of the permanent transmitters. So far only the temporary transmitters have been used which, even with the permanent directional aerial, give an e.r.p. of not more than 1.5 kW. I understand that, although the permanent transmitters are already installed, the G.P.O. has not yet given permission for them to be brought into use. The reason is that the station, with its permitted e.r.p. (depending on direction) of from 1 to 10 kW, would cause considerable interference in the service area of the Belgian station at Liège, which is temporarily working on low power. Near the east Suffolk coast the result of the continued use of the low-power transmitters means that people who bought receivers in anticipation of a reasonable signal in their area find that the field strength is around 100  $\mu$ V/m instead of 500. And that, as you know, makes all the difference between a good picture and one that's "snowy" and always liable to get out of sync. It also means that with TV sets being run all-out every scrap of interference makes its unwelcome presence seen and heard. When Norwich will radiate on full power no man can say. But those who live in East Anglia and parts adjacent fervently hope that it won't be long.

## Good Work!

FRANCE has given a lead which we would do well to follow in the matter of getting rid of interference from motor vehicle ignition systems. Within a year all users of such vehicles will be compelled to have them fitted with suppressors. Why we can't do the same thing I don't know: all that we've done so far is to make it an offence to sell a new car that has not been so treated. That's all very well, so far as it goes; but there are still large numbers of cars on the roads which were built before this regulation came into force. Not long ago I spent an hour or so checking the interference-producing proclivities of the cars and lorries which passed my window

and found that quite a number of the newer ones were just as bad in this respect as the old-stagers. One wonders if some suppressors have been removed, which is, of course, an offence.

## A Console Problem

MUCH AS I like television receivers of the console type, partly because those with full-length doors can be such attractive pieces of furniture but mainly because there's room enough in them for a good-sized loudspeaker, I've one quarrel with those who design them. If you want to view in comfort and to avoid eyestrain, as no doubt you do, the centre of the screen should be at just about the same height above the floor as is your eye when you're sitting in your favourite chair. Now, a typical centre-of-the-screen height for a console is about 28 inches. The height of your eye above the floor depends on what sort of chair you're using and how tall you are. But generally speaking it's likely to be between 35 and 40 inches. At any rate, it's a good bit more than 28 inches. This means either that you look down at the screen, or that you sit forward, bending your back and being liable to get a crick in the neck. Stands whose height is adjustable are, I believe, available for table models. Couldn't some ingeni-

ous designer of cabinets give us a console that would increase the comfort of viewing? I don't mean that the cabinet should be taller, for that would make it look ungainly. Wouldn't it, though, be possible to have the top compartment of the cabinet separate from the lower one and mounted on spring-loaded extending supports? Then when the doors were opened the screen could be raised to a pre-set height; at the end of the evening the upper part would be pressed down into place again and secured by closing the doors.

## They Say . . .

SOME queer rumours get about, and it's surprising to find how quickly they spread, even amongst intelligent people. The other day a friend said to me: "I'm told that as soon as this v.h.f. scheme is completed all present wireless sets will be obsolete and useless." He would hardly believe me when I assured him that if he wanted to go on receiving with the long-wave and medium-wave set that he has, he'd be able to do so for many years to come. So convinced, in fact, was he that there was truth in the rumours that it wasn't until he'd written to the B.B.C. and had a reassuring answer from them that his mind was at rest. It's much the same with colour television; lots of



## "WIRELESS WORLD" PUBLICATIONS

	Net Price	By Post
TELEVISION ENGINEERING: Principles and Practice. Volume III: Waveform Generation. S. W. Amos, B.Sc.(Hons.), A.M.I.E.E. and D. C. Birkinshaw, M.B.E., M.A., M.I.E.E. . . . .	30/-	30/11
TELEVISION RECEIVING EQUIPMENT. W. T. Cocking, M.I.E.E. 4th Edition . . . . .	30/-	31/6
FOUNDATIONS OF WIRELESS. M. G. Scroggie, B.Sc., M.I.E.E. 6th Edition . . . . .	12/6	13/6
WIRELESS SERVICING MANUAL. W. T. Cocking, M.I.E.E. 9th Edition . . . . .	17/6	18/6
RADIO VALVE DATA: Characteristics of over 2,500 Valves, Transistors and C.R. Tubes. Compiled by <i>Wireless World</i> . . . . .	5/-	5/7
SECOND THOUGHTS ON RADIO THEORY. "Cathode Ray" of <i>Wireless World</i> . . . . .	25/-	26/2
RADIO LABORATORY HANDBOOK. M. G. Scroggie, B.Sc., M.I.E.E. 6th Edition . . . . .	25/-	26/6
ELECTRONIC COMPUTERS: Principles and Applications Edited by T. E. Ivall . . . . .	25/-	25/9
THE OSCILLOSCOPE AT WORK. A. Haas and R. W. Hallows, M.A. (Cantab.), M.I.E.E. . . . .	15/-	15/10
TRANSISTORS: Circuits and Servicing. B. R. Bettridge . . . . .	2/6	2/8

A complete list of books is available on application

Obtainable from all leading booksellers or from

ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1

people believe the absurd rumour that all existing receivers will have to be consigned to the dustbin if and when it comes along. Rumours such as these do a lot of harm. I've heard folk say: "It's no good buying a television set now, since colour will make it useless so soon." It's no use telling them that colour isn't just around the corner, or anything like it, and that existing sets will be as useful as they are now when it does come. They'd rather believe the know-alls (or know-nothing-at-alls).

## OBITUARY

### Canon H. R. Wilkinson

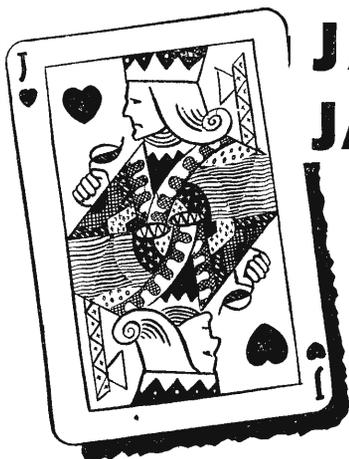
*Dr. H. J. Denham, of Cassor's, writes:*

BEST known to the public as the possessor of Cromwell's head, Canon H. R. Wilkinson, who died on April 13th, was, however, one of the first wireless enthusiasts. As far back as 1907 he was operating a full-size spark transmitter, working chiefly with a relation in the Navy who was engaged in developing Naval equipment. In those days he was Vicar of Stoke-by-Nayland in Suffolk, and his first aerial was slung from the tower of its noble perpendicular church on the hill top. His receiving equipment was on the grand scale, and his main inductance (200-3,000 metres) was, if the memory of a small boy can be trusted, about four feet long and a foot wide, rectangular in section. There were the remains of a magnetic detector of his own design, but he was using crystal detectors, molybdenum-zincite and zincite-copper pyrites, which burned out almost every time he transmitted in spite of a fantastically complicated key which short-circuited everything.

He was a brilliant mechanic, and his house was always full of ingenious contrivances which would have delighted "Free Grid." He served with the fleet as a naval chaplain, in the first world war, collecting several grants for ingenious gunnery inventions and an O.B.E. He never took up transmitting again, but retained his interest in radio till his death at the age of 85.

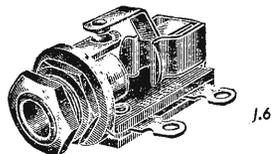
Among his many achievements was the wiring up of his Church for carbon microphones for the benefit of patients in a sanatorium five miles away, to which, with voluntary help, he ran a cable.

Last year he took up "hi-fi" with characteristic enthusiasm, because he could distort it to make up the deficiencies of his hearing-aid, and up to the age of eighty he made the rounds of his rural-deanery, on a motor cycle. A most remarkable man, and a well-loved priest.

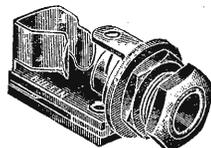


# JACKS AND JACK PLUGS

TO BS. 666



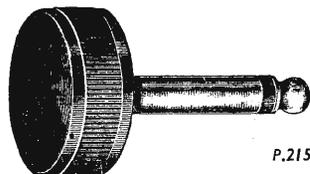
J.6



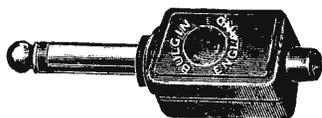
J.2



P.38



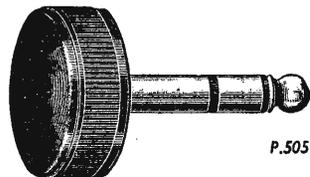
P.215



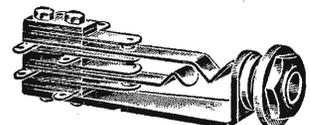
P.38/P.



P.500



P.505



J.15

**LIST NO. J.6.** Ruggedly constructed closed-circuit panel mounting jack with silver-plated solder tags for reliable connections. Gives continuity between terminal-tags when plug is "out."

**LIST NO. J.2.** Similar Jack to List No. J.6; s.r.b.f. insulation, nickel-plated front of panel nut. General purpose open-circuit Jack.

**LIST NO. P.38.** Slender handle Jack-plug, interior screw terminals; in highly polished bakelite case. Ideal for close grouping.

**LIST NO. P.215.** Flat-headed Jack-plug, minimum projection from panel and side-entry for flex. Highly plated metal parts and interior screw-terminals.

**LIST NO. P.38/P.** Unbreakable Jack-plug, similar to P.38 but moulded insulation is of P.V.C. Ideal for use in hospitals, schools, churches and anywhere where intercommunication systems are required.

**LIST NO. P.500.** Metal-cover Jack-plug, designed to reduce Electrostatic interference pick-up from outside sources. Also made in a co-axial version (List No. P.500/Co-Ax.).

**LIST NO. P.505.** A three pole version of List P.215 (above). Interior screw terminals on two-poles, solder-tag for tip pole. Side-entry for flex.

**LIST NOS. J.11-22.** Standard panel-jacks with  $\frac{3}{8}$  in.  $\varnothing$  Panel-Bushes. "Panel-area" occupied =  $\frac{1}{8}$  in.  $\times$   $\frac{3}{8}$  in., rear depth approx.  $2\frac{1}{8}$  in. Rust-proofed frames, spring "nickel-silver" leaves, pure silver contacts. A wide range of contact-combinations. Masking and bushing-accessories available.

**SEND FOR CATALOGUE**

197/WW.

PRICE 1/- POST FREE

# BULGIN

**A. F. BULGIN & CO. LTD.**  
**BYE-PASS ROAD**  
**BARKING ESSEX**

Telephone RIPpleway 5588 (5 lines)

# UNBIASED

By FREE GRID

## The Audio Unfair

THE TITLE I have given to this particular piece of unbiased comment might well have been applied to the Audio Fair, judging by the arbitrary, indiscriminate and random manner in which "invitations" were distributed. Even at the offices of *W.W.* admission tickets were, to use the jungle English of to-day, "in short supply," and many hundreds of readers who did not get one must be feeling aggrieved. It was certainly not the Editor's fault, however, as he did his best with the number he received, and even withheld one from me. As he rightly said, if I hadn't enough initiative to get in without one, I had no business to be writing for *W.W.*

I suppose everybody knows that, unless exhibitions are held in buildings provided with a sufficient number of exits and other precautions against fire, admission must be "by invitation only"; in other words, it is permitted to incinerate your friends but not your customers. For exhibitions in which a large number of more-or-less soundproof demonstration rooms are needed, an ordinary exhibition hall is out of the question, and only an hotel with its numerous bedrooms will suffice.

It has been suggested that the radio industry should build its own exhibition hall complete with demonstration rooms, and hire it out to other exhibition organizers when not wanted for radio or audio shows. But what other exhibition requires a hundred soundproof rooms? The answer is none. But surely, if every room had a built-in closed-circuit TV screen fed by a standard cinema projector, it could be used as a veritable cinema *de luxe*. The rooms would be booked up for weeks ahead by those self-respecting courting couples who are at present compelled to patronize the local cinema for their petting parties, to the annoyance and physical discomfort of those

who have come along to see the films.

But I digress. I used my initiative as the Editor suggested, and got into the show with little difficulty.

I have left myself but little space to talk of the exhibits, and so, being a stereo fan, will content myself with referring to the realistic demonstration of the new stereo-on-disc records. The ease with which discs are changed put them a good step ahead of stereo-on-tape, but one or two firms are already pioneering with the idea of tape records in cassettes. In these the "record" consists of two spools housed in one container, like the cassette of a magazine-loaded ciné camera, which can be slipped into position as easily as a disc.

## Influencing ERNIE

WHEN you read these words in the closing days of May I shall probably be sitting in an hotel in Lytham St. Annes, Lancs., working out final details for improving my financial position to the tune of, I hope, several thousand pounds in what I believe to be a perfectly legal and moral enterprise.

As you will know, the first draw in the Premium Savings Bond venture is to start at 9 a.m. on June 1. The gentlemen of the Press—which, believe it or not, includes me—are invited to be present while the £1,000 and £500 prizes, numbering about 250, are allocated by ERNIE, the electronic roulette wheel developed by Post Office engineers.

Technical details about ERNIE (Electronic Random Number Indicator Equipment) appeared in *W.W.* last September. Reading this description started me on my great venture which, to put it briefly, is to provide, from electronic apparatus concealed about my person, some not-so-random interference to try to influence ERNIE's numerical selections to my own pecuniary advantage. Obviously I can't reveal the details at this stage, but, briefly my equip-

ment consists of a programmed pulse generator feeding into a miniature magnetron transmitter with a highly directional microwave dish built into my bowler hat. A flexible waveguide run up the back of my neck will be concealed by long hair specially grown for the purpose.

As for the moral issue as to whether I am justified in trying to influence ERNIE to show more favour to me than to others in the audience who may have bought bonds, I would point out that anybody is at perfect liberty to bring his own not-so-random interference generator and try to beat me at my own game.

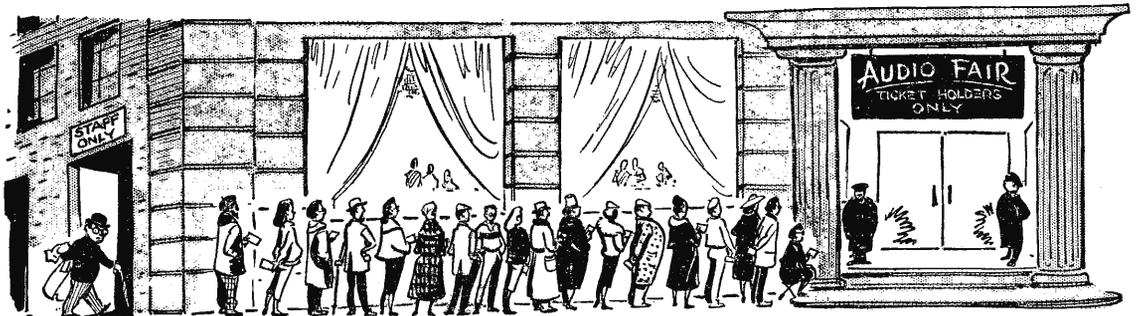
It then becomes a test of skill and not merely a game of chance. In fact, by turning a game of chance into one of skill I ought to earn approbation from high ecclesiastical authority rather than the censure which ERNIE'S progenitor has received.

## Radio Pædiatrics

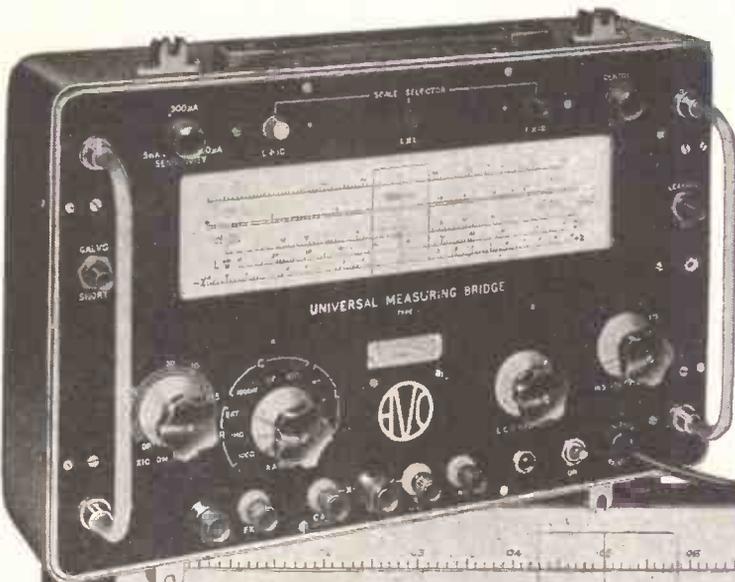
IT MUST be over 30 years since details were first published in this journal of a baby-alarm consisting of a simple microphone hanging over the child's cot for conveying signals of distress to the radio set downstairs.

This old-fashioned device is still in use despite a suggestion made more recently that the child's cries could be fed to an electronic analyser which would, according to the result of the analysis, trigger off an automatic nappie changer or a lullaby-loaded juke box to restore peace to the night nursery.

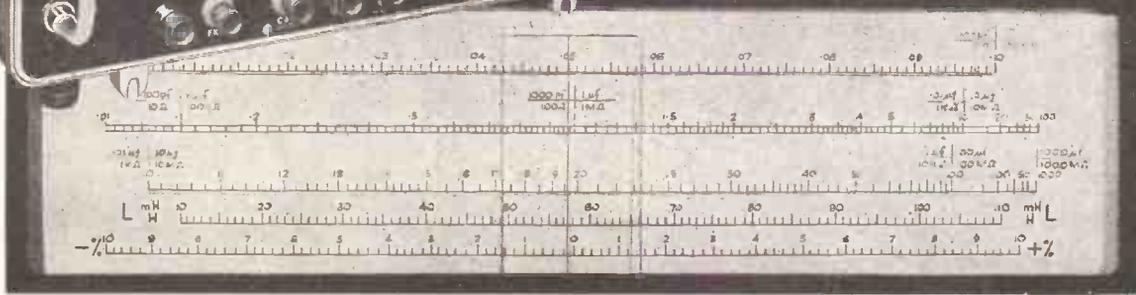
The latest idea from the U.S.A. is to provide the child with a musical pillow. No details are given but I can only conclude that American babies are easily satisfied. Surely it would be improved if the pillow gave out the sound of the mother's recorded voice admonishing the child to silence. Why not arrange for the child's cries to release a pre-determined quantity of nitrous oxide such as the dentist gives us?



I used my initiative as the Editor suggested



An  
*Entirely*  
**NEW**  
Standard



**THIS** new "Avo" Instrument is a self-contained mains driven model incorporating 24 calibrated ranges.

One sweep of the main calibrated dial covers four decades and assures a very rapid search for balance. This, combined with an automatic scale expansion device, enables the two lower accuracy decades of the main scale to be read at full scale accuracy.

Leakage currents can be measured down to  $0.01 \mu A$  at 450V, thus representing an ability to read up to 45,000 M $\Omega$ . Balance indication is clearly shown by a panel meter operating in conjunction with a valve voltmeter circuit.

For production checking, the Bridge has been fitted with a  $\pm 10\%$  comparison scale for use with external standards.

Resistance measurements employ D.C. When measuring inductance and capacity, the Bridge network is fed from an internal 1,000 c/s oscillator. Internal capacity strays have been eliminated electronically.

The instruction manual provided shows how components can be tested in situ.

Dimensions:  $15\frac{1}{2} \times 10\frac{1}{2} \times 10$  ins. approx. (with lid closed)

Weight: 16 lbs. approx.

Power Supply: 100-110V. and 200-250V.  
A.C. 40-65 c/s.

in  
**BRIDGE**  
Presentation



**Universal  
MEASURING  
BRIDGE Type 1**

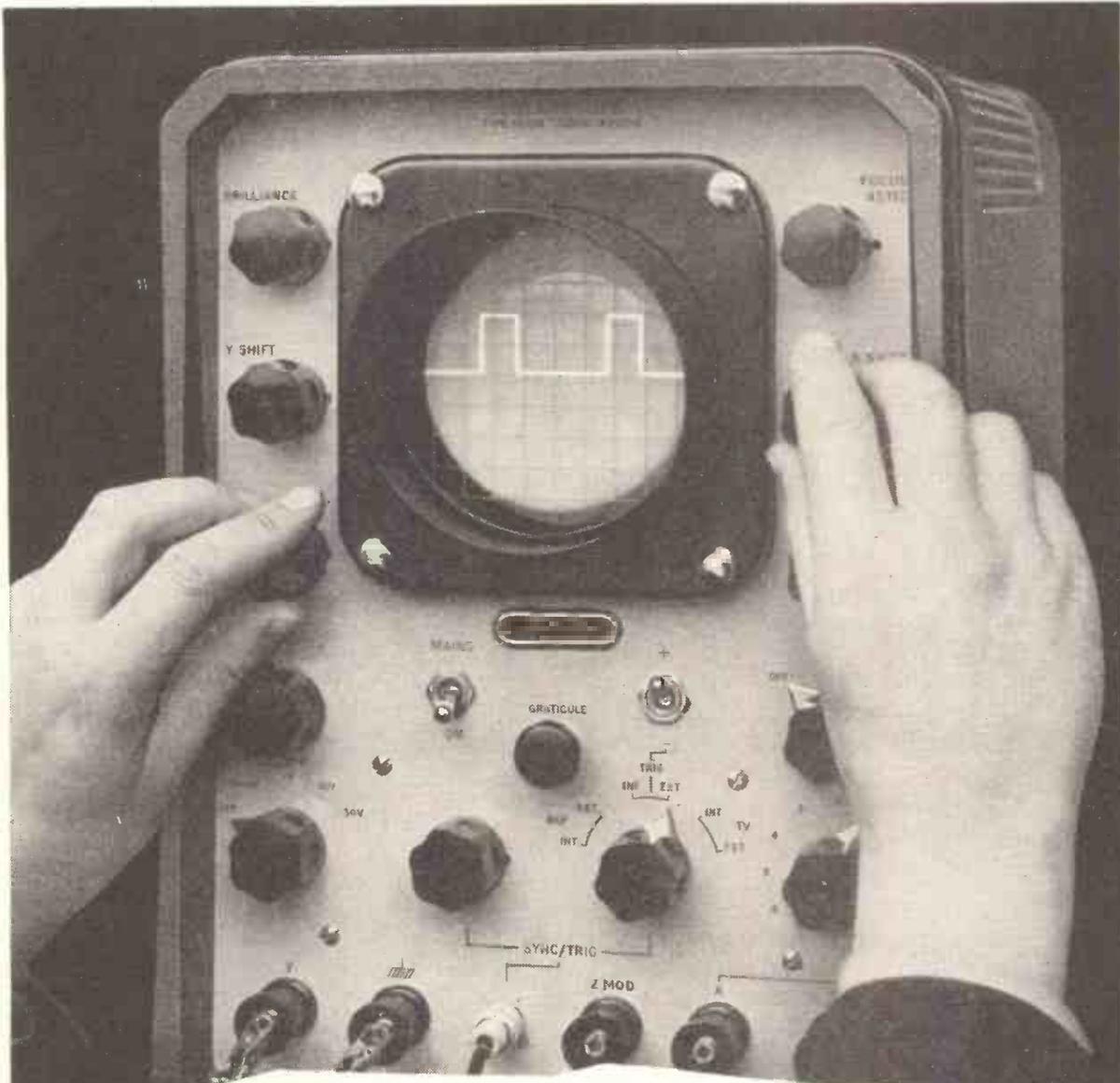
List Price **£75**

- RESISTANCE:** 6 calibrated ranges covering  $0.1 \Omega$  to 1,000 M $\Omega$ . (Accuracy  $\pm 1\%$  at midscale).
- CAPACITY:** 6 calibrated ranges covering  $1 \mu F$  to 1,000  $\mu F$ . (Accuracy  $\pm 1\%$  at midscale).
- INDUCTANCE:** 6 calibrated ranges covering 1 mH to 1,000 H. (Accuracy  $\pm 2\%$  at midscale).

*The* **AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO. LTD**

**AVOCET HOUSE • 92-96 VAUXHALL BRIDGE ROAD • LONDON • S.W.1.**

MB/I



***High performance . . . wide applications . . . truly portable***

In the Solarscope CD 614 we have included all the valuable features of heavier and more expensive oscilloscopes, while producing a truly portable instrument at an economical price.

It is particularly suited for radio communication, radar, TV and applications involving pulse work and transient investigations.

**BRIEF SPECIFICATION:**

NOMINAL BANDWIDTH  
1 c/s—9 Mc/s  $\pm$  1 Mc/s for 3 db down

SENSITIVITY CALIBRATION  
By a 50 c.p.s. square wave

EXPANSION  
10 diameters nominal

CALIBRATION  
By 0.1  $\mu$ s, 1  $\mu$ s, and 10  $\mu$ s markers  $\pm$  5%

TIME BASE  
10 c.p.s.—200 Kc/s. Trigger from TV frame block

***THE SOLARTRON ELECTRONIC GROUP LTD.***

*Internationally accepted...*



leading technicians  
throughout the world  
use the  
**Mullard**  
Dual Trace Oscilloscope

**The DUAL TRACE OSCILLOSCOPE  
TYPE L101 MARK 2 as used by**

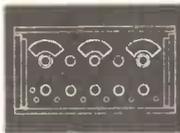
- Research Laboratories
- Government Establishments
- Communications and Television Development Laboratories
- Hospitals
- Universities
- Computer Engineers
- Electricity Supply Authorities
- Audio Engineers
- Nucleonic Engineers
- Instrumentation Engineers
- Aircraft Manufacturers
- Telephone Manufacturers
- Oil Refineries

Scientists and technicians throughout the world recognise that the quick, easy and accurate way to measure and compare waveforms is to use the Mullard Dual Trace Oscilloscope L.101 Mk. 2. Many hundreds of these oscilloscopes are now helping to speed production and research.

Here are some of the advanced design features that have brought this instrument international recognition: Two signals can be locked steady on the graticule for comparison and measurement by the turn of a knob. Two amplifiers preserve their frequency response on all gain settings—each has a 4Mc/s bandwidth (0.1 $\mu$ s rise time) irrespective of sensitivity, and a maximum sensitivity of 20mV pk/pk-cm. There is no interaction between channels. Free running or triggered, the time base has sweep speeds from 0.1 $\mu$ s/cm to 10ms/cm and the trace may be expanded five times. Both voltage ( $\pm 5\%$ ) and time ( $\pm 10\%$ ) are measured by the null method and calibration accuracy is preserved by a well regulated power supply.



Precision Oscilloscope



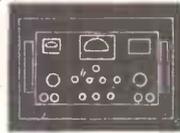
Precision Pulse Generator



Regulated Voltage Unit



Wide-Range Valve Voltmeters



Transistor Tester

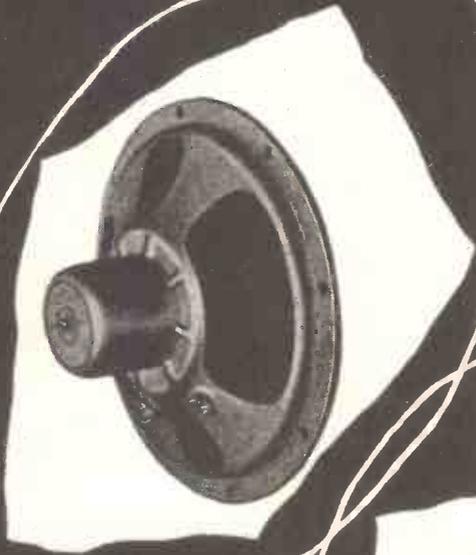


High & Low Pass Filters

Manufacturers and design engineers are invited to write for full details of the Oscilloscope L.101 Mk. 2 and other instruments in the Mullard range.

MULLARD LIMITED · EQUIPMENT DIVISION · MULLARD HOUSE  
TORRINGTON PLACE · W.C.1 · TELEPHONE: LANGHAM 6633





**ROLA CELESTION—**

acknowledged leaders for over 30 years in  
the design, development and manufacture  
of loud-speakers for all purposes . . . world  
famous for quality of reproduction, sensi-  
tivity in performance and long life under  
all climatic conditions.

**LOUDSPEAKERS  
FOR ALL  
PURPOSES**

**ROLA  
CELESTION**

**Rola Celestion Ltd.** FERRY WORKS THAMES DITTON, SURREY  
Telephone: EMBerbrook 3402

# It's time we restated the Ferrograph policy



## IN SIX MODELS :

### For portable use

Model 3A/N - 79 gns.  
Model 3A/NH - 86 gns.

### Permanent Installation

Model 66N - 84 gns.  
Model 66H - 88 gns.

### Stereophonic sound

Stereo 77 - 98 gns.  
Stereo 88 - 105 gns.

WE take pride in the fact that the first Tape Recorder ever to be designed and wholly manufactured in this country was the Ferrograph. That was eight years ago. Today there are so many different makes on the market that the production of Tape Recorders is almost an industry in itself.

During this period of continuous development and expansion, one thing has not changed—the Ferrograph policy. When a manufacturer is faced with an almost insatiable demand it takes courage and determination not to relax—if only temporarily—some of the high standards on which his reputation has been founded.

From the beginning this Company has had but one aim : to make the finest Tape Recorder that this country, with its abundance of technical skill, can produce. We remain true to those ideals.

We do not believe that Tape Recorders of the standard of the Ferrograph can be produced in larger quantities without some compromise with quality. To those, therefore, who have had to wait for their Ferrographs we offer this apology.

That the Ferrograph policy is right can be judged by its ever-widening circle of users among the world's Broadcasting stations—in industry—in music—in education—in medicine. Wherever, in fact, performance and dependability are assessed at their true worth and not in cost alone, there you will find the Ferrograph.

If you intend choosing your new Tape Recorder by the same measurement, you may feel that any delay in delivery is but a temporary embarrassment soon to be forgotten in the pleasure of owning such an outstanding instrument.

*Full details on request from*

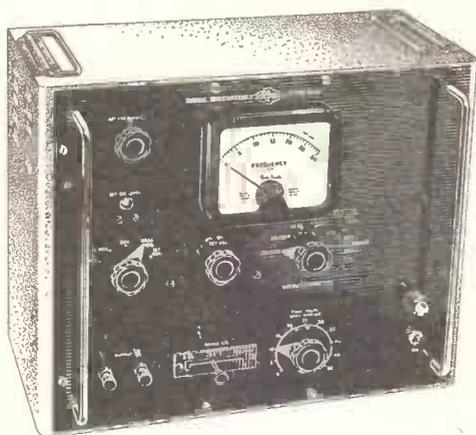
**BRITISH FERROGRAPH RECORDER CO. LTD**

*A SUBSIDIARY OF WRIGHT & WEAIRE LIMITED*

131 SLOANE STREET · LONDON · S.W.1 · Tel: SLOane 2214/5 and 1510

# 0.03 c/s-30 c/s

## V.L.F. SIGNAL GENERATOR



### Type 852

#### FREQUENCY RANGE

0.03 c/s-0.3 c/s.

0.3 c/s-3 c/s.

3 c/s-30 c/s.

#### HARMONIC DISTORTION

Less than 2%.

#### OUTPUT LEVEL

500 microvolts-50 volts.

#### NORMAL OUTPUT

IMPEDANCE

10k ohms.

#### LOW OUTPUT IMPEDANCE

150 ohm from a cathode  
follower.

**T**HE NEW Airmec Signal Generator Type 852 produces a sinusoidal signal continuously variable from 500 microvolts to 50 volts peak with small distortion over the frequency range 0.03 c/s to 30 c/s.

A variable speed motor used in conjunction with a three-speed gear box drives a specially designed modulating capacitor which modulates a high frequency signal. The modulated signal is rectified and amplified in a direct coupled amplifier employing negative feedback. The output frequency is adjusted by varying the speed of the D.C. motor and is indicated on the dial of a 6in. meter.

Since the frequency of the output signal does not depend upon the use of very high value resistors or capacitors, a good long term stability is obtained.

**QUICK DELIVERY**

**PRICE £100**

*Full details of this or any other Airmec instrument will be forwarded gladly on request.*

# AIRMEC LIMITED

HIGH WYCOMBE

BUCKINGHAMSHIRE

ENGLAND

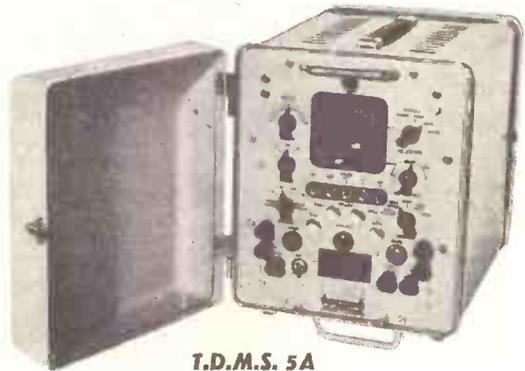
Cables : Airmec High Wycombe

Telephone : High Wycombe 2060

# *Distortion detected - Transmission unaffected*

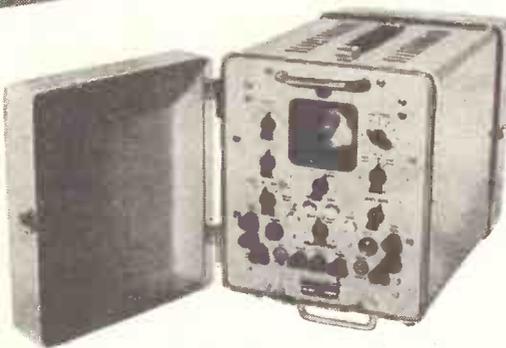
## *with the T. D. M. S.*

The T.D.M.S. 5A and 6A are portable sets designed to measure distortion at any point in a radio teleprinter or line telegraph circuit without interfering with normal transmission. The equipment consists of two units each  $18\frac{1}{2}$ " x  $11\frac{1}{2}$ " x  $13\frac{1}{2}$ " both mains driven and electronically controlled. Either may be used independently for certain tests or both may be used in combination to cover a comprehensive range of testing operations.



**T.D.M.S. 5A**

*Sends an automatic test message, or characters, or reversals at any speed between 20-80 bauds with or without distortion. The CRO has a circular time base for distortion measurements on synchronous signals only, or relay adjustment. Weight 37 lb.*



**T.D.M.S. 6A**

*For distortion measurements on working circuits without interrupting service. Each element of a start-stop signal appears separately on the spiral time base display. Adjustable speeds from 20-80 bauds. Weight 33 lb. Higher speed versions can be supplied to order.*

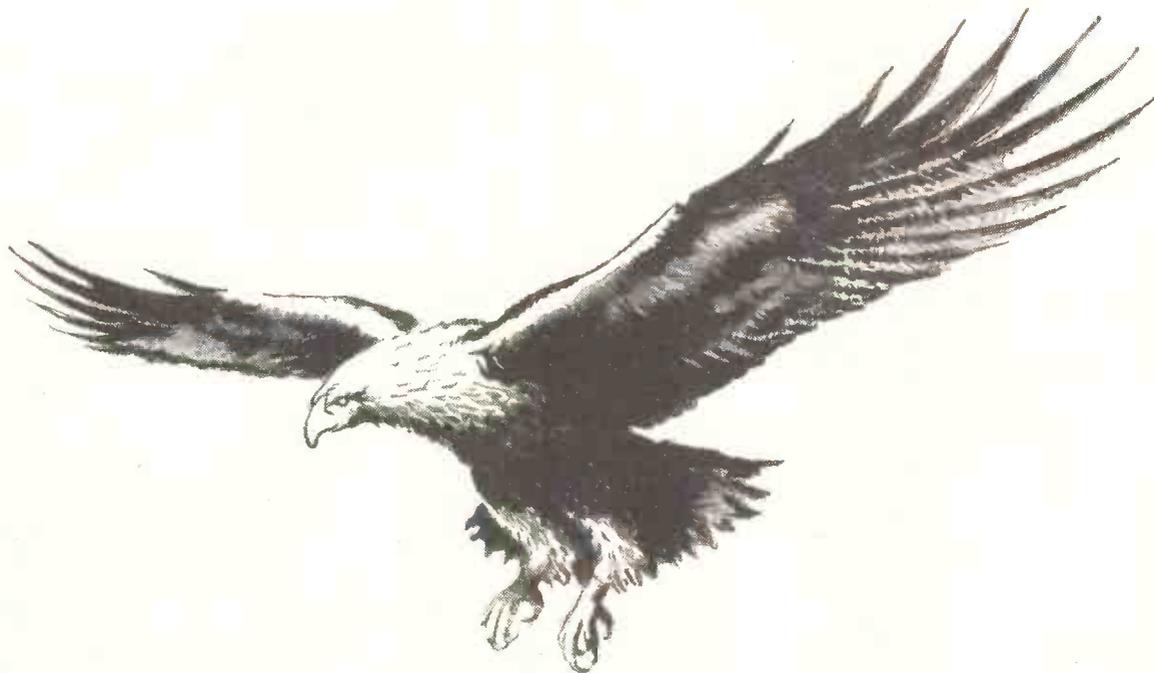
*You are invited to apply for a copy of a descriptive leaflet.*

**AUTOMATIC TELEPHONE & ELECTRIC CO. LTD.,**

STROWGER HOUSE, ARUNDEL STREET, LONDON, W.G.2.  
TELEPHONE : TEMPLE BAR 9262. CABLEGRAMS : STROWGEREX LONDON.



ATI4611-BX107



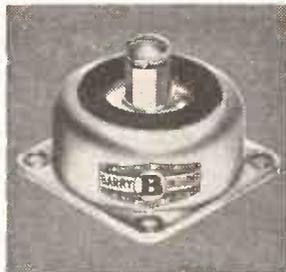
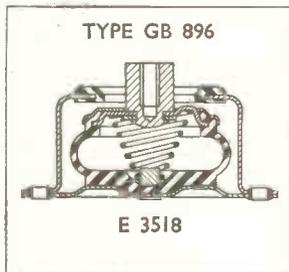
# Splendid Isolation

and how to achieve it in the air

ALWAYS the unrelenting enemies of the delicate and the vulnerable, shock and vibration are being reduced to impotence by a new and more effective method of isolation.

Today airborne electronic equipment rides safely—on "BARRYMOUNT" Isolators, air-damped to provide smooth, sweet travel for mounted apparatus. Because

they're air-damped there's no snubber contact even at resonance. Because they're air-damped they offer high shock resistance. Because they're made with balloons and snubbers of cold-resistant natural rubber they operate efficiently from  $-40^{\circ}\text{C}$  to  $+70^{\circ}\text{C}$ . And because of their non-linear characteristics they offer greater static deflection and wider load ranges—a big plus in flexibility.



**Give us a shock** or the most violent vibration and we'll find the answer in a standard "BARRYMOUNT" Isolator. Specification is simple — though its simplicity may not always be apparent. Why not get in touch with us at the earliest possible stage?

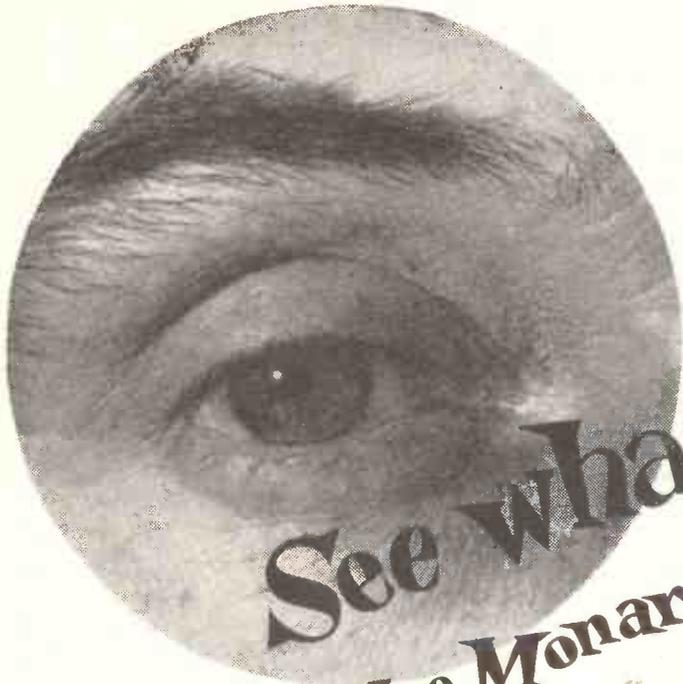
The wide range of "BARRYMOUNT" Air-damped Isolators for airborne apparatus is supported by "BARRYMOUNT" Shock Mounts—cup-type isolators designed to absorb high impact shocks and isolate frequencies above 40 cps—for mobile and marine equipment. Technical literature is freely available for both ranges.

Your equipment rides safely on the

MADE IN ENGLAND UNDER LICENCE  
**BARRY B MOUNT**  
 FROM BARRY CONTROLS INC. OF U.S.A.

"BARRYMOUNT" and "BARRY B MOUNT" are Registered Trade Marks

Cementation (Muffelite) Limited · 20 Albert Embankment, London, S.E.11 · Telephone: Reliance 6556



**See what I mean  
about the Monarch?**

I don't pretend to know all the "why's and wherefores," I just know it gives me what I look for and that's absolute purity of tone. Before I bought it I tried the lot and the Monarch was way ahead. Another thing too—it's remarkably gentle with my precious records—it plays through a batch of ten all sizes, in any order and has done so all this time without the slightest fault.

**FACTS AND FIGURES**

Technical details of listening tests and performance are readily available - ask for the U.A.8. Data Sheet



**Monarch UA8**

**World's Finest 4-Speed Autochanger!**



BIRMINGHAM SOUND REPRODUCERS LTD., MONARCH WORKS, OLD HILL, STAFFS., ENGLAND.

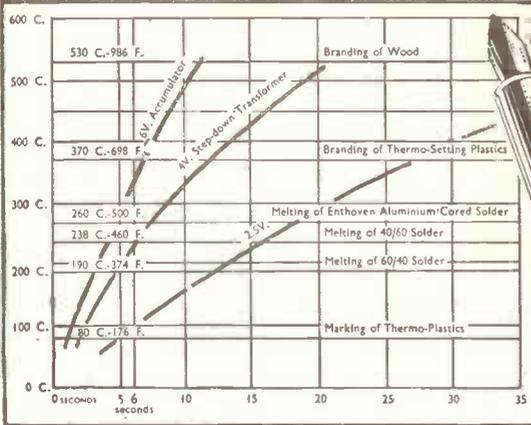
# The *Superspeed*

## SOLDERING IRON

**heats up from cold  
in 6 seconds!**

Manufactured for Enthoven Solders Ltd., by Scope Laboratories, Melbourne, Australia.

Designed on an entirely new principle, this light-weight, versatile iron is eminently suitable for soldering operations in the radio, television, electronic and telecommunication industries. For test bench and maintenance work it is by far the most efficient and economical soldering iron ever designed. Ideally suitable for use with Enthoven Aluminium Cored Solder (melting point 260°C. 500°F.).



**TIME/TEMPERATURE CURVE CHART from the SUPERSPEED SOLDERING IRON TIP/TEMPERATURE TIME CHECK**

The effect of different voltages on initial heating-up time is shown. Whilst 4V is the standard voltage normally employed, 6V will cause no harm, and accumulators are a useful source of current supply.



- \* Activated by light thumb pressure on the switch ring. When pressure is released, current is automatically switched off—thus greatly reducing electricity consumption, wear on copper bit and carbon element.
- \* Length, 10"; weight, 3½ ozs.; can be used on 2.5 to 6.3 volt supply (4 volt transformer normally supplied) or from a car battery.
- \* More powerful than conventional 150-watt irons; equally suitable for light wiring work or heavy soldering on chassis.
- \* Simple to operate; ideal for precision work.
- \* Requires minimum maintenance—at negligible cost; shows lowest operating costs over a period.

LIST PRICES	
IRON	39/6
TRANSFORMER	35/6
All prices and trade discounts subject to revision.	

For full particulars, including guarantee terms and free trial facilities, please write to the sole concessionaires in this country:—

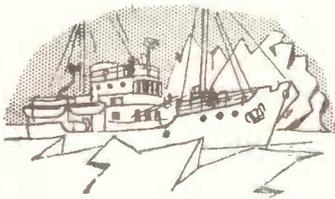
**ENTHOVEN SOLDERS LTD.** (Industrial Equipment Division)  
Dominion Buildings, South Place, London, E.C.2. **MONarch 0391**

Switch to the

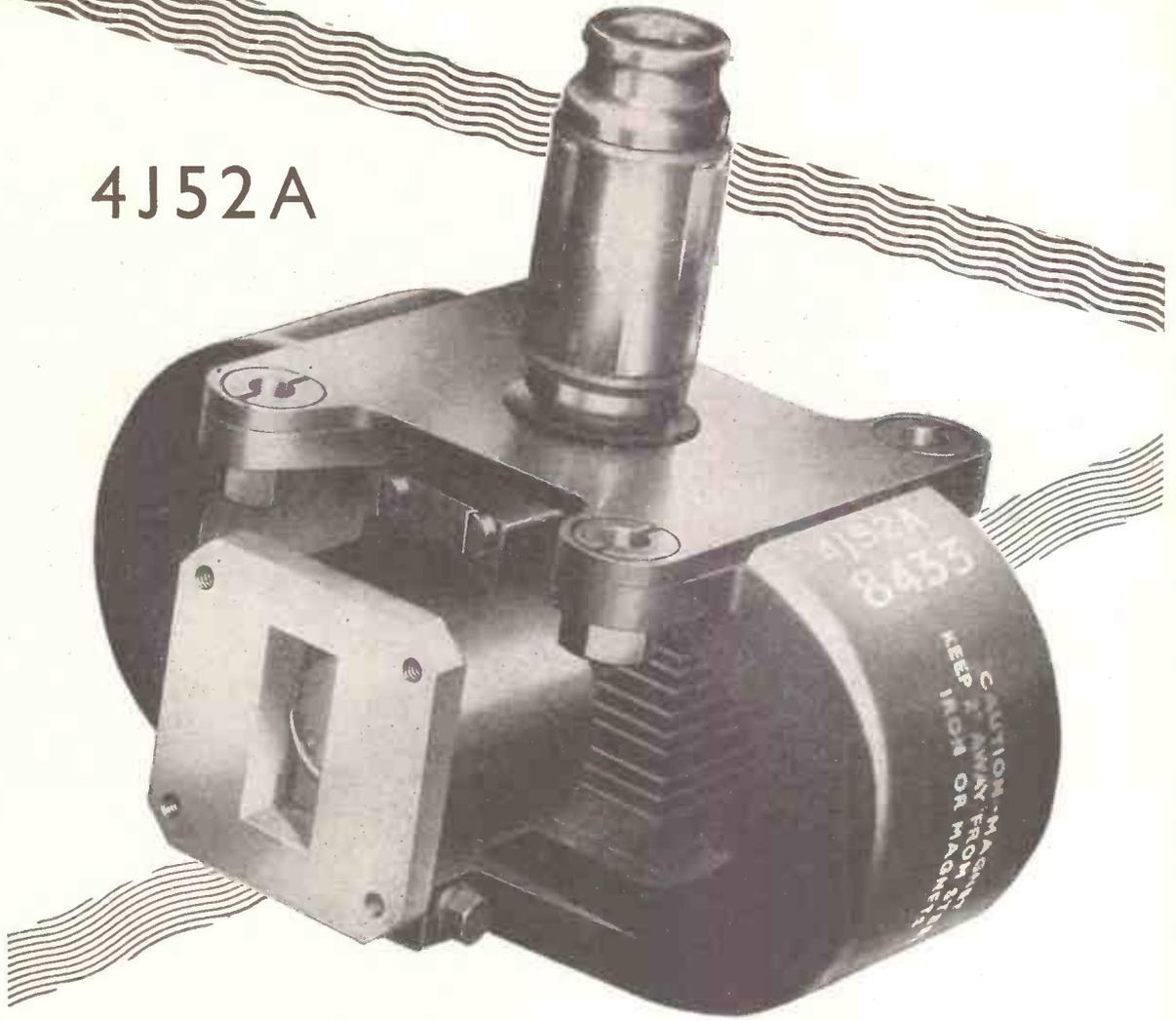
# *Superspeed*

## Soldering Iron

as being used by the  
Royal Society Antarctic Expedition  
for the International Geophysical Year.



4J52A



Write for data on our extensive  
range of Magnetrons

**'ENGLISH ELECTRIC'**

E.E.V. Type	American Equivalent	Class	Heater Starting		Maximum Frequency Range (Mc/s)	Typical Operation				
			Volts	Amps.		Peak anode voltage (kV)	Peak anode current (Amps)	Pulse length (Msec)	Pulse rate (p.p.s.)	Peak output power (kW)
M551	4J52A	*	12.6	2.2	9350-9400	15.0	15.0	1.0	1000	75

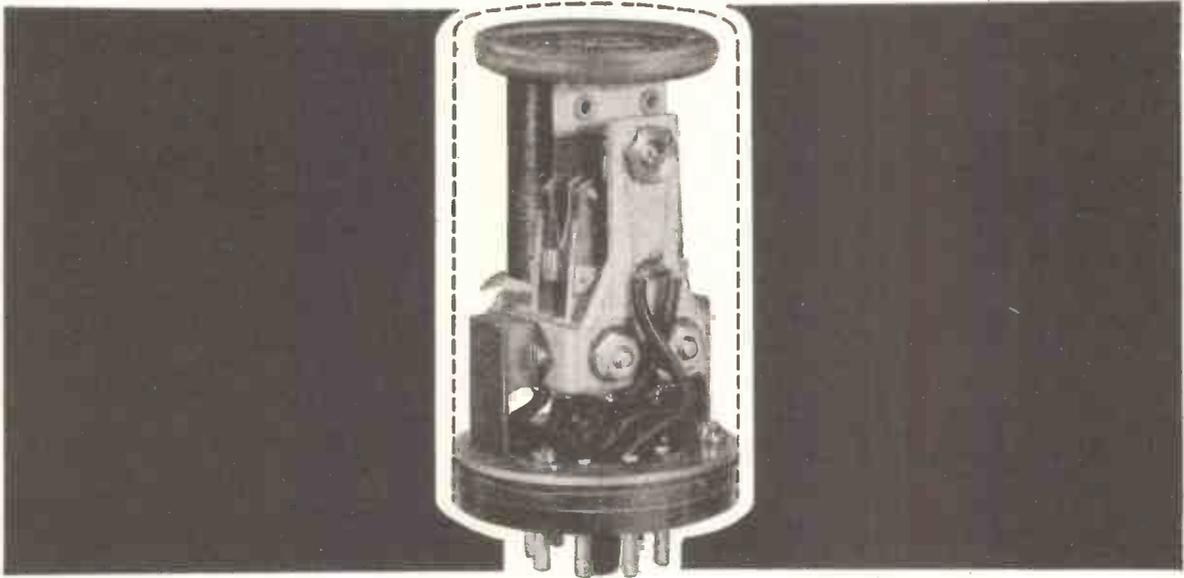
\* Denotes Fixed Frequency—Pulsed, Packaged Integral Magnet.

ENGLISH ELECTRIC VALVE CO. LTD.



Chelmsford, England  
Telephone: Chelmsford 3491

# the most efficient means of generating H.T. voltages from low voltage supplies



This is an accurate summary of this latest type heavy duty vibrator by Plessey, a product widely employed in Services equipment.

It is Design Approved and the supply position is good.

For all equipment where of necessity only a low voltage supply is available — as in certain electronic equipment, public address systems and portable transmitters — and for equipment where an emergency supply *must* be provided against mains supply failure, this 100 watt vibrator is the ideal component.

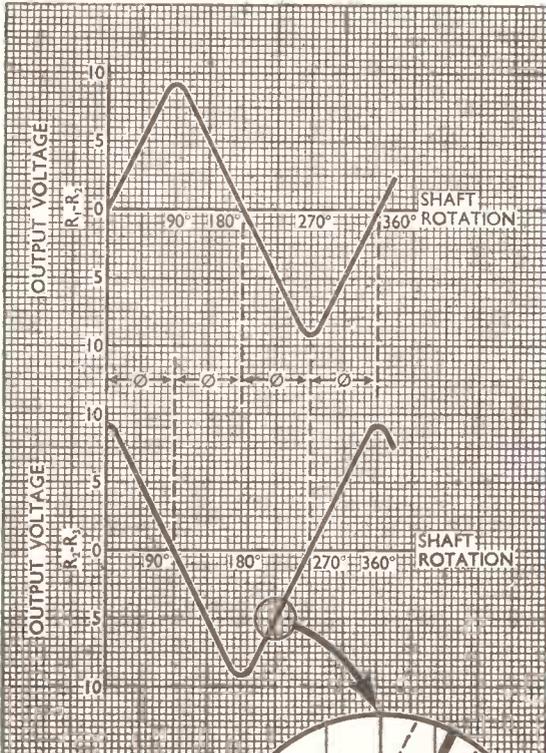
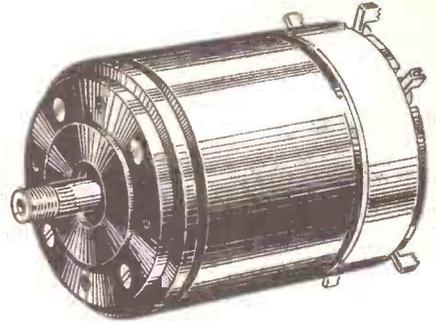
Equipment manufacturers and Design Engineers are invited to request a copy of Plessey Publication No. 769 which contains complete technical details and performance data.

heavy duty vibrators by

**Plessey**

# A NEW APPROACH...

## The SPERRY 15 VLT Synchro (Variable Linear Transformer)



The Sperry size 15 Variable Linear Transformer gives two output voltages whose amplitudes vary linearly with shaft rotation. It consists of a rotor with two windings at right angles which rotates in a stator having a single winding. If the Synchro is connected as shown, the voltages  $V_{R_1-R_2}$  and  $V_{R_2-R_3}$  vary linearly as shown in the accompanying graphs.

**SUPPLY:**— The unit is designed to work with a 1000 c.p.s. 10-volt signal applied to the stator, but will work at other frequencies including 400 and 50 c.p.s. with suitable adjustment of the signal level.

**TRANSFORMATION RATIO:**— The rotor output voltage, when the stator is excited at 10 volts 1,000 c.p.s., is arranged to rise to 5 volts when the rotor is displaced 45° from a null position. This transformation ratio of 2:1 varies  $\pm 0.2$  per cent between the windings in any one model and  $\pm 0.5$  per cent between models.

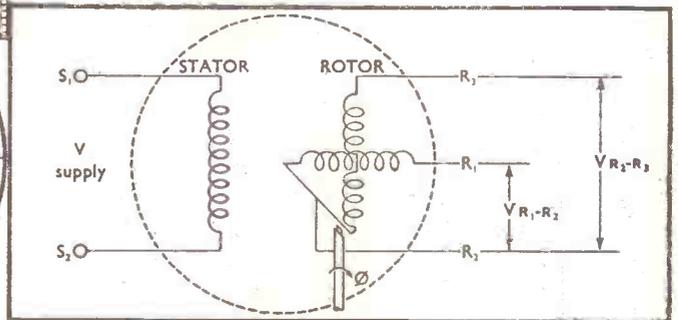
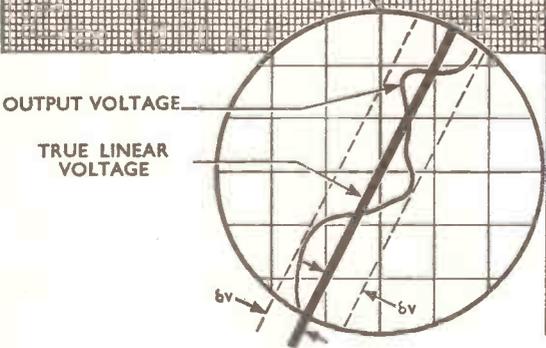
**NULL SPACINGS:**—  $\theta = 90^\circ \pm 4'$

**LINEARITY:**— The rotor output voltage rises linearly from the null position

- $\delta = \pm 0.4\%$      $0^\circ - 60^\circ$  displacement
- $\delta = \pm 0.5\%$      $60^\circ - 75^\circ$  displacement

Expressed as a percentage of the output voltage at  $60^\circ$ .

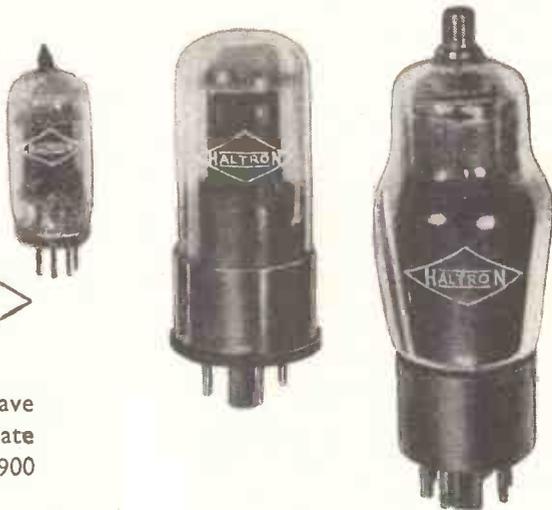
Linear Synchros offer a new approach to a wide range of computing problems and may also be used for position control and signal modulation.



Advice on their application to your problem is available

# SPERRY SYNCHROS

# EXPORT ONLY



As leading exporters of Radio Tubes, we have pleasure in giving hereunder our up-to-date stock list which comprises approximately 1,900 types in large quantities.

OA2	1L N5	2T/450E	5B P4	6A S7G	6P7E	6P F5	7E5	12J7GT	25Z8GT	6B DDT	260A
OA3	1M3	2V/400A	5B P7	6A T6	6P8G	6P F7	7E6	12K7GT	26J	62TH	262A/B
OA50	1N5G	2X2	5C/100A	6A T7	6P8GT	6B G7	7E7	12K8	26K	62VP	264
OA55	1N5GT	2X2A	5C/450A	6A U6	6P11	6B H7	7E7	12K9G	27B	63RE	270A
OA159	1N21B	3A4	5C P1	6A U8	6P12	6B H7GT	7G7	12K9GT	28D7	63SPT	274A
OA180	1N23	3A5	5C P7	6A V8	6P13	6B J7	7H7	12Q7GT	28D	64ME	276A
OA181	1N34(A)	3A8	5D B1	6A X4GT	6P16	6B J7GT	7K7	12S A7	30C1	64SPT	281A
OB2	1N35	3A/107A	5D/100	6B4G	6P33	6B K7	7N7	12S A7GT	30L1	65ME	282A
OB3	1N38(A)	3A/110A	5F P7	6B5	6O8G	6B K7GT	7Q7	12S C7	31	66KU	288
OC3	1N39	3A/141A	5G P1	6B7	6O8G	6B L7	7R7	12S E7	32	67PT	300B
OC801	1N43	3A/142A	5J P4	6B7G	6P7G	6B H7	7S7	12S E7	32E	71A	204B
OC802	1N45	3A/144A	5L P1	6B8	6H6G	6B H7GT	7V7	12S H7	33	72	204H
OD3	1N46	3A P1	5L35	6B8G	6H6GT	6B J7	7W7	12S J7	33A/100A	73	304TH
OE3	1N48	3B4	5R4GY	6B8GT	6B8	6B J7GT	7Y4	12S J7GT	34	75	304TL
OG3	1N51	3B7	5T4	6B A6	6J4	6B E7	7Z4	12S K7	34E	76	307A
OZ4	1N52	3B2A	5U4G	6B A7	6J5	6B S7	8A1	12S K7GT	35A5	77	310
OZ4A	1N54	2B56	5V4G	6B D7	6J5G	6B T7	8A8	12S L7GT	35G5	78	310A
OZ4G	1N55(A)	3B28	5W4	6B E8	6J5GT	6T7G	8D2	12S N7GT	35L8GT	79	310B
IA3	1N60	3B/151A	5W4G	6B E7	6J6	6T8	8D3	12S Q7	35T	80	311
IA5G	1N64	3B P1	5W4GT	6B G6G	6J7	6U4GT	8D5	12S Q7GT	35W4	80/S	311A
IA5GT	1N65	3C4	5X4G	6B H6	6J7G	6U6G	8D6	12S R7	36Z5	81	311SU
IA7G	1N69	3C23	5Y3G	6B I5	6J7GT	6U6/6G5	9A1	12U/G	35Z4GT	82	3130
IA7GT	1N72	3C24	5Y4GT	6B J6	6J8G	6U7G	9B W6	12X3	35Z5GT	83	314
IA B6	1P1	3C45	5Y4	6B K7	6K6G	6U8	9D2	12Y4	36	83V	325A
IA C8	1P5GT	3C/150E	5Y4G	6B L7	6K6GT	6V4	9D6	13D1	36A	84/6Z4	327A
IA D4	1P10	3C/351A	5Z3	6B M5	6K7	6V6	9HP7	13D2	37	85	328A
IA E4	1P11	3O P1	5Z4	6B Q5	6K7G	6V6G	9NP7	13D3	38	85A1	332A
IA H5	1Q5GT	3D6	5Z4G	6B Q6GT	6K7GT	6V6GT	9U8	13P6A	38E	85A2	332PEN
IA J4	1B4	3D22	5Z4GT	6B Q7A	6K8	6V6GT	10	13P6A	39/44	85J	334
IB3GT	1B5	3D/100A	5A3	6B R7	6K8G	6V9	10Y	13V7A	40	86CV	354V
IB34	1B4	2D P1	6A8	6B S7	6K8GT	6W4GT	10D1	14A7	40SUA	90AG	367A
IB28	1B5	3E29	6A7	6B W6	6L5G	6W7G	10F3	14B8	41	90CV	368A(WE)
IB27	1T2	3E P1	6A8	6B W7	6L6	6X2	10LD3	14E7	41E	95	371B
IO1	1T4	3F P7	6A8G	6B X4	6L6G	6X4	11D3	14H7	41MHL	100TH	380A
IC2	1T5GT	3H/150J	6A9GT	6B X6	6L6GA	6X5	11D5	14K7	41MP	117L7GT	388A
IC3	1T4	3L P4	6A9A	6B Y7	6L6GT	6X5G	11E2	14B7	41MPT	117N7GT	389A
IC5G	1U5	3Q4	6A B5	6C4	6L7	6X5GT	11E3	14E7	41MTL	117Z3	394A
IC5GT	1X2A	3Q5G	6A B7	6C5	6L7G	6X8	12A/112A	15A2	41MXP	117Z6GT	417A(WL)
ICP1	2A3	3Q5GT	6A B8	6C5G	6L34	6Y6G	12A6	15A6	41STE	119A	450TL
ID6	2A4G	3S4	6A C7	6C5GT	6LD3	6Y7G	12A6GT	15D1	42	121VP	451PT
ID6	2A6	3V/400A	6A D6G	6C6	6M1	6Z4	12A7	15D2	42E	160BE	610XP
ID8GT	2A6	3V4	6A D7G	6C8G	6M5G	6Z5	12A8GT	15E	42MPT	183BT	702A
ID13	2A7	4/100BU	6A D8	6C10	6M7	6Z5V5G	12A H7GT	15E	42SPT	205E	705A
IE4	2B7	4B31	6A E8	6C21	6N5	7A2	12A H8	15Y3	43	2C5F	707A/B
IE7G	2O81	4C27	6A F6G	6C26	6N7	7A8	12A J8	16A5	43U	210DDT	708A
IE7GT	2O22	4C29	6A F7G	6C D6G	6N7G	7A4	12A L5	17Z5	46	210HF	709A
IF1	2O28(A)	4C34	6A G5	6C D7	6N7GT	7A6	12A Q5	19A G5	45 Spec.	210HL	713A5
IF2	2C34	4D1	6A G6G	6C H6	6N8	7A6	12A T6	19B G6	47	210LF	714A5
IF3	2C40	4E P1	6A G7	6C J6	6P7G	7A7	12A T7	19E2	47	210SPG	715
IF5G	2D4A	4E27	6A H6	6C K6	6P8	7A8	12A U6	19T3	50B5	210SPT	716A
IFD1	2D21	4J53	6A J5	6C K8	6P9	7A N7	12A U7	19X3	50C5	210VPT	716B
IFD9	2E22	4T E A	6A J7	6C Q5	6P25	7B5	12A V6	19Y3	50C D6G	211	716C
IG4GT	2E30	4T P5	6A J8	6C R6	6P26	7B6	12A X7	20V6	50G6GT	212E	717A
IG5G	2G21	4X P	6A K5	6D1	6Q5G	7B7	12B7	20D2	50Y6GT	215P	721A
IG3GT	2J21A	5A P1	6A K6	6D2	6Q7	7B8	12B A6	20D3	53	215SG	723A/B
IG8GT	2J26	5A/102A	6A K7	6D6	6Q7G	7B P7	12B A7	21A6	53A	217C	724A/B
IH5G	2311	5A/102D	6A K8	6D7	6Q7GT	7C4	12B E6	23D	53KU	220B	725A
IH5GT	2J32	5A5	6A L5	6E5	6R7	7C6	12B H7	24G	54KU	220P	728A
IH9G	2334	5A Z4	6A M5	6E8	6R7G	7C6	12B K6	25A G6	54(EK)	220RC	731A
IJ6G	2336	4B4G	6A M6	6E8G	6R7GT	7C7	12B T6	25L6	57	220TH	800
IK5G	2339	5B/100A	6A N7	6F5	6S7	7D3	12B Y7	25L6G	578	230XP	801
IK7G	2348	5B/250	6A Q4	6F5G	6S A7	7D5	12C8	25L6GT	58	231D	801A
IL4	2354	5B/254M	6A Q5	6F5GT	6S A7GT	7D6	12C8GT	25N7GT	588	240B	802
LLA4	2E25	5B/502A	6A R8	6F8	6S B7	7D7	12D P7	25Y6	59	242B	803
LLA5	2N63	5B/700A	6A R5	6F8G	6S B7G	7D8	12E1	25Z4G	61PT	243B	800
LL6	2N64	5B/700A	6A R5	6F8GT	6S C7GT	7D9	12H6	25Z5	61P	249C	805
LLD5	2T/270K	5B P1	6A R6	6F7	6S D7GT	7D10	12J6GT	25Z6G	61SPT	250TH	806

## HALL ELECTRIC LTD

HALTRON HOUSE, 49-55 LISSON GROVE,  
LONDON N.W.1.

Tel.: Ambassador 1041 (5 lines)

Cables: Hallettric, London

HALTRON

HALTRON

807	1852	ACR13	CV80	DH81	ECC31	G650	1.610	PC1.82	EK75	UF43	VT91A
807JAN	1861	ACT6	VY92	DH142	ECC32	GD8	LD210	PC1.83	RKR7.3	UF50	VT93
808	1867	ACT9	CV100	DH147	ECC35	GDT4B	LD410	PD220A	RL18	UF85	VT94
809	1881	ACT17	CV101	DH149	ECC40	GEX00	LL2	PFA4	RL37	UF89	VT95
810	1903A	AE251	CV103	DH150	ECC91	GEX34	LL4	PEB4	RM14	UL41	VT98
811	2050	AL2	CV111	DH719	ECC82	GEX35	LN152	PEN25	RM1A	UL84	VT88A
813	2051	AL4	CV115	DK32	ECC83	GEX45/1	LP2	PEN36C	R2M2	UM35	VT99
814	2103	AP4	CV117	DK33	ECC84	GEX54/3	LP4	PEN46	RM3	UQ80	VT100B
815	2151	APR4B	CV118	DK40	ECC85	GEX54/4	LP6	PEN20A	RM4	UD5	VT107
816	3220K	APP4C	CV119	DK91	ECC91	GEX54/5	LP25	PEN383	EK233A	UU6	VT108
826	3951	APP4G	CV125	DK32	ECC92	GEX55	LS5	PE11	EX235	UU9	VT114
828A	4032A	AR2	CV122	DK92	ECC78	GEX55.1	LS8A	PL81	S231 P	UV21	VT501
829	4019A	AR10	CV174	DL33	ECC3	GEX66	LS650	PL82	S25A/B	V471	VT506
829A	4019B	AR11	CV179	DL35	ECH21	GL1	LD3	PL83	S265	VF85	VT610
829B	4020A	AR12	CV188	DL41	ECH22	GT1E	LD37	PM2	S27A	UX1N	VT82
830B	4021A	AR13	CV181	DL43	ECH35	GT1C	LZ318	PM2DX	S28A	V80	UX33
832	4022AR	AR300(A)	CV193	DL66	ECH42	GUR0	M125H	PM4DX	S130	V236	UY (A)
832A	4023A	AR310	CV210	DL70	ECH80	GUR1	M315H	PM13M	S130P	V245A	UY71
833A	4038L	AR32E	CV222	DL71	ECH81	GU00	MH4	PM22A	SDB	V872	UV72
834	4045A	ARD4	CV239	DL92	ECL80	GZ30	MH41	PM202	SD81	V914	VU113
835	4046A	ARF3	CV240	DL93	EOR30	GZ31	MH4105	POVT25	SG250	V1120	VU120
836	4049D	ARF4	CV309	DL94	EF8	GZ32	MHL4	PP2	S1M2	V1906	VU120A
837	4062A	ARF9	CV364	DL95	EF9	GZ34	MHLD6	PP3	SP2	V1907	VU133(A)
838	4060A	ARF10	CV415	DL96	EF22	GZ41	MK74	PP4	SP4	V1924	VU134
841	4061A	ARF13	CV481	DL101	EF36	H3	M14	PP5	SP13/C	V2023	VU1504
843	4062A	ARF34	CV980	DL651	EF37	H30	M16	PP225	SP22	V6566	VU506
845	4061B	ARF38	CV988	DL510	EF37A	H83	MPT42	P536/IE	SP41	VCR55	VX3027
850	4069A	AR53	CV1254	DM70	EF39	H210	MR10	PT5	SP42	VCR97	VX6010
852	4074A	ASG5025	CV1479	DM71	EF40	HBC90	MS4B	PT15	SP61	VCR139A	VZ7006
860	4078A	AS4100	CV1480	DQ2	EF41	HBC91	MSP4	PT4	SP10	VCR140	VZ7056
861	4079A	AT4	CV1481	DQ4	EF42	H24	MSF41	PT25	ST11	VCR140A	VZ7
862	4081A	AT5	CV1482	DRM1B	EF50	HD24	MS/Pen	PT80	STV70/20	VCR883	VZ21
863	4205E	AT40	CV1488	DRM2B	EF54	HP93	MS/Pen/B	PT82	STV280/40	VCR11B	W21
864	4212D	ATP4	CV1489	DW2	EF73	HP94	MT9F	PT82	STV280/80	VCR51C	W31
865	4212E	ATP7	CV1490	DW3	EF90	HP200	MT9L	PT75	SU750	VCR16A	W81
866A	4222B	ATP10	CV1510	DY80	EF98	HP300	MT6544	PZ1173	SU150A	VCR517A	W83
866JR	4223A	ATP75	CV1533	DY80	EF98	HP300	MT6544	PZ20	T110	VCR517E	W77
869B	4223B	AT825	CV1595	EZ35	EF99	H20	MT9/Pen	QA2400	TB1/60	VCR517C	W81
872A	4260A	ATS70	CV1856	E4442	EF99	H1E	N14	QA2401	TDD2A	VCR517E	W142
874	4264A	ATS750	CV1873	E1148	EF91	H1A	N15	QA2403	TH4B	VCR51E	W143
875A	4270A	AT5	CV8008	E1155	EF92	H1E3	N16	QA2404	TP22	VCR518A	W149
876	4274A	AT7	CV801	E1190	EF93	H1A1	N17	QA2405	TI7	VCR52B	W150
878A	4278A	AZ1	CV2	E1191	EF94	H1B0	N18	QA2407	TT10	VCR52B	W27
879	4279A	AZ11	CV31	E1192	EF94	H1B2	N19	QA2408	TT11	VCR52B	W232
884	4282B	AT15	CV2	E1223	EF904	HP2	N77	QK2C	TT15	VCR530	WD30
885	4300A	AZ31	D1	E1228	EH90	HP21	N78	QP21	TT16	VCU "C"	WD142
902	4304CA	AZ41	D4	E1231	EHT1	HP210	N151	QQV07/40	TTB31	VCU "F"	WD150
905A	4304CB	B21	D15	E1248	EKK2	HP4101	N152	QS40	TV03-10	VCU "N"	WD709
923	4307A	B30	D41	E1254	EK90	HP41010	N153	Q570/20	TV05-12	VCU "P"	W3A
931A	4310A	B36	D42	E1255	EL2	HP406	N164	Q575/20	TY1-50	WG121	WL417A
934	4313C	B35	D43	E1256	EL3	H2E V	N70	Q579/40	TZ20	VGT128	X14
935	4323A	B15B	D77	E1271	EL22	HR210	NC7	Q575/40	TV32	V1132	X17
956	4328A	B22B	D152	E1273	EL32	HT1	NC9	Q583/3	U10	VMP49	X18
957	4337A	B309	D400	E1320	EL33	HVR2A	NC10	Q585/10	U12	VP4	X21
968A	4357A	B319	DA30	E1323	EL35	HY90	NC11	Q5108/40	U14	VP4A	X22
959	4378	B329	DA41	E1338	EL37	HW015	NC13	Q5112/15	U15	VP6	X24
991	4602	BT19	DA30	E1342	EL41	IW3	NC19	Q5150/40	U17	VP12D	X31
1003	4600	BL43	DA50	E1359	EL42	IW3	NC19	Q5150/45	U18	VP21	X41
1201	5651	BM313	DA100	E1368	EL81	IW4	NE16	QV04/7	U19	VP23	X56
1203A	5657	BT45	DAC32	E1379	EL83	KD21	NGT1	QV05-25	U20	VP41	X61
1221	5672	CB16	DAP91	E1380	EL94	KD24	NGT5	QY2/100	U22	VP4	X61M
1223	5676	C1C	DAP98	E1415	EL90	KD25	N82	R1	U23	VB2	X63
1225	5678	C5B	D61	E1417	EL91	KK1	N85	R2	U31	VB21	X64
1229	5687	C8A	D63	E1436	EL93	KK2	N72	R3	U33	VB32	X65
1230	5725	C144	DC90	E1474	EM4	KR8/3	NT37	R3/16	U37	VR50	X66
1267	5750	CK502	DD4	E1489	EM34	KRN2	NT40	B10	U41	VR54	X71M
1273	5763	CK546	DD6	E1494	EM35	KT2	NT57T	R12	U43	VR57	X77
1274	5823	CK548	DD41	E1498	EM30	K78(C)	R16	B16	U62	VR59	X78
1282	6080	CK721	DDA1	E1516	EN91	K794	RT88	R17	U78	V465	X79
1281	6397	CK723	DDL4	E1550	EQ80	K730	K732B	R18	U81	VR85A	X81
1284	4600	CK905	DE32	E178	ESU800	K731	NT100	R19	U82	VR86	X143
1290A	7475	CK1008	DDR7	EABC80	EY61	KT32	NU2	RC8	U143	VR75/30	X150
1381HQ	8011	CL4	DDR25	EAC91	EY88	KT33(C)	NU4	REL21	U147	VR78	XD2/0V
1603	8012(A)	CL63	DEQ1	EAP42	EY91	KT41	NU6	REL38	U161	VR80/30	X91
1611	8018(A)	OMG25	DE73	EB84	EZ4	KT42	OM1	BG1	U162	VR91A	Y7
1612	8016	OM84B	DE75	EB41	EZ35	KT44	OM4	EGL-125	U164	VR102	Y83
1614	8019	OM8	DE79	EB93	EZ40	KT41	OM5	R81-240	U319	VR105/30	Z14
1616	8090	OM6	DET10	EBUC	EZ41	KT32	OM5A/B	E83-250	U690	VR125	Z19
1619	8022	OM6	DET12	EB038	EZ90	KT63	OM6	EG6	U709	VR150/30	Z21
1620	8025	CV12	DET16	EBD41	EZ90	KT66	OM9	EK20(A)	UABC80	VB24	Z21M
1622	8025A	CV15	DET18	EB090	FC2	KT61	OM10	EK25	UAF42	V837	Z22
1624	8028	CV43	DET19	EB090	FC4	KTW61	OM11	EK28	UBC41	VB10A	Z62
1625	9001	CV31	DET20	EB091	FC17	KTW82	P3	EK28A	UBF90	VT40	Z83
1626	9002	CV32	DET22	EBF2	FG27A	KTW63	P4	EK30	UBL21	VT13B	Z86
1628	9006	CV56	DF23	EBF50	FG67	KTW74M	P27/500	EK32	UCB9	VF23	Z77
1633	9004	CV57	DF21	EBF81	FG105	KTZ41	P41	EK33	UCB5	VF45	Z80
1635	9005	CV58	DF22	EBF98	FW4/500	KTZ63	P215	EK34	UCB21	VF46	Z142
1642	9006	CV83	DF96	EBL1	EK915	KTZ73	P385	EK38	UCB49	VF48A	Z150
1648	AC/FEN	CV84	DF841	EHL21	G7	L3	PA1	EK47	UCB81	VF53A	Z729
1649	AC/F	CV97	DF904	EC52	G8	L4	PAB080	EK48A	UCB11	VT60A	ZA1
1650	AC/FEN	CV73	DH30	EC54	G8A	L21	PC08A	EK57	UCB11	VT60A	ZA1
1651	AC/F	CV78	DH33	EC80	G8B	LD1DD	PC085	EK58	UF21	VT61A	ZD17
1616	AC/F	CV79	DH73	EC90	G78/ID	L80	PCF80	EK59	UF41	VT68	ZD19
1621	ACR1	CV86	DH76	EC91	G120/IB	L83	PCF82	EK60	UF42	VT82	ZD19
1651	ACR10	CV89	DH77	EC92	G180/2M	L77	PC1.81	EK73			

Contractors to British Commonwealth and foreign Governments, for Army, Navy and Air Forces, Post Offices, Civil Air Lines, etc.  
 Tubes can be supplied Commercial, C.V., or JAN specifications.  
 Our organisation is A.R.B. approved.

# HALL ELECTRIC LTD

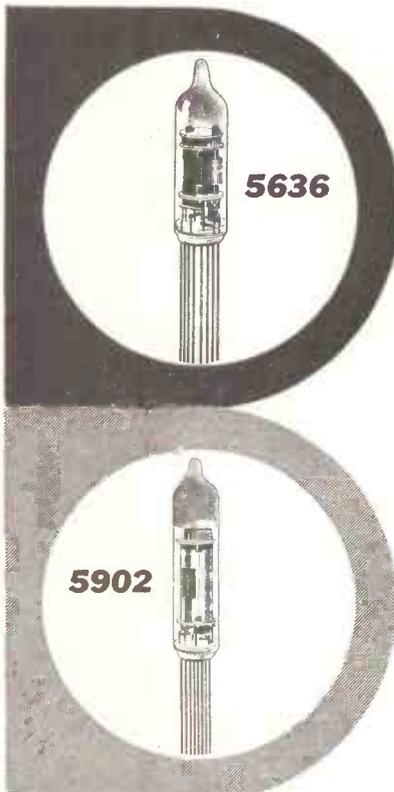
HALTRON HOUSE, 49-55 LISSON GROVE,  
 LONDON N.W.1.

Tel: Ambassador 1041 (5 lines) Cables: Hallettric, London



SPECIAL QUALITY PRODUCTION									
COMMERCIAL TYPE NUMBER (AMERICAN & MULLARD)		5636	5718	5840	5899	5902	6021	6205	5896
BRITISH SERVICES TYPE NUMBER		CV 3928	CV 3930	CV 3929	CV 477	CV 4029	CV 3986	—	CV 2698
STANDARD PRODUCTION COMMERCIAL TYPE NUMBER		EF 730	EC 71	EF 732	EF 731	EL 71	ECC 70	EF 734	—
DESCRIPTION		Short Suppressor Base RF Pentode	UHF Triode	RF Pentode	Variable- $\mu$ RF Pentode	AF Output Pentode	Double Triode	RF Pentode	Double Diode
HEATER	Vh (V)	6.3	6.3	6.3	6.3	6.3	6.3	6.3	
	Ih (A)	0.15	0.15	0.15	0.15	0.45	0.3	0.15	
LIMITING VALUES	Va (V)	165	165	165	165	165	165	165	
	Vg2 (V)	155	—	155	155	155	—	155	
	pa (W)	0.55	0.9	0.8	0.75	3.7	0.7	0.8	
	pg2 (W)	0.45	—	0.35	0.35	0.4	—	0.35	
	Ik*(mA)	16.0	22.0	16.5	16.5	50	22.0	16.5	
*CAPACITANCES	cin (pF)	4.0	2.2	4.2	4.3	6.5	2.4	4.2	
	cout (pF)	3.4	0.7	3.4	3.4	7.5	$\pm 0.28$ $\pm 0.32$	3.4	
	ca-gl (pF)	<0.02	1.45	<0.015	<0.015	0.2	1.5	<0.015	
TYPICAL CHARACTERISTICS	Va (V)	100	100	100	100	110	100	100	
	Vg2 (V)	100	—	100	100	110	—	100	
	Rk (ohms)	150	150	150	120	270	150	150	
	Ia (mA)	5.3	8.5	7.5	7.2	30.0	6.5	7.5	
	Ig2 (mA)	4.1	—	2.4	2.0	2.0	—	2.4	
	gm (mA/V)	3.2	5.8	5.0	4.5	4.0	5.4	5.0	
	$\mu$	—	27	—	—	—	35	—	
	ra (k $\Omega$ )	110	4.7	260	260	15	6.5	260	
NOTES		At Ia = <100 $\mu$ A Vg3 = -8V approx. Pout = 0.9W at f = 500 Mc/s.			At gm = 25 $\mu$ A/V Vg1 = -14V approx. Pout = 1.0W Values are for each section except where stated. This valve is the same as 5840 but with separate g3 connection				

- \* Extremely Rugged
- \* Shock Tested
- \* Vibration Fatigue Tested
- \* 220° C Life Tested
- \* Tested to U.S. Mil. Spec.
- \* N.A.T.O. Preferred



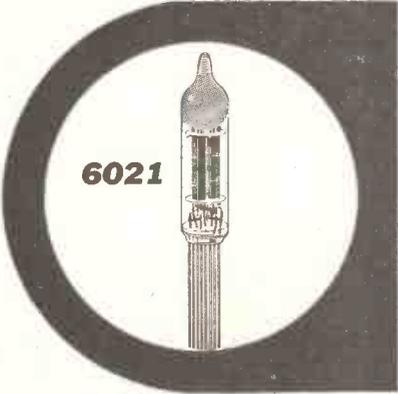
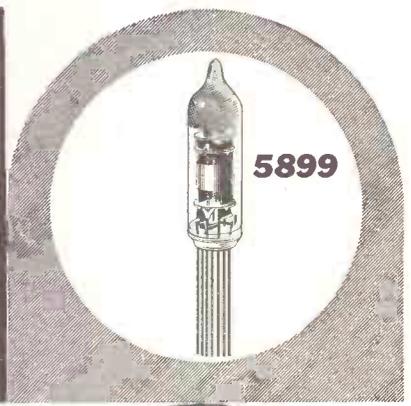
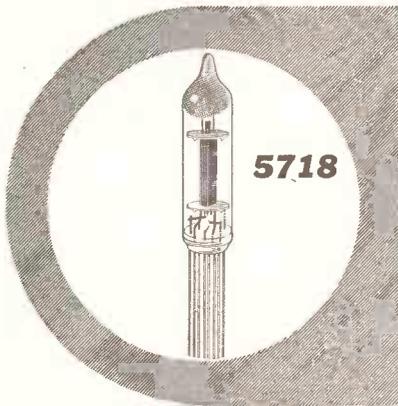
Under development

### ABRIDGED DATA

Notes †Section No. 1  
 ††Section No. 2  
 \*Capacitances are measured with external shield except for types 5718 and 6021.

For the first time in this country design engineers are offered a comprehensive range of internationally recognised indirectly-heated subminiature valves. With many advantages in small size, weight saving and high mechanical and electrical reliability to Special Quality standards, these valves are widely used by the American and NATO forces.

# Indirectly Heated Subminiature Valves Preferred Range

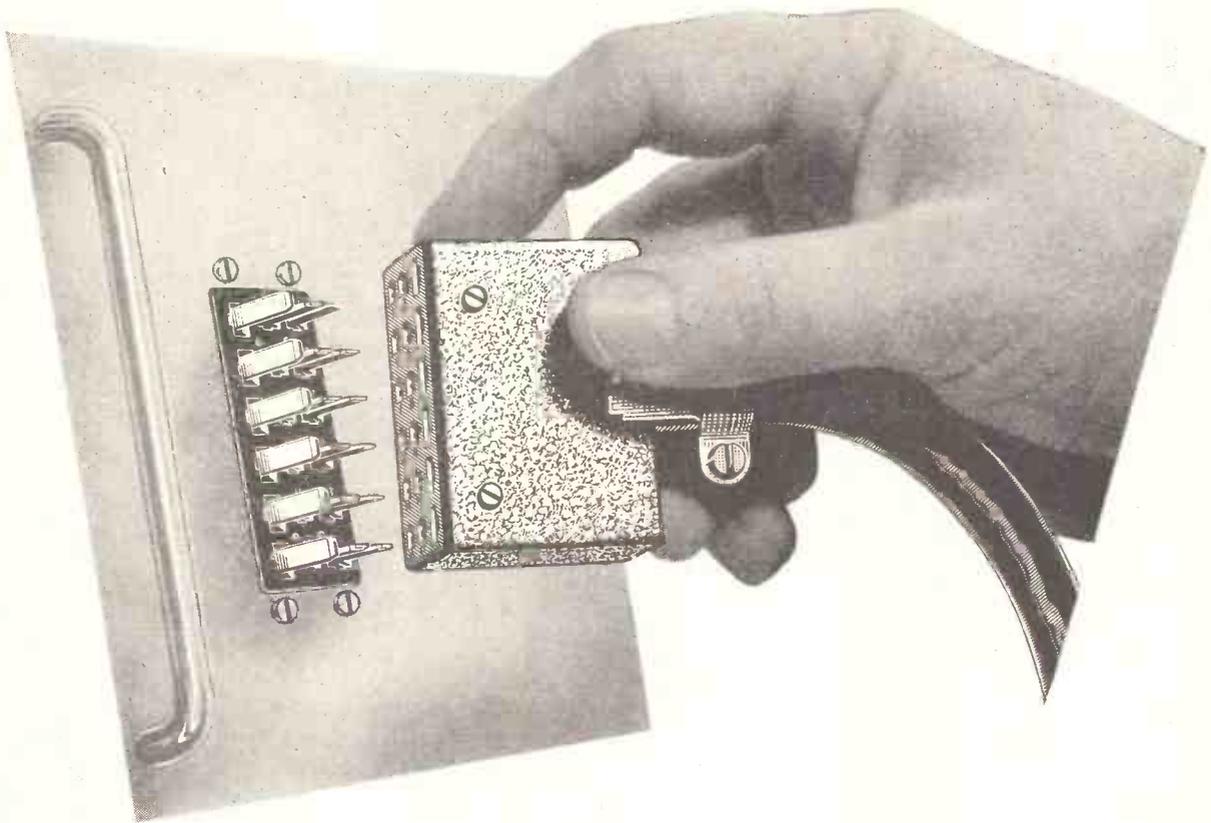


These Special Quality valves are now becoming available from Mullard under their American type numbers and are tested to U.S. MIL. specifications. The standard production versions are recommended for those applications where full MIL. assessment is not essential. In these applications certain electrical ratings may be increased and reference should be made to the relevant data sheets.

These data sheets and information on all Mullard subminiature valves are freely available on request.



Mullard Ltd.,  
Mullard House, Torrington Place,  
London, W. C. 1



## 'MULTICON' PLUGS AND SOCKETS

The reliability of the connectors used can determine the dependability of electrical and electronic equipment.

In the range of Painton 'Multicon' Plugs and Sockets are types suitable for most applications, whether used as cable connectors, for linking cables to panels or chassis, or as unitors.

In addition to the type of cover illustrated, there is a similar range with die-cast covers allowing checking of the connections without interrupting the operation of the circuit.

Please ask for full details of Painton 'Multicon' Plugs and Sockets.

**PAINTON**  
*Northampton England*

**E·M·I**

**NEW RECORDING EQUIPMENT**



**EMITAPE**

*Hi-Fi* **MAGNETIC RECORDING TAPE**

**'77' "PEN TESTED"**

for professional applications. Available on a range of spool sizes covering all professional and domestic hub machines.

**'88' GENERAL PURPOSE**

is a standard thickness base tape giving maximum sensitivity.

**'99' LONG PLAY**

is a specially developed thin base tape giving an increase of 50% playing time

**MODEL TR51**

This new Transportable Recorder replaces the well-known Model TR50 which is used by broadcasting and recording organisations and industrial research establishments throughout the world, meeting their exacting recording requirements under mobile conditions.

Model TR51 is built to C.C.I.R. recommendations and incorporates the proven features of its predecessor.

**RANGE OF MODELS**

Model TR51A Full Track 15 and 7½ i.p.s.

Model TR51B Full Track 7½ and 3¾ i.p.s.

Model TR51C Half Track 15 and 7½ i.p.s.

Model TR51D Half Track 7½ and 3¾ i.p.s.

For further details write to:—

**E.M.I. SALES & SERVICE LTD.**

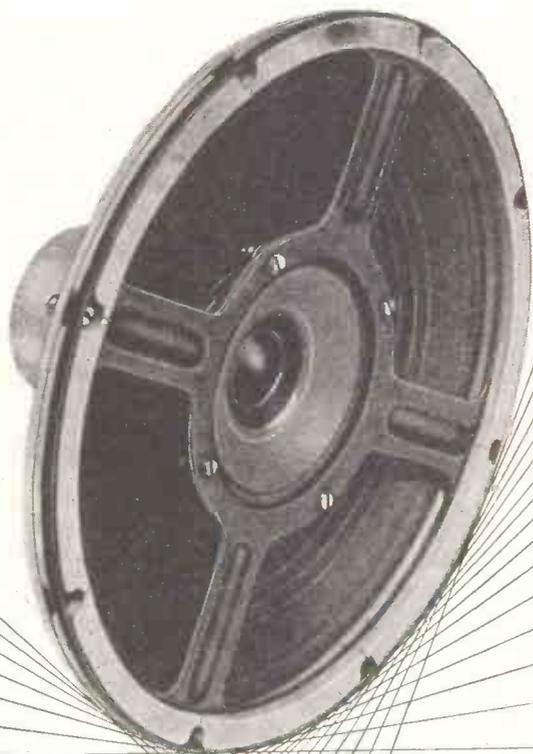
(Recording Equipment Division)

HAYES · MIDDLESEX



**MODEL L/2**

The L/2 Battery Portable weighs only 14½ lbs. (including batteries), is compact and easy to carry. It is used by broadcasting organisations throughout the world, (including the B.B.C.) for a variety of outdoor recording purposes. Where portability, combined with accurate and authentic quality recording, is essential—the L/2 Recorder provides the complete answer.



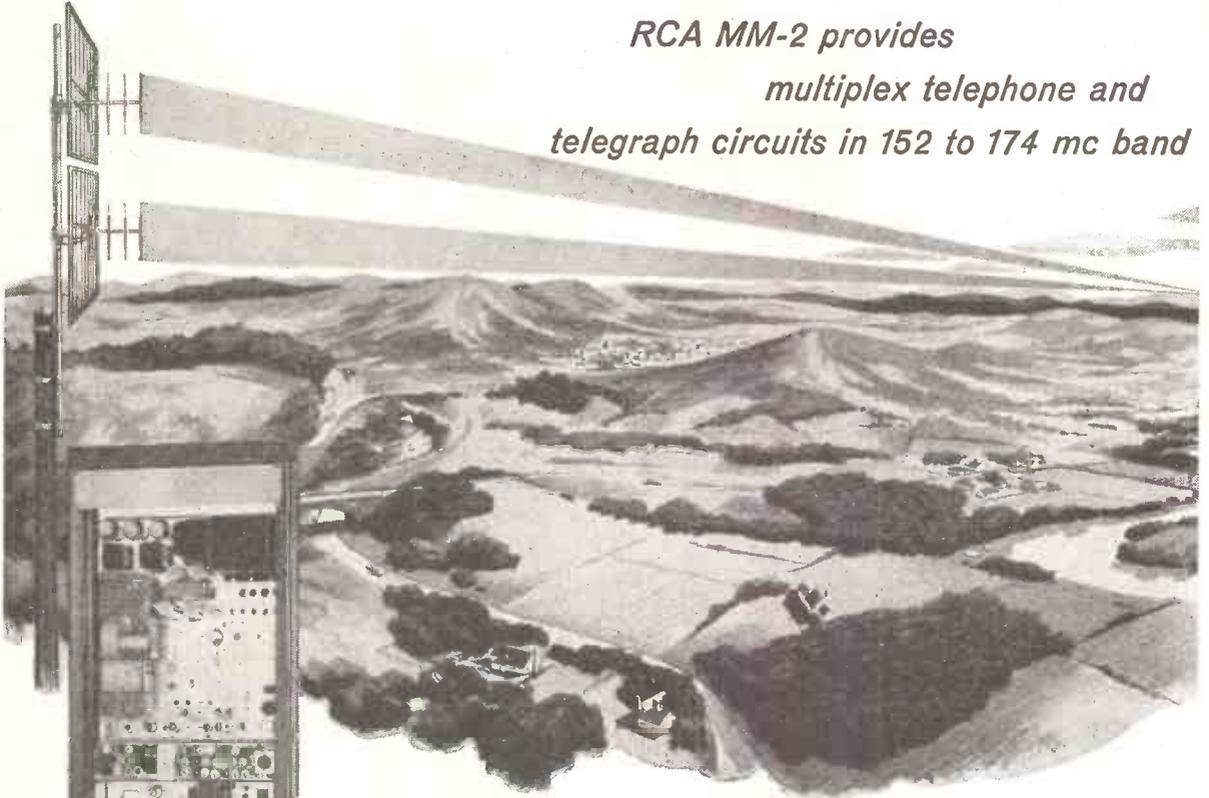
**LOUD-SPEAKER MANUFACTURERS  
FOR THE RADIO INDUSTRY SINCE 1930**

**REPRODUCERS AND AMPLIFIERS LTD.  
WOLVERHAMPTON · ENGLAND**

**TELEPHONE : 22241/2/3/4    CABLES : AUDIO**

# NEW LOW-COST RADIO RELAY EQUIPMENT FOR DEPENDABLE, ECONOMICAL MULTICHANNEL COMMUNICATIONS

*RCA MM-2 provides  
multiplex telephone and  
telegraph circuits in 152 to 174 mc band*



RCA MM-2 radio relay equipment is ideally suited for private, commercial or governmental application where from 1 to 6 channels are needed for opening new radio communications. The modulation bandwidth, from 300 cps to 28 kcs, can provide up to five 3 kc carrier derived telephone-channels plus one voice frequency channel. Each channel may be further multiplexed for high speed voice frequency carrier telegraphed circuits, teleprinter or manual telegraph, telemetering and control circuits.

**Compact, Easy Access Design.** The entire MM-2 equipment, including multiplex equipment such as the RCA MV-124, can be mounted in one standard 19" width rack. All tubes, components and adjustment controls are readily accessible for maintenance and service purposes. The simplicity and dependability of the equipment reduce maintenance to a minimum.

The Transmitter unit, with built-in power supply, features crystal con-

trol and phase modulation, and provides a power output of 60 Watts. When used in conjunction with a directional type antenna, the effective radiated power may be increased.

The Receiver makes use of two crystal controlled local oscillators in a double conversion superheterodyne circuit. A Receiver Power Supply is also furnished as part of the basic equipment.

**Low Cost MM-2 Packages** are available to meet the needs of every user. RCA Communication specialists will study the system requirements, terrain, and other factors, to recommend the correct equipment package. Adaptions will be made to meet local power supply, or a power supply will be included in the equipment package.

For further information on this low-cost radio communications equipment see your local RCA Engineering Products Distributor or write to Dept. RR49F, RCA International Division, 30 Rockefeller Plaza, N. Y. 20. N. Y.

**TYPICAL MM-2**  
TERMINAL rack shown here with transmitter, receiver, and power supply on upper half with multiplex equipment mounted below.



RCA INTERNATIONAL DIVISION

**RADIO CORPORATION of AMERICA**

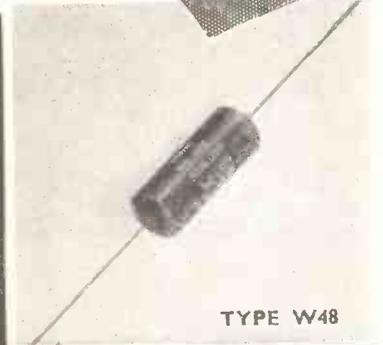
RCA Building, 30 Rockefeller Plaza, New York, N.Y., U.S.A.

Trademark © Registered

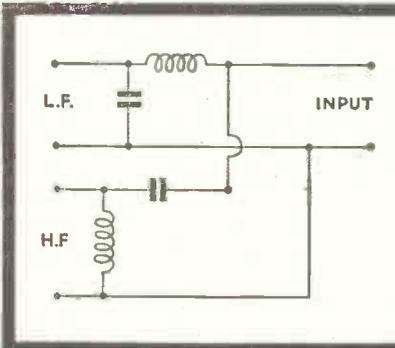
# Hunts Hi-Fi CAPACITORS

## FOR CROSS-OVER NETWORKS

Hunts patented Metallised Paper Capacitors are particularly suitable for loudspeaker crossover networks and are used extensively for this application. They have negligible self inductance with consequent lack of self resonance within the audio frequency range, and with the special method of end connections used on the capacitor unit, the equivalent series resistance down to zero applied volts is extremely low. The capacitors listed below are considerably smaller in dimensions than conventional types, occupying only 25-30% of the space required for their lowest voltage counterparts in foil and paper construction.



TYPE W48



A basic circuit for a twin speaker combination is shown on the left. The number of circuit elements and their capacitance and inductance values depends on the number of loudspeakers, their individual characteristics, and the required crossover frequencies.



TYPE W54/1

### STANDARD CAPACITANCE RANGE

LIST NO.	CAP $\mu$ F	VOLTS D.C. Wkg.	TYPE REF.	DIMENSIONS L D	LIST PRICE
A 316	1.5	150	W48	$1\frac{1}{8}'' \times \frac{1}{8}''$	4/9
A 304	2	150	W48	$1\frac{1}{8}'' \times \frac{1}{8}''$	5/-
B 557	3	150	W49/1	$1\frac{1}{2}'' \times \frac{3}{4}''$	7/6
B 550	4	150	W49/1	$2\frac{1}{2}'' \times 1''$	10/-
B 551	6	150	W49/1	$2\frac{1}{2}'' \times 1''$	12/6
B 552	8	150	W49/1	$2\frac{1}{2}'' \times 1\frac{1}{8}''$	17/6
WP 45	10	150	W54/1	$2\frac{1}{2}'' \times 1\frac{1}{8}''$	20/-
WP 38	12	150	W54/1	$2\frac{1}{2}'' \times 1\frac{1}{8}''$	22/-
WP 247	16	150	W54/1	$3\frac{1}{2}'' \times 1\frac{1}{8}''$	26/6



TYPE W49/1



**A. H. HUNT (Capacitors) LTD.**  
**WANDSWORTH, LONDON, S.W.18. Tel: BAttersea 1083**  
 And in Canada: HUNT CAPACITORS (Canada) LTD. AJAX, ONTARIO  
 Factories also in Surrey and North Wales.



## OBVIOUSLY . . .

*"The frequency-swept generator connected to the input of the r.f., i.f. or video stages of the receiver, and a c.r.o. synchronised to the sweep frequency, permits viewing of the receiver output, while internally generated calibration pips superimposed on the display enable tuning and bandwidth adjustments to be made with precision."*

**T**HAT'S the Marconi V.H.F. Alignment Oscilloscope in a nutshell. If he'd had any breath left our young student might have added that other important applications include the adjustment of discriminators in f.m. receivers and the matching of aerials to transmission lines.

However, the lad's penetrating observation will have revealed to those who are no less observant that here is another important Marconi instrument.

If you don't know as much about it as he does it's time you did. Write and ask for the full facts and we'll send you an informative leaflet post-haste.



**MARCONI V.H.F.  
ALIGNMENT OSCILLOSCOPE  
Type TF 1104**

For use with television and f.m. receivers. Frequency-swept output and visual display on built-in c.r.t. facilitates rapid evaluation and alignment without ancillary equipment. R.F. ranges: v.h.f. bands I, II and III. I.F. range: 10 to 40 Mc/s. V.F. range: 5 ko/s to 10 Mc/s. Frequency sweep: 10 Mc/s max., with marker pulses at 0.5, 1.0, or 5 Mc/s intervals.



AM & FM SIGNAL GENERATORS • AUDIO & VIDEO OSCILLATORS • FREQUENCY METERS • VOLTMETERS  
POWER METERS • DISTORTION METERS • FIELD STRENGTH METERS • TRANSMISSION MONITORS  
DEVIATION METERS • OSCILLOSCOPES, SPECTRUM & RESPONSE ANALYSERS • Q METERS & BRIDGES

**MARCONI INSTRUMENTS LTD · ST. ALBANS · HERTFORDSHIRE · TELEPHONE: ST. ALBANS 56161**  
*London and the South: Marconi House, Strand, London, W.C.2. Tel: COVENT Garden 1234*  
*Midlands: Marconi House, 24 The Parade, Leamington Spa. Tel: 1408 North: 30 Alblon Street, Kingston-upon-Hull. Tel: Hull Central 16347*  
**WORLD-WIDE REPRESENTATION**

# X-BAND NOISE TUBE

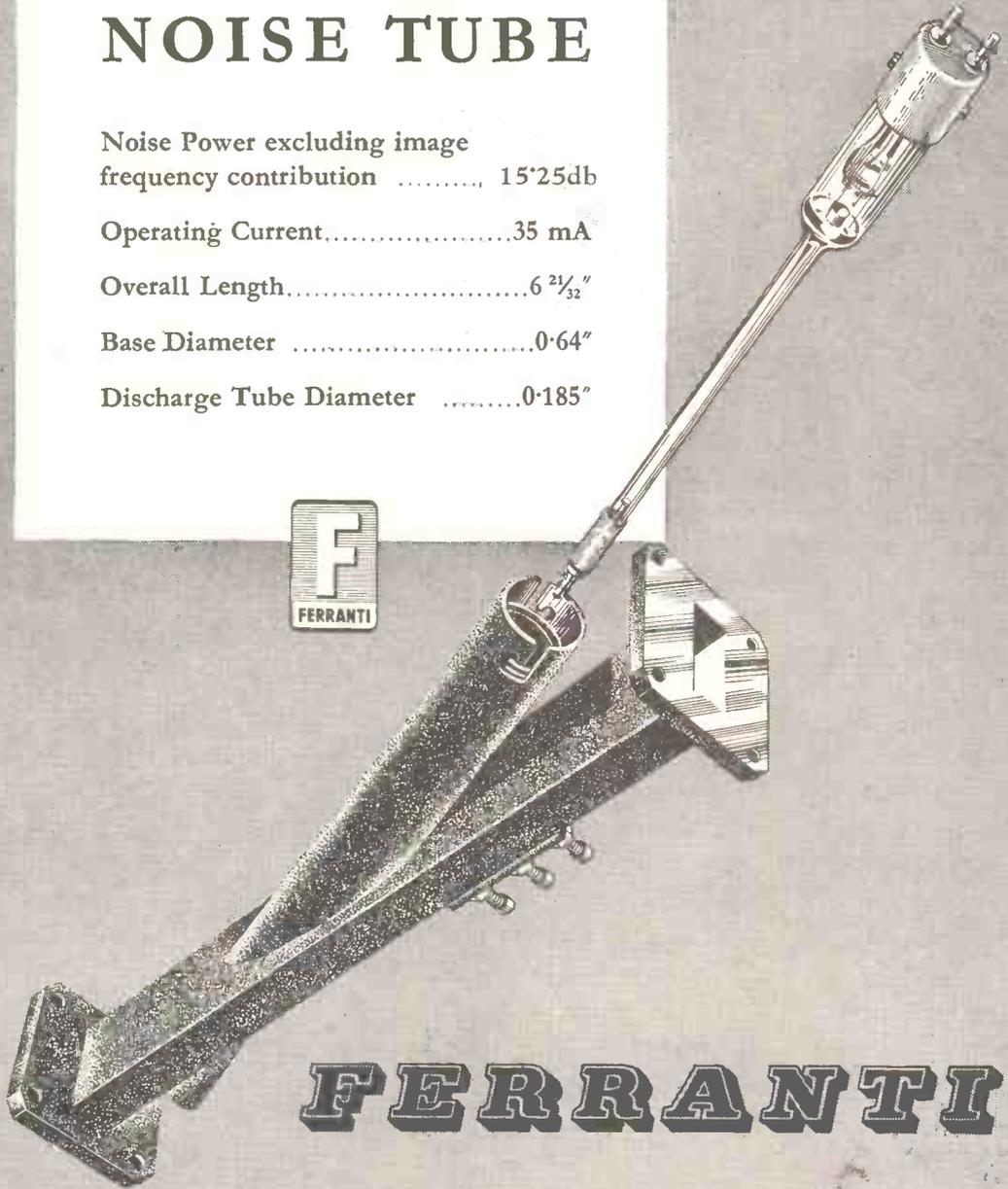
Noise Power excluding image  
frequency contribution ..... 15.25db

Operating Current.....35 mA

Overall Length.....6  $\frac{21}{32}$ "

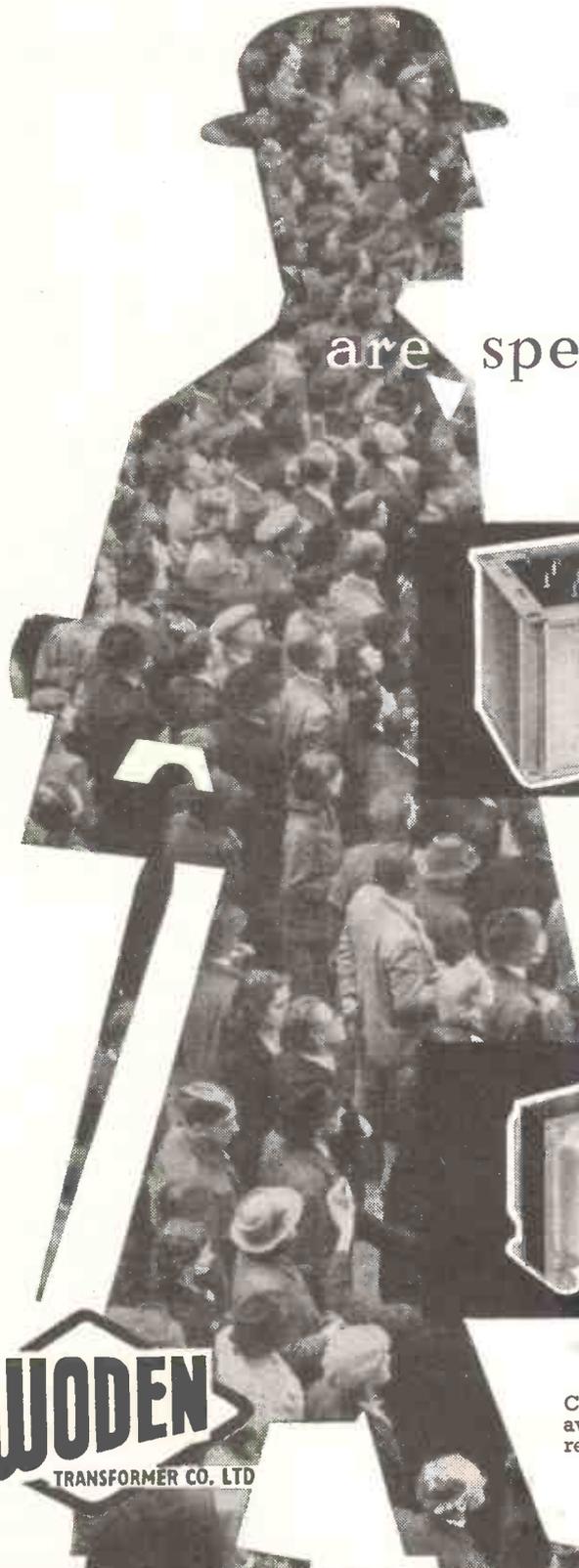
Base Diameter .....0.64"

Discharge Tube Diameter .....0.185"



## FERRANTI

FERRANTI LTD. · FERRY ROAD · EDINBURGH 5    Tel. Granton 89181

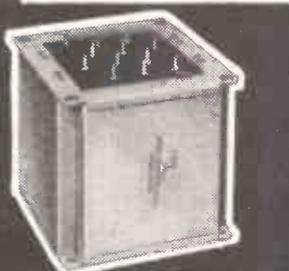


more and more users

are specifying



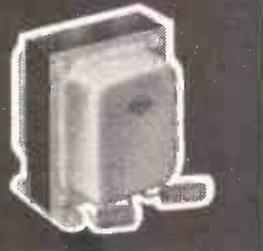
TRANSFORMERS



Left: Potted Compound Filled Transformers. A wide range of capacities for transformers and chokes. Complete reliability. Suitable for exacting industrial and climatic conditions.



Above: Cast Resin Transformers. Give complete mechanical and climatic protection for core and windings. Good heat dissipation.



Bottom Left: Shrouded and Open-Type Transformers. Combine first-class engineering with a popular highly competitive product. Vacuum impregnated and rigidly tested.

Catalogues available on request.



WODEN TRANSFORMER CO. LTD

MOXLEY ROAD  
 BILSTON · STAFFS  
 PHONE: BILSTON 41959

**There's a size for every job in the S.P. range of nickel metallised bushes**



**METALLISED  
BUSHES**



Please write for Catalogue No. 47

**STEATITE & PORCELAIN PRODUCTS LTD.**

STOURPORT ON SEVERN, WORCS • Telephone: Stourport 2271 Telegrams: Steatoin, Stourport.

for the closest approach to the original sound



# QUAD II

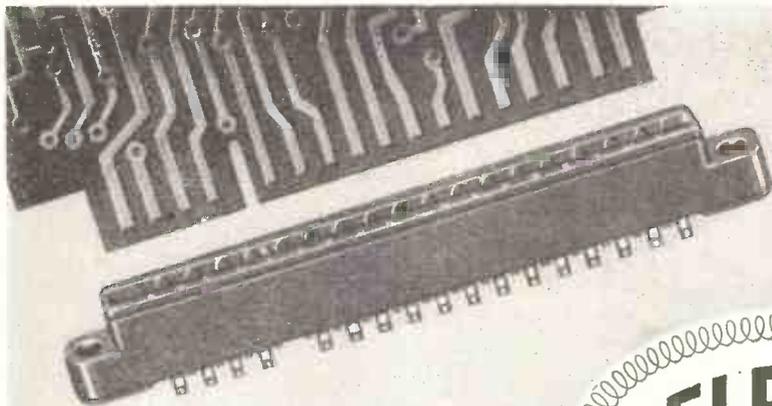
## AMPLIFIER

The criterion, as always, is that the reproduced sound shall be the closest approach to the original — that the enjoyment and appreciation of music may be unimpeded. This is reflected throughout the design of the QUAD II. It is reflected, too, in the straightforward and logical system of control, achieved without the sacrifice of a single refinement or adjustment capable of contributing to the final objective.

*Send for further details and booklet:*



HUNTINGDON, HUNTS • Telephone: HUNTINGDON 361



This K-18 connector is  
ACTUAL SIZE  
—made under U.S. licence from  
Winchester Electronics Inc.

**ELECTRO  
METHODS**  
LTD  
**OF STEVENAGE**

— the foremost manufacturers of

*printed circuit  
connectors*

**DATA RELATING TO  
SERIES 'K'  
PRINTED-CIRCUIT  
CONNECTORS**

•  
CURRENT CARRYING  
CAPACITY: 5 amps

•  
BREAKDOWN VOLTAGE  
BETWEEN CONTACTS:  
3 kV (at sea level)

•  
AVERAGE MATING  
AND UNMATING FORCE  
(per contact): 8 oz.

•  
CONTACT CENTRES: .156"

•  
FIXING HOLES: .125"

•  
POLARISING KEYS  
fitted in any position

•  
CONNECTIONS TO CONTACTS  
by rivets or solder-cups

•  
**SERIES 'K'**  
with 6, 12, 18 & 22 contacts  
**NOW AVAILABLE  
FOR  
PROMPT DELIVERY**

**GOLD-PLATED CONTACTS**

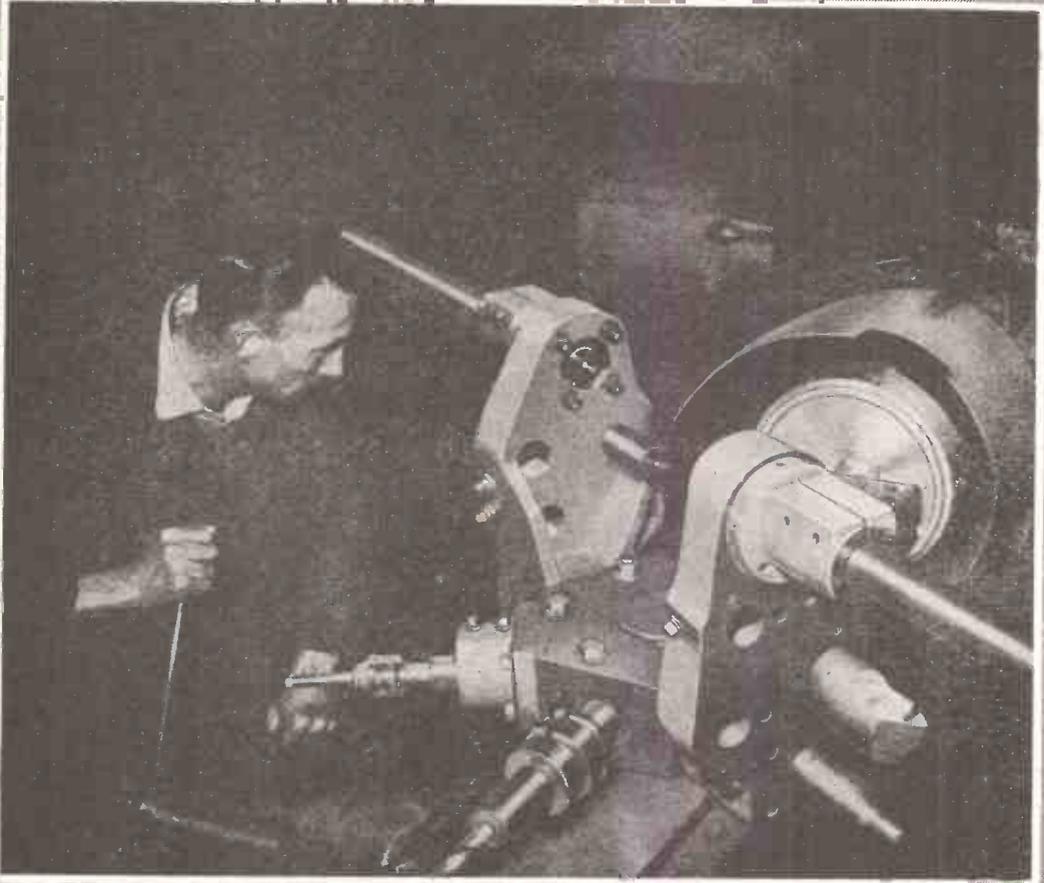
made from spring-tempered phosphor-bronze  
provide low contact-resistance,  
prevent corrosion and  
facilitate soldering.

**MELAMINE MOULDINGS**

conforming to B.S.S. 1322  
provide high arc-resistance,  
high dielectric  
and mechanical strength.

Full technical data and illustrated  
leaflets forwarded on request:

**ELECTRO METHODS LTD.**  
12-36 Caxton Way, Stevenage, Herts.  
Telephone: Stevenage 780



Turning

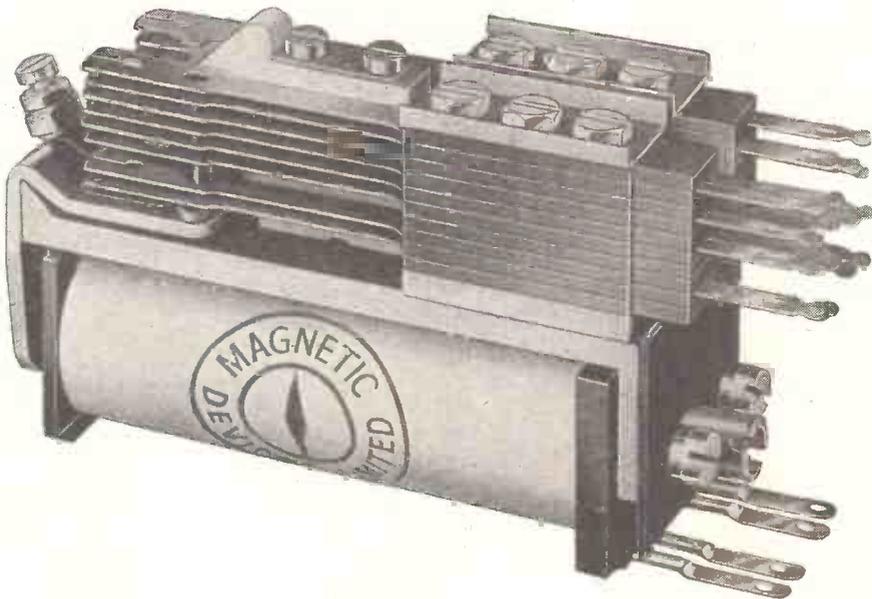
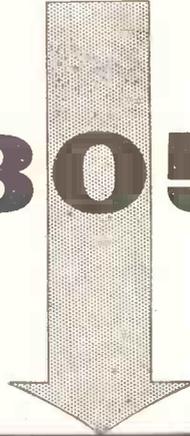
"Why  is best" series No 4

THE accuracy of turned parts is of vital importance to the quality and reliability of gramophone reproducing equipment. One example is the turntable of the well known Garrard Model 301 Transcription Motor, which is an aluminium casting weighing 8 lbs. It is turned on a Capstan lathe as illustrated above, then tested to ensure that it is true and perfectly balanced. One more reason why Garrard units are the finest in the world.

**Garrard** AUDIO  
PERFECTION

THE GARRARD ENGINEERING AND MANUFACTURING CO. LTD SWINDON · WILTS

# series 305 relay



## P.O. 3000 RELAY

This Relay is the well known P.O. 3000 Relay and can be supplied with coils wound for standard voltages up to 250 volts D.C.

Contact assemblies are available up to six pole changeover and alternative rivets can be supplied to suit varying duties. The Series 305 Relay can be slugged for make or break action and coils can be vacuum impregnated for tropical and humid conditions.

**Magnetic Devices**  
A.I.D. & A.R.B. approved. **LTD**

**MAGNETIC DEVICES LTD. EXNING ROAD, NEWMARKET, SUFFOLK**  
Telephone: Newmarket 3181/2/3      Telegrams: MAGNETIC, Newmarket

**10 to 300 Mc/s**  
**DIRECTLY**  
**CALIBRATED**

*The type D1/D is a V.H.F. Signal Generator designed for making measurements in the frequency range 10 to 300 Mc/s. Its outstanding features are:—*

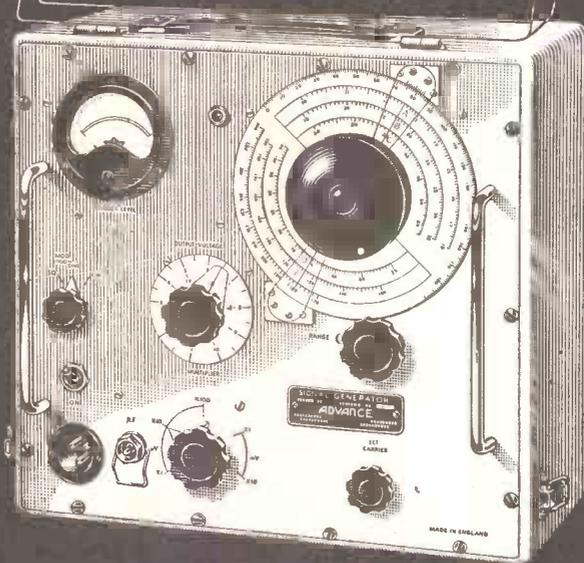
- Sine and square wave modulation.
- Attenuator variable over 100 db.
- Negligible stray field.
- Linear scale and vernier for high resetting accuracy.
- 50 : 1 slow-motion drive.
- Rugged construction and light weight (only 34 lb.).

NETT PRICE IN U.K.

**£97**

*Full technical details available in leaflet W43*

the  
**Advance**  
**V.H.F. SIGNAL GENERATOR**



**MODEL D1/D**

The **ADVANCE V.H.F. SIGNAL GENERATOR TYPE DIP/2.**

Directly calibrated in six ranges

**2 Mc/s to 190 Mc/s.**

This is a special version for the alignment of narrow band communication receivers which incorporates:—

- CRYSTAL MODULATOR ELIMINATING SPURIOUS F.M.
- 2 Mc/s CRYSTAL REFERENCE OSCILLATOR.
- BUFFER STAGE.

NETT PRICE IN U.K.

**£110**

*Full technical details available in leaflet W37.*

# Plastics mean progress!

COME TO

# BRITISH PLASTICS

International

# EXHIBITION

# AND CONVENTION

OLYMPIA · GRAND & NATIONAL HALLS  
10-20 JULY

See  
how the latest  
advances  
can be  
applied to your  
business

PRODUCTS

EQUIPMENT

MATERIALS



Visitors to the British Plastics Exhibition will reap a rich reward in new ideas, methods and plans for improved products—extended ranges—enhanced sales appeal—increased production and reduced costs!

This is your opportunity to see the biggest array of plastics products, materials and equipment ever assembled in Britain—covering over 200,000 square feet of floor space in Olympia's Grand and National Halls. A whole world of plastics, with exhibits from every branch of the British industry, and from Belgium, France, Germany, Holland, Italy, Sweden, Switzerland and the U.S.A.

Come and examine the latest plastics machinery (much of it in action); discuss your problems with experts; see how plastics can mean progress in *your* business—at this great exhibition organized by BRITISH PLASTICS, the journal that speaks for the industry.

At the British Plastics Convention, held simultaneously, important papers will be read and discussed in open forum.

## A whole world of plastics on view

Exhibition organised every second year by BRITISH PLASTICS, an ILIFFE Journal

Please send me the 1957 Exhibition Brochure, free season ticket, etc.

NAME \_\_\_\_\_ DATE \_\_\_\_\_

FIRM \_\_\_\_\_

ADDRESS \_\_\_\_\_

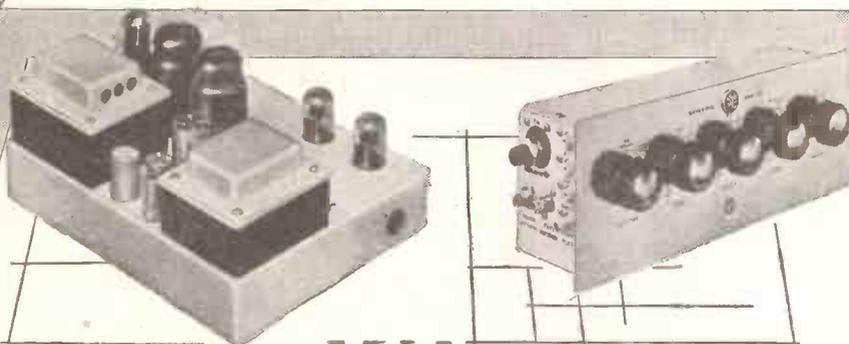
50B

**Plan your  
visit ahead  
Post this  
today!**

TO: EXHIBITION MANAGER · BRITISH PLASTICS · DOBSON HOUSE · STAMFORD STREET · LONDON, S.E.1



# HIGH FIDELITY STARTS HERE



## MODEL HF25

The amplifier has been critically designed to give living expression to recent improvements in recording and broadcasting techniques.

Life-like reproduction is ensured by the low harmonic distortion and by the infinite damping factor. 25 watts undistorted output is ample for any home system.

## MODEL HF25A

The pre-amplifier has phono-jack inputs for radio, microphone, pick-up, tape recording and 4 equalisation positions for U.S. LP, EUR. LP (R.I.A.A.), U.S. 78 and EUR. 78. Amplifier can be controlled from distances of 20 ft. without loss of performance. In walnut and sycamore veneered cabinet or chassis form.

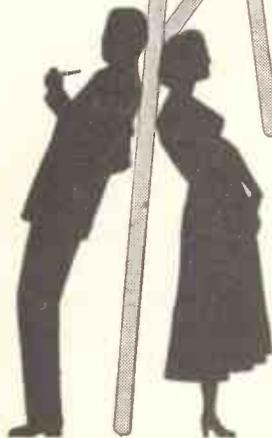
The highest standard of performance and reliability is ensured by neat chassis layout and superlative workmanship.

Very wide frequency range, 2-160,000 c.p.s. 26 db of negative feedback over the entire audible range.

A range of plug-in pick-up compensators allows quick and easy matching of any type of pick-up.

## PACKAGED HI-FI

These small matching Pye plug-in units are bringing high fidelity to the ordinary listener at a price he can afford. They're simple to operate, install in minutes and blend at once with modern furnishings.



# HIGH FIDELITY SYSTEMS

Pye Limited,  
Auckland, C.I.,  
New Zealand.

Pye Corporation of America,  
1149 Raritan Avenue,  
Highland Park,  
New Jersey, U.S.A.

Pye Radio and Television  
(Pty.) Ltd.,  
Johannesburg, South Africa

Pye (Ireland) Ltd.,  
Dublin, Eire.

Pye Limited,  
Tucuman 829, Buenos Aires.

Pye Limited,  
Mexico City.

Pye (Canada) Ltd.,  
Northline Road, Toronto.

Deutsche Pye G.m.b.H.,  
Berlin-Zehlendorf-West,  
Roonstrasse 2, Germany.

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

THE NEW  
**Westinghouse**  
 HA SERIES  
**TRANSMITTERS**  
 FOR CONTINUOUS, 24-HOURS-A-DAY  
 COMMERCIAL COMMUNICATIONS.



Here is a completely new series of 1 KW and 500 Watt High Frequency Transmitters Canadian designed and manufactured to meet modern operating conditions. The HA series incorporates many desirable features such as *continuous frequency coverage* and *suppressed TV frequency harmonics*.

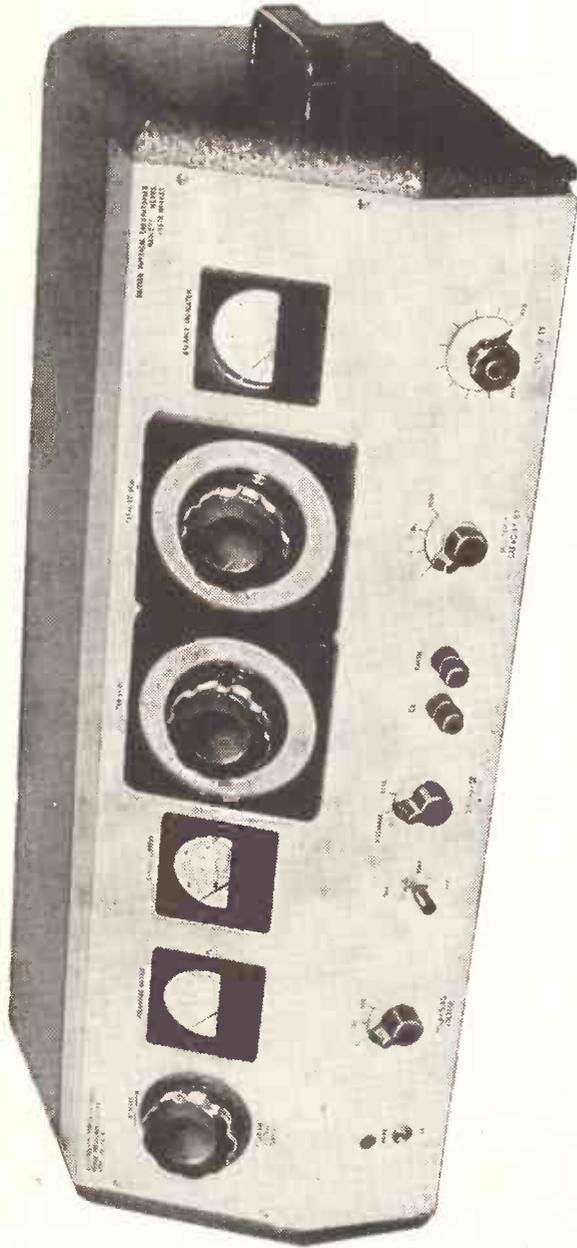
These new transmitters are available on a "building block" basis for a wide variety of applications.

- HA-1 CW and Frequency Shift Keying — single 1000 watt channel
- HA-2 CW and Frequency Shift Keying — 2 simultaneous 500 watt channels
- HA-3 CW and Frequency Shift Keying — 2 simultaneous 1000 watt channels
- HA-4 Radiotelephony — 1000 watts carrier 100% modulated (illustrated)

#### DESIGN FEATURES

1. Continuous frequency coverage 2.0 – 27.5 Mc/s *without* band switching.
2. Switch selection of *ten* crystal frequencies.
3. Output impedance 600 or 300 ohms balanced over 2 to 27.5 Mc/s with continuously tunable balun circuit.
4. Keying speeds A1 — 600 words/min.  
 F1 — 150 dot cycles/sec.  
 Complete suppression of carrier radiation during "space" up to keying speed of 60 w.p.m.
5. Frequency response (HA4)  $\pm 2$  db from 350 – 3000 c/s
6. Distortion (HA4) less than 7.5%, 350–3000 c/s, at 95% modulation.
7. Noise Level (HA4) more than 45 db below 100% modulation.
8. Rapid convenient tuning from five front mounted controls.
9. Highest quality components and conservative tube operating conditions ensure reliability under all extremes of temperature and humidity.
10. All components and tubes readily accessible.

COMMUNICATE WITH **Westinghouse**  
 ELECTRONICS DIVISION



Capacitance Bridge specifically designed to measure

## ELECTROLYTIC AND TANTALUM CONDENSERS

Capacitance Range: 0.1 to 11,000  $\mu$ Fd, Power Factor Range: 0.1 to 30%. Polarising Voltage: 0.5 to 600 volts.

*This is one instrument from our range which includes:*

**VALVE VOLTMETERS · OSCILLATORS · PULSE GENERATOR · ATTENUATORS · MEGOHMMETER  
BREAKDOWN TESTER · BRIDGES FOR MEASUREMENT OF R.C.L.**

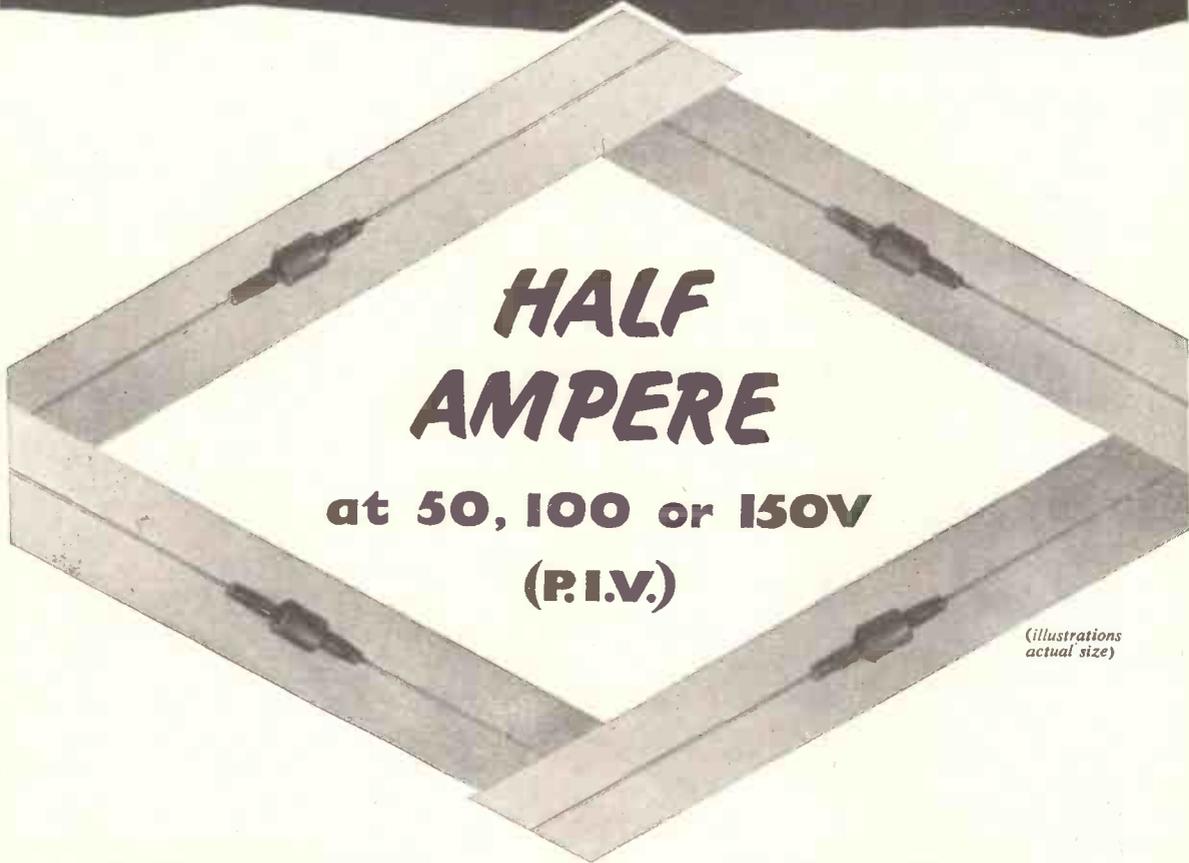
*Your enquiries for our comprehensive range of sensitive METERS are invited.*

## BRITISH PHYSICAL LABORATORIES · RADLETT · HERTS

Telephone: RADLETT 5674.

# SenTerCel

## LOW POWER SILICON RECTIFIERS



### HALF AMPERE

at 50, 100 or 150V  
(P.I.V.)

(illustrations  
actual size)

- High efficiency
- Small Size
- High temperature operation
- Hermetically sealed

*Now available from Production*

Write for Technical Data Sheet F/SIL 101



**Standard Telephones and Cables Limited**

Registered Office: Connaught House, Aldwych, London, W.C.2

RECTIFIER DIVISION: EDINBURGH WAY • HARLOW • ESSEX

**AMP**

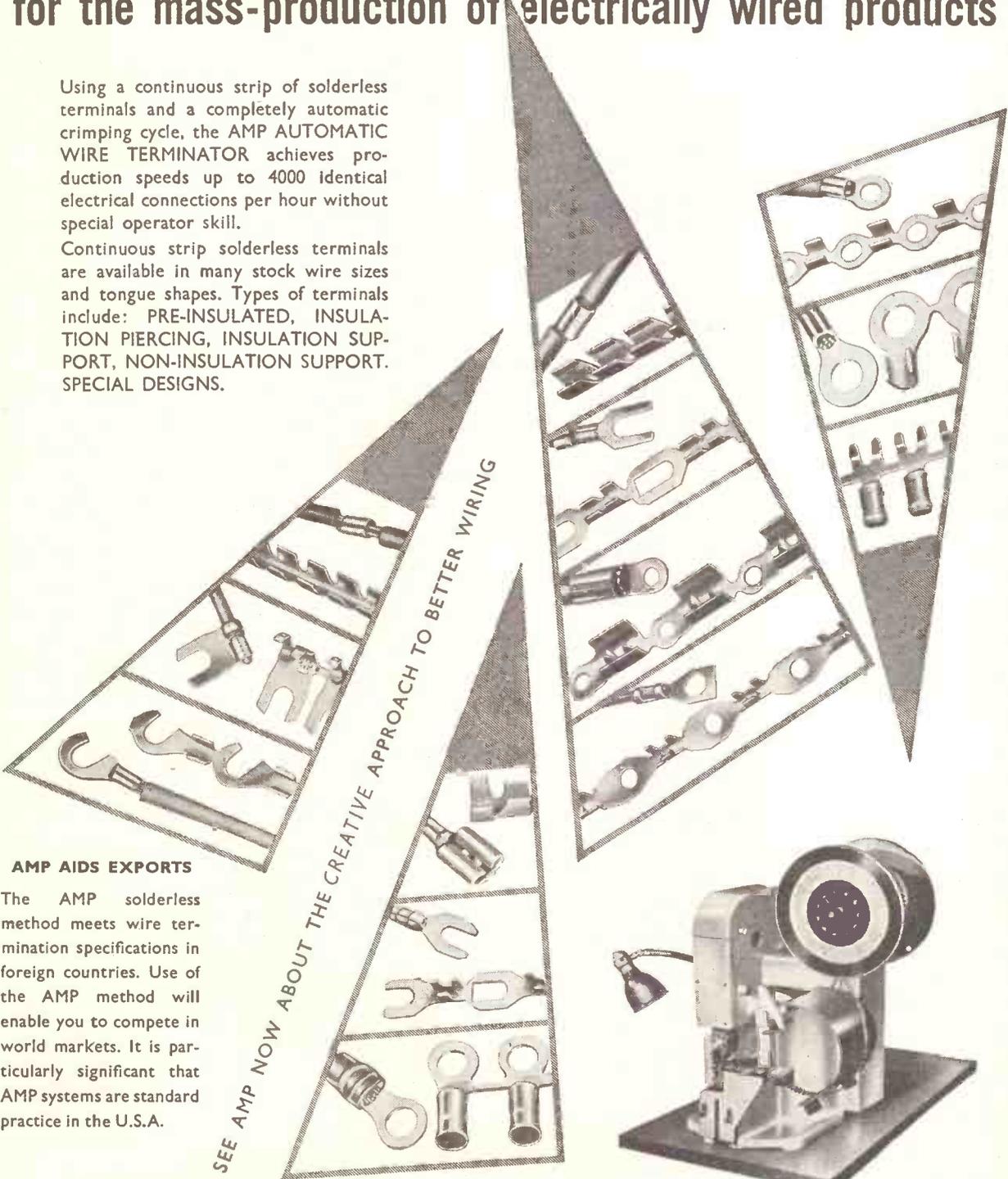
*Auto-strip*

TRADE MARK

for the mass-production of electrically wired products

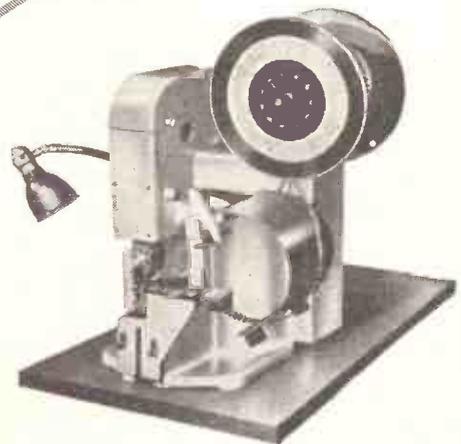
Using a continuous strip of solderless terminals and a completely automatic crimping cycle, the AMP AUTOMATIC WIRE TERMINATOR achieves production speeds up to 4000 identical electrical connections per hour without special operator skill.

Continuous strip solderless terminals are available in many stock wire sizes and tongue shapes. Types of terminals include: PRE-INSULATED, INSULATION PIERCING, INSULATION SUPPORT, NON-INSULATION SUPPORT. SPECIAL DESIGNS.



**AMP AIDS EXPORTS**

The AMP solderless method meets wire termination specifications in foreign countries. Use of the AMP method will enable you to compete in world markets. It is particularly significant that AMP systems are standard practice in the U.S.A.



**AMP**  
TRADE MARK

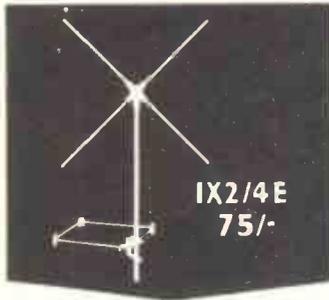
**AIRCRAFT-MARINE PRODUCTS (GT. BRITAIN) LTD.**

London Sales Office: DEPT. 15, 60 KINGLY STREET, LONDON W.1 Telephone: REG 2517-8 and 3681-2-3

Works: SCOTTISH INDUSTRIAL ESTATES, PORT GLASGOW, SCOTLAND.

AP323/46

# ANTIFERRENCE AERIALS

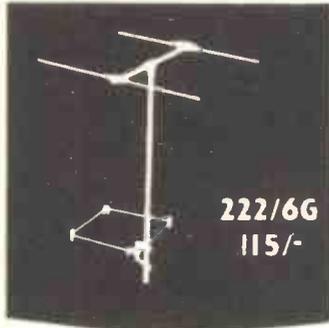


IX2/4E  
75/-

BAND I

## BAND I

A complete range of Antex (illustrated) Dipole, 'H', Fringe and Indoor models is available. Outdoor models can easily be adapted for Band III by adding Band III Grip-on aerials as 350/1C below.

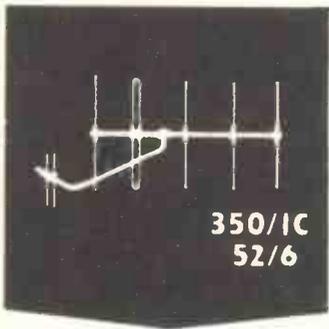


222/6G  
115/-

BAND II

## BAND II

Indoor and outdoor models to suit all conditions and to provide the very best results for VHF/FM equipment. Models for fitting to existing TV masts are available.

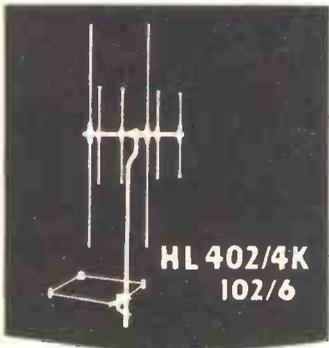


350/1C  
52/6

BAND III

## BAND III

3, 5, 8, 10 element and Stacked Arrays for outdoor installation and a comprehensive range of indoor models.



HL 402/4K  
102/6

HILO

## HILO

17 models to provide perfect Band I/Band III reception with only one aerial. All incorporate the patented Electronic Coupling exclusive to Antiferrence.

## Specially Designed EXPORT RANGE

Antiferrence offer a specially developed range of competitively priced Television and VHF/FM aerials for export including Horizontally or Vertically Polarised Single or Stacked Yagi Arrays, Broad-Band and All-Band types for International Frequencies including Continental (C.C.I.R.) and American channels. The well-known Antiferrence features of pre-assembly and robust construction combine with specially designed features to withstand the most extreme climatic conditions and to meet the varying technical requirements of countries abroad. Our Export Department will, on request, be pleased to give full details of this specially designed Export Range. Fully detailed literature showing current models and prices available on request.

### Standard PLUG & SOCKET



R.E.C.M.F. SPECIFICATION  
Robust and simple to fit.  
PLUG TVP/I  
SOCKET TVS/I

Both **8d** each

### 'Y' BOXES



For combining Band I and Band III Television Aerial down leads.

**OUTDOOR MODEL**  
Y.1. - 16/6  
**INDOOR MODEL**  
Y.2. - 12/6

Now BAND III & HILO  
AUTOMATIC  
WITH  
*Click-Mec*

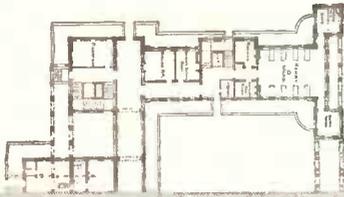
Far in advance of any other form of pre-assembly—'click' and they're fixed

# ANTIFERRENCE LIMITED

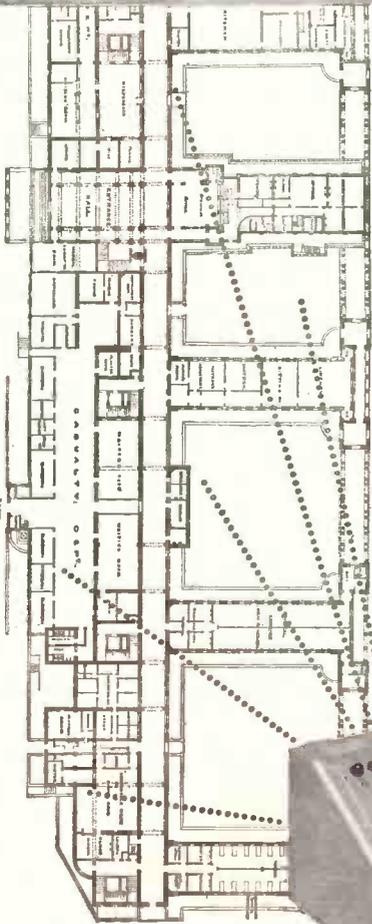
BICESTER RD., AYLESBURY, BUCKS.

THE ANTIFERRENCE GROUP  
Antiferrence Ltd., Aylesbury & London.  
Antiferrence (Canada) Ltd.  
Antiferrence (Australia) Pty. Ltd.  
Antiferrence Installations Ltd.

*Antiferrence Aerials are supplied through Appointed Antiferrence Distributors to all leading Radio & Television Dealers. We regret that we cannot supply direct to members of the public.*



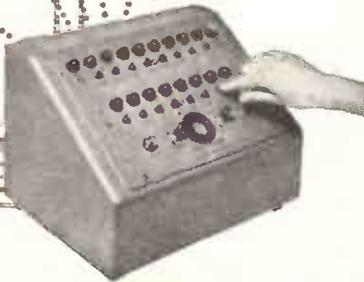
St. Thomas' Hospital, London, uses 70 receivers.



**new  
staff location system  
calls doctors  
quietly, personally**

"The result of this new system has been revolutionary, and it has far exceeded expectation in its effectiveness . . ." writes W. A. A. Pearson F.H.A. in 'The Hospital'. He is referring to Multitone PERSONAL CALL, developed in conjunction with the Electronics Department of St. Thomas' Hospital, London. Unlike loudspeakers bells, clock dials, flashing lights and buzzers it is a completely *personal* system. You can call anyone on the staff without distracting colleagues or disturbing patients. How does it work? By simple push-button transmission, to small receivers carried in the pocket.

This is the most efficient Staff Location System in existence and one of the cheapest to install. It can be used in big hospitals like St. Thomas' (1,660 ft. long, 240 ft. wide, 5 storeys high, using 70 receivers) or small business houses, in big factories or small stores. PERSONAL CALL COULD BE USED IN YOUR BUILDING. Write and we'll send you details.

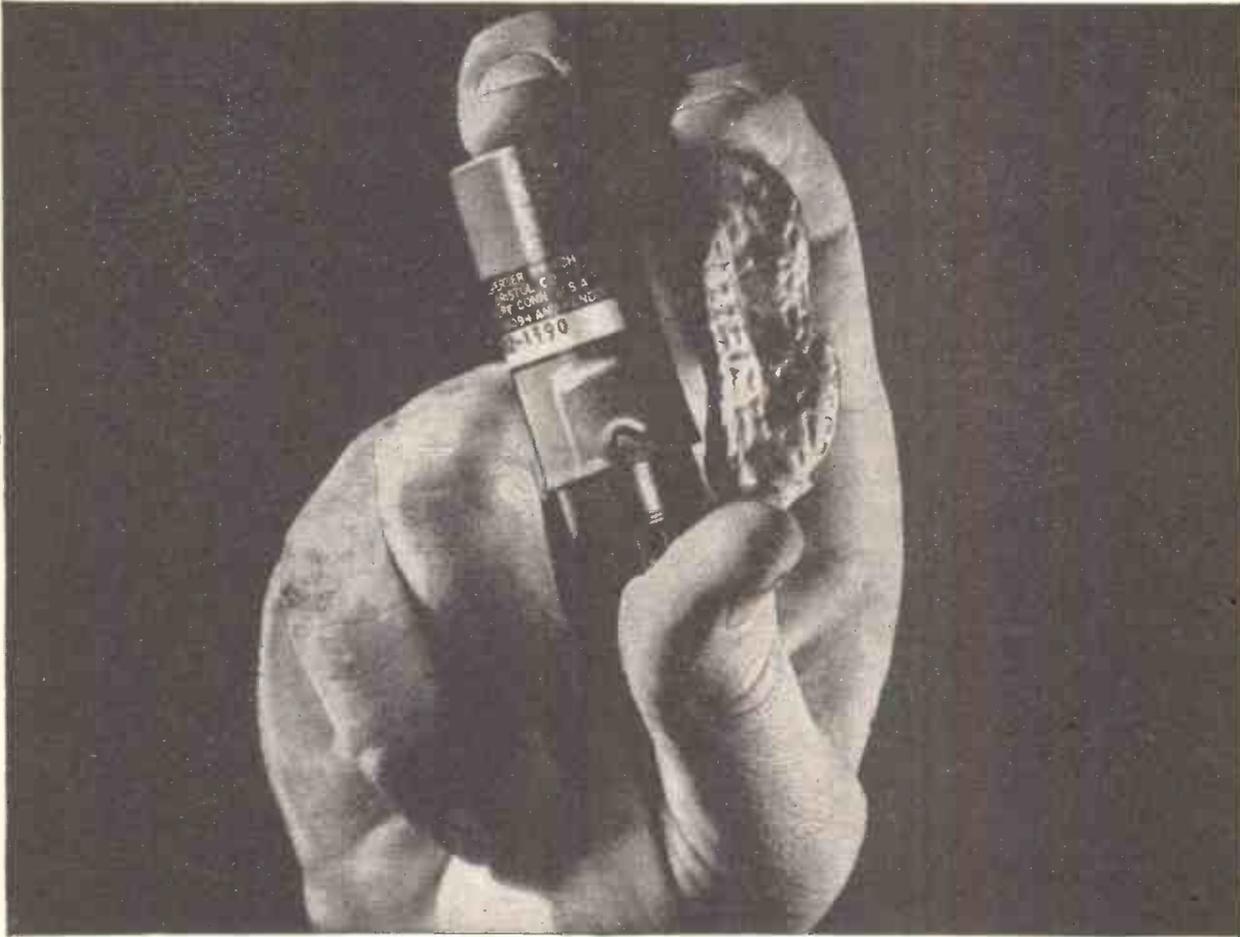


**multitone** personal call **STAFF LOCATION SYSTEM**

Multitone Electric Company Ltd., 12-20 Underwood Street, London, N.1. Tel: Clerkenwell 8022

**BRISTOL'S**

# MINIATURE Syncroverter Switch



*Actual size*

## SETS NEW PERFORMANCE STANDARDS

Recently introduced from the United States, Bristol's Miniature Syncroverter Switch is a polarized, single-pole, double-throw, non-resonant chopper providing break-before-make action in synchronism with the current wave of the driving source. Applicable for use over the excitation frequency range of 0-1,800 c.p.s., it converts low power D.C. signals into alternating voltages which can be amplified and applied to electronic, electrical and servo systems. It can be used also as a Precision Synchronous Rectifier. It is outstanding for its reliability, long life, light weight (only 1.7 ounces), low noise level and clean wave form. Send for details.

*The full range of Electrical Measuring Instruments Division products includes switchboard instruments, electrical recorders, portable instruments, testing sets, relays and tachometers.*

### TYPICAL OPERATION

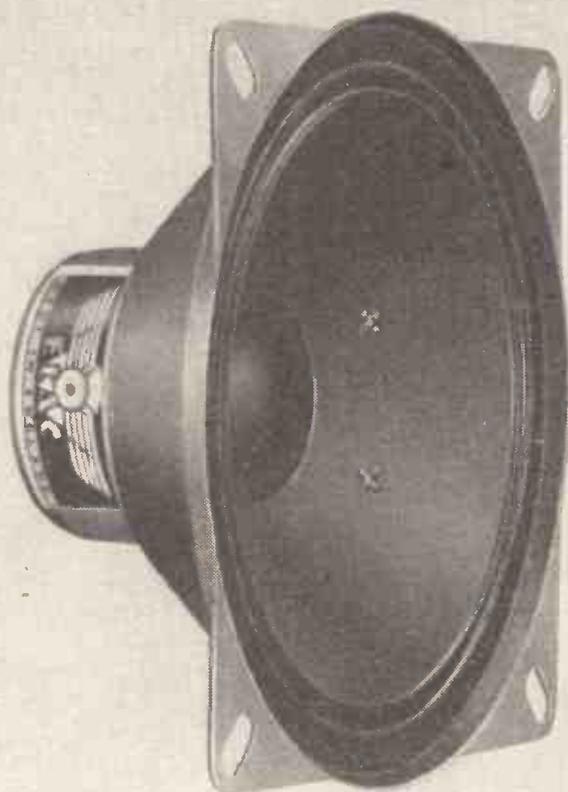
	400 c.p.s.	500 c.p.s.
Coil voltage	6.3V. sine, square, pulse wave	6.3V. sine, square, pulse wave
Coil current	55 milliamperes	45 milliamperes
Coil resistance	85 ohms	85 ohms
*Phase lag	55° ± 10°	65° ± 10°
*Dissymmetry	less than 4%	less than 4%
Temperature	-55° C. to 100° C.	-55° C. to 100° C.
*Switching time	15° ± 5°	15° ± 5°

Mounting—any position—fits 7-pin miniature socket

\*These characteristics are based on sine wave excitation

**ELLIOTT BROTHERS (LONDON) LTD., CENTURY WORKS, LONDON, S.E.13 • TELEPHONE: TIDeway 3232**

# The latest in the Hi-Fi range



## The Elac 4 inch Tweeter

A further addition to the "Elmag" High Fidelity range, this 4in. cone type Tweeter is the finest of its class yet produced. Response to transients is exceptionally good and the absence of undesirable peaks results in clear and smooth reproduction.

For best results it should be used with a suitable cross-over filter in conjunction with 1 or 2 larger units.

Frequency response within 5 dB from 5,000-17,000 cps, only  $7\frac{1}{2}$  dB down at 20,000 cps.

OVERALL SIZE: 4in. DIA. x  $2\frac{5}{8}$  in. DEEP.

POWER HANDLING: 2 W. Peak A.C. INPUT.

VOICE-COIL IMPEDANCE: 6 ohms at 5,000 cps.

**ELECTRO ACOUSTIC INDUSTRIES LTD**

STAMFORD WORKS BROAD LANE TOTTENHAM LONDON N.15 TEL.: TOTtenham 0505-9

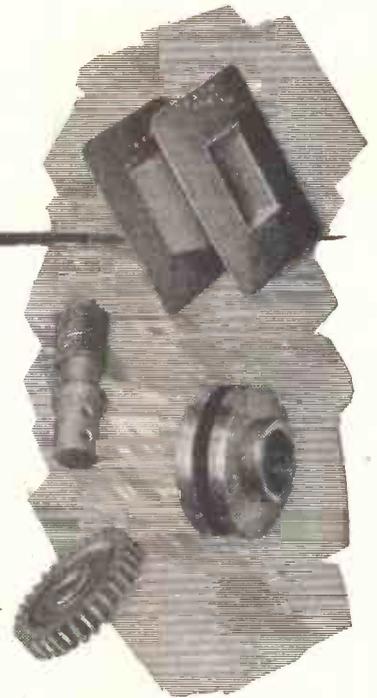
# PIRTOID

SYNTHETIC RESIN BONDED LAMINATE

brings you  
**MATERIAL SOLUTIONS**  
 to your  
**CURRENT PROBLEMS**



... because the range of PIRTOID Paper and Fabric base laminates affords all the machining qualities needed with consistent uniform dielectric and mechanised strength. Read this booklet, sent gladly on request.



**H. CLARKE & CO. (MANCHESTER) LTD.**

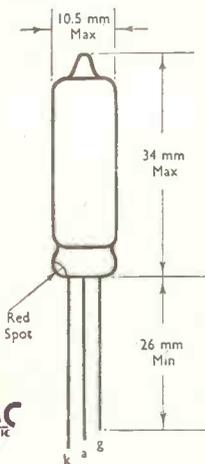
ATLAS WORKS, PATRICROFT, MANCHESTER

Tel. No. ECCLES 5301-2-3-4-5

dmCK4

You can count on

## Hivac Cold Cathode Tubes



**HIVAC**  
 THE SCIENTIFIC  
 VALVE

### Cold Cathode Triode XC18

The XC18 is a wire-ended subminiature cold cathode triode. It is an electrically reliable and mechanically robust tube of superior quality.

Minimum main gap breakdown voltage	73V ± 5
Maintaining voltage	210V
Trigger strike voltage	68V ± 6
Maximum continuous cathode current	1mA
Maximum pulsed cathode current	5mA

(Assuming a maximum duty cycle of 1 : 5)

Our Technical Service Department will be pleased to supply further information and assist in any problems arising from the use of Hivac tubes.

## Hivac Limited

A member of the Automatic  
 Telephone & Electric Group

STONEFIELD WAY

SOUTH RUISLIP

MIDDLESEX

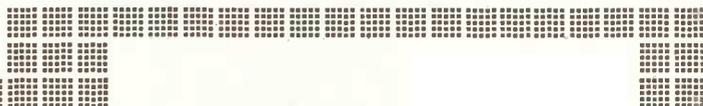
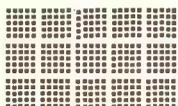
Ruislip 3366



Single pillar lampholder supplied completely prewired with 3 ft. leads ready for immediate installation. Reference No. 80/10/0155

# Thorn pillar lampholders for the illumination of instrument panels . . .

Originally designed for aircraft control panels (and widely used throughout the British aircraft industry) these Thorn pillar and bridge piece lampholders are of universal application for industrial use wherever instrument panels require illumination. A full range of these components is available.



## . . . and bridge pieces

The special advantage of Thorn pillar and bridge pieces is their notable economy of panel space and the clear illumination they provide. Wiring arrangements are extremely simple and bridge pieces can be quickly added to existing control panels without any difficulty.



Bridge pieces are supplied with double entry leads for emergency stand-by lighting if required.

The present range of bridge lighting units is as follows:—

TYPE A	Mk. G4B Gyro Compass	4 lamps
TYPE B	Artificial Horizon	2 lamps
TYPE C	Large S.A.E. Case (4BA screws)	2 lamps
TYPE D	Small S.A.E. Case (4BA screws)	2 lamps
TYPE E	Horizontally mounted Double Desynn	2 lamps
TYPE F	Large S.A.E. Case (2BA screws)	2 lamps
TYPE G	Small S.A.E. Case (2 BA screws)	2 lamps
TYPE H	Large Air Ministry Case	2 lamps
TYPE J	Instruments with 3" P.C.D. fixing	2 lamps
TYPE K	Double Desynn mounted vertically	2 lamps

**SPACE SAVING:**  
All these components are of minimum size because they are designed round the unique Atlas Midget lamp only 0.575" long and 0.249" in diameter.



Three types of Thorn midget panel bulbs are available.

28 volts	0.04 amps
12 volts	0.1 amps
6 volts	0.1 amps



Write for illustrated brochure giving full details

Thorn Electrical Industries, Aircraft Components Division, Great Cambridge Road, Enfield, Middlesex. Tel.: Enfield 5340

The living  
truth in  
sound

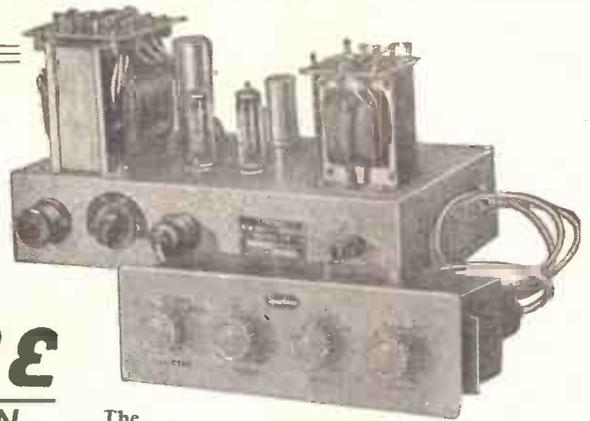
# Spectone

FIVE-FIFTEEN

## AMPLIFIERS

Based on the famous Mullard 5-10 circuit, this equipment represents a marked advance in high-quality amplifier design and construction, as incorporated in the Spectone Stereophonic Reproducers.

Write for descriptive leaflet with full technical specifications



The  
WINDSOR  
POWER AMPLIFIER with PRE-AMPLIFIER

Volume Control, Bass and Treble Controls and Input Selector Switch on chassis. Two inputs; one for radio tuner or pre-amplifier and the second for a pick-up. Treble Control continuously variable from + 16 db to - 15 db at 10 Kc/s. Bass Control continuously variable from + 18 db to - 12 db at 20 c/s.

£24/17/6

**SPECTO LTD. Vale Rd Windsor**

**"YOU CAN RELY ON US"**

*Stockists of all Radio and Electronic components for  
manufacturers, laboratories, Educational authorities,  
and the amateur.*

MULLARD 510 AMPLIFIER AND G.E.C. 912 AMPLIFIER—ALL  
PARTS STOCKED AND AVAILABLE ON H.P.



INCLUDING ELCOM, BULGIN, TCC, HUNTS, DENCO, ETC.

DETAILED LISTS ON ABOVE AVAILABLE

ALL AVO, TAYLOR, INSTRUMENTS FROM STOCK

# RADIO SERVICING COMPANY

82, SOUTH EALING ROAD, LONDON, W.5.

Next to South Ealing Tube (TURN LEFT) 9 to 6 p.m., Wednesday 1 o'clock.

Telephone: EAL. 5737

# NEW *Taylor* oscilloscope

**model 32A**

*especially for the radio and T.V. engineer  
exceptionally good synchronization and triggering*

This is a versatile Portable Oscilloscope primarily intended for T.V. and Radio Service work, but having an outstanding performance and many features which make it invaluable for general-purpose use wherever an Oscilloscope is required.

**Tube**

4in. Green trace (Blue can also be supplied). Electrostatic deflection. EHT 1200V Cathode to final Anode. High Brilliance Trace. Hood provided to facilitate use under high ambient light.

**Sensitivity**

12.5-V. R.M.S. per inch. Input resistance 5 megohms (approx.).

**"Y" Amplifier**

Push-pull output, sensitivity 80 mV per inch, frequency response 10 c/s to over 6 Mc/s. Input impedance 1 megohm. Maximum input 70 V. R.M.S. or 200 V. peak to peak. Wide shift range.

**"X" Amplifier**

Push-pull output, sensitivity 0.45V. R.M.S. per inch maximum. Wide shift range. Frequency range 5 c/s to 500 Kc/s.

**Time Base**

Hard Valve covering 2 c/s to 100 Kc/s in five ranges free running or recurrent trigger.

**Synchronization**

Exceptional synchronization, characteristics, switchable internal/external. External synchronization impedance 1 megohm 20 p.f. Flyback suppression incorporated. Facility for observing Flyback available.

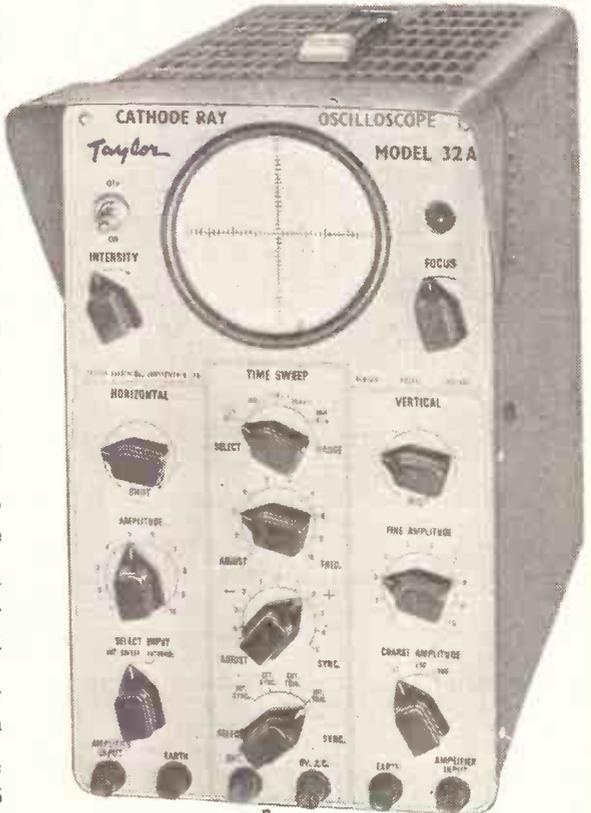
**Power Supply**

105/125 V. or 200/250 V. A.C., at 40/100 c/s. Consumption 100 Watts.

**Dimensions**

Height 13in., Width 7½in., Length 19in., Weight 32lb. (16.5 Kg.).

ALTERNATIVE MODEL 31A has all the features essentially similar to those of Model 32A except for the Time Base Frequency which is 10 c/s to 500 Kc/s.



**PRICE: £70. 0. Prompt Delivery**

**Credit Terms: 9 monthly payments of £8.15.0.**  
Carriage and packing paid in U.K.

Unique offer: You can part exchange an old Taylor Instrument for a new one; write for details.

ALL INSTRUMENTS AVAILABLE ON 7 DAYS' APPROVAL

Write for catalogue of our very wide range of Radio, Television and Electrical Test Instruments, also our new Moving Coil panel Meters.

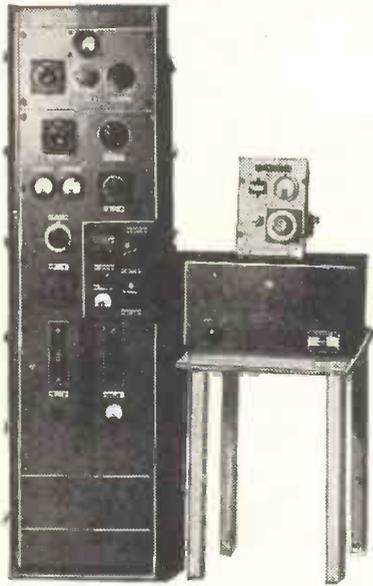
**TAYLOR ELECTRICAL INSTRUMENTS LTD**

MONTROSE AVENUE, SLOUGH, BUCKS.

TELEPHONE: SLOUGH 21381

# FAMOUS RCA TRANSMITTERS

## TYPES ET 4336, K & L.



Frequency 2 mc.-20 mc.

Power output: 350 w. telegraph.

250 w. telephone.

Type of modulation—Class B high level.

Audio Input impedance 500 ohms.

Power supply 190 to 250 v. single phase 50-60 c.

Tube complement: Crystal oscillators—807, Master oscillators—807, Intermediate amplifier—807, Power amplifier—813(2), Modulator—805(2), Rectifier—866A(4).

Complete with Master Oscillators, crystal multipliers, speech amplifiers, microphones, keys, instruction manual, etc.

We guarantee full supply of all replacement parts for a minimum of 5 years after purchase.

## P.C.A. RADIO

Offices and Works

BEAVOR LANE, HAMMERSMITH, LONDON, W.6

Telephone: RIV 8006/7

**H.R.O. COILS.** 50-100 kc/s, 100-200 kc/s, 180-400 kc/s, 0.9-2.05 mc/s, 1.7-4 mc/s, 3.5-7.3 mc/s. Price 25/- each. Band spread 1.7-4m/cs, 3.5-7.3 mc/s. Price 45/- each. Packing and Carriage 4/-.

**B 46 RECEIVERS.** Made by Standard Radio, 1.4 Mc/s-15 Mc/s 12V Battery operated. New, tested, £12. Packing and carriage 15/-.

**B 47 RECEIVERS.** Made by Standard Radio, 40 kc/s-500 kc/s. 220-250V A.C. New and tested, £17/10/-. Packing and carriage 15/-.

**ROTARY CONVERTER UNITS.** Input 11.5-12.5V D.C. Output 300V 200mAmps D.C. Price 30/-, packing and carriage 15/-.

**FIELD TELEPHONE TYPE "F."** In excellent condition. £3 each, carriage 10/-.

**AMERICAN VALVE TESTER Model 314.** Individual lever switches for each tube element. Roll Chart for American type valves. 220/30V A.C. Brand new in nice wooden case with leather handles. Full instruction booklet. £10. Carriage 10/-.

**HIGH RESISTANCE HEADPHONES.** 2,000 ohms. Brand new, ex W.D.. boxed. Type D.H.R. 11/- per pair, postage 1/6.

**LOW RESISTANCE HEADPHONES.** Brand new ex W.D., boxed, Type C.L.R., 5/6 per pair, postage 1/6.

**RELAYS TYPE 300.** Two change over 6,000 ohm coil. 11/6.

**SMOOTHING CHOKE.** Heavy duty 90 ohms 200 mA 10H. 10/6.

**MINIATURE AF CHOKE.** (1in. dia. x 1½in.) 3H 30 mA. 7/6.

**OUTPUT TRANSFORMER.** 3W 40,000/600 ohms impedance. 5/-.

**VARIABLE CONDENSERS.** 110 pF 1,000V. 4/6.

**POTENTIOMETER.** W.W. 60 ohms 1W, 2in. spindle, 1/9 each. 100 ohms 1.5W, short spindle, 1/- each.

**TOGGLE SWITCH.** On/off locking or press action Cutler Hammer, 20 amps. 2/-.

**R 109A** covering 1.5 to 12 Mc/s. 12V D.C. £4/5/-. Packing and carriage 15/-.

**U.S. HIGH VOLTAGE MOULDED MICA CONDENSERS.**

1,200-2,500 volt test. 200, 1,000, 2,000, 5,000 pF. 1/6 each. Post and packing below 1 doz. 1/6.

2,500-5,000 volt test. 100, 200, 300, 500, 1,000, 5,000, 10,000 pF. 2/6 each.

Post and packing below 1 doz. 1/6.

**W.W. RESISTORS.** 5W-250, 400, 800, 1,000, 10,000 ohms. 1/3 each.

Postage and packing below 1 doz. 1/6.

10W-200, 250, 1,000 ohms. 2/- each.

Post and packing below 1 doz. 1/6.

**VITREOUS RESISTORS.** 10,000 ohms, 150W. 4/6 each.

Post and packing below 4, 1/6.

5,000 ohms 50W. 3/- each.

Post and packing below 4, 1/6.

**1155L RECEIVERS COVERING TRAWLER BAND.**

Frequency range 200 kc/s-500 kc/s and 600 kc/s-18.5 Mc/s. Working and guaranteed. £12/19/6. Pack. and carr. within U.K. £1.

## J. P. ELECTRIC

MAIL ORDER  
DEPT.

156 ST. JOHN'S HILL · LONDON · S.W.11



REF.	WATTS	MAX. VOLTS	OHMS	MIN. ORDER FOR FREE UNIT	UNIT STORAGE CAPACITY
------	-------	------------	------	--------------------------	-----------------------

**RESISTORS**

T	1/2	250	10 to 10M	240	720
R	1	500	10 to 10M	180	500

Tolerances available  $\pm 20\%$  10% 5%

**HIGH STABILITY RESISTORS**

HS3	1/2	750	1 to 500M	93	500
-----	-----	-----	-----------	----	-----

Tolerances available  $\pm 5\%$  2% 1%

**WIREWOUND RESISTORS**

LM	5 & 10	—	5 to 100K	72	300
LP	5 & 10	—	5 to 100K	72	300

**CERAMICAPS**

CER	Tubular	500	3 to 470pf	141	500
HK	Tubular	500	470 to 5000pf	141	500
HKD	Disc	500	470 to 5000pf	141	500

Tolerances available  $\pm 2\%$  10%

Thousands of LAB Continuous Storage Units are daily solving the problem of control and storage of the great range of resistors. Compact, and capable of storing up to 720 separate resistors, LABpak make selection positive, simple and speedy. Now that Ceramicaps, Histabs and Wirewound resistors have been added to the carded range the usefulness of LABpak storage units is enhanced.

FREE with any purchase of the LABpak range, these units are the complete answer to the storage problems of small production units, laboratories, etc.

**MAKE UP YOUR ORDER TODAY — DELIVERY EX-STOCK**

All LABpak resistors are carded in ohmic value, rating and tolerance, colour indexed and tabbed for easy selection.

The LAB Continuous Storage Units are available from your normal source of supply, but more detailed information and literature can be obtained from

**THE RADIO RESISTOR COMPANY LIMITED**

50 ABBEY GARDENS, LONDON, N.W.8 • Telephone: Maida Vale 5522

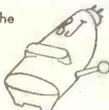
# The World's Finest HI-FI Products

# BJ

**BJ C12 HEAD** combines high sensitivity with low mass



**BJ PLUG-IN SHELL** is the cartridge carrier with attractive lines and finger-lift control



**BJ ADAPTOR** couples all ACOS heads to the BJ ARM



**BJ COUNTER WEIGHT UNIT** gives speed and accuracy in weight control



'STANDARD' ARM



'SUPER 90' ARM

**TEST YOUR TRACKING!**

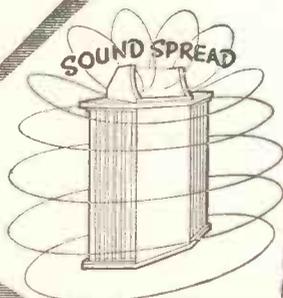
INTRODUCING THE FIRST  
**ALIGNMENT PROTRACTOR**

IN PLASTIC IVORINE FOR MEASURING THE TRACKING ACCURACY OF ALL PICK UP ASSEMBLIES.

Send P.O. for 7' - to-day!

**ARMS OVERCOME TRACKING ERROR**

BJ Arms and BJ Reproducers are available at your Local Dealer. For full details write to:-



**BJ REPRODUCER**

the ultimate 2 or 3 speaker design for all 10 inch, 8 inch and tweeter units

# BJ

**BURNE-JONES SUNNINGDALE ROAD CHEAM SURREY ENGLAND**

# TELCON CELLULAR POLYTHENE INSULATED DOWNLEADS

This range of 75 ohm coaxials has been especially designed for the reception of Band II (FM sound 87.5 - 100 Mc/s.) and Band III (Television 174 - 216 Mc/s.)

Attenuation db/100 ft.	ET.5.M	ET.6.M	ET.7.M	ET.8.M	ET.10.M
10 Mc/s. . . . .	1.3	1.5	1.0	1.1	0.6
50 " . . . . .	3.0	3.4	2.3	2.6	1.5
100 " . . . . .	4.3	4.8	3.2	3.6	2.2
200 " . . . . .	6.3	7.2	4.9	5.3	3.3

Dimensions (inches)	ET.5.M	ET.6.M	ET.7.M	ET.8.M	ET.10.M
Centre Conductor . . . . .	1/0.022	7/0.0076	1/0.029	7/0.010	1/0.044
Over Cellular TELCOTHENE . . . . .	0.093	0.093	0.128	0.128	0.200
Over Wire Braid . . . . .	0.117	0.117	0.152	0.152	0.230
Over TELCOVIN Sheath . . . . .	0.157	0.157	0.202	0.202	0.290

Please ask for a copy of Publication TV5

# TELCON CABLES

THE TELEGRAPH CONSTRUCTION & MAINTENANCE CO. LTD.  
MERCURY HOUSE, THEOBALD'S ROAD,  
LONDON, W.C.1. HOLBORN 8711

BRANCHES: CARDIFF, DUDLEY, MANCHESTER, NEWCASTLE AND NOTTINGHAM



When you want

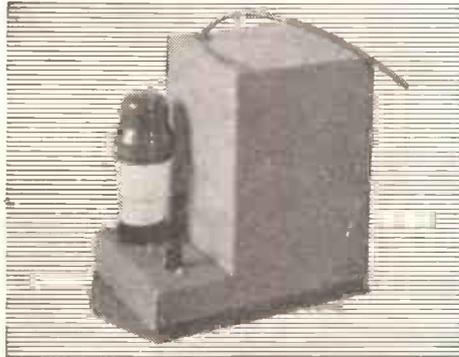
# SPECIALISED ELECTRONIC EQUIPMENT

★ Designed, Developed,  
or made to specification

Consult

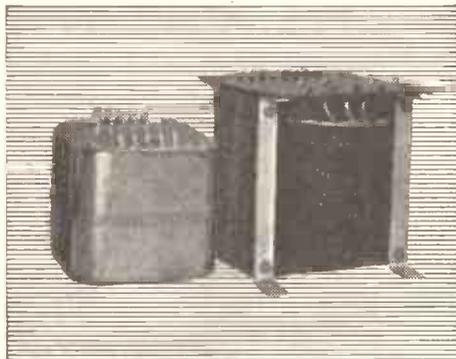
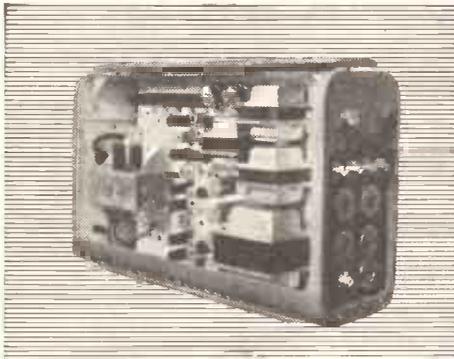


Model P.48 Pro-  
jection Receiver  
for closed circuit  
Television for  
Industrial use  
giving a picture  
up to 4ft. x 3ft.



R.F., E.H.T. Unit.  
A safe D.C. high  
voltage unit design-  
ed to meet the need  
for a reliable source  
of supply for all  
Television C.R.  
Tubes, including  
the new wide angle  
and aluminised  
types. Also satis-  
factory for flash  
testing where a D.C.  
supply is necessary

Mobile sound and  
vision designed and  
produced by P.A.M.  
for Marconi's Wire-  
less Telegraph Com-  
pany Limited. It  
is primarily intend-  
ed for use in studio  
and mobile control



Open and Shrouded  
types of Transform-  
ers for general use  
in electronic equip-  
ment. Designed  
and manufactured  
to individual re-  
quirements

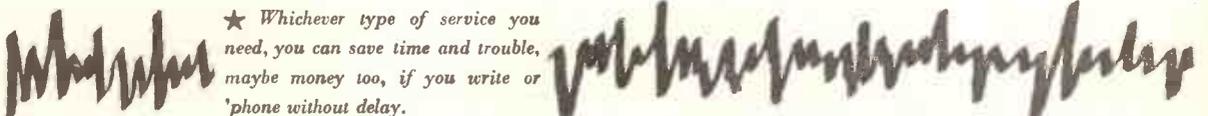
P.A.M. Electronics Division  
combines the technique and  
experience of several  
companies long-established  
in the field of Electronics,  
with the ample modern  
production resources of  
P.A.M. Ltd. Examples of  
recent work are illustrated

P.A.M. Limited  
*Electronics Division*

MERROW, GUILDFORD, SURREY  
Tel: Guildford 2211

*One of the group of companies in the  
Southern Areas Electric Corporation Ltd*

★ *Whichever type of service you  
need, you can save time and trouble,  
maybe money too, if you write or  
'phone without delay.*



# ARCOLECTRIC

## MAINS VOLTAGE

Designed for mains 15 watt B.C. pigmy lamps. Also available with 3-slot holder. Polished chromium plated bezel. Supplied with removable coloured dome, either Yellow, Amber, Orange, White, Red, Green or Blue. Delivery from stock.

Write for Catalogue 131

**ARCOLECTRIC**  
SWITCHES · LTD



## SIGNAL LAMP

There are many other smaller Arcoelectric signal lamps—low voltage, mains and neon. Arcoelectric signal lamps are used in the latest supersonic military aircraft.

Actual Size

Cat. No.  
S.L.100

**CENTRAL AVENUE, WEST MOLESEY, SURREY - TELEPHONE: MOLESEY 4336 (3 LINES)**

# Connoisseur 3 SPEED MOTOR

The turntable with a 4% variation on all three speeds.

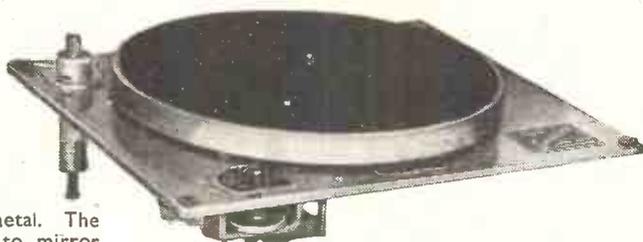
The Connoisseur motor is made for the perfectionist. It is one of the finest turntables in the world.

The speed change is arranged mechanically and gives a 4 per cent variation on all speeds. A synchronous motor, which is virtually vibrationless with low noise level and hum induction, maintains a constant speed at all settings. There is no braking action to obtain speed change.

The 12in. turntable is lathe turned in non-ferrous metal. The main spindle, which is precision ground and lapped to mirror finish, runs in phosphor bronze bearings.

A sound, precision engineering job, the Connoisseur motor provides the foundation for perfect reproduction.

Price £20, plus P. Tax £8/11/-.



Matching Connoisseur Pick-up Mark II with a frequency range from 20-20,000 cycles:

Pick-up complete with I head fitted with Diamond armature £8/19/- plus P. Tax £3/16/6.

## A. R. SUGDEN & CO. (ENGINEERS) LTD.

WELL GREEN LANE, BRIGHOUSE, YORKSHIRE. Phone: Brighouse 2397. Grams: Connoisseur, Brighouse.

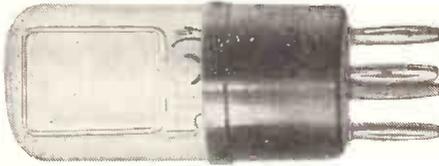
### OVERSEAS AGENTS:

SOUTH AFRICA: W. L. Proctor (Pty.) Ltd., 63, Strand Street, Cape Town. U.S.A.: Ercona Corporation, 551 Fifth Street, New York, 17, N.Y. CANADA: The Astral Electric Co. Ltd., 44, Danforth Road Toronto 13, Ontario. NEW ZEALAND: Turnbull & Jones Ltd., Head Office, 12/14, Courtenay Place, Wellington. HONG KONG: The Radio People Ltd., 31, Nathan Road, Hong Kong.

### MAIN DISTRIBUTORS:

AUSTRALIA: British Merchandising Pty. Ltd., 183, Pitt Street, Sydney, and J. H. Magrath (Pty.) Ltd., 208, Little Lonsdale Street, Melbourne. EAST AFRICA: International Aeradio (East Africa) Ltd., P.O. Box 3133, Nairobi. MALAYA: Eastland Trading Co., 1, Prince Street, Singapore.

# PHOTO-ELECTRIC CELLS



*Cinema-Television Limited have been designing and manufacturing photo-electric cells for over a quarter of a century as a result of which they can now offer a service and 'know-how' second to none.*

*With over 80 different types of photo-cell in the current manufactured range there is a type suitable for practically every known application and an equivalent for almost every cell manufactured in the world.*

*We shall be pleased to discuss your particular requirement and can manufacture special cells where required. Full data sheets are available on request.*



## CINEMA TELEVISION LTD

A COMPANY WITHIN THE RANK ORGANISATION LIMITED  
 WORSLEY BRIDGE ROAD · LONDON · S.E.26  
 HITHER GREEN 4600

# TELE-RADIO'S REMARKABLE TAPE PRE-AMP UNIT MASTERLINK-M2

## STILL FURTHER IMPROVED



27 GNS.

COMPLETE—Carriage extra

### Worth Listening to . . .

Collaro Tape Deck Mk. III	£22 0 0	Leak Pick-up, L.P. Head	£13 16 5
Tele-Radio Williamson Kit	£25 0 0	Tannoy Canterbury Speaker	£57 15 0
Jason switch controlled Tuner	£19 16 10	Wharfedale S.F.B/3 Speaker	£39 10 0
Rogers Junior Amplifier and Pre-amp	£26 0 0	Westrex "Acoustilens" Speaker	£169 0 0
Quad Mk. II Amplifier and Control unit	£42 0 0	G.E.C. Metal Cone Speaker and Pressure Unit	£13 4 6
Carriage and Packing Charged at Cost.			

**TELE-RADIO (1943) LTD.**
**189 EDGWARE ROAD, LONDON, W.2**

Telephone: PADDINGTON 4455-6

A few minutes from Marble Arch • Our only address • Open all day Saturday (1 p.m. Thursday)

## M. R. SUPPLIES Ltd.

(Established 1935)

First-class ELECTRICAL MATERIAL for immediate delivery, carefully packed. Prices nett.

**F.H.P. GEARED MOTORS.** It is widely recognised that we have the best service for delivery of first-grade small Geared Motors. We carry a large stock of series-wound and capacitor/induction units in a range of final speeds from 300 r.p.m. to 1 r.p.m. and final torques up to 75lb./in. Our new list GM/357 is now available, giving details of the various ratings—copy sent on request.

**SHADED POLE INDUCTION MOTORS, 200/250 v. A.C.** Very silent running and ideal for many lab. and domestic applications, stirrers, cooling fans, extractors, etc. No interference with radio/TV. Brand new units: B.T.H., body 3in. dia. by 2½in. with three-hole mounting flange. Shaft ½in. dia. by ½in. proj. 2/76 (despatch 1/6). Also Delco super model, fan-cooled, body 4½in. by 3½in., shaft proj. 1½in. torque 500 gm/cm., and the perfect unit for tape recorders in addition to above duties. 42/6 (des. 2/7). All of the above are 4-pole and speeds are: B.T.H., 1,400; Hoover, 1,200; and Delco, 1,400 r.p.m.

**SYNCHRONOUS TIMER MOTORS, 200/250 v. 50 c. (G.E.C.—brand new).** Compact motors, 2½ × 1½ × 1½in. with 1in. shaft proj. Self-starting, high torque, 6 r.p.m., suitable also for display turntables. 57/6 (des. 1/-).

**VERY MINIATURE I.V. MOTORS, 3/6 volt D.C., low consumption, only 100 m.a. at 4.5 volts, suitable for dry battery operation.** Size 1in. by 1in., with mounting flange, shaft and pulley. Fine bargain for model makers. 7/6 (des. 6d.).

**A.C. CONTACTORS, 230 v. A.C. coil, 2-pole 7½ amp. "make," base 4½ by 2in., 12/6 (des. 1/-). MINIATURE RELAYS (STC) 250 ohms coil, 2 pole C.O. (double contacts), 1½ × ½ × ½in., 9/6. DELAY RELAYS (Western Electric), 24 volt, 120 ohms-coil, 2-pole "make" with precision adjustable delay action (max. delay 3 seconds) on base 4½ by 2½in. New, boxed, 15/6 (des. 1/-). AMMETERS, 9/6 amp. D.C. m/coil, 2in. sq. flange, 12/6 (des. 6d.). MICRO SWITCHES, single pole "make" or "break," at choice, 5 amps. A.C., new, boxed, 3/-.**
**L.T. RECTIFIERS (new G.E.C.), Full-wave, 12/15 v. 4 amps., 15/6 (des. 1/3). Also 24 v. 4 amps. f.w., 27/6 (des. 1/6).**
**B.F.L. MEASURING INSTRUMENTS.** At the moment we have a good shelf stock of 3.35 and 3.50 deflection 1 m.a. down to 0/50 microamps. Details on request.

**AIR COMPRESSORS (B.T.H.).** Ex-Govt. In fine condition. Up to 250lb/sq. in. Bore 1in., stroke 1in. (approx.). Power required about ¼ h.p. Limited supply at only 25/- each (des. 2/-).

**HIGH DUTY AIR BLOWERS.** We number many of the largest industrial concerns amongst our very satisfied customers for these fine units. We now offer the last few, and see no prospect of being able to repeat this fine offer: powered with B.T.H. repulsion/induction motor, 230/250 v. 50 c. 1 ph. Estimated delivery 1,500 c. ft./min. Overall length 24in., width 20in., height 18in. Inlet 7in. dia. Outlet 7in. by 3in. Weight approx. 1 cwt. Brand new in original cases. £22/10/- (des. mainland 20/-)

**COMPLETE SEWING MACHINE MOTOR OUTFITS.** There is no better quality job at any price and we have many hundreds of very satisfied customers and large sale, from recommendations. 30/6/50 v. A.C./D.C. fitted with latest radio/TV suppressors including motor with fixing bracket, foot control, needle light with switch, belt, etc. and instructions for fitting to ANY machine. And we still offer the complete outfit for £8/15/- (des. 2/9).

**G.E.C. RECTIFIERS, 150 v. 350 m.a. half-wave, 7/6, two for 300 v. 35- m.a., 15/- (post paid), or four in bridge for 230 v. 0.75 amp. f.w., 29/6 (post paid).**
**EXTRACTOR FANS.** Very well made units at much below normal prices. 200/250 v. A.C. (induction motor, silent running, no interference). With mounting frame and back grille, ready for easy installation. With 8in. impeller, £5/12/6 (des. either 3/-).

**M. R. SUPPLIES Ltd., 68, New Oxford St., London, W.C.1.**  
 Telephone: MUSEUM 2958

★ The Tele-Radio "Masterlink M.2," like its highly successful prototype, enables existing quality amplifying equipment to be used for tape recording to professional standards. This new version offers increased scope in the use of tape together with still better characteristics and added refinements of layout and appearance. As well as adjustable playback equalisation, the M.2 also has provision for C.I.R. characteristic. A separately housed power pack is included as an integral part of the equipment. ALL CONNECTIONS AT REAR OF UNIT. Demonstrations gladly given at any time during business hours. Descriptive leaflet free on request.

### Brief specification of new model

- ★ Switched input for Microphone and Radio/P.U.
- ★ Frequency response  $\pm$  2db. at all speeds, viz. 3½in.—30/8,000 c/s; 7½in.—30/14,000 c/s; 15in.—30/15,000 c/s.
- ★ Adjustable Bias Output with Metering Facility.
- ★ Playback via Cascode Input Circuit.
- ★ Pre-set adjustment for play back equalisation on all speeds PLUS C.C.I.R. Standard characteristic.
- ★ Output approx. 200 mV with metering facility.
- ★ TRADE ENQUIRIES INVITED.  
C.W.O. or C.O.D.

● **CATALOGUE** 56 pages of today's best Audio-Electronic Equipment 1/3, post paid.

## WALMORE ELECTRONICS LIMITED

**PHOENIX HOUSE, 19/23 OXFORD STREET,  
LONDON, W.1.**

Telephone: GERrard 0522

Cables: Valvexpor

For immediate response Telex London 8752.

EXPORTERS OF RADIO, TELEVISION AND INDUSTRIAL TUBES, HAVE PLEASURE IN INTRODUCING THEIR BRAND



AND INVITE ENQUIRIES FROM BUYING AND CONFIRMING HOUSES EXCLUSIVELY FOR EXPORT

SUPPLIERS OF RADIO COMPONENTS ELECTROLYTICS, AND CATHODE RAY TUBES

*Reduce*

your press tool costs

*with the*

**HUNTON**

UNIVERSAL BOLSTER OUTFIT

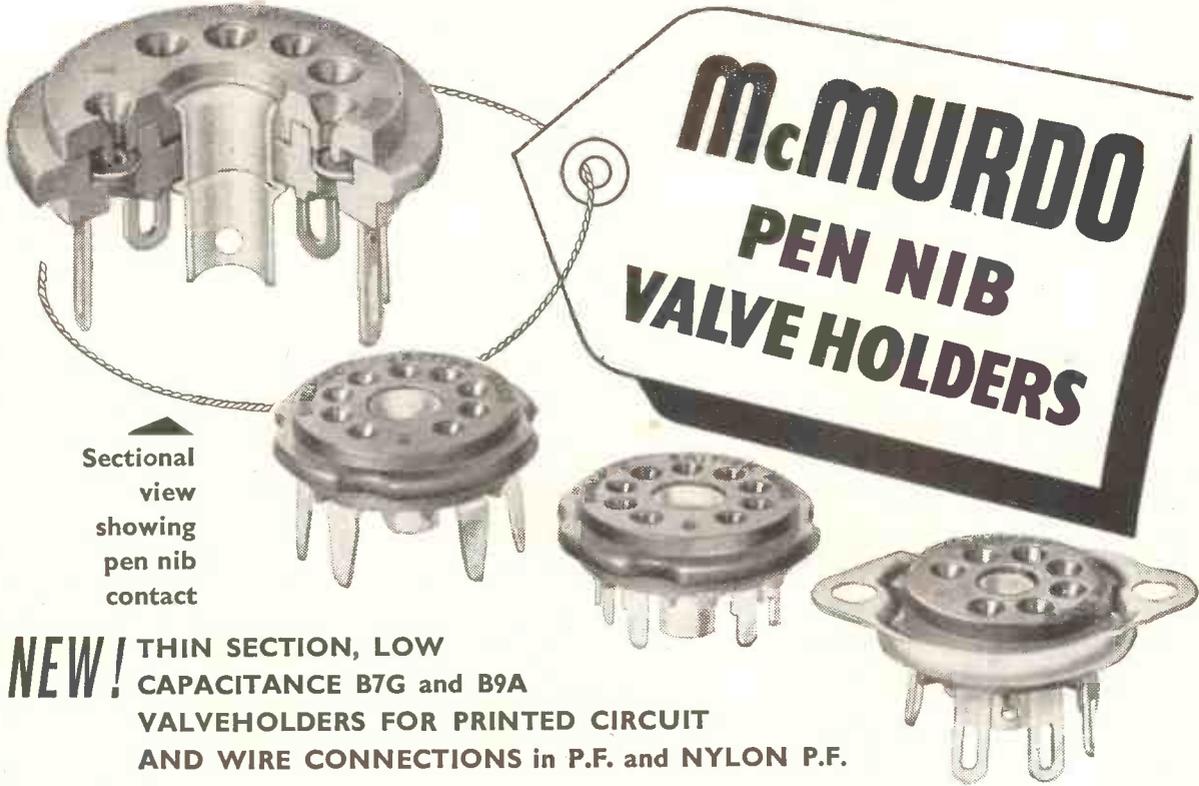


In addition to the range of Punches and Dies  $\frac{1}{8}$ " to  $3\frac{3}{4}$ " dia. available from stock, some of the tools usually required in the Radio and Electronic Industry have been standardised for use with the Hunton Universal Bolster Outfit. Illustrated above are a few which can be supplied quickly or from stock. In London and Home Counties, ask for a practical demonstration in your own works. Alternatively, write for illustrated price list W.W.1.

**HUNTON LIMITED**

PHOENIX WORKS, 114-116, EUSTON ROAD, LONDON, N.W.1.

Telephone: EUSton 1477



Sectional view showing pen nib contact

**NEW!** THIN SECTION, LOW CAPACITANCE B7G and B9A VALVEHOLDERS FOR PRINTED CIRCUIT AND WIRE CONNECTIONS in P.F. and NYLON P.F.

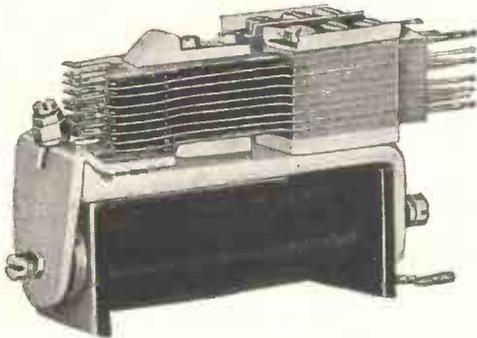
Send for full details to :

**THE McMURDO INSTRUMENT CO. LTD., ASHTEAD, SURREY.**

**Tel: ASHTEAD 3401**  
JSP.MPN 5

**POST OFFICE TYPE**

3,000 and 600 relays to specification



- Specialists in tropical and Services jungle finish
  - GUARANTEED TO FULL A.I.D. & I.E.M.E. STANDARDS
- PROMPT DELIVERIES, PROTOTYPES 7 TO 10 DAYS  
(Manufacturers and Trade enquiries only)

Manufacturers to H.M. Govt. Depts. and leading Contractors

**L. E. SIMMONDS LTD.**  
5 BYRON ROAD, HARROW, MIDDX.  
Telephone: Harrow 7797/9



**THIS MAGNIFICENT RECORDER TAKES EVERYTHING IN ITS STRIDE**

The remarkable performance on standard or pre-recorded tapes of the Celsonic high-fidelity magnetic Tape Recorder is world famous. It also takes in its stride the superimposing of words over music and the conversion of silent films to sound.

Long playing times possible on reels up to 3,280ft. Full track and half track available.



Send for details

**EXCEL SOUND SERVICES LTD., (Dept. W.D.K.)**  
Garfield Avenue, Bradford 8, Yorkshire. Tel.: 45027  
Please PRINT your name and address.

# world-wide approval

Pye Telecommunications Limited are now marketing the widest and most modern range of V.H.F. fixed and mobile radio-telephone equipment available in the world. This range of equipment has been designed to expand the application of Pye Radio-Telephones already in constant use in 77 different countries.

Pye Ranger V.H.F. equipment has now received approval from the British G.P.O. for Land, Marine and International Marine applications employing A.M. or F.M. systems, type approval from the Canadian D.O.T., and type acceptance of the F.C.C. of the United States of America.

No other Company holds so many approvals for this range of equipment, which now covers every conceivable requirement.



**Leading the world in  
V.H.F. RADIO-COMMUNICATIONS**

We can offer

**FREQUENCY RANGE**

All frequencies from 25 to 174 Mc/s.

**POWER RANGE**

All powers up to 1 Kilowatt.

**CHANNEL SPACING**

All channel spacings including 20 and 25 kc/s in full production.

**MODULATION**

A.M. or F.M.

No matter what your V.H.F. requirements are, Pye Telecommunications Ltd., can fulfil them. Your enquiries are invited.

# P RECIOUS M ETAL D EPOSITORS

**"BE YOUR OWN BOSS"**

## PLATING CONSULTANTS

ELECTRO-PLATING OF GOLD,  
RHODIUM, SILVER, INDIUM, ETC.

CONVERSION COATINGS FOR ALUMINIUM.  
(IT'S FULLY CONDUCTIVE AND IS BETTER PROTECTION  
THAN ANODISING.)

## ELECTRO-FORMING

WE HAVE A SPECIALIST KNOWLEDGE OF  
PLATING :— SWITCH PARTS, PRINTED CIRCUITS,  
MICROWAVE PARTS, PLUGS AND SOCKETS,  
ALSO MAGNESIUM AND ALUMINIUM  
COMPONENTS.

**DID YOU SEE US ON B.B.C. TELEVISION?**

OUR MR. R. F. NAYLOR CONVINCED  
SEVERAL EMINENT BUSINESS MEN OF  
OUR ABILITIES AS PLATERS AND WAS  
AWARDED £3,500.

WILL YOU ALLOW US TO DEMONSTRATE  
OUR EXCEPTIONAL SKILL TO YOU BY  
LETTING US HANDLE YOUR PLATING  
PROBLEMS.

**PRECIOUS METAL DEPOSITORS**  
**HEARSALL LANE,**  
**COVENTRY**

## THE BRITISH NATIONAL RADIO SCHOOL

ESTD. 1940

NOW IN OUR SIXTEENTH YEAR  
AND STILL

**NO B.N.R.S. STUDENT  
HAS EVER FAILED**

to pass his examination(s) after completing  
our appropriate study course

**DO YOURSELF A BIT OF  
GOOD, TAKE—  
A B.N.R.S. Study Course**

A.M.Brit.I.R.E. and CITY and GUILDS Radio and  
Telecommunications Exams., etc., etc.

**PRINCIPAL,  
BRITISH NATIONAL RADIO SCHOOL**  
66 ADDISCOMBE ROAD, CROYDON, SURREY  
Tel. ADDiscombe 3341

## 1.5 VOLT STABILIZERS



### THE A.E. RANGE OF HERMETICALLY SEALED LOW VOLTAGE STABILIZERS

Regulation: .07 V approx.  
Max. operating currents: 20 mA to 1 A.  
Slope Resistances: 3.5 to .07 Ohms.  
Ambient temp. limits: -5° to 70° C.  
Useful frequency range: up to 10 Mc/s.

Also available with small "emergency" storage capacity. Suitable for operation in series and parallel. "Filter action" of 400 mA type at 50 c/s equivalent to 60,000 $\mu$ F. Applications include: "Fixed bias" operation, protective ccts., D.C. heater supplies, reference potentials, semi-conductor circuitry, stabilized supplies, etc.

Brochure from Sole Concessionaires:  
**MERCIA ENTERPRISES LTD. 30 Silver St., Coventry**

**GOODMANS***present the*

# 315 REPRODUCER

*The "315" Reproducer is the first British Loudspeaker system of its kind. It is unique in that all its components are precision instruments designed and built with no adoption of compromise at any stage, together forming an integrated system of exceptional merit.*

*The "315" Reproducer is housed in an enclosure which is craftsman built and hand finished.*

## SPECIFICATION

**Frequency Range**

30 c/s to 16,000 c/s (minus 8 db at 20 Kc/s).

**Power Handling Capacity**

15 watts.

**Impedance**

15 ohms at 400 c/s

**Crossover Frequencies**

750 c/s and 5,000 c/s

**Driving Units**

*Bass.* 12" direct radiator, (Audiom 60)  
A.R.U. Loaded.

*Middle.* Horn loaded pressure driver (Midax).

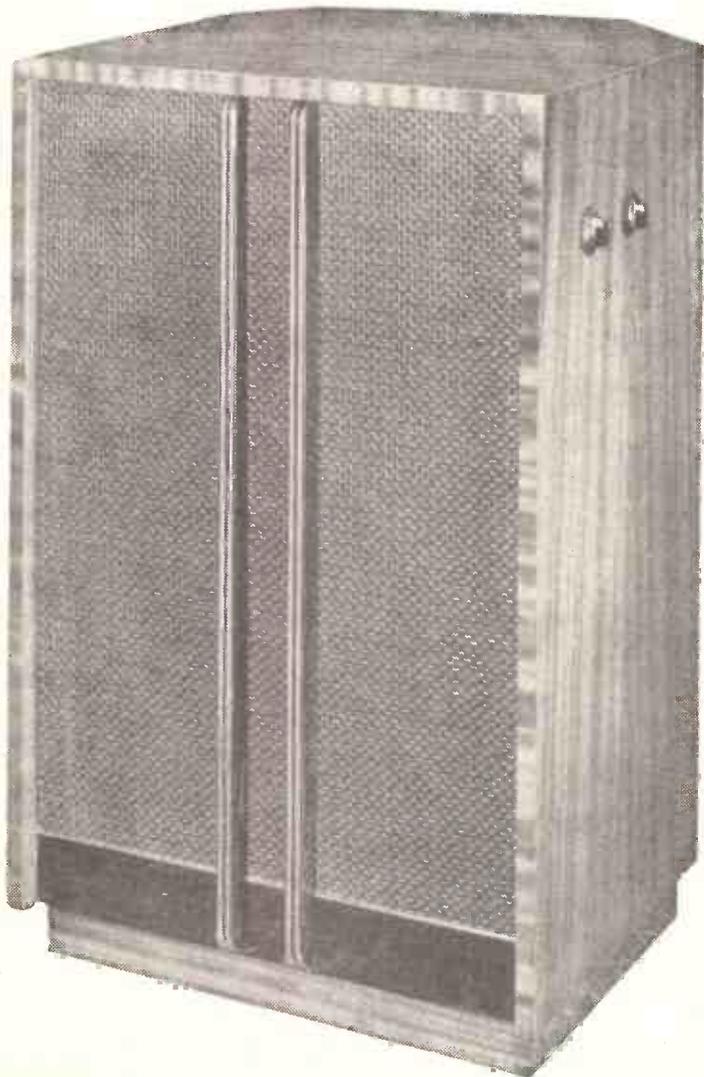
*Treble.* Horn loaded pressure driver (Trebax).

**Controls**

Two constant impedance variable attenuators, calibrated in 2 db steps for independent control of mid range and treble units.

**Dimensions**

37" high x 23½" wide x 20½" deep.

**GOODMANS**

*Full details of the 315 Reproducer will be sent on request*

**GOODMANS INDUSTRIES, LTD.** AXIOM WORKS, WEMBLEY, MIDDX. Telephone: WEM 1200 Cables: Goodaxiom, Wembley, Middx.

Scottish Distributors: Land, Speight & Company, Limited, 2 Fitzroy Place, Sauchiehall Street, Glasgow Telephone: Glasgow Central 1082

# THE WEYRAD AM/FM RECEIVER

THIS RECEIVER WHICH HAS BEEN SPECIALLY DEVELOPED FOR THE AMATEUR CONSTRUCTOR PROVIDES COMPLETE COVERAGE OF THE SOUND BROADCAST BANDS—LONG, MEDIUM AND SHORT WAVE AM WITH 87.5-100 Mc/s. V.H.F. FOR FM. WE HAVE PRODUCED A FULLY ILLUSTRATED BOOKLET WHICH GIVES INFORMATION ON THE ASSEMBLY AND ALIGNMENT OF THE 4-BAND SEVEN-VALVE RECEIVER, INCLUDING CHASSIS LAYOUT, CIRCUITS AND POINT-TO-POINT WIRING DIAGRAM.

- ★ "WEYRAD" B.61 COIL PACK, P.23 I.F. TRANSFORMERS, T.S.61 TUNING SCALE, Q2 I.F. FILTER, E.822 MAINS TRANSFORMER AND E.823 OUTPUT TRANSFORMER.
- ★ ALUMINIUM CHASSIS WITH ALL PUNCHING AND BENDING COMPLETE.
- ★ DESIGNED FOR LATEST TYPE MULLARD VALVES.
- ★ RECEIVER OUTPUT CAN BE MODIFIED FOR USE AS A RADIO FEEDER FOR QUALITY AMPLIFIERS.

THE BOOKLET & PRICE LIST .....2/6d.

ILLUSTRATED FOLDER OF AM. COMPONENTS .....3d.

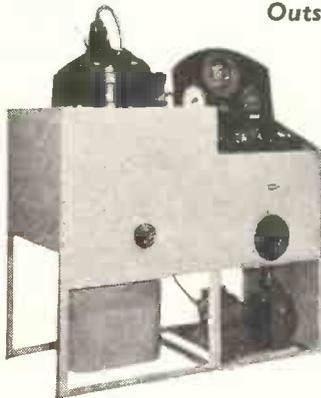
**WEYMOUTH RADIO MANUFACTURING CO., LTD.**  
CRESCENT STREET, WEYMOUTH, DORSET.

## IMPREGNATE your coils with ease

### BLICKVAC

High Vacuum Impregnators meet the most stringent specifications and yet are easy to handle. Full range of models available to meet the needs of the large-scale producer, the research laboratory or the small Rewind shop.

#### Outstanding Features :



- Ease in control.
- Ease in cleaning.
- Elimination of vibration.
- Unequaled flexibility and performance.
- Simple attachment of auxiliary autoclaves.
- Units available suitable for Varnish, Wax, Bitumen and Potting Resins.

Users include M.O.S., N.C.B., G.E.C., Pye, Marconi, Metro-Vick.

If your problem is COIL IMPREGNATION or impregnating or casting with Potting Resins consult :

**BLICKVAC ENGINEERING LTD.**

Bede Trading Estate, Jarrow, Co. Durham.  
96/100 Aldersgate Street, London, E.C.1.

Jarrow 89/7155  
Monarch 6256/8

## WAFER SWITCHES TO SPECIFICATION

As we specialise *only* in the manufacture of small quantities of wafer switches (to individual specification) we can guarantee competitive prices—and . . .

### FASTEST DELIVERY

Write, Phone or Call for Comprehensive Price List and Design Chart.

### SWITCHES TO PUBLISHED DESIGNS (FROM STOCK)

<b>G.E.C. 912-PLUS</b>		<b>Mullard Tape Amplifiers</b>	
S1 (14061/B1)	} 14/6 pair	<b>Amplifier "A"</b>	
S2 (14062/B1)		SS/567/A	} 32/6 the set
S4 (SS/556/1)	.. . . 11/6	<b>Amplifier "B"</b>	
S5 (SS/556/2)	.. . . 10/6	SS/567/A	.. . . . 16/6

## SPECIALIST SWITCHES

23 Radnor Mews - Sussex Place  
London W2 - AMBassador 2308

Suppliers to the leading electronics, aeronautical and automobile companies and to research institutions, the G.P.O. and Universities.

MINIATURE  
**CERAMIC CAPACITORS**  
 FIXED & VARIABLE

*FINISH: STOVE ENAMELLED OR BAKELITE COATED*

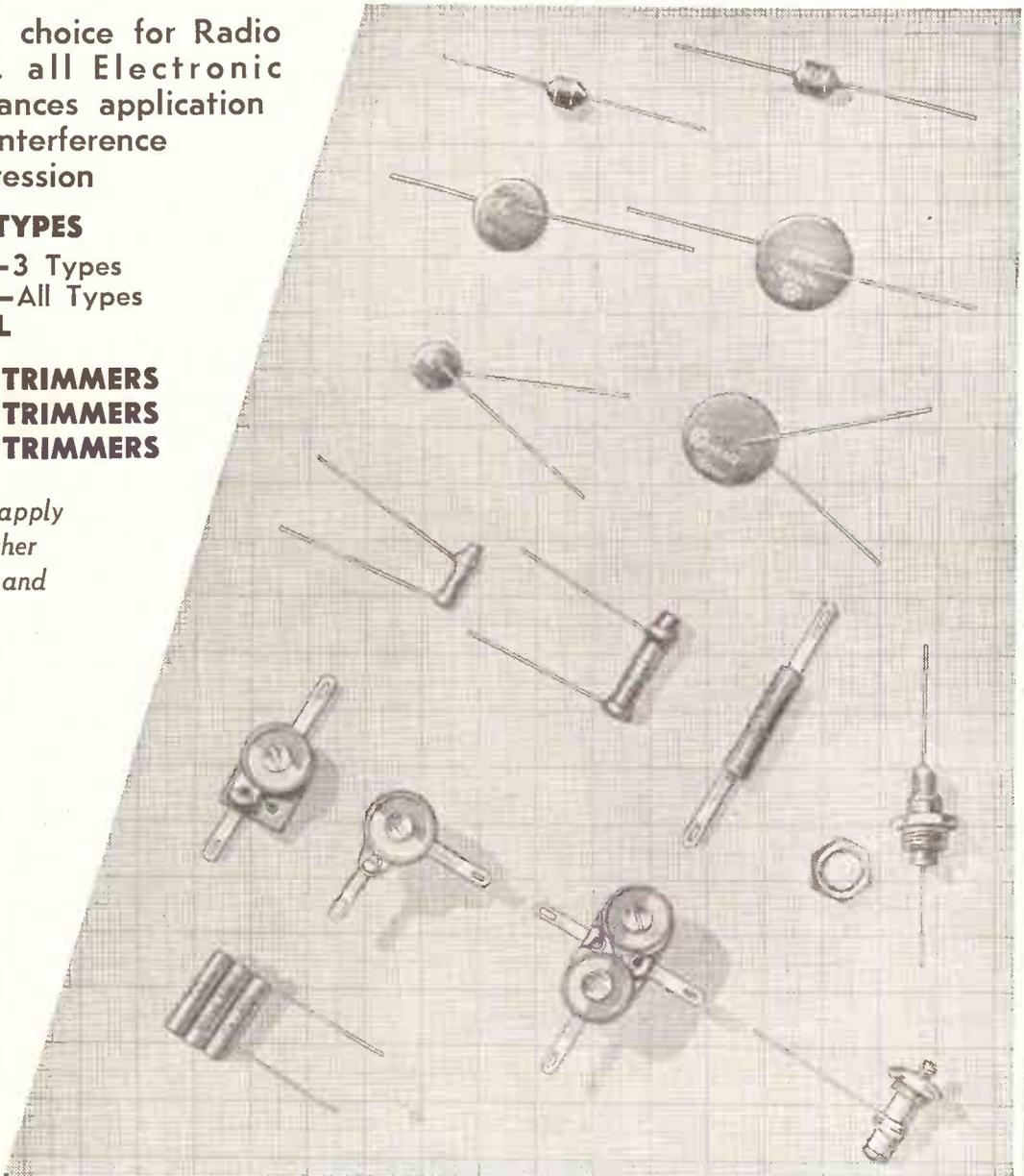
Wide choice for Radio  
 T.V., all Electronic  
 Appliances application  
 and Interference  
 Suppression

**TYPES**

- DISC**—3 Types
- TUBE**—All Types
- PEARL**

- DISC TRIMMERS**
- TUBE TRIMMERS**
- WIRE TRIMMERS**

*Please apply  
 for further  
 details and  
 Prices*



**STEATITE INSULATIONS LTD.,**  
 25 SOMERSET ROAD, EDGBASTON, BIRMINGHAM, 15.

Telephone: . . . . . EDGBASTON 5381/2.  
 Telegraphic Address: "STEATITE-BIRMINGHAM, 15"



## FLEXIBLE REMOTE CONTROL OUTFITS

offering facilities for making prototype flexible remote controls as required, without flexible casing.

The Remote Control Flexible Shafts in these Outfits cover the range of torque loadings required for volume controls, wave change switches and condensers used in electronic, radio and television equipment.

No. 130 (.130 in. dia.) for controls up to 4 inches long  
No. 150 (.150 in. dia.) for controls up to 6 inches long

Longer controls with flexible casing made to order.  
Detailed Parts and Price List available upon request to Dept. W.



BRITANNIA WORKS, 25-31, ST. PANCRAS WAY, N.W.1.

Telephone: EUSton 5393

R.C.A.

## Dulci ULTRA LINEAR AMPLIFIER D.P.A.10 WITH CHOICE OF CONTROL UNITS

D.P.A.10. 10-14 watt Power Amplifier. Valves: EF86, ECC83, two EL84, EZ81  
Switched matching ro speakers of 3-5, 6-8, 12-16 ohms.  
Frequency response 10-35,000 cps.

PRICE

£12.12.0

### TONE CONTROL UNIT

With controls for on/off and volume, Bass, Treble (cut and lift) and three positions selector switch. Input impedance 250k at 500mV on all channels for full loading of D.P.A.10.

PRICE £3.3.0

### SELECTOR PRE-AMPLIFIER

With full range Bass, Treble controls giving 15 db cut and lift. Multiple input channels with sensitivities from 1.5mV to 300mV with impedance to fully load D.P.A.10. Provisions for microphone tape, pick-up, tuners, etc. Valves: two type EF86.

PRICE £7.7.0

DIRECT FROM THE MANUFACTURERS TO OTHER ENTHUSIASTS

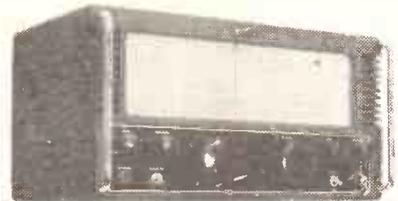
Full Details from Ref. W.W.

**THE DULCI CO., LTD.**

97-99 VILLIERS ROAD, LONDON, N.W.2

Telephone: WIllesden 6678/9.

## EDDYSTONE COMMUNICATION RECEIVERS



Model 840A illustrated  
Cash Prices and Statutory Terms

Model	Cash Price	Deposit	8 Monthly Payments of
820	£31 18 0	£3 14 6	£3 14 6
870	£34 16 0	£4 1 6	£4 1 6
840A	£55 0 0	£6 8 4	£6 8 4
750	£78 0 0	£9 2 0	£9 2 0
888	£110 0 0	£12 16 8	£12 16 8
680X	£120 0 0	£14 0 0	£14 0 0

Cash price if paid in 6 months by Bankers' order  
Carriage paid per passenger train.

Model 840A is for A.C. or D.C. 110/250 v.; 750 and 680X 110/240 v. A.C. These sets are the choice of the discerning professional and amateur users. Descriptive literature gladly forwarded.

Latest EDDYSTONE Component Catalogue 1/-



The  
**Eddystone**  
**Specialists**  
**SERVICES LTD.,**

55 COUNTY ROAD, LIVERPOOL, 4  
Telephone: AINTREE 1445 ESTAB. 1935  
Branch address: MARKET CROSS, ORMSKIRK



*First in the field*

These have been in regular quantity production for the past two years, and have proved themselves reliable and stable in a *variety* of applications. They are admirably suitable for all forms of DC to DC or DC to AC Converters, High Power portable Amplifiers and Public Address Equipment. "GOLTOP" Power Transistors are the first to be offered for immediate delivery in quantity. Representing the latest developments in semi-conductor technique for power applications, these entirely British-made p-n-p Germanium Junction Transistors will open up entirely new fields to designers of industrial, commercial and military equipment.

# GOLTOP POWER TRANSISTORS

*available NOW in commercial quantities*

<p>Available in 6 TYPES, all for 10-watts power dissipation:                  V15/10P. V15/20P. V15/30P. for 15 volts max.                  V30/10P. V30/20P. V30/30P. for 30 volts max.</p>		
<p>Maximum Collector Power Dissipation (DC or Mean) for all types</p>	<p><math>t_{amb}=25^{\circ}C</math></p>	<p><math>t_{amb} &gt; 25^{\circ}C</math> Reduction!°C</p>
<p>(1) Clamped directly on to 50 sq. in. of 16 S.W.G. aluminium</p>	<p>10W</p>	<p>200mW</p>
<p>(2) Clamped directly on to 9 sq. in. of 16 S.W.G. aluminium</p>	<p>4W</p>	<p>80mW</p>
<p>(3) As (2) but with 2 mil mica washer between heat sink and transistor</p>	<p>2W</p>	<p>40mW</p>
<p>(4) Transistor only in free air</p>	<p>1W</p>	<p>20mW</p>

- \* High power rating—up to 10W at audio and supersonic frequencies.
- \* High current ratings up to 3A DC.
- \* Long life.
- \* Excellent resistance to mechanical shock.
- \* Hermetic sealing and rigorous manufacturing control ensure uniformity and stability of a high order.



*British Design, Materials and Craftsmanship*

Data sheets gladly forwarded on request

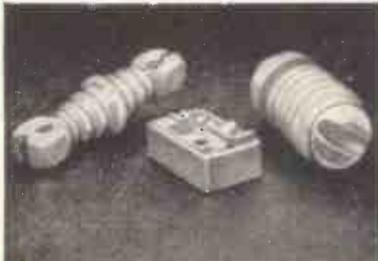
All trade enquiries to: **Newmarket Transistor Co. Ltd.**

Erning Road, Newmarket. Telephone: Newmarket 2963 and 3203

TA 10705

# Bullers CERAMICS FOR INDUSTRY

High quality material and dimensional precision are attributes of Bullers die-pressed products. Prompt delivery at competitive prices.



We specialise in the manufacture of—**PORCELAIN**  
for general insulation  
**REFRACTORIES**  
for high-temperature insulation

**FREQUELEX**  
for high-frequency insulation  
**PERMALEX & TEMPLEX**  
for capacitors



## BULLERS LIMITED

MILTON · STOKE-ON-TRENT · STAFFS

Phone: Stoke-on-Trent 21381 (5 lines) · Telegrams & Cables: Bullers, Stoke-on-Trent

Ironworks: TIPTON, STAFFS      London Office: 6 LAURENCE POUNTNEY HILL, E.C.4

Phone: Tipton 1691                      Phone: MANsion House 9971

## PRE-SET CONTROL LOCK

Designed to lock the spindles of pre-set potentiometers or trimmers without rotational or lateral displacement of shaft.

Will accept wide range of panel thicknesses.



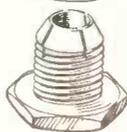
**TYPE P**

Very attractive appearance for panel mounting.



**TYPE C**

Send for leaflet A.1



## "KNOB LOCK"

The ideal method of locking panel mounted controls. Positive guard against vibration, etc.

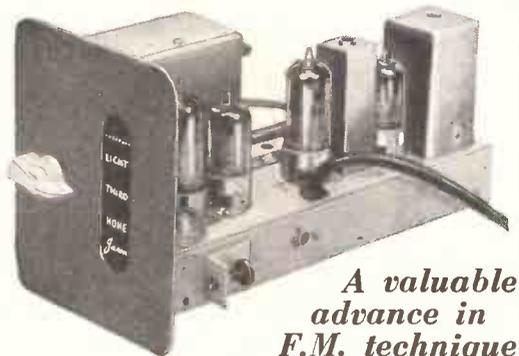
This development of our popular pre-set control lock is finished in black plastic and embodies control knob and instantaneous finger-tip locking knob.

Send for List No. A.6

**SUTTON COLDFIELD ELECTRICAL ENGINEERS**

Reddicap Trading Estate, Sutton Coldfield. 'phone SUT 3038 & 5666

## SWITCH-TUNED F.M. UNIT BY JASON



*A valuable advance in F.M. technique*

- Automatic Frequency Control.
- Complete stability—no drifting.
- Single 3-position switch control alone tunes to desired programme.
- To operate from Amplifier or Jason Power Pack (extra).
- Exclusive Jason design.

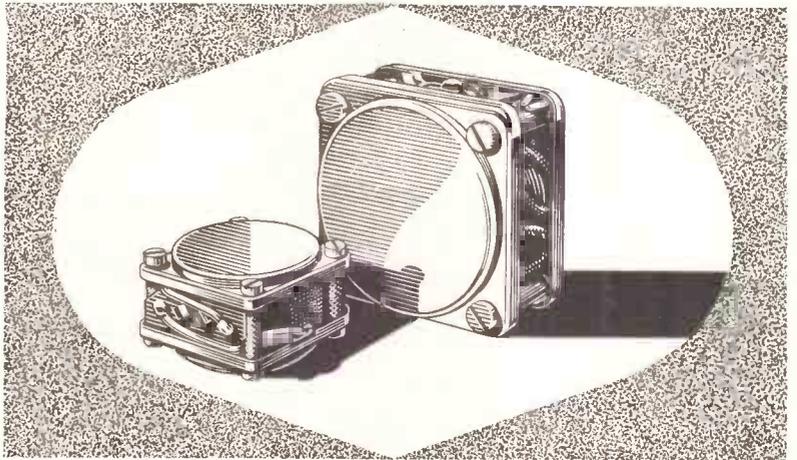
Tested, tuned and guaranteed. Good range. Highest quality. Complete £19-16-2

FROM LEADING STOCKISTS EVERYWHERE. DETAILS FROM—

**JASON MOTOR & ELECTRONIC CO.** Phone: SPEEdwell 7050  
328 CRICKLEWOOD LANE, LONDON, N.W.2

# THESE HIGH Q COILS

## are now even easier to install



Designers of communications equipment, will welcome the new mounting and terminating arrangements of the Mullard 25mm and 36mm pot cores.

Unique design features that make installation easier than ever, include positions for tag boards on three sides and a new system of fixing, which eliminates the need for additional mounting plates.

Combining constructional advantages with sound technical performance, these 25mm and 36mm pot cores take full advantage of the low loss of Ferroxcube to produce inductances of up to 30 henries, together with high Q values over a wide frequency range. As an additional service these pot cores can be supplied wound to individual specifications, if required.

Write now for full details of the comprehensive range of Mullard pot cores currently available.

#### Outstanding features

- \* Controllable air gap, facilitating inductance adjustment
- \* Self screening
- \* Controllable temperature coefficient
- \* Operation over a wide frequency range
- \* Ease of winding, and assembly

# Mullard

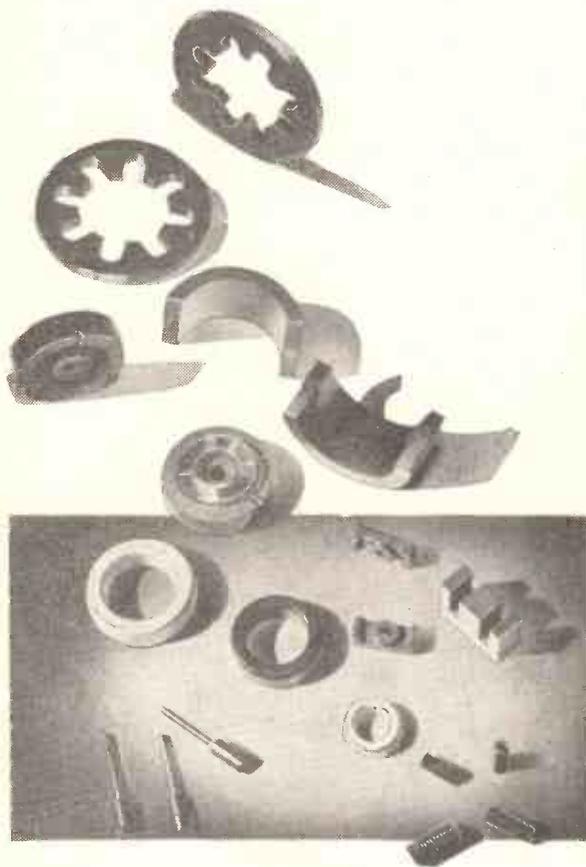


'Ticonal' permanent magnets  
Magnadur ceramic magnets  
Ferroxcube magnetic cores

Mullard Ltd., Component Division, Mullard House, Torrington Place, W.C.1

## GECALLOY MAGNETIC CORES

ALLOY AND IRON POWDER  
CORES FOR EVERY PURPOSE  
FULL TECHNICAL DATA AVAILABLE  
ON APPLICATION



Apply to:

**SALFORD ELECTRICAL INSTRUMENTS  
LIMITED**  
(COMPONENTS GROUP)

**TIMES MILL, HEYWOOD, LANCASHIRE**  
Telephone: Heywood 6868. Telegrams: "Sparkless, Heywood."

GROUP HEAD OFFICE:  
SCHOOL STREET, HAZEL GROVE, STOCKPORT, CHES.

REGISTERED OFFICE:  
MAGNET HOUSE, KINGSWAY, LONDON, W.C.2.

## ASK ARTHURS FIRST

LARGE STOCKS OF VALVES and C.R.T.s. METERS, Avo, Advance, Taylor, and Cossor Oscilloscopes in stock. AMPLIFIERS, Leak, Trix & Quad. GRAM UNITS, Garrard & Collaro. Collaro TRANSCRIPTION UNIT 2010PX.

LOUDSPEAKERS, Goodmans, Wharfedale, WB Tannoy and leading makes. PICK-UPS and STYLI of most makes. TAPE RECORDERS, Grundig, Philips, Truvox, Playtime & Ferrograph.

### LATEST VALVE MANUALS

Mullard, 10/6; Osram & Brimar No. 6, 5/- each; Osram Part 2, 10/-.

Postage 9d. each extra.

### PARTICULARS ON REQUEST

Terms C.O.D. OR CASH with order.

*Arthur's* EST. 1919  
PROPS: ARTHUR GRAY, LTD.

GRAY HOUSE, 150-152 CHARING CROSS ROAD, LONDON, W.C.2  
TEMPle Bar 5833/4 and 4765 Cables: TELEGRAY, LONDON

## MAINS TRANSFORMERS

### Primaries 200/250 v. Half Shrouded.

HSM63. 250-0-250 v. 60 m/a., 6.3 v. 3 a., 5 v. 2 a. (Midget) ...	16/3
HS2. 250-0-250 v. 80 m/a., 0-4-6.3 v. 4 a., 0-4-5 v. 2 a. ....	19/-
HS3X. 350-0-350 v. 100 m/a., L.T. as above .....	23/-
HS150. 350-0-350 v. 150 m/a., 6.3 v. 3 a., 5 v. 3 a. ....	27/9

### Fully Shrouded

FSM63. 250-0-250 v. 60 m/a., 6.3 v. 3 a., 5 v. 2 a. (Midget) ...	16/9
FSM66. 250-0-250 v. 60 m/a., 6.3 v. 3 a., 6.3 v. 2 a. (Midget)	17/3
FS43. 425-0-425 v. 200 m/a., 6.3 v. 4 a., C.T., 6.3 v. 4 a., C.T. 5 v. 3 a. ....	57/6
F36. 250-0-250 v. 100 m/a., 6.3 v. 6 a., 5 v. 3 a. ....	29/6
FS150X. 350-0-350 v. 150 m/a., 6.3 v. 2 a. C.T., 6.3 v. 2 a. C.T., 5 v. 3 a. ....	31/6

### FILAMENT TRANSFORMERS

Primary 230 v. F3X 6.3 v. at 1.5 amps. ....	5/9
---	-----

### Primaries 200/250 v.

F.3. 6.3 v. at 3 amp., 8/11. F6. 6.3 v. 2 a. ....	7/6
F12X. 12 v. 1 a., 7/9. F12. 0-6.3-12.6 v. 3 a. ....	16/6
F24. 0-12-24 v. 3 a. ....	23/6
F34. 0-4-9-15-24 v. 3 a. ....	26/6

C.W.O. Postage 1/3 extra under 10/-, 1/9 extra under £2  
2/9 extra under £3.

Lists, etc., stamped addressed envelope please.

**H. ASHWORTH (Dept. W.W.),**  
676, Gt. Horton Road, Bradford 7, Yorks.

FROM THE RANGE OF ADVANCE SERVICE INSTRUMENTS

# The *NEW* Type 62

## WIDE BAND SIGNAL GENERATOR



**WIDE RANGE  
150 k/cs to 220 M/cs**

**RELIABLE ATTENUATION**

**MOVABLE CURSOR  
FOR ADJUSTING CALIBRATION**

**--- and at the right price**

**£32.10**

**LIST PRICE  
IN U. K.**

*Send for fully descriptive  
leaflet No. W45.*

Here is another 'Advance' contribution to quicker and more efficient servicing—a signal generator with a phenomenally wide range covering all carrier and intermediate frequencies used for sound and television.

Note the features, remember the 'Advance' reputation for reliability, consider the modest price—surely the finest value for money yet offered in its sphere.

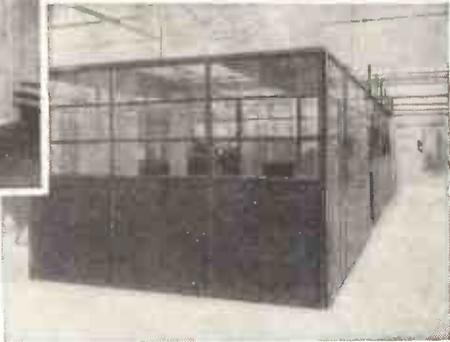
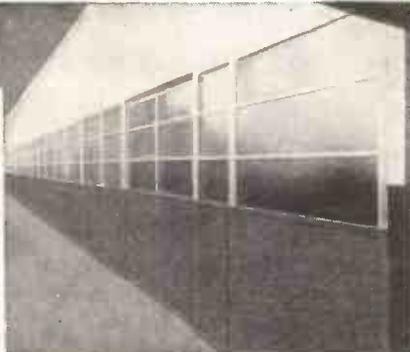
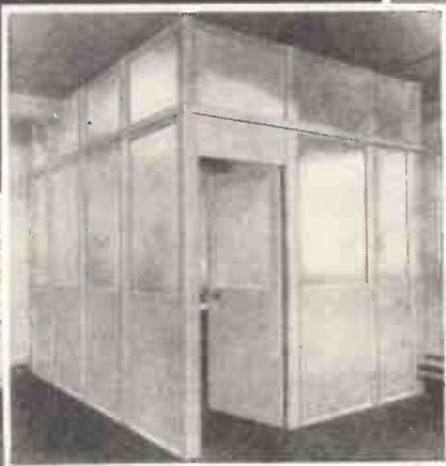
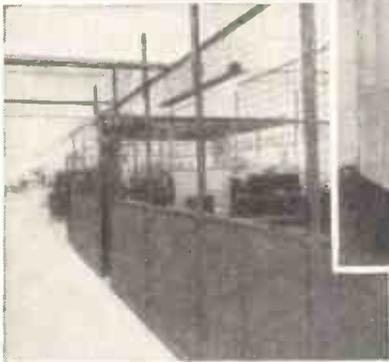
# Advance

**ADVANCE COMPONENTS LTD · ROEBUCK ROAD · HAINAULT · ILFORD · ESSEX · TEL: HAINAULT 4444**

# ABIX STEEL PARTITIONING

for

## OFFICE or FACTORY



ABIX Partitions are light, strong, fire-resisting and easy to erect. Manufactured in standard units for quick installation, easy removal or extension to existing screens. We will be pleased to help and advise you on any partitioning problem.

**OTHER ABIX PRODUCTS:** Steel Cycle Stands, Clothes Lockers, Material Racks, Slotted Angles (Junior, Universal, Senior), Car and Cycle Shelters, Tool Lockers, Adjustable Steel Shelving.

please write for fully illustrated Catalogues to:

# ABIX

## (METAL INDUSTRIES) LIMITED

STEEL EQUIPMENT FOR OFFICE AND FACTORY

Phone: BA T erseja 8666/7 TAYBRIDGE HOUSE, TAYBRIDGE ROAD, LONDON, S.W.11 Grams: Abix, Batt. London

## CHAS. H. YOUNG, LTD.

**CRYSTAL CALIBRATORS.** 1,000 kc/s Crystal Controlled with switched 100 kc/s and 10 kc/s Locked Multi-Vibrators. These excellent units are as new and contained in a polished bakelite case with carrying handle. The circuit uses 6 valves and operates from 2 volt L.T. and 120 volt H.T. Price only £3/10/- complete with crystal and valves, post free, or with suitable A.C. Power Unit, £6.  
These are non-repeatable and there is only a limited quantity available.

**AMERICAN 807 VALVES.** New, boxed, 7/6 each: 4 for 25/-.  
**ELECTRON MULTIPLIERS.** Type 931A. Only 35/- each, or 2 for £3. Holders available at 2/- each.

**31N. AERIAL INSULATORS.** Ribbed glass. 1/6 each or 6 for 7/6. 12 or more post free.

**CONDENSERS.** TCC type III, 8 mfd. 1,000 v. List over £3. Only 10/6. Post 1/9. 8 mfd. 750 v. 5/6 each. Post 1/6.

**COPPER AERIAL WIRE.** 14 g. H/D 140 ft., 17/- 70ft. 8/6. P. & P. 2/- Stranded 7/25, 140ft. 10/- 70ft. 5/- P. & P. 2/-.

**RACK MOUNTING PANELS.** all 19in. long by 5½in., 7in., 8½in., or 10½in., 5/9, 6/6, 7/6, 9/- respectively. Post 2/-.

**ABSORPTION WAVEMETERS.** 3 to 35 mc/s. in 3 switched bands, complete with indicator bulb. 17/6. Post free.

**TRANSMITTER TUNING CONDS.,** by Johnson, U.S.A., 500 pf. 1,550 v. rating, ceramic insulation. 15/- each. Post free.

**HEADPHONES.** High resistance (4,000 ohms), very sensitive. Bargain price only 12/6 pair. P. & P. 1/6.

**AMERICAN BREAD MIKES.** Swivel head. Push to talk and lock on switch. Beautiful job. Only 12/6. P. & P. 1/6.

**BRITISH BREADY MIKE UNIT,** complete with pair of 4,000-ohm phones in strong wooden carrying case, 8½ x 4½ x 7½. Ideal for mobile operators. Only 17/6. P. & P. 2/-.

**LOW RESISTANCE HEADPHONES.** New ex-W.D. stock. C.L.R. types. Only 8/6 pair. P. & P. 1/6. Special Terms Quantities. Most comprehensive stock of HiFi Equipment in the Midlands, including QUAD, LEAK, W.B., RCA., ROGERS, WHARFEDALE, GOODMANS, etc. Details and demonstrations with pleasure.

NO C.O.D. UNDER £1.

All Mail Orders to Dept. "W." Please print your name and address.  
CHAS. H. YOUNG LTD., 110 DALE END, BIRMINGHAM, 4.  
Phone: CENTRAL 1635

# A GREAT QUARTET

Every lover of music and perfect record reproduction will want to possess these informative and entertaining books by G. A. Briggs.

## SOUND REPRODUCTION

Third edition, second impression, 368 pages, 315 illustrations. Chapters on Resonances, Cabinets, Room acoustics, Response curves with Oscillograms, Crossover networks, Recording Systems, Records, Pick-ups, etc. Total sales exceed 35,000. 17/6 (18/6 post free).

## LOUDSPEAKERS

4th edition. 92 pages, 45 illustrations. Standard reference work on loudspeakers. Detailed information, diagrams, description of Electrostatic speaker and concert hall demonstrations. Total sales 45,000. 7/6 (7/9 post free).

Sold by radio dealers and bookshops. Published by Wharfedale Wireless Works, Ltd.

## HIGH FIDELITY

Packed with sound sense about sound reproduction in the home. Non-technical language, enlivened by many humorous touches and accounts of incidents connected with concert hall demonstrations. 190 pages, 65 illustrations. 12/6 (13/3 post free). De Luxe edition 17/6 (18/6 post free).

## PIANOS, PIANISTS AND SONICS

A book for sound enthusiasts and music lovers written in G. A. Briggs' entertaining style. Chapters on piano history and construction. Harmonic analysis. Touch, Tone Tuning, etc. 192 pages, 102 illustrations. 10/6 (11/- post free).



# Wharfedale

WIRELESS WORKS LTD.

IDLE, BRADFORD, YORKS.

# Low price precision tubes

by

**G.E.C.**

**6 EP**

**I**

**6 EP**

**4**

**6 EP**

**7**

**6 EP**

**11**

**6 EP**

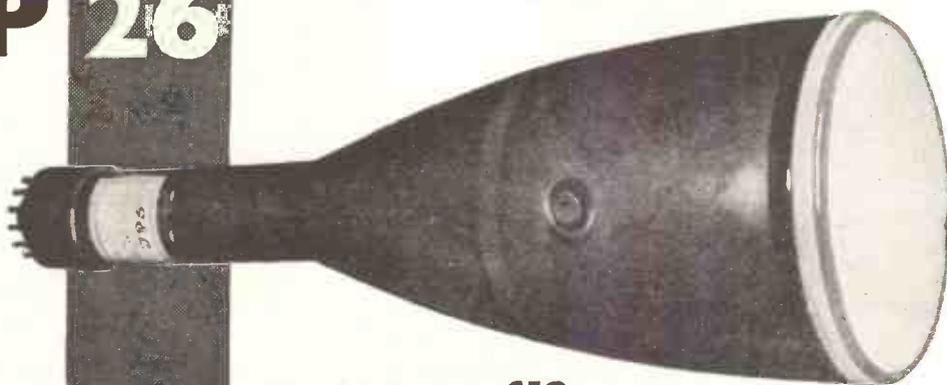
**26**

For optimum performance from your oscilloscope fit one of these new G.E.C. Precision Instrument Tubes.

This new 6" tube is obtainable in a standard range of five screen phosphors with persistences of from 1 millisecond to 170 seconds.

This tube has many distinct advantages over those previously available. Some of the advantages being given below:

- ★ *Plate glass screen*
- ★ *One stage of post deflection acceleration*
- ★ *Low interelectrode capacitances*
- ★ *Overcapped pressed glass wafer seal*
- ★ *Orthogonality of deflection axes  $\pm 1^\circ$*
- ★ *Spot centring. The undeflected spot will fall within a radius of 7 mm. concentric with the tube face.*
- ★ *Deflection linearity. The plate sensitivity for a deflection of less than 75% of the useful scan will not differ from the plate sensitivity for a deflection of 25% of the useful scan by more than 2%.*



**LIST PRICE £12**

The 4 GP series of 3½" tubes recently announced are now also available with any of five different screen phosphors.

**LIST PRICE £10.**



*Additional information on these tubes may be obtained from the G.E.C. Valve and Electronics Department.*

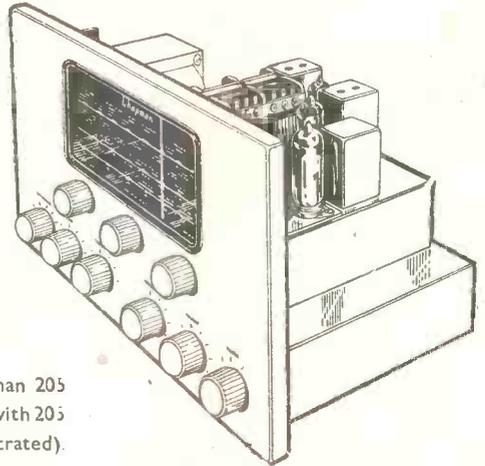
# AM and FM plus Pre-amplifier

For nearly a decade we have specialised in the design and manufacture of Tuners of the highest quality. Performance, workmanship, and appearance are fundamental in the basic design.

During 1956 we moved into a larger, better equipped factory and have been able to enlarge our scope of manufacture.

At the London Audio Fair in April we introduced the Chapman 205 Amplifier and Pre-Amplifier and showed a range of Tuners fitted with 205 Pre-Amplifier for easy installation, such as the FM85CU (illustrated).

Incorporating AM Medium Wave and Long Wave, and the full VHF, FM band PLUS a really comprehensive Control Unit with: 5 Inputs, Tape Output, Amplifier Output at 200 m/v, 3 switched Mains Outlets, Bass and Treble Controls, Roll off filter, Rumble filter, Volume Control PLUS the CHAPMAN Compensator accurately following the famous Fletcher Munson Loudness Contours for realism at low level listening.



## C. T. CHAPMAN (Reproducers) LTD.

WORKS: CHAPEL LANE. SANDS,  
HIGH WYCOMBE, BUCKS.

Telephone: High Wycombe 2474.

SALES OFFICE. RILEY WORKS,  
RILEY STREET, LONDON, S.W.10.

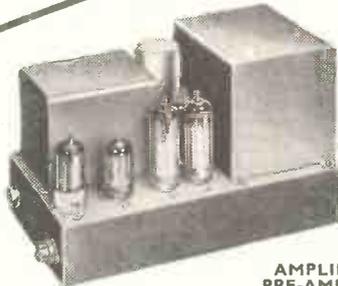
Telephone: FLaxman 4577.

**AVAILABLE SHORTLY!**  
**THE VERDIK FM TUNER**

USING EXCLUSIVE NEW TECHNIQUES  
MAKING IT THE ULTIMATE IN  
DESIGN & PERFORMANCE

The outstanding FM Tuning Unit  
may be heard, together with all  
other Verdik products

**at**



2-SPEED TAPE RECORDER

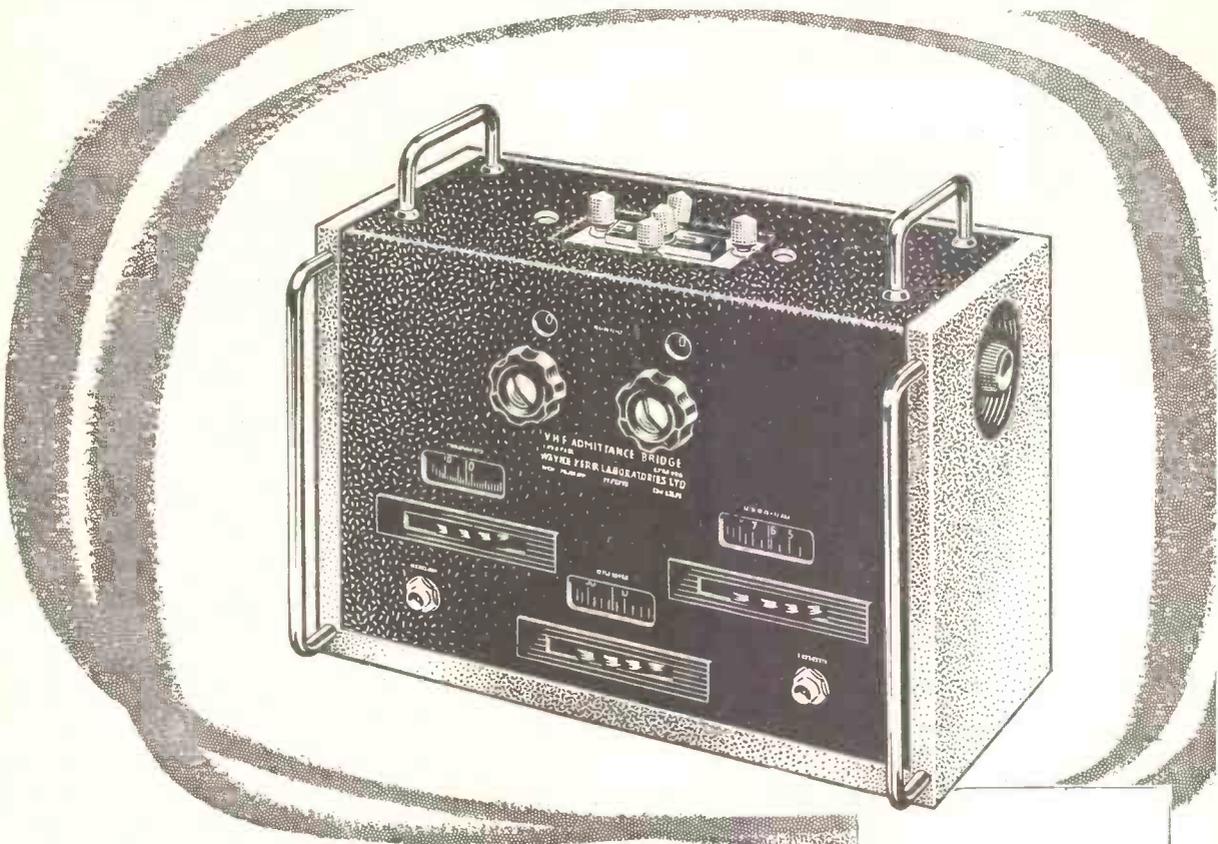


45 Gns.

AMPLIFIER &  
PRE-AMPLIFIER  
20 Gns. ONLY  
COMPLETE



VERDIK SALES LTD., 8, RUPERT COURT  
WARDOUR ST., LONDON, W.1 (GERrard 8266)



**V.H.F. BRIDGE TYPE B.801**

An extremely stable transformer ratio-arm bridge designed for aerial, feeder, cable and component measurements, balanced or unbalanced, at frequencies between 1 and 100 Mc/s.

Calibration, which is independent of frequency, is in terms of conductance and positive or negative capacitance.

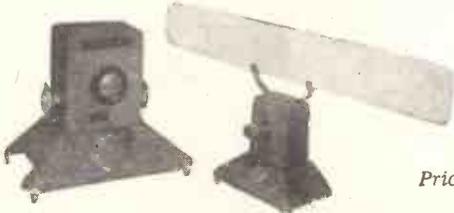
Specially designed source and detector are available.

**Specification :**

- Frequency range: 1 to 100 Mc/s
- Susceptance range:  $\pm 230$  pF
- Accuracy:  $\pm 2\% \pm 0.5$  pF
- Conductance range: 0 to 100 mmho
- Accuracy:  $\pm 2\% \pm 0.1$  mmho
- Price: £150



**WAYNE KERR**



**X-BAND  
MICROWAVE  
WATTMETER  
TYPE U.181**

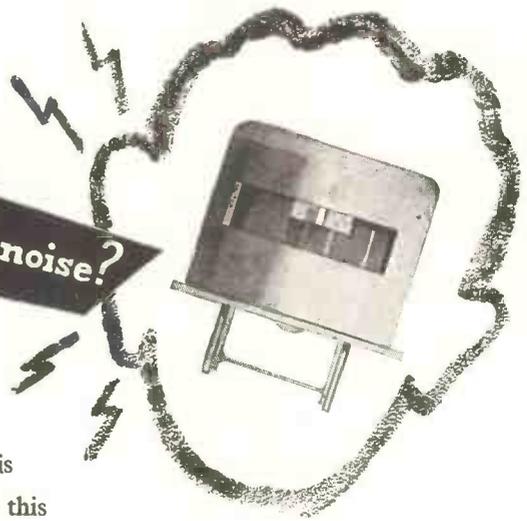
Price £300 net ex works.



**X-BAND  
OSCILLATOR  
TYPE S.381**

Price £150 net ex works (valve extra)

**Why tolerate unnecessary noise?**

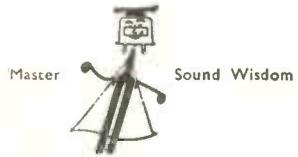


**MASTERTAPE** is renowned for its low back-ground noise. Our many customers confirm this fact. A Trial will convince you of the truth in this statement. Professional quality can be yours.



# Mastertape

If your dealer has no stock, write direct to:—  
M.S.S. Recording Co. Ltd., Colnbrook, Bucks.



Tel. Colnbrook 430

- ▶ FREQUENCY MODULATION ENGINEERING
- ▶ T/V ENGINEERING
- ▶ RADIO SERVICING
- ▶ RADIO ENGINEERING
- ▶ RADAR ENGINEERING
- ▶ BASIC ELECTRONICS ▶ INDUSTRIAL ELECTRONICS
- ▶ ELECTRONIC ENGINEERING

**NEW — 'LEARN-AS-YOU-BUILD' PRACTICAL RADIO COURSE**  
Build your own radio receiver and testing equipment.

**PRACTICAL, UP-TO-THE-MINUTE I.C.S. training . . .**

can help you to attain one of the many well-paid posts that exist today in the radio world. Prepare yourself now, at home and in your own time, with the expert help of I.C.S. tutors. The cost of an I.C.S. Course is moderate and includes all books.

Complete the coupon below and post it to us today for further details of the Course which interests you. Write to: Dept. 223H, I.C.S., 71 Kingsway, W.C.2

**INTERNATIONAL CORRESPONDENCE SCHOOLS**  
Dept. 223H, International Buildings, Kingsway, London, W.C.2

Please send **FREE** book on.....Age.....

Name.....  
(Block letters please)

Address.....

Occupation..... 6.57

**INTERNATIONAL CORRESPONDENCE SCHOOLS**

## B T-H TRANSISTORS

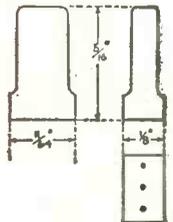
Pioneers in the field of crystal devices, British Thomson-Houston, by constant advances in manufacturing techniques, are able to supply transistors of unsurpassed quality at highly competitive prices.

LARGE QUANTITIES AVAILABLE FROM STOCK

Type	Typical cut-off frequency (Common Base) Mc/s	Current Amplification h <sub>ie</sub> (Common Emitter)	Maximum Peak Collector Voltage Volts	Maximum Collector Current mA	Maximum Power Dissipation mW
GT 1	0.8	20	-15	-10	50
GT 2	0.9	40	-15	-10	50
GT 3	1.0	65	-15	-10	50
GT 11	4.0	30	-15	-10	25
GT 12	6.0	40	-15	-10	25
GT 13	9.0	50	-15	-10	25

Ratings given pertain to ambient of 25°C

Maximum Storage Temperature 55°C



**BRITISH THOMSON-HOUSTON**  
THE BRITISH THOMSON-HOUSTON COMPANY LIMITED • RUGBY • ENGLAND  
an A&A Company

# Outstanding Values FOR ENTHUSIASTS!



## THE 'SUPEREX 55' BATTERY PORTABLE RECEIVER

- ★ FOUR VALVE SUPERHET
- ★ LONG AND MEDIUM WAVE
- ★ LARGE ELLIPTICAL SPEAKER
- ★ B7G MINIATURE VALVES
- ★ SIMPLE CONSTRUCTION

A first-class receiver guaranteed to give good reception throughout the country. Equal in appearance and performance to most commercial models. Cabinet size: 10½" x 8½" x 4½". All parts available separately.

**BUILDING COST**  
**£7.15.0**

Plus 4/- Carriage.

Send 1/6 for SUPEREX CONSTRUCTION booklet.

## THIS MONTH'S 'SUPERIOR' BARGAIN!

### THE DULCI F3

RADIO/GRAM CHASSIS ASSEMBLY

PRICE

**£4 - 5 - 0** CONTAINING:

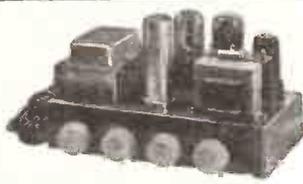
- ★ Punched chassis, Backplate, etc. Size 12"x7"x8".
- ★ Multi-colour Glass Dial L.M.S.G.
- ★ Drive Drum and Spindle.
- ★ 1 pair Midget I.F.T.s.
- ★ Mains Transformer.
- ★ Output Transformer.
- ★ Twin Gang (500 pF) Condenser.
- ★ Wave Change Switch.
- ★ Five Valve Holders.
- ★ Smoothing Condenser.
- ★ Two controls Vol/Tone.
- ★ Continental Control Knobs.

Theoretical circuit and rough component layout free with each assembly.



## AMPLIFIERS

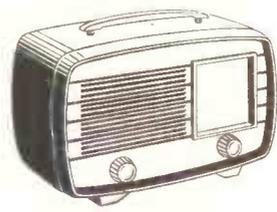
High quality three valve three watt amplifier for A.C. mains 200/250 volts. Four controls give a wide tone variation. 3 ohm speaker output. Chassis fully isolated. Valve line-up: 6B97, 6V6, 6X5. Bronze finished chassis size 8in. x 4in. x 8in. high. Supplied built and tested and guaranteed for twelve months (90 days valves).



PRICE **£5.15.0** Plus 3/6 postage and packing.

## BAKELITE CABINET

Ideal for midget construction. Available in Green only. Size 12in. long, 7in. high, 5½in. deep. Complete with handle, back, dial and two knobs.

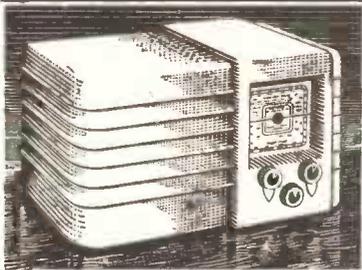


PRICE **15/6** Plus 3/- p.p.

## THE REGENT CABINET ASSEMBLY

Comprising a cream bakelite cabinet and back, size 11in. x 6in. x 7in. Attractive 3-colour dial and pointer. Metal chassis punched for 4 valve (B.9.A) superhet and fixing brackets. Drum, Drive-Spindle, Spring, Pointer and 3 Knobs. CONSTRUCTION BOOKLET on the REGENT 4-valve superhet available shortly. Watch for details.

PRICE **30/-** Plus 3/6 p.p.



## SUPERIOR BUREAU

An elegant cabinet in richly figured walnut veneer, internal panels in polished eyesame. A drop front lid covers a sleeping, uncut control panel (18in. long x 10½in. high) alongside which is an uncut baseboard (15½in. long x 13½in. back to front). The inside of the drop front lid is panelled in beige leatherette. In the lower part of the cabinet are two large storage cupboards (18½in. high, 7½in. wide, 16½in. deep). The lid and cupboard handles are in chased Florentine bronze. Overall dimensions (63in. high, 34in. long, 16½in. deep).

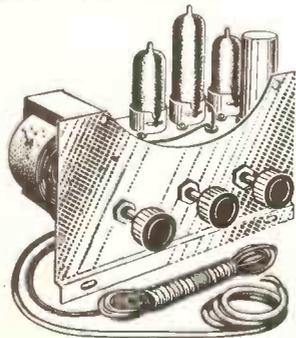


PRICE **16½ GNS.** Plus 25/- carriage.

## TWO COMPACT RECORD-PLAYER AMPLIFIERS

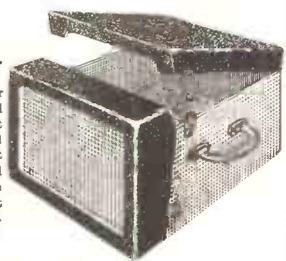
THREE VALVE TYPE (ECC85, EL84, E280). A high quality amplifier designed to satisfy the requirements of the more discriminating record enthusiasts. Three controls give a very wide variation of tone. Output approx. 2 watts. Fully isolated chassis. Overall size approx. 6½in. x 5in. x 2½in. Price **24/10/-**, plus 2/6 postage and packing. 2-3 ohm O/P transformer 6/- extra.

THREE VALVE (EBC41, EI41, E241). Ideal for use in a low priced record player. Output approx. 2 watts. Two controls—volume and tone. Mains transformer and fully isolated chassis, less output transformer which is available separately. Overall size approx. 6½in. x 5in. x 2½in. Price **23/10/-** plus 2/6 postage and packing. 2-3ohm O/P transformer 6/- extra.



## SUPERB QUALITY! REXINE COVERED CABINET

Rexine covered cabinet suitable for housing speaker and amplifier in end compartment. Adjustable uncut motor board 14½in. x 12½in. Internal clearance from lid to base of cabinet 9in. Two colour covering in blue and grey or wine and grey rexine. Handle fittings, locks and hinges are in gilt with a solid white plastic handle. Overall size 18in. long, 9½in. high 13½in. back to front.



PRICE **£4.5.0.** Plus 7/6 carriage and packing.

**Superior**  
*Radio supplies*  
37 HILLSIDE, (HARROW ROAD)  
STONEBRIDGE, N.W.10. Elgar 3644

RECORD PLAYERS. Latest four-speed auto changers, single play units by Collaro, BBR and Garrard.

QUALITY SPEAKERS. A good quality speaker is an essential part of any radio or sound system. Always in stock, speakers from 3½in. to 12in. by GOODMANS, WHTLEBY, WHARFEDALE, G.E.C. and ELAC.

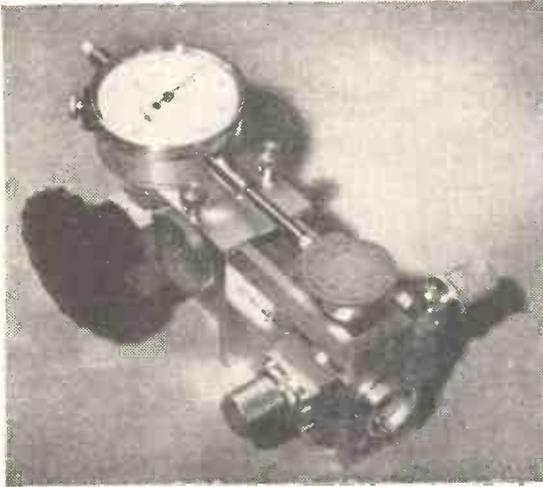
HIGH FIDELITY AMPLIFIERS. We can supply any of the high quality amplifiers and pre-amplifiers by B.R.A.K., QUAD, ARMSTRONG, GRAMPLAN and WHITELEY; also home construction kits suitable for OSRAM 942 and MULLARD 810.

TERMS C.W.O. OR C.O.D. U.K. ONLY.

## RADIO/GRAM CHASSIS

- TYPE AM5: 5 Valve Superhet, 3 waveband. 12 gns.
  - TYPE AM7: 7 Valve Superhet with push-pull output, 3 waveband. 16 gns.
  - TYPE AM/FM37: 7 Valve Superhet with FM/VHF Band (4 waveband). 234 gns.
  - TYPE AFM49: 9 Valve Superhet with FM/VHF Band (4 waveband). Push-pull output including one speaker. 26 gns.
- Carriage and Packing 12/6 extra.

SHOP OPEN : 9 a.m. to 6 p.m. Mon. to Sat. 1 p.m. Thursday.



## waveguide components for the 8-10 mm band

wavemeters and reference cavities, standing wave indicators (*ill.*), attenuators, directional couplers, waveguide switches, isolators, crystal holders, thermistor mounts, drawn or precision electroformed guide, waveguide benches and pillar supports, etc.

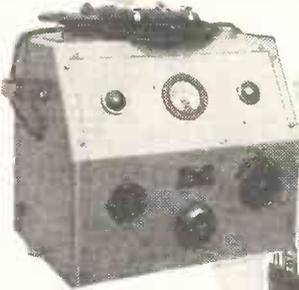
All components are based on the standard size WG 22 with internal dimensions of 0.280in. by 0.140in. They are normally fitted with U.K. standard, pressurized, screwed-ring connectors with plain flanges but choke flanges or U.S.-type flanges are also available. The usual external finish is silver plating flashed with rhodium (satin chrome for benches and pillar supports). All components are made with the necessary high order of precision.

For full details write for catalogue W/W 6

**HILGER & WATTS LTD 98 ST PANCRAS WAY, LONDON, NW1 TEL: GUL 5636**

*Makers of precision scientific apparatus for more than a century*

**THE IDEAL *Portable* HIGH VOLTAGE TEST SET**



**FOR EVERY TEST LABORATORY**



**CUBICLE**  
Strongly constructed portable steel case with lifting handles, adequately ventilated, finished in attractive grey "hammer" finish enamel.

**DIMENSIONS**  
Height 17in. by length 20in. by width 12in.

**WEIGHT** 34 lb.

**CONTROL**  
Continuous and smoothly variable from zero to 2,500 volts by means of continuously variable regulating transformer. The test voltage is applied smoothly without high stress from voltage surges.

**PROTECTION**  
A miniature magnet circuit breaker, in the primary circuit and double pole on-off switch with double pole mains fuses provide perfect protection.

**VOLTMETER**  
A high-grade instrument connected in the primary circuit but sealed to read output voltage.

**2.5 KV at 500 VA  
INSULATION TEST SET**  
Price £40.8.6  
Complete with test prods.

**DAVENSET**

**PARTRIDGE WILSON & CO. LTD. Davenset Elect. Wks., Leicester**

**ALWAYS "FIT"**



**CASTORS**  
THE WORLD'S BEST

**CONTRACTING  
TUBE  
ADAPTOR**

For  $\frac{7}{8}$ ", 1",  $1\frac{1}{8}$ ",  $1\frac{1}{4}$ " tubes, Quickgrip Adaptors are fitted by hand as no tools are required. 2",  $2\frac{1}{2}$ ", 3" and 4" wheels may be used.

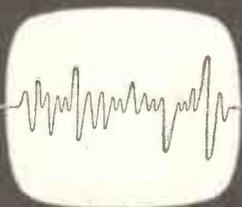


**Ask for Brochure 395**  
and pages 8, 25, 57.

Numerous other types of head fittings available.

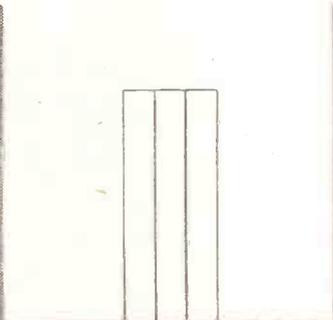
Engineers, Patentees and Sole Manufacturer,  
**AUTOSET (PRODUCTION) LTD.**  
DEPT. "H," 75-81 STOUR STREET, BIRMINGHAM, 18  
EDG. 1143 (3 lines). Estd. over 35 years.

Please mention "Wireless World" AT16



# Valves and tubes for Electronic Instruments

Whether it's a question of valves and cathode ray tubes for existing equipment or for new designs, the logical choice is Mullard. There is a Mullard valve or tube for nearly every type of electronic instrument. An authoritative technical advisory service is always available at Mullard House to advise engineers and designers on the selection and operation of electronic valves and tubes for given applications.



# Mullard

COMMUNICATIONS AND INDUSTRIAL VALVE DEPARTMENT



MULLARD LIMITED  
MULLARD HOUSE - BARRINGTON PLACE - LONDON - W.C1

RADIOS • DEAF AID

THESE ARE  
ACCUMULATORS

SIGNALLING



hermetically  
sealed, too!



TEST!



DEAF AID

from  
50 mAh  
to  
7.5 Ah  
cap.

DEAC PERMA-SEAL  
Hermetically sealed Ni-Cd accumulators have these advantages:

No corrosion — No gassing — unlimited shelf-life.

No maintenance—can be permanently wired-in. Easily re-charged. A range of three types: disc, cylindrical and rectangular from 50 mAh to 15 Ah capacity. Disc cells can be stacked for the higher voltages.

Write for leaflet D13 giving further details.

RADAR • GUIDED



fully patented

G · A · STANLEY PALMER LTD

MAXWELL HOUSE, ARUNDEL ST., LONDON, W.C.2  
Telephone: TEMple Bar 3721/3

BK

SPECIALISED LOUDSPEAKER ENCLOSURES

New!



Introducing an amazing new dual unit loudspeaker system for less than £25. The enclosure, the BK-LPR103, incorporates the new Wharfedale Acoustic Filter used with the approval of Mr. G. A. Briggs. Price (including HF level Control and filter condenser), £12/8/6.

Send for literature and technical report by Ralph L. West, B.Sc., A.M.Brit.I.R.E.

LOUDSPEAKERS. Wharfedale Bronze 10/CSB  
A new 10in. unit of remarkable specification and performance at £5/11/3. Wharfedale Super 3. One of the best HF units available. £6/19/11.

- Reasonable Price
- Modest dimensions 20 in. w. x 29½ in. h. x 11 in. d. at base
- Real high quality reproduction
- All the advantages of dual speaker
- Ideal for stereophonic sound

It is impossible to give full details of this magnificent enclosure here . . . send for literature, or, better still, call and hear it demonstrated at our showrooms on a wide range of amplifiers, including the new Goodsell PRESIDENT and MA5|UL|C. Trade enquiries invited

**New demonstration hours**

Tuesday, Wednesday, Friday & Saturday, 10.30 a.m.—5.30 p.m.  
Thursday 10.30 a.m.—7 p.m. Closed all day Monday.

**B. K. PARTNERS LTD.**

229 REGENT ST., LONDON, W.1. (Entrance Hanover St.) Phone: REG 7363

Train for a wonderful  
future in  
**ELECTRONICS...**

...with **E.M.I.**

With the ever increasing extension of the applications of television and the many technical advances being made in radio techniques, there is a pressing demand for trained radio and television technicians. These are careers with an assured and remunerative future. Here is your opportunity to enter for:—

**1 YEAR COURSE** Full-time day course in the Principles and Practice of Radio and Television. Mainly designed for the training of Radio and Television Servicing Engineers. Next courses commence in May and September, 1957.

**THE E.M.I. COLLEGE OF ELECTRONICS**

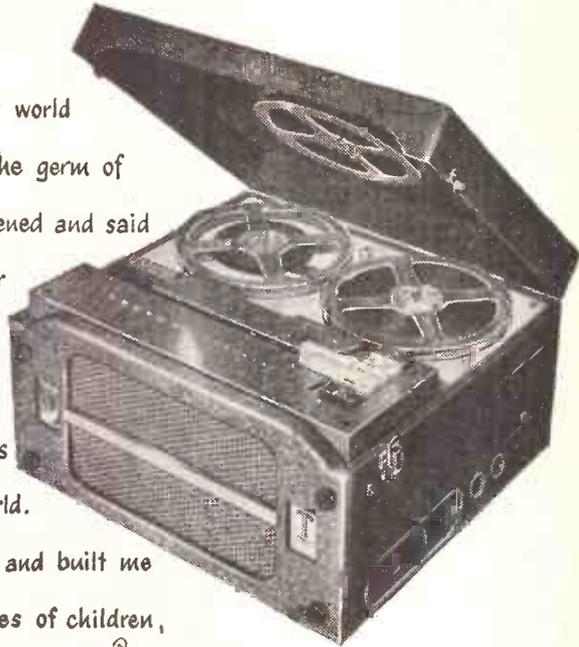


Dept. 127, 10 Pembridge Square, London, W.2.  
Telephone: BAYswater 5131/2

The College is part of the E.M.I. Group which includes "His Master's Voice", Marconiphone, E.M.I. Electronics Ltd., etc.

I was conceived in the minds of two enthusiasts   
 and I grew up on a kitchen table  at the time when my world  
 was young. They built and rebuilt me, as I evolved from the germ of  
 an idea  into reality. Came men who saw and listened and said  
 "This we must build". They drew me  on paper  
 and made me in metals;  they put power in my  
 circuits and as they developed me so I grew over 6 long  
 years, improved constantly, until I was no longer a fractious  
 child but mature  and fit to face the outside world.

The enthusiasts who dreamed me and those who finalised and built me  
 now say with pride "This is well done".  The voices of children,  
 the eloquence of oratory, sweetest of music, thunder of orchestra  - all this, and more - I give you.



Send for details of the TRUVOX Tape Recorder Model R1.

# TRUVOX LIMITED

Sales Office: 15 LYON ROAD, HARROW, MIDDX.  
 Telephone: Harrow 9282

Tech. & Service Dept. : 328 Station Rd., Harrow, Middx. (Harrow 4455)

# TAKE YOUR PICK

Our wide range of capacitors, incorporating all the latest developments, are described fully in these new leaflets . . .

## SEND NOW for COPIES

DALY has succeeded in maintaining full capacity values and working voltages in more compact designs, specially suited to ultra modern equipment :—

- PHOTO-FLASH EQUIPMENT • DEAF AIDS
- PRIVATE TELEPHONE INSTALLATIONS
- AMPLIFIERS • D.C. POWER UNITS
- TRANSISTOR EQUIPMENT
- MAGNETISATION EQUIPMENT
- TEST GEAR

# DALY ELECTROLYTIC CAPACITORS

Condenser Specialists for over 20 years.

**DALY (Condensers) LTD., WEST LODGE WORKS,**  
 THE GREEN, EALING, LONDON, W.5. Phone: Ealing 3127-8-9. Cables: Dalcyon, London

# THE RD JUNIOR

## TABLE CABINET

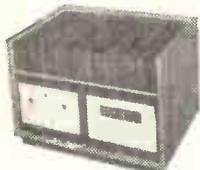
A general purpose equipment cabinet, the RD JUNIOR Table Cabinet may be used to house the RD JUNIOR group of units together with a suitable transcription motor unit, alternatively it may be used to house a tape deck and its associated equipment. The illustration shows the cabinet fitted with the RD JUNIOR Control Unit and FM Unit also a COLLARO Model 2010 Transcription Motor Unit, the Main Amplifier being immediately behind the Control Unit. Cabinets are available ready cut and drilled to take these units or alternatively they may be supplied uncut. Extremely compact the cabinet measures only 20 $\frac{1}{2}$ in. wide  $\times$  15in. deep  $\times$  14 $\frac{1}{2}$ in. high while styling follows that of the Corner Horn enclosure, the two together forming an attractive two part High Fidelity System.

The standard finish is Australian Walnut, the edges and interior of the motor compartment being contrasted in Birch. Selected veneers are used and each cabinet is hand-polished to a pleasing eggshell finish.

PRICE: Cut or uncut £10-10-0d. (ex works). (Special finishes + 5%).



### PART OF A COMPLETE HOME HIGH FIDELITY SYSTEM



A new illustrated leaflet giving concise details of the complete range of matched units forming the RD JUNIOR Home High Fidelity System is now available, and may be had on request.

For use with the Corner Horn enclosure we can particularly recommend the outstanding new Lowther PM6 Pressure Unit—owners of existing cabinets will be pleased to know that the PM6 can be fitted without modification. Demonstrations may be had at our Catford Showroom week-days between 10 a.m. and 5 p.m. (the Showroom is no longer open on Saturday mornings).

## ROGERS DEVELOPMENTS (ELECTRONICS) LTD.

"RODEVCO WORKS" • 4-14 BARMESTON ROAD • CATFORD • LONDON, S.E.6  
Teograms: RODEVCO, LONDON SE6

Telephone: H1Ther Green 7424



## Potentiometers

Whether wire wound or composition, whether Single, Ganged or Tandem, if the need is Potentiometers then 'RELIANCE' have the answer - from a comprehensive range of types that include linear, log, semi-log and non-inductive characteristics. Linearity or tolerances  $\pm 1\%$  P.I.W. types up to 500 K. linear, 250 K. log. From stock or "to specification", a 'RELIANCE' embodies the best in potentiometer design and practice.

# RELIANCE

Full details  
on request.

RELIANCE MANUFACTURING CO., (SOUTHWARK) LTD.  
Sutherland Road, Higham Hill, Walthamstow. E.17.  
Telephone ; Larkwood 3245

## METERS

To B.S.89 Calibrated and scaled to your requirements.  
DEVELOPMENT & PRODUCTION  
PROBLEMS ASSISTED BY  
PROMPT DELIVERY

Stockists of:  
ERNEST TURNER, BALDWIN,  
EAC, WEIR and LEADING  
MANUFACTURERS  
INSTRUMENTS.

MOVING COIL, MOVING  
IRON, THERMO COUPLE,  
ELECTROSTATIC.

CIRCULAR (Flush or Projecting),  
SQUARE, RECTANGULAR, &  
INDUSTRIAL PATTERNS.



Typical 2 $\frac{1}{2}$ in. &  
3 $\frac{1}{2}$ in. Round Flush  
Pattern

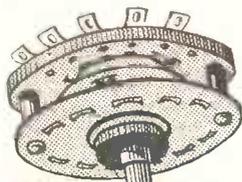
We can supply meters with Non-Standard Current and  
Voltage Ranges to any specification. DELIVERY 14-21 days.

For examples of types available see our advertisement  
in October and November 1956 issues.

Manufacturers of:  
ELECTRONIC TEST EQUIPMENT, NETWORK ANALYSERS, EDU-  
CATIONAL, GEOPHYSICAL and SPECIAL INSTRUMENTS, PORTABLE  
MULTIRANGE TEST SETS at 1 megohm per Volt, ELECTRONIC  
INSULATION TEST-SETS.

May we quote for your requirements?

**ANDERS ELECTRONICS LTD.**  
91, HAMPSTEAD RD., LONDON, N.W.1. EUSon 1639  
Suppliers to Govt. Depts., B.B.C., Tech. Colleges,  
Leading Manufacturers & Research Laboratories



**REMOTE CONTROL ?**

We cannot do the Indian Rope Trick but with

**FLEXIBLE SHAFING**

We can operate any element requiring rotation or push-pull movement, or both, no matter if the controlled element is close to or at a distance from the control point.

We can operate from an accessible point, switches, valves and other electrical and mechanical devices located in inaccessible places.

We can, in fact, solve your problems.



*Flexible Shaft Handbook available to technicians on request to Dept. W.*

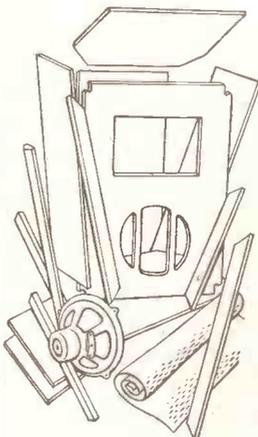
*S. J. White*

**THE S. J. WHITE CO. OF GREAT BRITAIN LTD. INDUSTRIAL DIVISION BRITANNIA WORKS, ST. PANCRAS WAY, LONDON, N.W.1.**

Telephone: EUSton 5393

R.C.3

**So easy!**



**A simple kit brings true high-fidelity within your means**

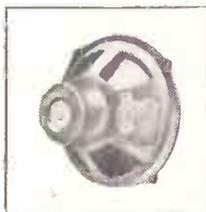


**NO HEADACHES**

with this kit of parts. Everything you need to build an acoustically perfect loudspeaker is here; including the famous Grampian 1255/15 speaker unit, grille material and working diagrams. All parts are accurately finished, machined and drilled, only assembly and polishing to suit your taste remains to be done. Ingeniously designed for either a corner or flat against the wall, the cabinet will enhance your room—to say nothing of your listening!

**PRICE of complete kit including 1255 15 Grampian high-fidelity speaker £20**

**Deferred terms available if desired on complete kit or speaker and cabinet purchased separately.**



The well-known Grampian 1255/15 high-fidelity speaker unit may be purchased separately if required. It is a 12in unit especially designed for use with high quality amplifiers. It has an extended frequency coverage of from 20 to 15,000 c/s with exceptional performance over the useful audio range. Price of 1255/15 unit only, £9.

*Write for full details of complete cabinet, copy of the response curve and information about suitable amplifiers today—*

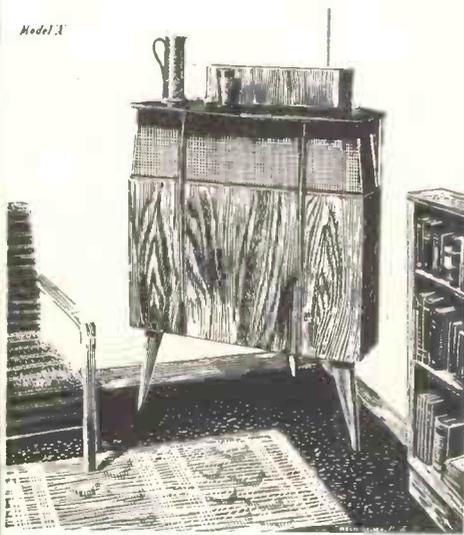
**GRAMPIAN REPRODUCERS LIMITED**

Makers of High-Quality Sound Equipment

**17 HANWORTH TRADING ESTATE, FELTHAM, Middx Telephone: Feltham 2657/8. Telegrams: Reamp Feltham**

# CITY SALE & EXCHANGE LTD

*The High Fidelity Specialists*



*Our Mail Order Service is superb. L.P. Records, Diamond needles and Tape accessories guaranteed by return of post.*

## LOWTHER T.P.I CORNER REPRODUCER

This is a very compact speaker and preserves to an amazing degree true relationship between fundamental and harmonics whether it be low or high frequency. Speech is smooth, forward, and gives a feeling of the presence of the artist. Strings, brass and percussion alike have a clarity comparable to a concert hall performance.

**Price £96 . 0 . 0**

Part Exchange is our speciality. We will give you a fair offer for your present proprietary radio goods against the purchase of either new or secondhand apparatus. This allowance can be used as deposit or part deposit in the event of a credit or hire purchase transaction, for example:

New Acoustical Quad II Amplifier and control unit £42.  
Allowance on Present Quad I amplifier and control unit £12.  
Balance paid in eight monthly instalments of £4/0/11.

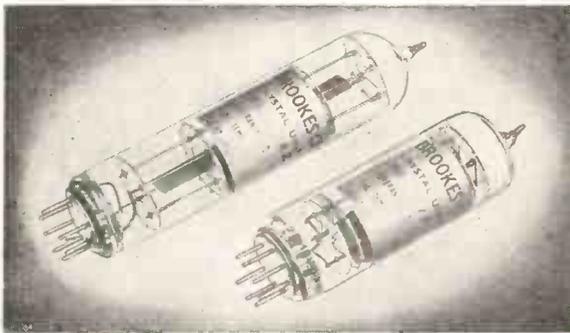
## GUARANTEED SECONDHAND APPARATUS

Connoisseur variable 3 speed motor complete with B.J. arm and shell .....	£27 10 0
Speaker system comprising: Goodmans Audiom 60, Wharfedale Super 8/CS, Wharfedale Super 3, complete with crossover network in very handsome, strongly made walnut cabinet .....	£35 0 0
Leak T.L.10 Main Amplifier, as new .....	£15 0 0
Leak Varislope I pre-amp. ....	£7 10 0
Leak Varislope II pre-amp. ....	£14 0 0
R.D. Junior Control Unit .....	£5 0 0
E.A.R. Mullard 5-10 Amplifier .....	£15 0 0
Lowther Master Control Unit .....	£10 0 0
Chapman Column Reproducer Axiom 150 Mark II unit Quad I Control Unit .....	£25 0 0
Garrard T/B 3 Speed Gram Unit with 2 Decca X.M.S. heads .....	£8 0 0
Barker Duode 12in. speaker .....	£7 10 0

**93-94 FLEET STREET, LONDON, E.C.4**

Phone: FLEet St. 9391/2

## BROOKES Crystals



**mean DEPENDABLE frequency control**

• Illustrated above are  
Left: Type G.2 Crystal Unit. Frequency 62 kc/s.  
Right: Type G.1 Crystal Unit. Frequency 100 kc/s.

ALL Brookes Crystals are made to exacting standards and close tolerances. They are available with a variety of bases and in a wide range of frequencies. There is a Brookes Crystal to suit your purpose—let us have your enquiry now.

## Brookes Crystals Ltd.

Suppliers to Ministry of Supply, Home Office, B.B.C., etc.  
181/3 TRAFALGAR ROAD, LONDON, S.E.10  
Phone: GREenwich 1828 Grams: Xtals, Green, London



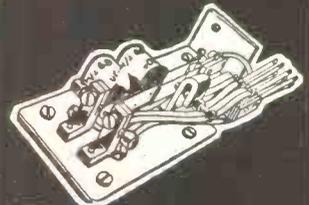
## RELAYS

**P.O. TYPES MANUFACTURED TO YOUR SPECIFICATION PROMPT DELIVERY**



### 3000 TYPES

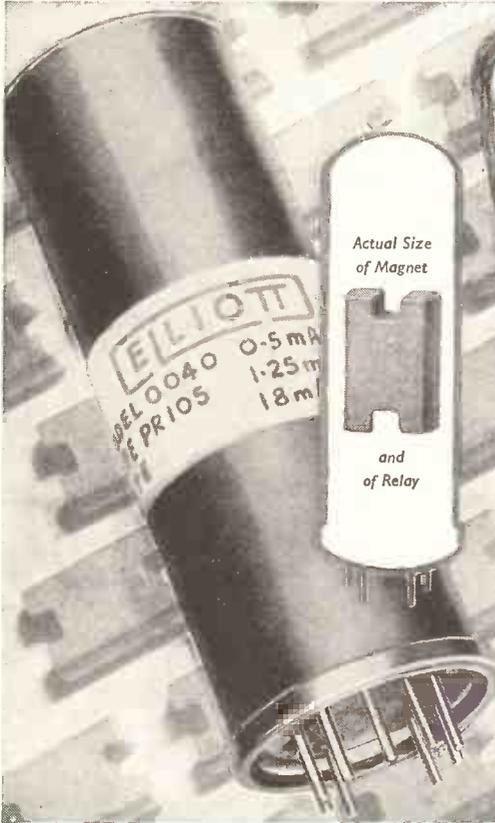
COILS up to 80,000Ω.  
CONTACTS up to 8 c/o's  
Tropicalizing and impregnating to order.  
600 and HIGH-SPEED TYPES also Supplied.



**LARGE STOCKS OF KEYSWITCHES**

## THE KEYSWITCH CO.

ALL POST OFFICE EQUIPMENT  
Enquiries to Sales Manager  
126 KENSAL ROAD, LONDON, W.10  
Telephone: LAD. 0666, 4640 Grams: "Fonsquipt", London, W.10  
Contractors to Home & Overseas Governments & H.M. Crown Agents



**MUREX SINTERED PERMANENT MAGNETS** are used in this **ELLIOTT Hermetically SEALED MOVING COIL RELAY**

Where the need for high magnetic stability and efficiency is essential Murex Sintered Permanent Magnets continue to give accurate and reliable service in this and many other applications.

★

**MUREX LIMITED**  
(Powder Metallurgy Division)  
**RAINHAM · ESSEX**  
Telephone: Rainham, Essex 3322  
Telex 28632. Telegrams: Murex,  
Rainham-Dagenham, Telex  
London Sales Office: CENTRAL HOUSE,  
UPPER WOBURN PLACE, W.C.1  
EUSton 8265

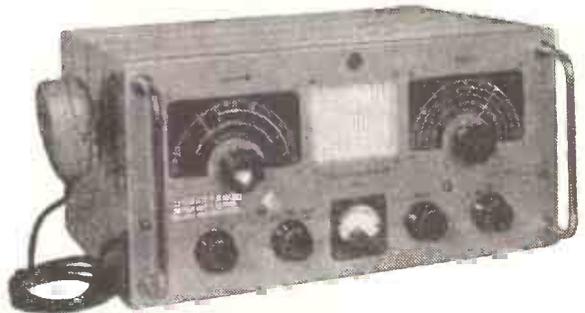


# Teleradio\* 5A

## SIMPLE EFFICIENT

Made by AWA, Australia's largest manufacturer of telecommunications equipment of all types. AWA are approved contractors to the Crown Agents.

The 5A is in use by Governments and private networks in many places. Please write for details.



## SPEECH COMMUNICATION

The AWA Teleradio 5A is a low-power H.F. transmitter-receiver for distances up to several hundred miles over land or sea.

One to four channels between 2 and 9 mc/s may be pre-tuned in the crystal-controlled transmitter. The receiver also tunes from 550 to 1540 kc/s.

The standard model operates from 12-volt battery. An A.C. model is also available.

\* Regd. Trade Mark 34699 (Aust.)

**AMALGAMATED WIRELESS (AUSTRALASIA) LIMITED**  
47 YORK STREET, SYDNEY, N.S.W. 99 ALDWYCH, LONDON

For even  
greater  
enjoyment  
from  
your car

## Value-for-Money Motoring

by J. R. Davey of "The Autocar"

This book is specially designed to show the motorist how he can run his car at the lowest overall cost. Covers servicing, tuning for maximum miles per gallon, recognising trouble, use of tools, buying new and second-hand cars and methods of preserving the bodywork. Shows how anyone without much technical knowledge can ensure greater reliability, lengthen the life of his car, reduce garage bills and save himself pounds. 128 pp. 7s 6d net by post 8s

## Caravanning & Camping for Motorists

by John Yoxall of "The Autocar"

Deals thoroughly with everything essential to the full enjoyment of mobile caravanning and motor camping. Written by a member of "The Autocar" staff with a wide experience of the subject, it covers such items as choosing a matched outfit; interior layout; lighting and heating; water supply; sanitation; maintenance; caravanning abroad; tents and equipment; clubs; and legal matters. 142 pp. 8s 6d net by post 9s

from all booksellers

Published for  
"The Autocar" by

ILIFFE AND SONS LIMITED DORSET HOUSE STAMFORD STREET LONDON S.E.1

All good 'Labs' use  
**RadioSpares**

quality components  
for design  
development and  
prototype work



**Service  
Engineers!**

Remember—Radiospares components are  
delivered absolutely "by return"

**EXECUTIVES REQUIRE  
CRISP, CONCISE  
REPORTS—DICTATE  
THOSE DETAILS IN  
YOUR CAR!  
VALRADIO DC/AC  
CONVERTERS  
MAKE DICTATING  
MACHINES AND  
TAPE RECORDERS  
MOBILE**



For use too with Record  
Changers, Radiograms,  
Electric Gramophones, Television  
Receivers, and T.V. from country house  
lighting plants. (Prices according to  
instrument.)

**INPUTS . ENTREES . ENTRADAS**  
6, 12, 24, 32, 50 110 or 200/250 v.  
**OUTPUTS . SORTIES . SALIDAS**  
110 v. or 230 v. AC, 50 or 60 c/s, 30 to 300 w.

Prices DC/AC Converters

From £3/18/—for Small Motors.

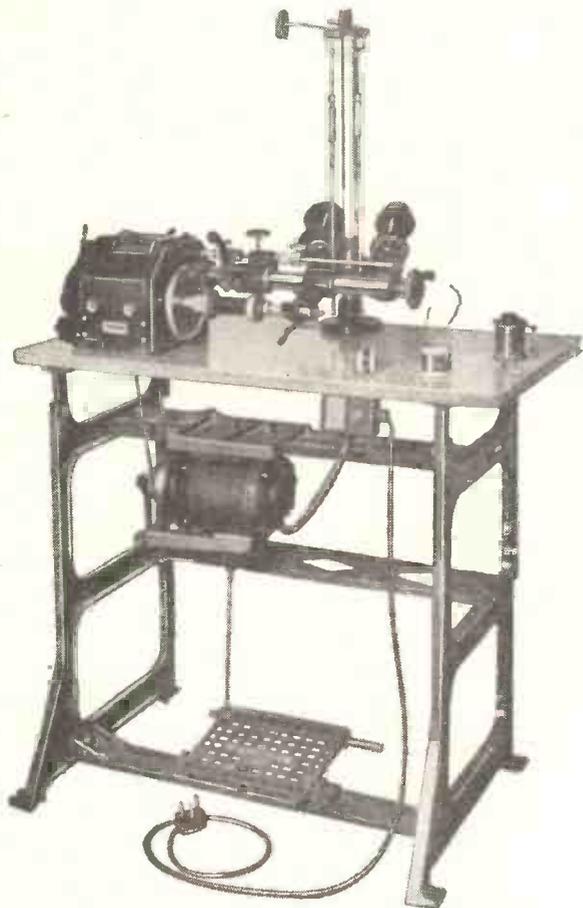
From £11/16/6—for Radiograms (including 3-speed Types).

Units complete and ready for use. **VALRADIO.** Write for  
descriptive folder, WW/C. ACCEPTED AS THE STANDARD by RADIO  
MANUFACTURERS, the Trade and the Aircraft Industry.

Les rapports destinés aux chefs de service doivent être rédigés d'une  
façon bien concise—ditez-les donc dans votre voiture!  
Les convertisseurs C.C./C.A. "VALRADIO" consentent la mobilité aux  
machines à dicter et aux enregistreurs sur bandes.  
Ils peuvent également être utilisés pour changeurs de disques, appareils  
combinés, électrophones, téléviseurs, etc., partant d'installations  
d'électricité particulières.

Las retas iones destinadas a los jefes tienen que redactarse de modo muy  
conciso—dícenlas en el coche!  
Los inversores C.C./C.A. "VALRADIO" les prestan movilidad a las  
máquinas de dicar y a los grabadores de cinta.  
También pueden utilizarse para cambiadores de discos radio-combinados,  
gramófonos eléctricos, aparatos de televisión, etc., aprovechando las  
instalaciones eléctricas privadas.

Specialists in converters since 1937. **VALRADIO LIMITED.**  
BROWELLS LANE . FELTHAM . MIDD. . Phone: Feltham 4242/4837  
OVERSEAS ENQUIRIES TO:—DEMANDES D'OUTRE-MER A:—  
TODA INFORMACION DE EXPORTACION HA DE PELIRSE A:—  
E.M.I. SUPPLIERS LTD. HAYES MIDDLESEX ENGLAND.



## AUTOMATIC COIL WINDING MACHINE

Type AII.1. (25-50 S.W.G.)

Type AII.X (19-46 S.W.G.)

### COMPLETE WITH

- ★ Cast-iron stand and polished wood table-top.
- ★ Dual reel carrier and tensioner.
- ★  $\frac{1}{4}$  h.p. integral clutch motor with foot control.

### THE MOST OUTSTANDING MACHINE ON THE MARKET!

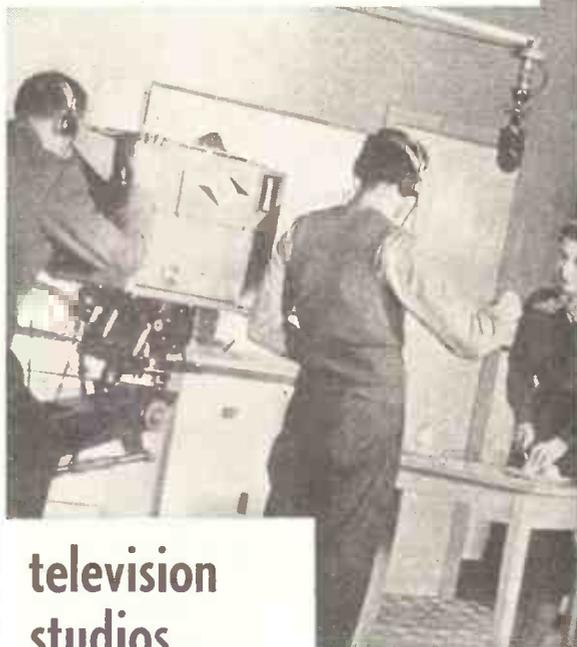
Dustproof construction—up to four coils can be wound simultaneously—micrometer traverse setting—easily adjusted wire gauge setting—cadmium and chromium-plated steel parts—instantaneous re-set counter reads up to 100,000 turns—Wire Tensioning Stand holds two reels.

*We will be pleased to send you an illustrated leaflet giving a full technical specification on request.*

**KOLECTRIC LTD**

73 UXBRIDGE ROAD,  
EALING, LONDON, W.5.  
EALing 8322.

## For proved performance



*Photograph by courtesy of High Definition Films Ltd.*

television studios are using\*

## S. G. BROWN Headphones

For essential studio control, television and broadcasting companies the world over choose reliable BROWN Headphones, famous for their quality of reception. All BROWN instruments are of tried and proved performance, capable of the maximum sensitivity and purity of tone.



### \* Type F

Particularly suited to the rigours of every day use—light yet strongly made. Shockproof and highly sensitive, this general purpose instrument will give lengthy and trouble free service.

**Brown**

Headphones of all types. 'Automatic Helmsman' Marine Compasses. 'Echo Sounders.' 'Navigational Equipment.'

*For full details of BROWN Headphones and other equipment write to 'Telephone' Dept.*

### S. G. BROWN LTD.

SHAKESPEARE STREET WATFORD HERTS  
Telephone Watford 7241

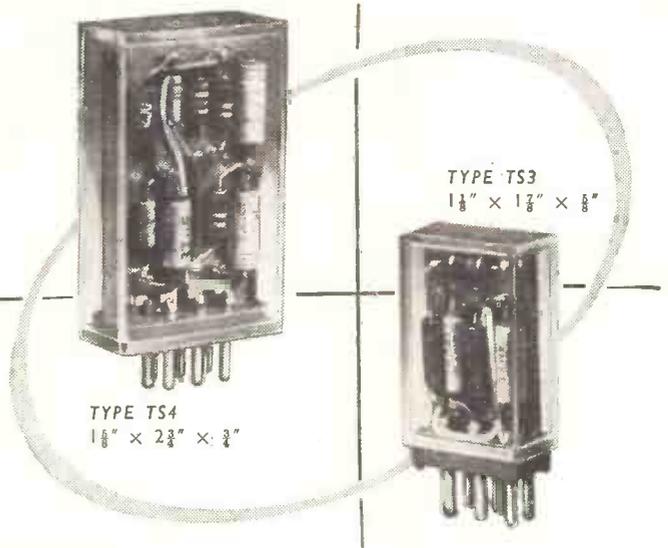
# VENNER

TRANSISTORIZED

## PLUG-IN AMPLIFIERS

**TYPE TS3.** For industrial applications. Frequency response within 3 db from 15 c/s to 125 Kc/s. Ideal for pulse amplification. **List Price £6/5/-.**

**TYPE TS4.** For audio frequency amplification. Frequency response within 3 db from 120 c/s to 10 Kc/s. **List Price £4/7/-.**



Both amplifiers have low power consumption, employ two stages usable separately or in cascade giving a voltage gain of approximately 1,000. Using both stages—no phase reversal, ideal for oscilloscope amplifiers. Both have same plug connections and are therefore interchangeable.

Write for fully illustrated Brochure WW/104



"An Eye to the Future"

## VENNER ELECTRONICS LIMITED

KINGSTON BY-PASS · NEW MALDEN · SURREY · Tel.: MALden 2442. Associated Companies: Venner Limited, Venner Accumulators Ltd.

# IMPORTANT ANNOUNCEMENT A.D.S. RELAYS LTD.

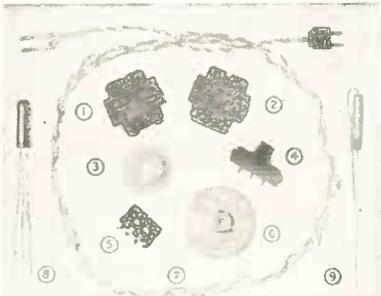
MANUFACTURERS OF 3000 & 600T RELAYS  
Wish to make it known that they are **FULLY TYPE APPROVED** TO

INTER SERVICES SPECIFICATION R.C.S. & R.C.L. 161  
(Certificate Nos. 1000, 1001, 1003 & 1004)

**A.I.D.**  
A.R.B. & ADMIRALTY  
APPROVED

**A.D.S. RELAYS LTD.** Dept. W.W.  
12, STORE STREET, LONDON, W.C.1.  
Tel.: MUSEum 2453

### SUB-MINIATURE TRANSISTOR COMPONENTS



1. 4.5:1 OUTPUT TRANSFORMER 250Ω 10/-
2. 8.5:1 INTER-STAGE do. 10/-
3. EARTIP 2/9
4. D.P. SWITCH 4/-
5. EARPHONE PLUG SOCKET 1/6
6. SINGLE EARPHONE 250Ω 18/-
7. CORD WITH PLUGS 5/-
8. TRANSISTOR (ALL TYPES)
9. T.C.C. SUB-MINIATURE CONDENSERS (Special List available of all Sub-miniature Components)

### FULL RANGE OF HI-FI

- AMPLIFIERS
  - F.M. UNITS
  - GRAM UNITS
  - SPEAKERS
- ON DEMONSTRATION

ALL COMPONENTS FOR OSRAM 912 PLUS MULLARD 5/10 and WILLIAMSON AMPLIFIERS (Lists available)

FULL RANGE OF GILSON TRANSFORMERS, Etc.

**BERRY'S**  
RADIO  
25 HIGH HOLBORN, LONDON, W.C.1  
Tel: Holborn 6231-2  
(OPPOSITE CHANCERY LANE)

# Get the FULL value from



with the NEW *Armstrong*

## FM 61 VHF TUNER

### EXCEPTIONAL SENSITIVITY

An adequate signal level is assured even at relatively long distances from the transmitter, and in ordinary reception areas aerial complication and expense are reduced to a minimum.

### COMPLETE FREEDOM FROM DRIFT

The high stability of the FM 61 avoids the irritating necessity for retuning. Tuning is not affected by changes in the working temperature—the set can for instance be switched off after use at night and the simple act of switching on in the morning will bring in the station.

### SWITCHED AUTOMATIC FREQUENCY CONTROL

This will not normally be used in the U.K. It is fitted to meet the somewhat variable reception and transmission conditions in America, and not, as is sometimes the case, to cover drift in an unstable circuit.

### CATHODE FOLLOWER OUTPUT

This increases the permissible length of lead from tuner to amplifier enabling them to be sited at a convenient distance apart whilst maintaining the quality of the signal.



- ★ Full Band II Coverage (88-108 Mc/s)
- ★ Adjustable Output Matching Control
- ★ High Overall Gain
- ★ Completely silent background
- ★ Price: £22.1.0.

Post this coupon for full descriptive literature or call at your local High Fidelity dealer or at our Holloway showrooms for full demonstration.

NAME (BLOCK CAPITALS PLEASE) .....

ADDRESS .....

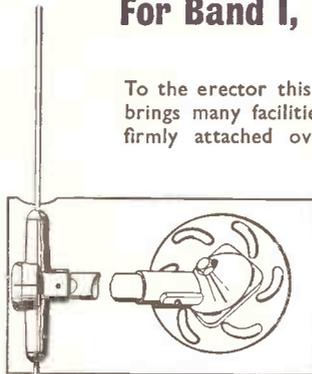
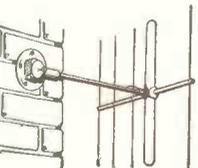
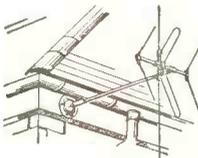
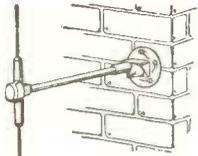
..... WJ

**ARMSTRONG WIRELESS & TELEVISION CO. LTD., WALTERS RD., LONDON, N.7.**

Telephone: North 3213

# TURRET WALL MOUNTING BRACKET

## For Band I, II and III & combined aerials



To the erector this new "Turret" wall bracket (patent applied for) brings many facilities never before available. The base plate can be firmly attached over a range of fixing centres from 3" to 4" spacing. Combinations of turret and shank positions give 360° orientation from any mounting position—vertical, horizontal or tilted.

There is no external situation or spacing to which the turret bracket cannot be fixed, and once in position it is guaranteed not to move or break.

Ask your wholesaler for samples now. It means money for your pocket!

	TYPE	RETAIL PRICE
BAND I ... ..	A/LW ... ..	32/6
BAND I ... ..	A/HW ... ..	60/-
BAND II FM ... ..	A/FM/LW ... ..	30/-
Combined in-line BAND I/BAND III Channels 8, 9, 10	A/SDW+3 ... ..	65/-
	A/SDW+4 ... ..	75/-
BAND III Channels 8, 9, 10 ... ..	A/JY3W... ..	40/-
	A/JY5W... ..	49/-
	A/Wide Spaced/JY5W 55/-	

# WOLSEY Pacemakers to the Aerial Industry

SEE US ON STAND NO. 46 AT THE SCOTTISH RADIO EXHIBITION

**WOLSEY TELEVISION LIMITED** Cray Avenue, St. Mary Cray, Orpington, Kent

Electrical Division, Gas Purification & Chemical Company Limited)

Telephone : Orpington 26661/2/3/4  
W.40

## THE BEST OF BOTH WORLDS

Whether you want a self-contained plug-in-and-play High Fidelity instrument or a complete range of matched High Fidelity units—specify RCA. For over 25 years the world's recording studios have consistently preferred RCA. Now let RCA bring this same studio quality to your home.

### New Orthophonic High Fidelity

#### Matched Units



Super-sensitive FM Tuner.  
£24.3.0 plus £9.8.4 P.T.



Panoramic Multiple Speaker  
System. £56.11.0



20 watt Power Amplifier.  
£24.10.0



Transcription Turntable  
Deck. £22.6.0 plus £8.14.0  
P.T.



Versatile Pre-amplifier  
Control Unit. £16.10.0

### High Fidelity

#### PLUG-IN-AND-PLAY Record Reproducers

Above is the RCA "PRESIDENT" High Fidelity phonograph, ready-to-play, automatic changing, console record reproducer of outstanding quality. Panoramic multiple speaker system; new triple control with balanced loudness feature; 20 watt peak push-pull power from extended range amplifier; elegantly styled in superb cabinets in walnut, light oak, or dark oak finishes.



**67 GNS.**  
(tax paid)

The RCA "VICE PRESIDENT" High Fidelity phonograph (illustrated right) is a beautifully styled record reproducer with a quality of reproduction never before associated with instruments of its size. Panoramic triple speaker system; 10 watts peak power from push-pull amplifier with frequency range 40-20,000 cycles; triple control system; 4-speed changer.

**41 GNS.** (plus £1.15.0 optional legs)  
tax paid.



**RCA GREAT BRITAIN LIMITED, Lincoln Way, Sunbury-on-Thames, Middx.**

(An Associate Company of Radio Corporation of America) Telephone: Sunbury-on-Thames 3101.

### RADIO HAM SHACK LIMITED

**SPECIAL OFFER. WELL-KNOWN MAKE OF TURRET TUNER.** Available in 10 and 16 megs. I.F. output, with either series or parallel heaters. Series Tuner employs PCF80 and PCC84 valves; Parallel Tuner employs ECF80 and BCC84 valves. Please state B.B.C. and I.T.V. channels required. Price includes Knob Assembly. £5/5/- post paid.

**SIMON "CADENZA" Twin Impedance Ribbon Microphone.** As shown at the Audio Fair. Gives level response from 50-14,000 c.p.s. No matching transformer required. Packed in attractive presentation case. £10/10/- post paid.

**REMPLY SOLDERING IRON.** A lightweight iron with small bit and neon indicator set in handle. 230-250 V. only. 22/6, post 1/6.

**LEAK TL/10 AMPLIFIER AND POINT ONE PRE-AMPLIFIER.** This Hi-Fi amplifier still leads in the field of quality reproduction. Leaflet on request. £28/7/- carriage paid.

We are stockists of W.B. Cabinets and Speakers, Bernards and Norman Price Publications, and a wide range of valves and radio components. Send 6d. in stamps for our list.

**155, SWAN ARCADE, BRADFORD 1, YORKS.**

We stock a variety of Radio, Electronic and Telephonic Equipment and Spares of British and American make.

We also specialise in Z.A. Equipment and Spares as used by Government Departments and the Services.

*Suppliers to Manufacturers and Trade only.*

**FINSBURY TRADING CO.,**  
12 Stoke Newington High St., London, N.16  
Telephone: CLIssold 7342

## TELEVISION AERIAL COMPONENTS DESIGNED FOR CONSTRUCTING BAND I & BAND III T.V. AERIALS ELEMENT DIMENSIONS SUPPLIED FOR ALL CHANNELS

Selecting at random from our new multi-page catalogue :

- ★ Band III Folded Dipoles (As illustrated)
- ★ Mast Coupling units for 2" Masts
- ★ Reflector and director rod holders
- ★ Insulators, both Rubber and Plastic (As illustrated)
- ★ Masthead Fittings for  $\frac{3}{4}$ ", 1", 1 $\frac{1}{2}$ " and 2" Masts
- ★ Alloy Tubing for Elements, Cross boom and masting

Send 1/- P.O. for the revised, fully illustrated catalogue to :

**FRINGEVISION LTD., Marlborough, Wilts. Phone 657/8**



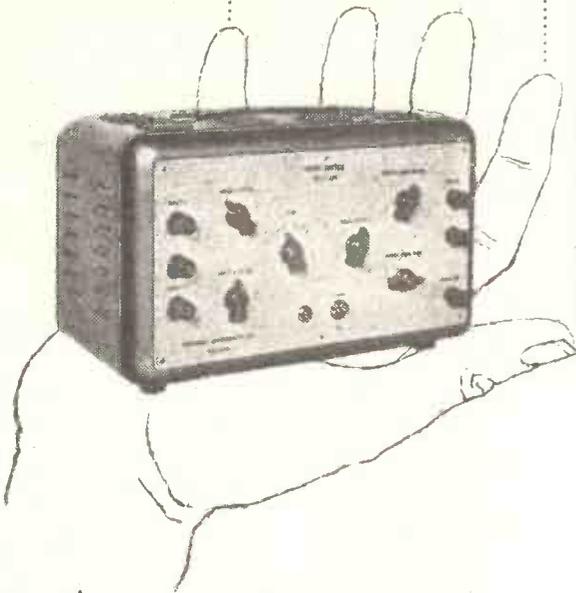
Synchronisation either channel  
either polarity

High input impedance with  
low output impedance

Separate attenuation  
each channel

Variable  
switching rate

5 Mc/s  
bandwidth

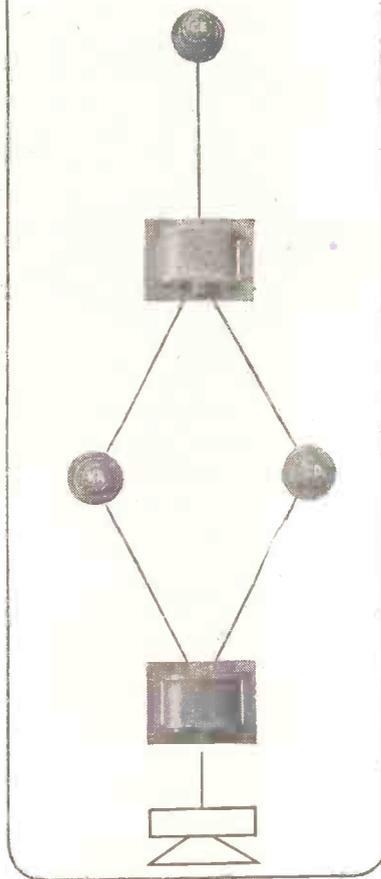


**An extra  
beam on  
any  
oscilloscope**

*Furzehill  
Laboratories Ltd.*

57 CLARENDON ROAD, WATFORD, HERTS.  
TELEPHONE: GADEBROOK 4686

# BELCLERE TRANSFORMERS



**"BN" "EN"  
"KN"**

Driver and Output  
Transformers for  
use in 200 mW.  
push-pull Transistor  
Amplifiers

**"KN"**

Driver and Output  
Transformers for  
use in 1 Watt  
push-pull Transistor  
Amplifiers

The photograph shows  
the "EN" Size without  
its clamp.

**DIMENSIONS**

<b>"EN"</b>	<b>"BN"</b>	<b>"KN"</b>
$1" \times \frac{3}{4}" \times \frac{2.5}{8}"$ (plus clamp)	$\frac{3}{4}" \times \frac{9}{16}" \times \frac{5}{8}"$	$1\frac{5}{8}" \times 1\frac{3}{8}" \times 1\frac{3}{8}"$ (plus clamp)

UNITS ALSO AVAILABLE FOR 2, 5, 10 AND 20 W  
TRANSISTOR AMPLIFIERS

**POWER TRANSFORMERS  
UP TO 60 VA**

**A.F. TRANSFORMERS, INDUCTORS**

Contractors to Admiralty  
and Ministry of Supply  
A.I.D. approved

**BELCLERE TRANSFORMERS**

P.O. BOX No. 22

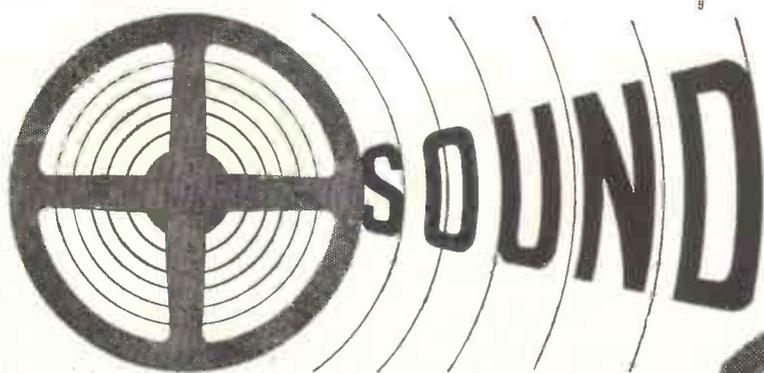
117, HIGH STREET, OXFORD

Phone: Oxford 3432

Cables, Belclere, Oxford

# London's Leading Tape Recorder Centre

See the



3 speeds—3 hours' continuous playback with instantaneous track reversal. Complete automatic control by push buttons. Complete with spool of LP tape and crystal desk microphone. 4 WATTS OUTPUT.

**TAPE RECORDER**  
**55 GNS.**

*Yours for £6.8.4  
deposit.*



All products shown at London Audio Fair are available from us on the M.O.S. Personal Credit Plan. Send S.A.E. for details.

now available . . .



## PIEZO-ELECTRIC MICROPHONE

Specially designed for use with Tape Recorders. Free of amplitude phase and harmonic distortion.

**50/-** or fitted with special screened jack plug 55/-

**E & G MAIL ORDER SUPPLY CO.**

**33 Tottenham Court Road, London, W.1.**  
Tel: MUSEum 6667 *The Radio Centre*

## LANGUAGE COURSES WITH YOUR TAPE RECORDER IN 30 DAYS



15 complete Conversational lessons for beginners in Spanish, German, French, Italian and Russian. One Single Tape comprises a complete elementary course in any of the above languages. Practical English Conversations for foreigners, and also a tape and book of studies in Pronunciation, Elocution, Intonation and public speech by well known lecturers in English, are in course of preparation.

Retail Price £3.17.6

Also full comprehensive language course consisting of 2 hours' recording. Retail price £7.7.0 including handbook.

Please write for explanatory leaflet

**TUTOR TAPE CO.**

70 BREWER STREET, LONDON, W.1

GERrard 3376

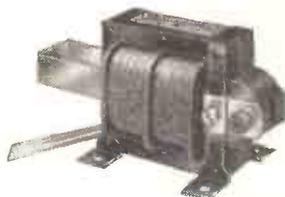
## INSULATING SLEEVINGS

P.V.C. and POLYTHENE  
SLEEVINGS  
INSULATED WIRES  
and FLEXIBLES  
A.I.D. AND A.R.B. APPROVED.

**PLASTICABLE LIMITED**  
HAWLEY LANE - FARNBOROUGH - HANTS  
PHONE: FARNBOROUGH, HANTS 85

## A.C. SOLENOID TYPE SBM/T

GREATLY INCREASED PERFORMANCE

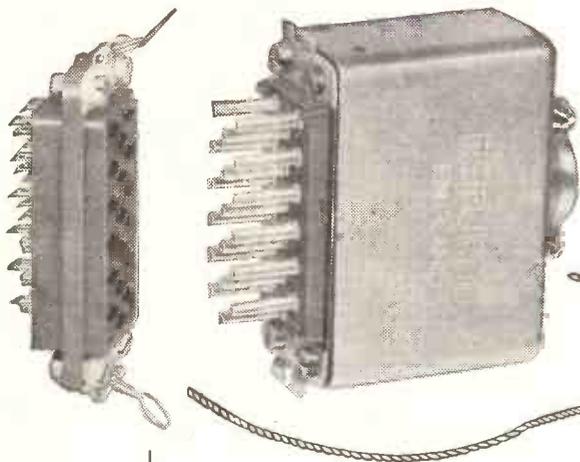


Continuous 3½ lbs. at 1"  
Instantaneous to 16 lbs.  
Same dimensions as  
Type SB. Smaller sizes  
available. Greatly in-  
creased discounts for  
quantities. Also trans-  
formers to 7kVA 3 phase

**R. A. WEBBER LTD.**

18 FOREST ROAD, KINGSWOOD, BRISTOL

PHONE 74065



**8 WAY** | **18 WAY**

**12 WAY** | **25 WAY**

**Sturdy, Reliable and Inexpensive**  
 Nylon—PF mouldings. Silver plated contacts. Solid drawn aluminium cans. Positive locking mechanism.  
*Breakdown voltage 3.5kV.*

Send for full details to :—

**THE McMURDO INSTRUMENT CO. LTD.**  
**ASHTEAD, SURREY.** Telephone: Ashtead 3401

JSP. MSC 6

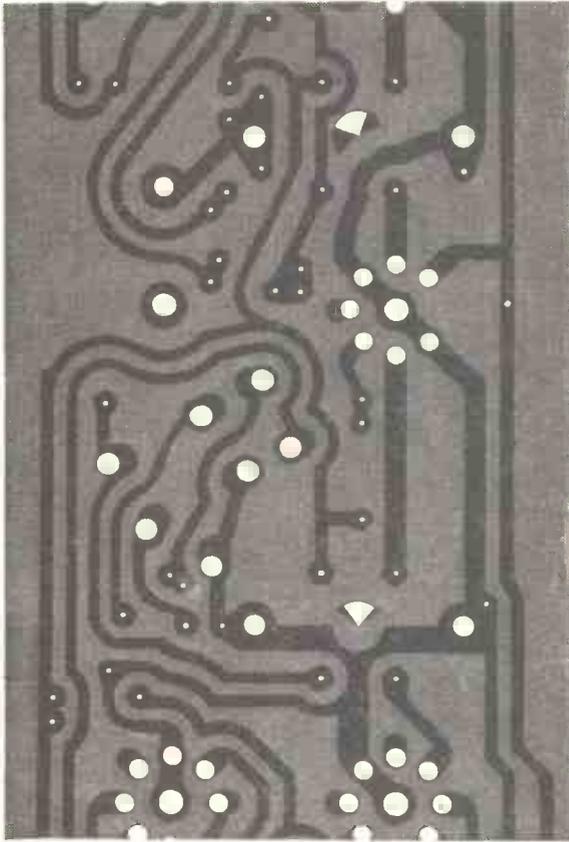
# VITAVOX

**MULTICELL. HORNS**

For accurate and planned sound distribution in high grade theatre and public address installations.

2-20 cells—Prices on application

*Full details on request from:*  
**VITAVOX LIMITED**  
 Westmoreland Road, London, N.W.9  
 Telephone: COLindale 8671



ask Ashdowns  
 for **'ASHLAM'**  
 copper clad laminates  
 for printed circuits  
*for radio, television, electronics*  
*also copper clad glass cloth laminates*  
*for higher temperatures*

## Ashdowns Limited

Makers of 'ASHLAM'\*\* laminates, glass fibre reinforced laminates and mouldings, 'UNDULITE'\*\* fibreglass reinforced translucent sheeting, 'Formene G.I.' high impact polystyrene sheet and vacuum formed thermoplastic sheet fabrications.

\*REGISTERED TRADE MARKS

Ashdowns Limited is a subsidiary of Pilkington Brothers Limited.

ASHDOWNS LIMITED, ECCLESTON WORKS, ST. HELENS, LANCs.  
 Telephone: St. Helens 3206

LONDON OFFICE: 29/30 ST. JAMES'S STREET, LONDON, S.W.1.  
 Telephone: WHITEhall 6002

## CABINETS

MANY & VARIED DESIGNS IN BUREAU,  
 PIANO CONSOLE & TABLE MODELS

### Consort Mk II

A new design of a popular style (as illus.). This is a polished oak with nicely contrasting speaker fabric. Motor board, approximate size 25 x 13 1/2 in., is uncut and therefore suitable for user's own equipment. Clearance of motor board is 6 in. Height of cabinet to top of lid is 2 ft. 5 in. Depth 1 ft. 2 1/2 in. Width 2 ft. 5 1/2 in. Storage space 13 1/2 x 3 1/2 x 12 in.

Send for our cabinet list for details of this and many other types.

Send for detailed Wholesale List for Cabinets, Wire Chassis F.M.I., A.M. Complete TV's, Radio Aerials, Converters & Sundry Electrical Components, e.g., Shaver, etc.

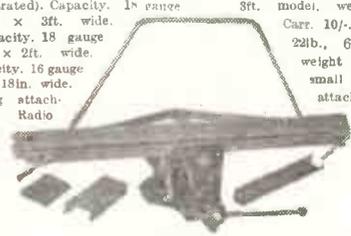


**V.E.S. WHOLESALE SERVICES LTD.**

(Dept. W.W.), 11 Gunnersbury Lane, Acton, London, W.3. Acorn 5027

## PARKER'S SHEET METAL FOLDING MACHINES. HEAVY VICE MODELS

No. 1 (Illustrated). Capacity. 18 gauge mild steel x 3ft. wide. Carr. 10 1/2. 2ft. model, weight 56lb., £6/5. 22lb., 65/- 18in. model, weight 18lb., 65/-, carr. on small models 4/- if with attachments 5/6.  
 No. 2. Capacity. 18 gauge mild steel x 2ft. wide.  
 No. 3. Capacity. 16 gauge mild steel x 18in. wide.  
 End folding attachments for Radio chassis, Tray or Box making, are supplied if required.  
 Attachment angle for 3ft. 3/8 per ft. Small models 2/- per foot.



Machines guaranteed Send for details

**A. B. PARKER** WHEATCROFT WORKS, WELLINGTON STREET, BATLEY, YORKS. Tel.: Batley 426

# OSMOR SWITCH TUNED F.M. (WITH FREQUENCY CONTROL)

A completely stable and drift free tuner for adding to an existing radio or radiogram, or hi-fi amplifier. Size 5 1/2" long x 4 1/2" wide front x 4 1/2" high. Owing to its small size installation is extremely simple and convenient.

**Free!**

Send 10d. in stamps for circuits, practical drawings on band III Converters, T.R.F. & S'her tuners and receivers. Circuit of switch-tuned (frequency controlled) F.M. Tuner. Components and information on most published circuits.

**OSMOR RADIO PRODUCTS LTD.**

Dept. (W.W. 11) 418 BRIGHTON RD., SOUTH CROYDON, SURREY

Telephone: CROYdon 5148/9

# STABILISED POWER

for transistors and sub-miniature valves

# H.T. REGULATION BETTER THAN .03%

H.T. 22.5 to 150 v D C

L.T. 1.25 v 1.4 v 2.8 v 6.3 v

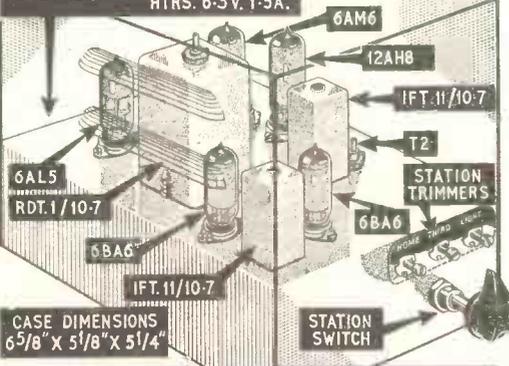
May we send leaflet No. 109B?



LION WORKS, HANWORTH TRADING ESTATE  
 FELTHAM MIDDLESEX  
 TELEPHONE: FELTHAM 3567 & 2922

# MAXI-Q

POWER REQUIRED H.T. 250V. 60mA.  
 HTRS. 6.3V. 1.5A.



## V.H.F./F.M. HOME, LIGHT AND THIRD PROGRAMMES INSTANTLY SELECTED AT THE TURN OF A SWITCH

Full constructional details, point-to-point wiring diagrams and alignment instructions for building the "MAXI-Q" PRE-SET F.M. TUNER and also the VARIABLE TUNED version are given in Technical Bulletin DTB.8, 1/6.

Completely punched chassis, screens and bronze finished cover, 19/-. Station Indicator Plate, 1/1. 3 position switch, 4/3. Station Condenser Trimmers, 3-9 pF., 2/- each.

**RATIO DISCRIMINATOR TRANSFORMER, RDT.1/10.7 Mc/s.** Secondary winding of bifilar construction, iron dust core tuning, polystyrene former, silver mica condensers. Can size: 1in. square x 2 3/4 in. high, 12/6.

**I.F. TRANSFORMER. IFT.11/10.7 Mc/s.** Miniature I.F. Transformer of nominal frequency 10.7 Mc/s. The "Q" of each winding is 90 and the coupling critical. Can size: 1 1/2 in. x 1 1/2 in. square, 6/6.

**COILS TYPE L1, T1 and T2.** Specially designed for use in this unit are wound on polystyrene formers complete with iron dust core tuning, 3/11 each.

THE "MAXI-Q" PRE-SET F.M. TUNER is available completely wired, assembled, valved and housed in a sturdily made bronze finished cover at £8/11/5, plus £3/8/7 P.T., =£12.

"MAXI-Q" VARIABLE F.M. TUNER is available completely assembled at £7/17/2 plus £3/2/10 Purchase Tax-£11

GENERAL CATALOGUE covering technical information on full range of components, 1/-, post free.

Trading terms for direct postal orders: c.w.o. plus appropriate postage charge

**DENCO (CLACTON) LTD.**  
 (DEPT. W.W.) 357/9 OLD ROAD  
 CLACTON-ON-SEA, ESSEX

Stop Press: "MAXI-Q" 60 kc/s TAPE DECK OSCILLATOR COILS. TDO.1—for high impedance Erase Heads (Truvox, etc.), 5/- TDO.2—For low impedance Erase Heads (Brenell and Collaro), 5/-.

**Question** "Why don't dealers stock and recommend our Amplifiers and Tuners, etc?"

**Answer** "Because they cannot afford to as we give their discount to YOU (the public)."

This direct trading explains why our products, though in the top class, are so much cheaper than our competitors'. If any reader should have his mind set on a high-priced amplifier of another make and would like to save money if possible, we should like to make the following clear-cut offer: If he buys one of our "Symphony" Amplifiers or Tuners and is not entirely satisfied with it he may return it for full credit against any other amplifier or tuner on the

market. It should be emphasised at this stage that we can supply any Amplifier, Radio Tuner, etc., advertised. Our chief Engineer, who is operating a Technical Guidance Service, is available daily including Saturdays from 10 a.m. to 6 p.m. or will deal with enquiries by return of post. Send for new catalogue mentioning "Wireless World."

The new No. 1 "SYMPHONY" AMPLIFIER Mark III is a 3-channel 5-watt Gram/Radio Amplifier with astonishingly flexible tone control. You can lift the treble, the bass, or—and here is the unique feature—the middle frequencies to suit your own ear characteristics, and the record or radio programme being heard. Independent Scratch-cut is also fitted and special negative feedback circuit employed. The Amplifier can accommodate a wide variety of records from old 78s to new LPs. Input is for all types of pickup of 0.1 v. output or more and there is full provision for Radio Tuner Tape take-off and Playback. It is available to match 15 ohms or 2-3 ohms speakers. Price 12 gns. (carriage 7/6). Fitted in Portable Steel Cabinet 2 gns. extra.

The new No. 2 "SYMPHONY" AMPLIFIER Mark III as No. 1 but with 10-watt Push-Pull triode output and triodes throughout. Woden mains and output transformers and choke. Output tapped 3, 7.5 and 15 ohms. provision for Tuner and Tape. Competes with the most expensive amplifiers on the market yet costs only 16 gns. (carr. 7/6). Fitted in Portable Steel cabinet 2 gns. extra.

"SYMPHONY" AMPLIFIERS with REMOTE CONTROL Both the above model Amplifiers are available with all controls on a separate Control Panel with up to 4 feet flexible cable which simply plugs into the amplifier. Enables the Amplifier proper to be sat in the bottom of a cabinet whilst the controls are mounted conveniently higher up. Extra cost 2 gns.

No. 1 "SYMPHONY" F.M. TUNER. High grade instrument with extremely silent background. Based on the latest type of permeability-tuned Coil Assembly of advanced design housed in anti-radiation shroud giving extreme sensitivity and high music/noise ratio. Suitable for amplifiers in the highest fidelity class. £15/8/-. Power Pack £3/7/6. Magic eye £1 extra if required.

No. 2 "SYMPHONY" AM/FM TUNER. Combining all the specifications of our Long, Medium and Short wave Superhet AM Tuner and our No. 1 FM Tuner. Separate Coil Assemblies and I.F.s. Fully self-powered on one chassis. 26 gns. (carr. and pkg. 7/6). Double beam magic eye £2/5/- extra if required.

"SYMPHONY" AM/FM RADIOGRAM CHASSIS, Mk. II. Very high grade Radiogram Chassis incorporating the Long, Medium, Short and VHF Bands; nine valves including new fan-type, built-in Magic Eye; push-pull output for high quality reproduction. Input sensitivity adequate for Studio Professional quality (P) and transcription (PX) pick-up cartridges. New type ultra-sensitive, anti-radiation, no-drift FM front-end; built-in ferrite rod A.M. aerial; plug-in F.M. indoor dipole aerial supplied free. Negative feedback; 15 ohms tapped 3 ohms output; entirely new-look German-type dial and knobs in gold, brown and cream, measuring 1 1/2 in. x 6 in. horizontally. Depth front-to-back 8 in. An extremely attractive up-to-the-minute instrument. Price complete with 10 in. Goodmans Loudspeaker, 26 gns. plus carriage, 10/-. Alternatively, allowance made on standard Speaker against a more expensive, high fidelity speaker. Delivery from stock.

#### RECOMMENDED GRAMOPHONE UNITS

LENCO GL50 4-speed TRANSCRIPTION UNIT, complete with pick-up and either Studio crystal or variable reluctance cartridge and two sapphires, £21/17/10. Ditto, less pick-up, £17/10/4. Illustrated leaflets available.

#### NORTHERN RADIO SERVICES

Dept. WW, 11 KINGS COLLEGE ROAD, ADELAIDE ROAD, LONDON, N.W.3. Phone: PR1mrose 3314  
Tubes: Swiss Cottage and Chalk Farm.  
Buses: 2, 13, 31, 113 and 187.

"SYMPHONY" BASS REFLEX CABINET KITS. 30 in. high, consist of fully cut 3 in. thick, heavy, inert, non-resonant, patent acoustic board, deflector plate, felt, all screws, etc., and full instructions. 8 in. speaker model 85/-; 10 in. speaker model 97/6; 12 in. speaker model 125/7/6. The design is the final result of extensive research in our own laboratory and is your safeguard of optimum acoustic results and full rich bass. Carriage 7/6. Ready built 15/- extra. As above but fully finished in figured walnut veneer with beautiful moulding and speaker grille 10 in. £11/-; 12 in. £11/10/-. Other veneers to order.

THE "SYMPHONY" DE-LUXE TAPE RECORDER, 2-speed, twin-track, microphone, radio and gramophone inputs. Facilities for playback through high quality internal elliptical speaker, or through external high fidelity speaker or through external high fidelity amplifier. Automatic head demagnetisation. Wide frequency range heads. Housed in handsome polished walnut cabinet. Fantastic value for money at 49 gns., or 9 monthly payments of 6 gns. Plus carriage £1. Full details in catalogue.

## ADAPTATAPE

is the name of the new SONOMAG Pre-Amplifier recommended on page 238 of the November "Hi-Fi News" to those already owning Hi-Fi equipment and wishing to add tape reproduction of the same quality.

This is the ONLY pre-amp. at present available designed specially for the new Collaro Transcripator, and rigidly fixed as a unit to it.

Demonstrations to all Hi-Fi enthusiasts of our pre-amp. used in conjunction with the Collaro Transcripator Tape Unit, Collaro Transcription Motor, Leak Dynamic Pick-up and Diamond stylus, Leak Trough-line F.M. Tuner, Wharfedale Baffle 3-speaker system and Leak main amplifiers, will convince you of the fine standard of recording possible. Day, or evening (by appointment).

Price 34 gns.

(Power pack, if required, 4 gns. extra.)

Fitted into Fireside Console cabinet, oak, walnut or mahogany finish, 42 gns.

Your own Collaro Unit fitted, aligned, tested and guaranteed (at our factory only) for 19 gns.

Complete Tape Recorders, including Collaro Microphone and 1,200ft. tape. Portable 52 gns. Console (with extra large speaker) 60 gns.

Leaflet on request.

Credit facilities from:

H. C. Harridge, 8, Moor Street, Cambridge Circus, W.1.  
Holleys Radio, 315, Camberwell Road, Camberwell Green, S.E.5.  
Jackson Radio, 163, Edgware Road, W.2.  
London Radio Supply Co. Ltd., Balcombe, Sussex.  
Readings Music Stores, 11, Station Approach, Clapham Junction S.W.11.  
Sound-Tape-Vision, 71, Praed Street, Paddington, W.2.  
Woods Radio, 198, Lavender Hill, Clapham Junction, S.W.11.

## SONOMAG Ltd.,

2 St. Michael's Road, Stockwell, S.W.9

(Minute from Stockwell Tube)

Telephone: BRI 5441

THE WORLD'S GREATEST BOOKSHOP

# FOYLES

★ ★ FOR BOOKS ★ ★

FOR ALL YOUR

## Technical Books

Foyles have departments for Gramophone Records, Stationery, Handicraft Tools and Materials, Music, Magazine Subscriptions, Lending Library.

119-125 CHARING CROSS ROAD, LONDON, W.C.2

Gerrard 5660 (20 lines) ★ Open 9-6 (T'bus. 9-7)

Nearest Station: Tottenham Court Road

## POLYTHENE

PROTECTIVE CAPS & PLUGS  
FOR  
STANDARD INTERNAL & EXTERNAL  
THREADS  
OR  
SPECIAL MOULDINGS

### AMPLEX APPLIANCES (KENT) LTD.

19 DARTMOUTH ROAD, HAYES, BROMLEY, KENT  
(RAVensbourne 5531)

All export enquiries to

ANGLO NETHERLAND TECHNICAL EXCHANGE LTD.  
3, TOWER HILL, LONDON, E.C.3.

# THE LINEAR 'DIATONIC'

## A HIGH FIDELITY ULTRA LINEAR AMPLIFIER WITH INTEGRAL PRE-AMP

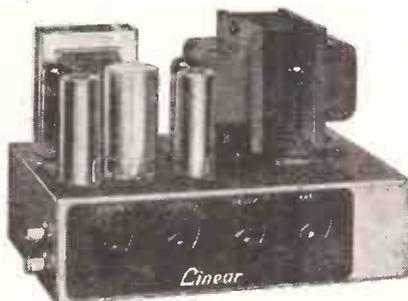
A special feature is the compactness of the unit. Full advantage has been taken of latest component miniaturisation developments to produce a 10-watt Hi-Fi push-pull amplifier incorporating tone control preamplifier stages within the measurements of 10 x 6 x 6in.

In addition two high impedance input sockets are provided for microphone and gram, etc. Each input has its associated vol. control, five B.V.A (Mullard) valves are employed ECC83, ECC83, EL84, EL84, EZ81

H.T. and L.T. power supply point is included for a radio tuner.

### L45 MINIATURE 4/5 WATT QUALITY AMPLIFIER

Size only 6 x 5 x 5 1/2 in. high. 12 d.b. Negative Feedback. Sensitivity 30 m.v. for full output. 3 Mullard valves, ECC83 Twin Triode, EL84 Power Output, EZ90 Rectifier. Separate Bass and Treble Controls. Mains switch incorporated in control. For 200—250v. 50 c.p.s. A.C. Mains. An ideal unit for use with Gram. or 'Mike.' Output matching for 2—3 ohm speakers.  
Retail Price £5-19-6



SIZE ONLY 10—6—6ins.

Weight: 12 1/2 lbs. Power consumption 90 watts For 200-230-250v. 50 c.p.s. A.C. mains. Outputs for 3 and 15 ohm speakers.

Chassis finish stoved Grey —Blue hammer.

Retail Price

**12 GNS.**

Send S.A.E. for descriptive literature.

**TRADE AND EXPORT ENQUIRIES**  
to

**FREQUENCY RESPONSE**  
± 2 d.b., 30-20,000 c.p.s.

**MAXIMUM POWER OUTPUT**  
In excess of 11 watts.

**RATED OUTPUT 10 WATTS.**

**SENSITIVITY**

Volume (1) 22 millivolts for rated output.

Volume (2) 220 millivolts for rated output.

**TREBLE LIFT CONTROL**

Continuously variable + 6 d.b. to —13 d.b. at 12,000 c.p.s.

**BASS CONTROL**

Continuously variable + 13 d.b. to —18 d.b. at 50 c.p.s.

**HUM LEVEL**

Referred to maximum output and including integral pre-amp —60 d.b.

**HARMONIC DISTORTION**

0.25% measured at 6 watts.

**NEGATIVE FEEDBACK**

Total 32 d.b. including 24 d.b. in main loop.

**LINEAR PRODUCTS LTD.**

5-9 MAUDE STREET, LEEDS, 2.  
Tel. 23116

# Relays

## POST OFFICE TYPE 3000 & 600 RELAYS

Manufactured to your specification to A.I.D. and I.E.M.E. standards. COILS up to 80,000Ω. CONTACTS up to 8 amp. INSULATION up to 5kv. Prototypes 7-14 days.

*Prompt Delivery — Prompt Quotations*

Over 100,000 relays available from stock.  
Siemens high speed relays. All values. Ex stock.  
Specialists in tropicalisation.

Contractors to leading manufacturers  
and GOVERNMENT DEPARTMENTS.



**DEPENDABLE RELAY CO.**

12a Tottenham Street, LONDON, W.1

Phone: LANgham 7391/2 (Near Goodge St. Station)

# PRECISION *High Fidelity*

## 4 SPEED TRANSCRIPTION UNIT

WITH VARIABLE SPEED ADJUSTMENT.

### MAIN FEATURES

- Speed continuously variable from 29 r.p.m. to 86 r.p.m. Pre-set adjustable "click-in" positions for 78, 45, 33½ and 16 r.p.m. Playing old celebrity discs requiring speeds above 78 r.p.m. Tuning record pitch to a musical instrument. Correcting for mains frequency variations.
- Accurately balanced heavy precision made turntable eliminates Wow and Flutter.
- Unique VERTICAL EDGE-DRIVE PULLEY principle eliminates Rumble.
- Less than 1% change in speed for up to 13% change in Line Voltage.
- Large resilient 4-pole constant velocity motor.
- Revolutionary new device for accurate groove selection.
- Model GL 56 is fitted with weight adjustable precision Pick-up-Arm with plug-in shell, incorporating the Superb Goldring Variable Reluctance Cartridge No. 500.



MODEL GL 50/4



MODEL GL 55

TYPE GL 50/4 Low loading velocity operated Automatic Stop Price £15.15.0 P.T. £6.2.10  
 TYPE GL 55. Without Pick-up. Fitted with Band Location Device Price £12.12.0 P.T. £4.18.4  
 TYPE GL 56. Complete with Pick-up. Fitted with Band Location Device Price £16.16.0 P.T. £6.11.0  
 (Diamond Stylus Extra £3.15.0 plus P.T. £1.9.3)

Write for technical reports to:—

## THE GOLDRING MANUFACTURING CO. (GT. BRITAIN) LTD

486/488 HIGH ROAD, LEYTONSTONE, LONDON, E.11

LEYtonstone 8343/4/5.

**ALTHAM RADIO COMPANY LTD.**  
 Jersey House, Jersey Street, Manchester 4.  
 Tel. : Central 7834/5/6.

**TO OVERSEAS BUYERS**

We have the largest stock in Europe of U.S.A. Government surplus electronic material. What do you require?

*This month's special offer :*

TRANSISTORS Red-Spot, approximate equivalent Mullard OC71 ... .. 5s. 4d. each

**WE WANT TO BUY**

All U.S.A. Test Sets prefixed TS and APN3, APN9, ARC3, ARN7, ART13, BC221, BC788C, CPN2.

**TRANSFORMERS**  
**COILS** LARGE OR SMALL QUANTITIES  
**CHOKES** TRADE ENQUIRIES WELCOMED

SPECIALISTS IN

**FINE WIRE WINDINGS**

MINIATURE TRANSFORMERS, PICK-UP, CLOCK AND INSTRUMENT COILS, ETC.  
 VACUUM IMPREGNATION TO APPROVED STANDARDS

**ELECTRO-WINDS LTD.**  
 CONTRACTORS TO G.P.O., M.O.S., L.E.B., ETC.

123-5-7 PARCHMORE ROAD, THORNTON HEATH, SURREY  
 LIVINGSTONE 2261 EST. 1933

## GET ALL YOUR RADIO COMPONENTS & ELECTRONIC EQUIPMENT

ACOS  
 B-LEE  
 BRIMAR  
 COLLARO  
 ENTHOVEN  
 MULLARD  
 BULGIN  
 DENCO  
 ACRU  
 J.B.

E D D Y S T O N E S  
 F. M.



phone OXFORD 47783

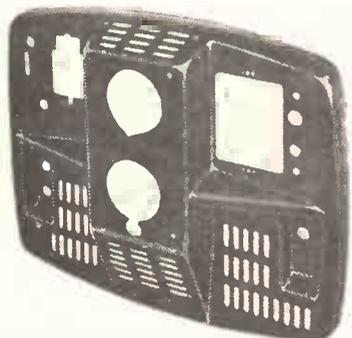
E D D Y S T O N E S  
 R E C E I V E R S

G.E.C.  
 HUNTS  
 HENLYS  
 GOODMAN'S  
 CONNOISSEUR  
 RELIANCE  
 GARRARD  
 TANNON  
 LEAK  
 W.B.

from **L. WESTWOOD 46 GEORGE STREET**

# FIBRE FORM LIMITED

Are you looking for HIGH MECHANICAL STRENGTH at LOW COST?



MOULDED BACK FOR  
17" MURPHY TV RECEIVER

Size of product often precludes the use of a moulding but FIBRE FORM can be moulded in any size.

FIBRE FORM is a new material based on the combination of strong cellulose fibre with synthetic resins. There are other reinforced plastics but FIBRE FORM mouldings are not only LIGHTER and STRONGER but they are CHEAPER.

Leading manufacturers use FIBRE FORM for TV portable cabinets, portable radios, TV masks, TV cabinet backs (right up to 21" console model), radiogram backs, TV tube end protectors, etc. etc.

The illustration shows a moulded back for the new Murphy 17" TV cabinet. Its strength, dimensional stability and good appearance make this back a vital STRUCTURAL component of the cabinet design.

Please note the outstanding average strength figures of

FIBRE FORM:- Ultimate Tensile strength - 14,000 - 18,000 p.s.i.  
Impact strength (Izod  $\frac{1}{2}$ " ) - 2.5-3.5 ft. lbs.

WE CAN IMPROVE YOUR PRODUCTS AND REDUCE YOUR COSTS

## FIBRE FORM LIMITED

Garratt Mills, Trewint Street,  
London, S.W.18

Tel.: Wimbledon 3946

Holloway Street, Lower Gornal,  
Nr. Dudley, Worcs.

Tel: Sedgley 3486

## WHARFEDALE ACOUSTIC FILTER in NEW AF10 REFLEX CABINET

The AF10 Reflex Cabinet has been specially designed for Wharfedale 10in. units with foam surround. It incorporates the well-known Wharfedale Acoustic Filter\* which effectively loads the cone at very low frequencies so as to reduce the incidence of distortion, and assists in maintaining smooth mid-range response. The reproduction from this cabinet is remarkably clean and crisp for such a small enclosure.

Where it is required to augment the extreme high frequency response, a Super 3 tweeter housed in the special Super 3 Cabinet can be placed on top of the main enclosure, no crossover unit being necessary.

For stereophonic reproduction in the home, loudspeaker systems must of necessity be compact, attractive, and reasonably priced. A combination of the Super 3 and AF10 Reflex Cabinets fitted with their respective units fulfils these requirements.



PRICE

**£15**

This elegant cabinet is available in walnut, oak or mahogany veneers with contrasting front frame, black base runners, and anodised bronze grille.

Size 30in. x 17in. x 10 $\frac{1}{2}$ in.  
Weight 35lb. less unit.

Recommended units: 10in. Bronze/FSB, Golden/FSB, W10/FSB.

A typical two-speaker system can be made up as follows:

AF10 Reflex Cabinet . . . . .	£15 0 0
Super 3 Cabinet (10/15 ohms) . . . . .	£3 10 0
10in. Bronze/FSB . . . . .	£5 11 3
Super 3 . . . . .	£6 19 11

£31 1 2

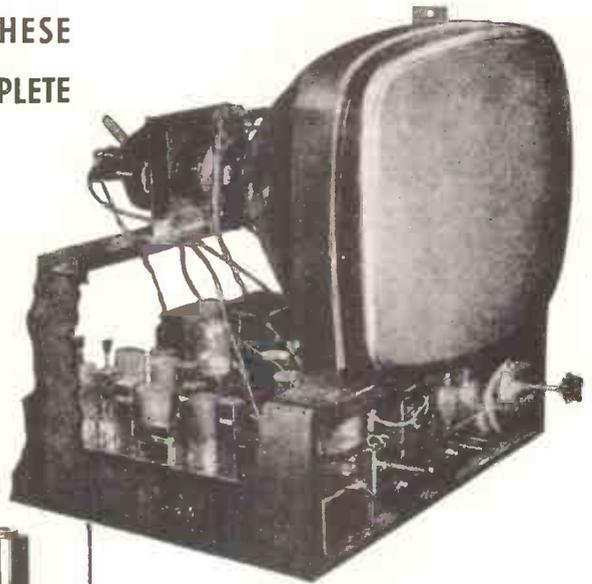
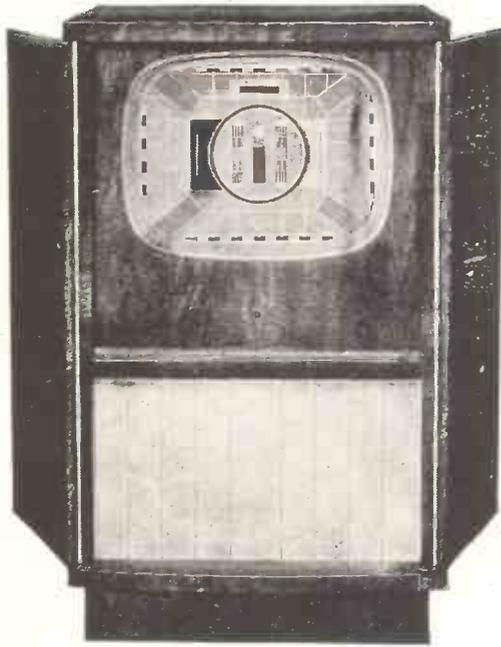
Prices include purchase tax.  
\*Patent applied for No. 4483/56.

# Wharfedale

WIRELESS WORKS LTD., IDLE, BRADFORD, YORKS. Telephone: Idle 1235/6. Grams: Wharfedel, Idle, Bradford.

# YOU'LL DO BETTER WITH PREMIER

**SAFETY FIRST!** BUILD THESE PREMIER TELEVISORS WHICH GIVE COMPLETE SAFETY TO THE CONSTRUCTOR.



These Televisors use a double wound mains transformer which gives you complete safety from contact with the mains supply when handling the chassis or controls

★ **B.B.C. & I.T.A. DESIGN No. 1 with NEW TURRET TUNER**  
MAY BE BUILT FOR £33-7-11 PLUS COST OF C.R.T.

★ **B.B.C. (ALL CHANNELS) DESIGN No. 2**  
MAY BE BUILT FOR £27-9-4 PLUS COST OF C.R.T.

BUILD IN 5 EASY STAGES. FULL CONSTRUCTION DETAILS AVAILABLE. INSTRUCTION BOOK 3/6 POST FREE INCLUDES BOTH DESIGNS.

CONSOLE CABINETS with full length doors for 14in., 16in. and 17in. tubes PRICE £14/14/- H.P. Terms: Deposit £7/7/6 and 9 monthly payments of 18/6. CONSOLE CABINETS. Half door, previously advertised, still available at £12/12/- H.P. Terms: Deposit £6/6/- and 8 monthly payments of 18/3.  
On above cabinets add 2/- for pkg. and carr.

**PORTABLE TAPE RECORDER CABINETS**

All Rexine Covered			
Tape Deck	Amplifier	Type	Price
Lane Mk. VI	Premier	Mt. VI	£4 19 6
Lane Mk. VI	Premier	de Luxe	£4 19 6
Truvox Mk. III	Truvox C	T.D.3	£4 4 0

Plus Postage and Packing 5/-.

**CABINETS-PORTABLE**

**MODEL PC/2**  
Grey Lizard Rexine covered ..... 45/-  
Overall dimensions 15in. x 15in. x 6in. Clearance under lid when closed 3in.

**MODEL PC/2 DE LUXE**  
Two colours, wine and grey, with cutout for speaker and amplifier ..... 55/6  
Dimensions as above.

**MODEL PC/3**  
Grey Lizard Rexine covered ..... 69/6  
Overall dimensions 16in. x 14in. x 10in. Clearance under lid when closed 6in.

**MODEL PC/3 DE LUXE**  
As above but with cutouts for Speaker and Amplifier ..... 79/6  
Dimensions as above.

THE ABOVE CABINETS ARE COMPLETE WITH CARRYING HANDLE FASTENERS AND PANEL.  
Packing and Postage 3/- each.

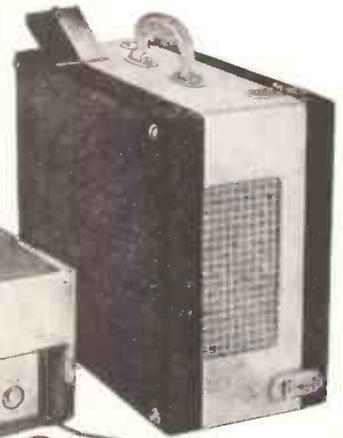
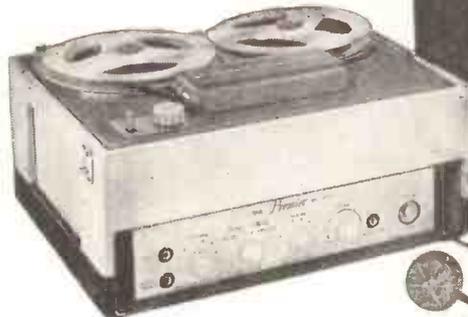
Junction Transistors 10/- each  
Equivalent of the OC70 Type

A RANGE OF BAND 3 AND F.M. AERIALS IS NOW AVAILABLE

Air spaced co-axial wire, 1/9 per yard.

## TAPE RECORDER

£5 DEPOSIT & 8 MONTHLY PAYMENTS OF £4. 18. 6 or CASH PRICE £40 plus 21/- pkg. & carr.



H.P. Terms: Deposit £20 and 12 monthly payments of £1.17.1

★ Case finished in Brown and Antique Fawn. Size 15in. x 12in. x 7in., with the very latest type continental gilt fittings. For A.C. mains 200-250 volts 50 cycles.

# PREMIER RADIO COMPANY



## ALL DRY BATTERY PORTABLE RADIO RECEIVER

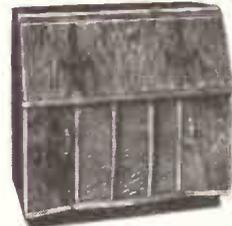
MAY BE BUILT FOR **£7.8.0** Plus 3/- Pkg. & Postage  
 4 Miniature valves in a superb circuit covering medium and long waves, Rexine-covered cabinets 11 1/2 in. x 10 in. x 5 1/2 in. in two contrasting colours, wine with grey panel. Instruction book 1/8 post free, which includes full constructional details and list of priced components.

## CONTINENTAL STYLE CABINET



Dark Piano finished with gold and black styling, overall size 39 in. long, 32 1/2 in. high, 16 in. deep. 2 sliding doors, concealing on the left a black panel 18 1/2 in. x 20 1/2 in. finished in medium mahogany, and on the right a detachable board 12 1/2 in. x 18 1/2 in. and a shelf which may be used for record storage. Cash Price 18 gns., plus 25/- pkg. and carr. H.P. Terms: Deposit 9 gns., 12 monthly payments of 17/6. Credit Terms: Deposit £2/18/-, and 8 monthly payments £2/4/11.

**THE NEW SPENCER WEST BAND THREE CONVERTER** is now available at £6/5/- plus pkg. and post 3/-.  
**SPENCER WEST PATTERN UNIT** 25/- plus 1/- pkg. and post. For elimination of B.B.C. interference or I.T.A.  
**Latest Collaro Record Changer** 4 speed RC456 £10/19/6, plus pkg. and carr. 7/6. Credit terms: Deposit £1/19/6, 8 monthly payments £1/6/3.

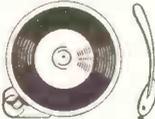


## PREMIER BUREAU DE LUXE

A superb cabinet in finely figured walnut veneer. Interior light sycamore, with rexine matching lining. Overall dimensions: 33 in. high, 34 in. long, 17 1/2 in. deep. Uncut control panel

on right hand side approximately 16 in. x 10 1/2 in., uncut base-board on left hand side 15 1/2 in. long, 13 1/2 in. deep. Two full size left-lined storage cupboards in the lower part of the cabinet. Cash price 16 1/2 gns. H.P. Terms, deposit £8/13/6 and 12 monthly payments of 16/1. Credit Terms, deposit £2/3/10 and 8 monthly payments of £2/2/10. Packing and Carriage 25/- extra.

**B.S.R. T.U.8 3-speed Record Player** £4/12/6 plus 2/6 post and packing.



P.U. complete with arm 36/-.

We carry a comprehensive stock of components by all leading manufacturers.

SEND 2 1/2 d. STAMP FOR OUR NEW 1957 CATALOGUE

## LATEST B.S.R. MONARCH 4-SPEED AUTOCHANGER

Designed to play 12 in., 10 in. and 7 in. Records Inter-mixed in any order at 16, 33 1/3, 45 or 78 r.p.m. Capacity 10 Records. New reversible Dual Stylus Crystal Pick-up, for use on 100/250 v. 50 cycle A.C. mains, £9/15 plus packing and postage 3/-. Deposit 25/- and 8 monthly payments of 25/-



## 4 WATT AMPLIFIER

MAY BE BUILT FOR **£4.10.0** Plus 2/6 Pkg. & Postage  
 Instruction Book 1/- post free.  
 A steel case is now available, complete with engraved panel, for 15/6 extra. The amplifier may be supplied complete for £5/5/- plus pkg. and post 3/6, or fitted in case at £6 plus pkg. and post 3/6. Engraved panel 3/6. Post Free.

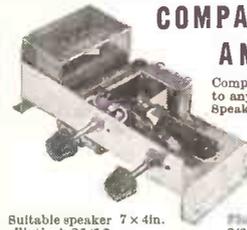


## 2-BAND TRF RECEIVER MAY BE BUILT FOR £5.15.0

plus pkg. & post 3/-

## 3 BAND SUPERHET RECEIVER

MAY BE BUILT FOR **£7.19.6** Plus 3/- Pkg. & Postage  
 These two receivers use the latest type circuitry and are fitted into attractive cabinets 12 in. x 6 1/2 in. x 5 1/2 in. in either walnut or ivory bakelite or wood. Individual instruction books 1/- each, post free.



## COMPACT GRAM AMPLIFIER

Complete ready to connect to any type of Pick-up and Speaker (8 ohms) A.C. Mains 200/250 volts. Volume and tone control fitted with knobs. Overall size 7 1/2 in. long x 3 1/2 in. wide x 2 1/2 in. high. £2 : 19 : 6  
 Suitable speaker 7 x 4 in. elliptical 21/10. 2/6. packing and postage

## THE JASON "ARGONAUT"

MW/FM DESIGN

★ All Premier components are designed & approved  
 All components to build the complete Receiver, including output stage, may be purchased for £15/5/-, or all components less output stage but including Power Supply, for £13/19/6, plus packing and postage 3/6 on each.

T.S.L./Lorenz.		
LP 312-2 Speaker System	£14	19 6
LPH 65 Treble Speaker	£1	19 6
LP 216 Concert Speaker 8 in.	£8	17 10
Concert Soundcorner	£13	18 3

Send for illustrated catalogue on above.

★ IT WILL PAY YOU TO VISIT OUR NEW HI-FI DEMONSTRATION ROOM.



## THE NEW TSL FM TUNER HIGH STABILITY MODEL

6 Valves including Magic Eye and Power Supply using the latest type Gortler permeability Unit complete with first audio stage and preset output volume control. Maximum radiation less than 10 microvolts per metre. Sensitivity better than .5 microvolts. Cash price £17/10/- (inclusive) or on H.P. terms, deposit £8/15/- and 9 monthly payments of £1/1/8. Credit terms, deposit £2/3/9 and 8 monthly payments of £2/3/4. Postage and packing 5/- extra.



Why not make the best!

## MULLARD AMPLIFIER KIT

NOW SUPPLIED WITH ULTRALINEAR OUTPUT TRANSFORMER.

All the components for model 510, PLUS pre-amplifier, on one chassis (total six valves), chassis gold hammer finished. May be purchased for £12/12/- plus pkg. & post 7/6, or pre-amplifier and tone control in a separate unit £14/14/- plus pkg. and post 7/6.

## AM/FM RADIOGRAM CHASSIS OF THE LATEST TYPE

Cash £22/10/-, or credit terms £2/16/3 deposit and 8 monthly payments of £2/15/6. H.P. Terms £11/5/- deposit and 12 monthly payments of £1/0/11. Packing and Carr. 7/6. This chassis has 8 valves and covers short, medium and long FM and Gram. Printed circuit on F.M. ensures a high degree of stability. Overall size 14 in. long, 6 1/2 in. high, 9 in. deep. Dial size 12 x 6 1/2 in.



**WHY BUY SURPLUS OR RE-CONDITIONED TUBES WHEN THESE FULLY GUARANTEED WIDE ANGLE TUBES ARE AVAILABLE? THE LATEST TYPE 17" RECTANGULAR TUBE MW43/64 BY TELEFUNKEN AT £17 (INC. TAX) POST AND PACKING 21/- EXTRA. ALSO 14" RECTANGULAR TUBE TYPE 14 LP4, £13/17/6 (INC. TAX). PKG. & CARR. 15/- EXTRA.**

**TUNING CONDENSERS (Miniature type)** 2-gang .0005 mfd 5/-.

**METER RECTIFIERS** Miniature type with leads 1-5 mA. 5/-, post paid.

## WEYMOUTH MINIATURE COIL PACK

Covering Med./Long/Short Wave Bands. Iron Core Coils Dimens: Ht. 1 1/2 in., length 3 1/2 in., width 2 1/8 in. Price 29/6.

## TERMS OF BUSINESS:

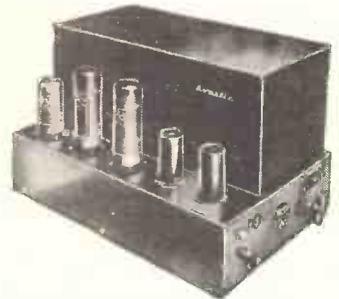
One with order or O.O.D. over £1. Please add 1/- for Post Orders under 10/-, 1/6 under 40/-, Unless otherwise stated.

207 EDGWARE RD., LONDON, W.2

Tel: AMBassador 4033 and PAddington 3271

# FACTS

## about the new *Avantic* DL7-35



This amplifier needs no "sales talk" — the specification speaks for itself

### Announcing the *Avantic* **'GLYNDEBOURNE'**

The DL7-35 with wide range speaker system can be supplied in two superb cabinets finished in natural mahogany at £144.5.0. net. Provision is made for any of the following items which can be fitted as optional extras: 4-speed single or automatic record player; Avantic vhf-fm or mw-am/vhf-fm radio feeder unit; Avantic tape player. The Avantic loudspeaker system comprises a 12" diameter low frequency unit and two 2 1/2" high frequency units. The frequency range of the system is 20—22,500 cps. and the peak power ratings are 40 watts (l.f.) and 10 watts (h.f.).



#### POWER AMPLIFIER

Push-pull distributed load output stage producing an output of 27 watts at 0.1% total distortion.  
Frequency response:  $\pm 1$  dB 1 c/s. to 100 Kc/s.  
Damping factor: 50. Sensitivity: 255 mV. for 27 watts output.  
Hum & noise: -89 dB relative to 20 watts output.  
Output impedances: 4 $\Omega$ , 8 $\Omega$  & 16 $\Omega$  switch selected; automatic feedback adjustment. Built-in volume control and two audio input sockets.

#### PRE-AMPLIFIER CONTROL UNIT

Output: 200 mV. at 0.1% and 2.0V. at 0.2% total distortion.  
Intermodulation distortion: power & pre-amplifier combined: 1% for 20 watts output.  
Noise: -64 dB on radio or tape inputs; -53 to -56 dB on pick-up inputs.  
Radio power outlet: 6.3V. 2.5A., 440V 30 mA. Tape recorder outlet, 8-inputs: Tuner (2 levels) Pick-up (3 levels) Tape & Auxillaries (2 levels).  
Controls: 8 position selector switch incorporating 5 record play-back characteristics.  
Loudness control providing compensation for low level reproduction of high level inputs in accordance with Fletcher-Munson loudness curves.  
Bass Control: -15 dB at 30 c/s. to +16 dB at 50 c/s.  
Treble control: -15 dB to +15 dB at 10 Kc/s.  
Low-pass filter: 3-positions: 20, 10 & 5 Kc/s. Slope: 12 dB/octave.  
Rumble filter: 40 c/s. turnover frequency. Slope: 12 dB/octave.  
Monitor/Record switch: 3 positions.  
Price: Power amplifier and pre-amplifier control unit complete £55.

Please send me illustrated leaflets on the DL7-35 and 'Glyndebourne'; also the name of my nearest Avantic dealer.

NAME .....

ADDRESS .....

.....

.....

..... W.1

# *Avantic*

HIGH FIDELITY REPRODUCERS  
MANUFACTURED BY  
*Beam-Echo Limited*

Witham, Essex.  
Telephone: Witham 3184. Telegrams: Parion Witham

# Wireless World

ELECTRONICS, RADIO, TELEVISION

Managing Editor : HUGH S. POCKOCK, M.I.E.E.

Editor : F. L. DEVEREUX, B.Sc.

Editorial Consultant : H. F. SMITH

JUNE 1957

## ***In This Issue***

- 253 Editorial Comment  
254 High Definition on 405 Lines  
256 World of Wireless  
258 Personalities  
259 Audio Fair, 1957  
262 Television Interference from Sea Reflections  
*By J. K. S. Jowett*  
266 Wideband Communications Systems  
267 Components Exhibition  
273 Letters to the Editor  
275 Limiters and Discriminators for F.M. Receivers—4  
*By G. G. Johnstone*  
281 Manufacturers' Products  
282 Valves and Semi-Conductors  
283 C.R. Tubes and Photoelectric Devices  
284 Short-wave Conditions  
285 The Blocking Oscillator *By "Cathode Ray"*  
290 Limiting Factors in Gramophone Reproduction—2  
*By D. A. Barlow*  
295 Technical Notebook  
297 National Gramophone Conference  
298 News from the Industry  
300 Random Radiations *By "Diallist"*  
302 Unbiased *By "Free Grid"*

VOLUME 63 No. 6

PRICE: TWO SHILLINGS

FORTY-SEVENTH YEAR  
OF PUBLICATION



Offices: Dorset House,  
Stamford Street, London,  
S.E.1

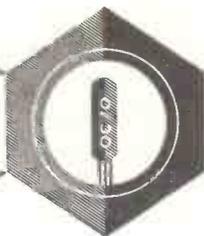
Please address to Editor,  
Advertisement Manager or  
Publisher, as appropriate.

Telephone :  
WATERloo 3333 (60 lines)

Telegraphic Address :  
"Ethaworld, Sedist, London".

PUBLISHED MONTHLY (4th Tuesday of preceding month) by ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1. Telephone: Waterloo 3333 (60 lines). Telegrams: "Iliffepres, Sedist, London." Annual Subscription: Home and Overseas, £1 12s. 6d. U.S.A. and Canada \$5.00. BRANCH OFFICES: BIRMINGHAM: King Edward House, New Street, 2. Telephone: Midland 7191. COVENTRY: 8-10, Corporation Street. Telephone: Coventry 5210. GLASGOW: 26B Renfield Street, C.2. Telephone: Central 1285. MANCHESTER: 260, Deansgate, 8. Telephone: Blackfriars 4412. OVERSEAS OFFICES: U.S.A.: 111, Broadway New York, 6, N.Y. Telephone: Digby 9-1197. CANADA: 67, Yonge Street, Toronto, 1, Ontario. Telephone: Empire 6-0873.

# Transistor



# Class B Push-Pull Output Stages

Symmetrical or single-ended Class B push-pull stages are generally used in transistor receivers and similar portable equipment because of their battery economy. At first sight it appears that the symmetrical circuit is superior, but on closer examination it is found that the single-ended arrangement is often preferable.

Comparison of the two circuits shows that the single-ended circuit in Fig. 2 can be derived from the symmetrical one in Fig. 1 by splitting it into two parts along the line of symmetry—after duplicating the battery and bias potentiometer—and then combining the halves so that the loads coincide and the batteries appear to be in series. The decoupling capacitor C prevents feedback from collector to base of Tr2 via the bias potentiometer.

The circuits of Fig. 1 and Fig. 2 are then exactly equivalent: each transistor still operates at the same voltage, the same quiescent current, and handles alternate half-cycles. The drive and peak collector currents are the same but the battery must have twice the voltage and about half the ampere-hour capacity for the same life. Therefore essentially a single-ended circuit working from 9 + 9V will behave in exactly the same way as a symmetrical circuit working from 9V—it will have the same currents, drive, distortion, stability and battery consumption for the same output.

A single-ended circuit working from 9V total will behave like a 4.5V symmetrical circuit and this, assuming equal electrical output from the transistors, will differ from the 9V symmetrical circuit in the following respects: The peak and mean collector currents, in the 4.5V symmetrical circuit, will be 2 times greater, the drive power requirements will be nearly 4 times greater and also the distortion (due to  $a'$  curvature) will be greater. However, the thermal stability will be easier to achieve, the load impedance will be  $\frac{1}{2}$  of the total load of the 9V symmetrical circuit and the battery consumption will be approximately the same.

So that except for the disadvantages of lower stability and higher load impedance the symmetrical circuit is preferable for obtaining a given electrical output with a given total battery voltage.

If the load is a loudspeaker the comparisons given above are valid only if a very efficient transformer is used in the symmetrical circuit. Two causes of reduced output must otherwise be considered—either the halved acoustic efficiency of a centre-tapped speaker, or the power loss in a practical transformer.

Normally, no transformer is needed in the single-ended circuit, so that no loss arises from that cause. Therefore, to obtain the same acoustic output from the symmetrical circuit, twice the electrical output is required when either a tapped speaker is used, or when the transformer used has an efficiency of 50%. This is a likely figure only for miniature trans-

formers. The use of a more efficient transformer is considered later.

Comparison of the two circuits for operation at the same battery voltage and equal sound output shows that the single-ended circuit is preferable because of battery power economy, lower transistor dissipation, ease of winding the speaker coil and of stabilisation.

The maximum acoustic output obtainable, which is limited by transistor dissipation, is twice as great. The only disadvantages are that an extra electrolytic capacitor (about 4 $\mu$ F)\*, 3 extra resistors R1', R2' and R1a, and a tap on the battery (or twin batteries) are required.

The advantages and disadvantages of the two versions are much more evenly balanced if an output transformer or tapped choke with an efficiency much exceeding 50% is used in the symmetrical circuit. However, this method is more expensive.

The main characteristics of the single-ended and symmetrical

push-pull circuits may be summarised as follows:

1. The single-ended Class B push-pull circuit is exactly equivalent to a symmetrical circuit with half the total battery voltage.
2. When a given electrical output is required from the transistors with a fixed total battery voltage, the symmetrical circuit is preferable on the grounds of lower drive and lower distortion, although the single-ended circuit scores on ease of stabilisation and more convenient impedance matching for direct speaker loading.
3. However, when the inefficiency of tapped speakers or the losses in a 50% efficient small output transformer are considered, the single-ended circuit is seen to be preferable. As speakers can readily be wound to the impedance required, the speaker and transformer losses are avoided and the electrical power required for equal sound output is only about half. Under these circumstances the single-ended circuit gives almost a 50% battery saving, is comparable in sensitivity and distortion and much easier to stabilise thermally. The maximum sound output obtainable with a directly-fed speaker is twice that of the symmetrical circuit.
4. When using a transformer or choke with an efficiency considerably greater than 50% in the symmetrical circuit, the results obtained lie between those of (2) and (3). The advantages of the two circuits then tend to balance. Whereas the single-ended circuit is cheaper and shows some battery saving, the symmetrical circuit is intrinsically more sensitive and gives less distortion at large signals. Its greater sensitivity may however be largely

offset by the effect of the extra stabilisation it requires. \*When a small measure of negative feedback in the output stage is acceptable, this capacitor can be omitted. The top end of R1' must then be connected to point X instead of to the battery tap.

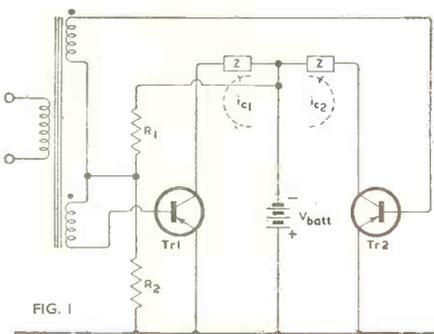


FIG. 1

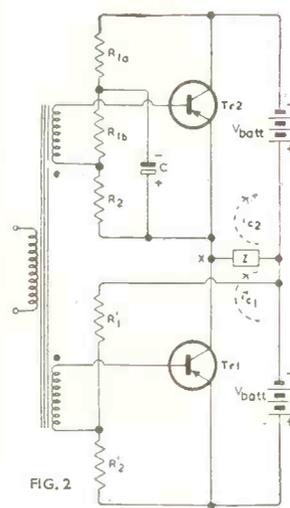
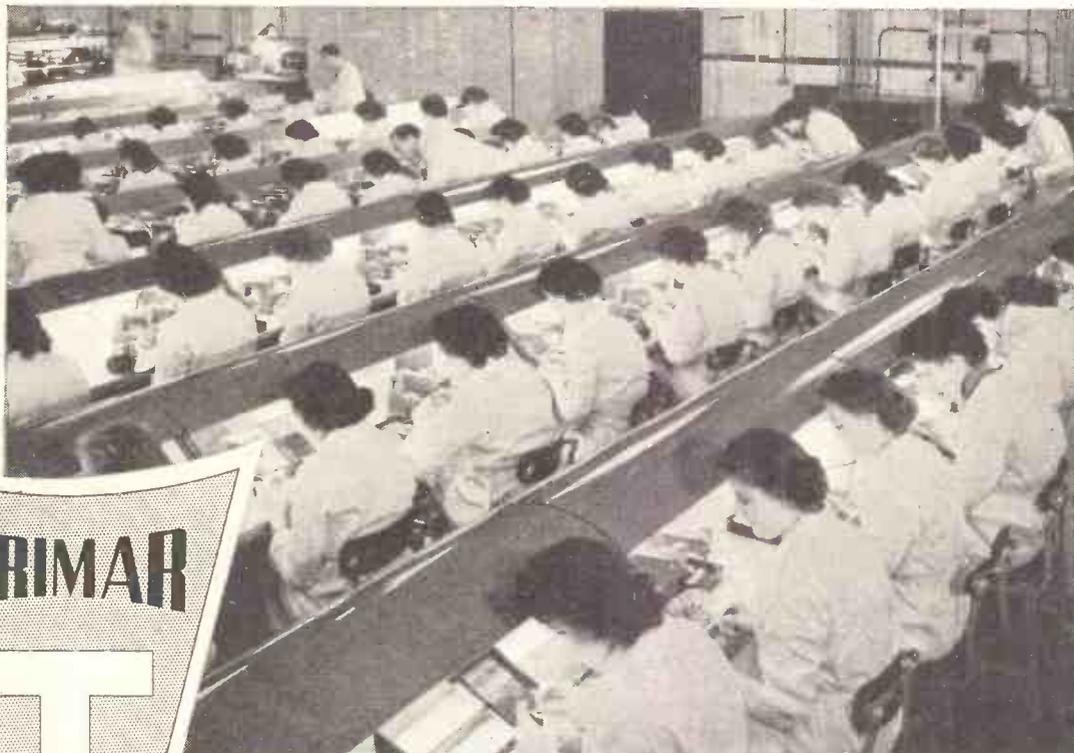


FIG. 2





the **TRUSTWORTHY** safeguard

for  
*Communications  
and Industry*

The special Trustworthy quality valves have been designed to give maximum efficiency with reliability—most valuable in equipment required to operate for lengthy periods unattended. Primarily established to meet Service requirements, the Trustworthy techniques, including shock and vibration tests, have been extended to include many commercial types. The accompanying table shows the range of industrial "T" valves. These can also be supplied with flying lead, or flying lead valve assemblies for chassis mounting, the information on which can be obtained on application.

Most types are available within a reasonable period. In many instances additional types can be made available for special applications.

INDUSTRIAL  RANGE			
 Code	Equivalent Commercial Type Code	Function	Base
5726	6AL5	Double Diode Short Bulb	B7G
6058	6AL5	Double Diode	B7G
6516	6AM5	Power Pentode	B7G
6064	6AM6/8D3	High Slope R.F. Pentode	B7G
6066	6AT6	Double Diode Triode	B7G
5749	6BA6	Vari Mu R.F. Pentode	B7G
5750	6BE6	Heptode Mixer	B7G
6059	6BR7	Low Noise A.F. Pentode	B9A
6061	6BW6	Output Beam Tetrode	B9A
6132	6CH6	Video Output Pentode	B9A
6100	6C4	Triode Amplifier	B7G
6180	6SN7GT	Low Mu Double Triode	Octal
6063	6X4	Full Wave Rectifier	B7G
6065	9D6	Vari Mu R.F. Pentode	B7G
6060	12AT7	High Slope Double Triode	B9A
6057	12AU7	Low Mu Double Triode	B9A
6057	12AX7	High Mu Double Triode	B9A
6158	13D3	Special Purpose Double Triode	B9A
6062	5763	V.H.F. Beam Tetrode	B9A
6157	R17	Half Wave Rectifier	B9A
6443	R18	Half Wave Rectifier	B9A
6L6GA	6L6GA	Output Beam Tetrode	Octal
25L6GT	25L6GT	Output Beam Tetrode	Octal
6042	25SN7GT	Low Mu Double Triode	Octal
50C5	50C5	Output Beam Tetrode	B7G



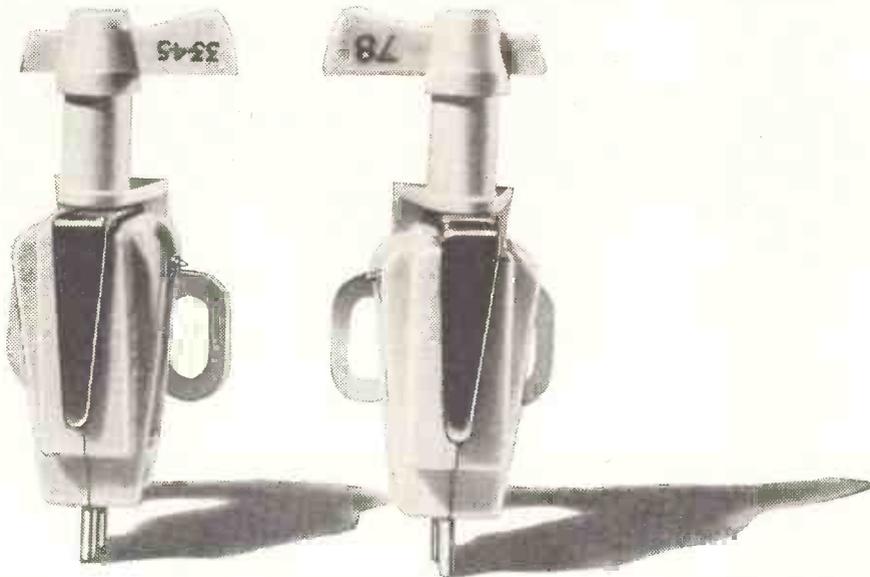
**Standard Telephones and Cables Limited**

Regd. Office : Connaught House, 63, Aldwych, London, W.C.2

FOOTSCRAY · SIDCUP · KENT · FOOTscray 3333

'My output is astonishingly high'

'Yes, but my range is amazingly wide'



On the left is Acos Cartridge Type 65-3. Its output is as high as 1.0V\* (but its compliance is very good, for all that). On the right is Cartridge 65-1, whose frequency range extends to 12 kc/s. This one is particularly hi-fi, hi-g, high-quality (but its output is 0.15 V\*, for all that). Both have x500 individually tested styli, in slip-in fittings. The length and breadth of the matter is that you'll not find a range of cartridges better than this Acos Series 65.

\* At 1 cm/sec velocity, 1,000 c/s.

• **acos** •

**ARE DOING THINGS IN STYLI**

## "BELLING-LEE" NOTES

We have just got back to the office after a very tiring few days at the R.E.C.M.F. exhibition. We showed only components this year, and confined our aerial activities to a few photographs. Nevertheless we had a tremendous number of enquiries from visitors as to how they could improve their band III reception. Now all the visitors were technical people, therefore it is a constant source of surprise how little the non-specialist knows about the subject. It is certainly easier to discuss reception problems with engineers, they quickly grasp the various points, and presumably they will be remembered.

The most frequent mistake is to expect comparable results from the higher frequency transmissions without making any extra effort. For example, a man has enjoyed a very good B.B.C. picture with a loft aerial, why cannot he get a comparable I.T.A. picture? Questions bring out that although he is only fifteen miles from Croydon, he has a fair sized hill close to him, and between him and the transmitter, and he has been using a band III three element array also fixed in the loft. In a recent issue we emphasised that fringe area conditions are not necessarily a function of distance, but of weak signal. This man was recommended to try fixing a three element out-of-doors, which would probably give him 1½ to 2 dB improvement, but he was told he might have to resort to an out-of-doors six element array to give him an I.T.V. picture of real entertainment value.

It was pointed out that the gain of any array was proportional to its size, and that the higher the frequency the smaller the aerial, calling for an increased number of element compensation. Further, valves are not so efficient on the higher frequencies and receiver in general, although greatly improved, had not quite the gain on band III as on band I, comparable troubles accrued at the transmitter and at the transmitting aerial, and to make matters worse, whereas a band I signal tended to bend down over a hill, a band III signal tended to go over and away, leaving a far more pronounced shadow. Those shadow areas were not necessarily devoid of any signal, but they must be classed as fringe areas, and in some cases

a worthwhile signal will be obtained only at considerable expense because big aerials are costly, and so is specialised knowledge.

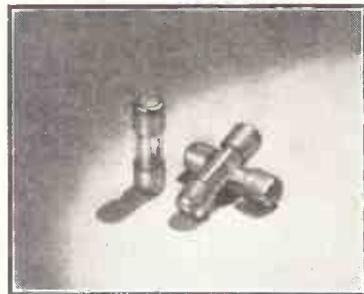
"Belling-Lee" do not try to compete with dealers, and specialist aerial riggers, but we do maintain one or two aerial teams for what we call "V.I.P." jobs, where cost is unimportant and results all-important. There is no record of our men failing to get results. This may read like exaggeration, but it is true. Invariably there is a signal, but the ordinary viewer is not prepared to pay the price. In locations a long way from a transmitter, it is sometimes found that a transmitter other than the nearest comes in best.

In this electronic age, it is becoming increasingly difficult to find the right kind of man to fill a particular post. For example, we require a copywriter in our advertising department. In our normal advertising for staff, we receive replies from writers who have little or no technical knowledge, and from technicians whose knowledge of the English language is inadequate. If any regular reader of the "Wireless World," with a G.C.E. pass in English and a flair for writing, and who would like to take it up, will please get in touch with us, we will arrange an interview. We will make a copywriter out of him, and we will guarantee him an interesting time. Most "Wireless World" readers know our interests are very wide, our products are used extensively by the Services in aircraft, ships and fighting vehicles of all kinds, navigational aids, communications and radar, in instrumentation for nuclear physics and electronic computers to mention only a few applications.



Advertisement of  
**BELLING & LEE LTD.**  
 Great Cambridge Rd., Enfield, Middx.  
 Written 24th April, 1957

## "BELLING-LEE" FUSE-LINKS

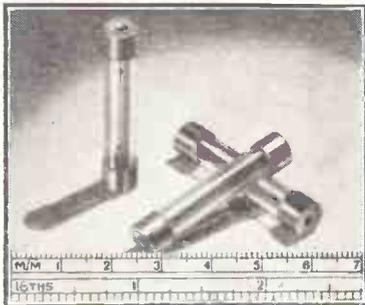


### MINIATURE (GLASS)

**L.562** ( $\frac{5}{8}$  in.  $\times$   $\frac{3}{16}$  in.)

**50mA to 7A**

Designed to blow within  $\frac{1}{2}$  second on 100% overload. The glass body is colour coded and the rating is coded on the nickel-plated caps.

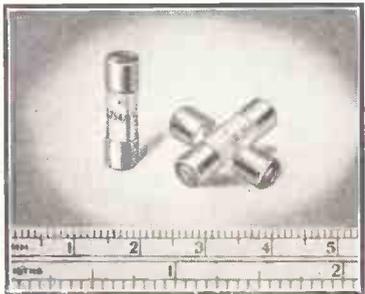


### "MAG-NICKEL" delay fuse (glass)

**L.338** ( $1\frac{1}{4}$  in.  $\times$   $\frac{1}{8}$  in.)

**250, 500 & 750mA colour coded**

Conform to the dimensions and blowing requirements of our standard L.1055 and can withstand a surge current of 10 to 30 times their rated current for a period not exceeding 0.01 second.



### "MINIFUSE" miniature (ceramic)

**L.754** ( $\frac{5}{8}$  in.  $\times$   $\frac{3}{16}$  in.)

**10, 15 & 25mA**

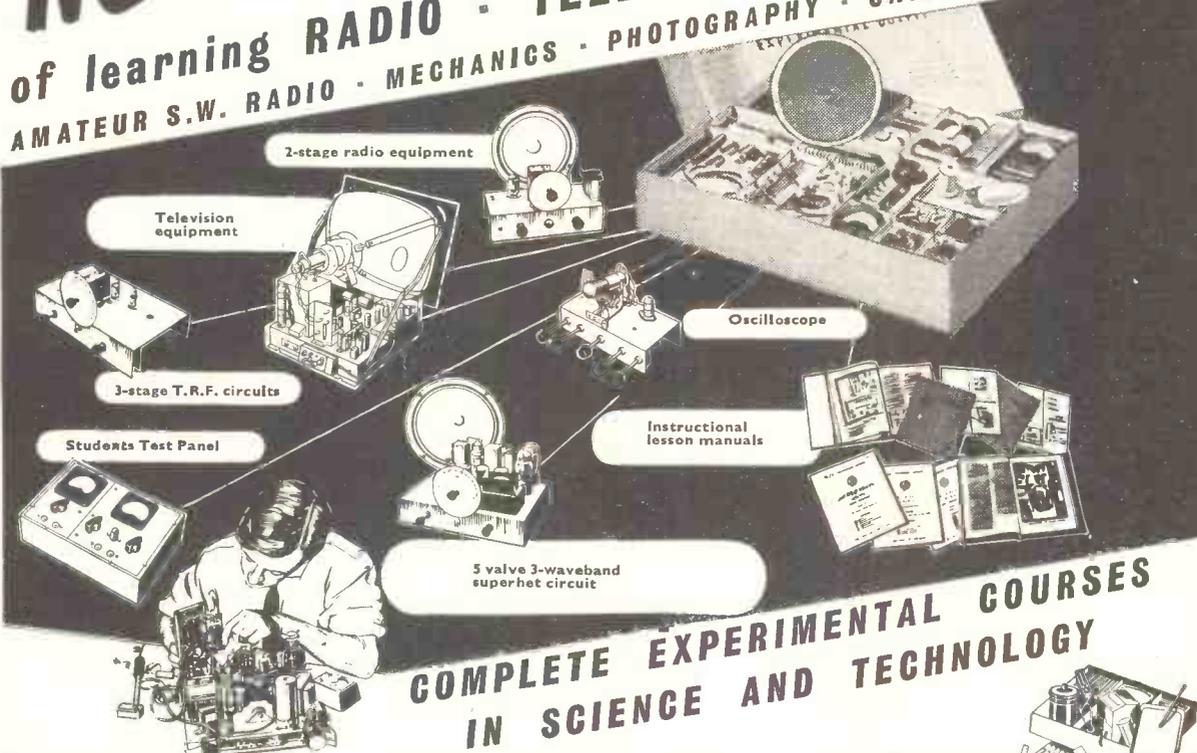
Primarily designed for the protection of small meters, test and laboratory gear, etc., "Minifuses" are designed to carry their rated current indefinitely and blow within 0.01 sec. at  $3\frac{1}{2}$  times their rated current.

**BELLING & LEE LTD**  
 GREAT CAMBRIDGE RD., ENFIELD, MIDD., ENGLAND

Telephone: Enfield 3322 Telegrams: Radiobel, Enfield

# NEW! — THE PRACTICAL WAY

of learning **RADIO · TELEVISION · ELECTRONICS**  
**AMATEUR S.W. RADIO · MECHANICS · PHOTOGRAPHY · CARPENTRY etc. etc.**



## COMPLETE EXPERIMENTAL COURSES IN SCIENCE AND TECHNOLOGY

**NEW** — completely up-to-date methods of giving instruction in a wide range of technical subjects specially designed and arranged for self-study at home under the skilled guidance of our teaching staff.

**NEW** experimental outfits and lesson manuals are despatched on enrolment and remain the student's property. A tutor is allotted to each student for personal and individual tuition throughout the course.

In the case of radio and television, specially prepared components are supplied which teach the basic electronic circuits (amplifiers, oscillators, detectors, etc.) and lead, by easy stages, to the complete design and servicing of modern commercial radio and television receivers.

If you are studying for an examination, wanting a new hobby or interest, commencing a career in industry or running your own full-time or part-time business, these practical courses are ideal and may be yours for moderate cost. Send off the coupon to-day for a free Brochure giving full details. There is no obligation whatsoever.

**The only Home Study College  
run by a World-wide  
industrial organisation**

E.M.I.  
Factories at  
Hayes.

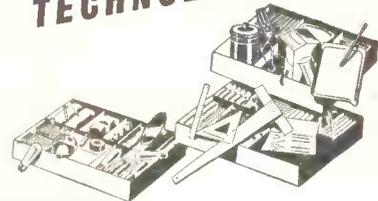


# EMI INSTITUTES

— Part of "His Master's Voice," Marconiphone, etc. etc.

### SUBJECTS INCLUDE:-

- RADIO · SHORT WAVE RADIO**
- TELEVISION · MECHANICS · CHEMISTRY**
- PHOTOGRAPHY · ELECTRICITY · WOODWORK**
- ELECTRICAL WIRING · DRAUGHTSMANSHIP**
- ART, etc.**



**COURSES FROM 15/-  
PER MONTH**

FILL IN COUPON  
FOR  
**FREE**  
PROSPECTUS



E.M.I. INSTITUTES, Dept. 127x, London, W.4

NAME \_\_\_\_\_ Age \_\_\_\_\_  
 (if under 21)

ADDRESS \_\_\_\_\_

I am interested in the following subject(s) with/without equipment

BLOCK  
CAPS  
PLEASE

JUNE

We shall not worry you with personal visits

ICS

# Cossor Kits

In laying down their programme for the design and production of a range of apparatus in Kit Form, Cossor Instruments Limited have chosen as their "opening pair" two most valuable items of test gear; a VALVE VOLTMETER and a single-beam cathode-ray OSCILLOSCOPE.

PRINTED CIRCUITS are utilised for built-in stability and reliability for both of these instruments. Bearing in mind the highly satisfactory specification cost ratio of these instruments and being aware of the instructional value in building them, the Laboratory or Service Department Engineer will certainly place them high on his list of essential purchases.

## Model 1044K Valve Voltmeter Kit

### Brief Specification

**D.C. Voltmeter** 7 ranges: 1.5V — 1,500V Full Scale.

**A.C. Voltmeter** 7 r.m.s. ranges: 1.5V-1,500V Full Scale  
7 peak-to-peak ranges: 4V-4,000V Full Scale

**Ohmmeter** 7 ranges: Allowing resistance measurement from 0.1 ohm — 1,000 megohms.

### Dimensions

Height: 9½ in. (24 cm.)

Width: 5 in. (12.7 cm.)

Depth: 4¾ in. (12 cm.)

Weight: 4½ lb. (2 kg.)

**LIST PRICE £20**

**HIRE PURCHASE TERMS AVAILABLE**

*Please write for fully descriptive leaflets*



# COSSOR INSTRUMENTS LIMITED

*The Instrument Company of the Cossor Group*

COSSOR HOUSE

HIGHBURY GROVE

LONDON, N.5

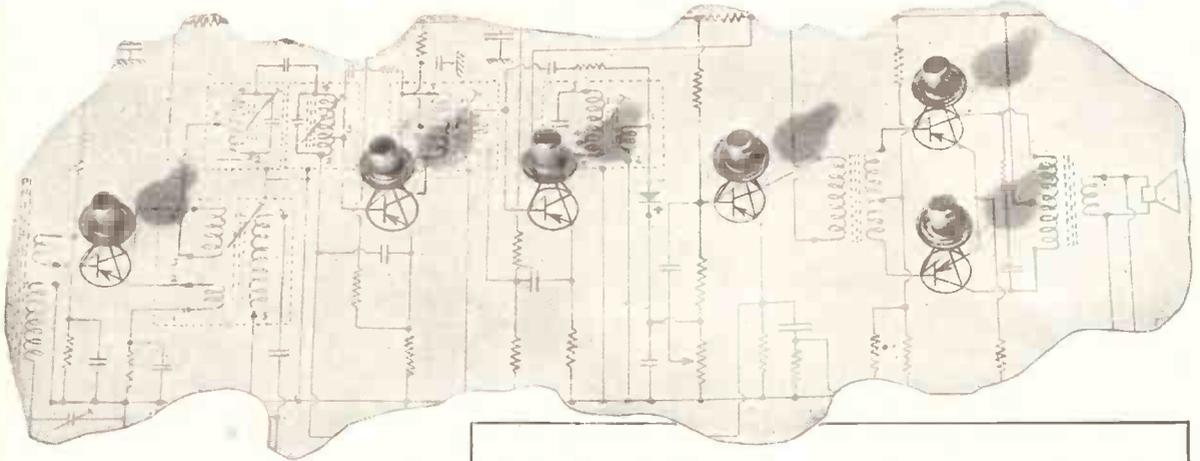
Telephone: CANonbury 1234 (33 lines)

Telegrams: Cossor, Norphone, London

Cables: Cossor, London

# A Complete range of TRANSISTORS

for radio and electronic applications



The welded metal-to-metal containers ensure hermetic sealing against moisture penetration even under conditions of high humidity at elevated temperatures.

A full range of Ediswan Transistors is now available for immediate delivery. Characteristic curves and data will be supplied on application.

TYPE	APPLICATION	CHARACTERISTICS
	Frequency Changer/Oscillator	Average cut-off frequency 8 Mc/s.
	I.F. Amplifier	Average cut-off frequency 5 Mc/s.
	L.F. Stage	Average current gain 30. Noise factor * (common emitter) 6db.
	L.F. Stage	Average current gain 66. Noise factor * (common emitter) 6db. * $f = 1000$ c/s, source impedance = $500\Omega$ $V_c = -2V$ , $I_c = -0.5mA$ .
	† Output Stage	Maximum collector dissipation (absolute) $115mW$ at $35^\circ C$ ambient. Maximum junction temperature (absolute) $70^\circ C$ . Thermal resistance in free air $0.3^\circ C/mW$ . Thermal resistance with appropriate heat sink $0.21^\circ C/mW$ .

† The XC101 is also available in matched pairs for push-pull output.

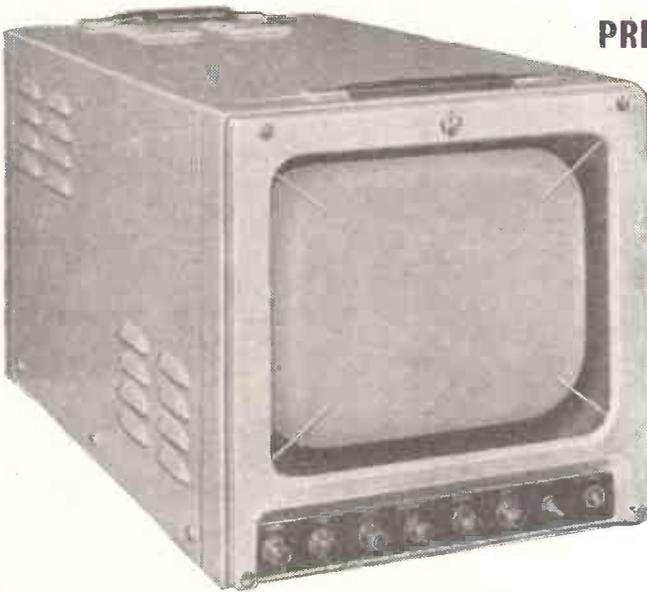
RV.35a

# EDISWAN

## MAZDA

### VALVE & CRT DIVISION

THE EDISON SWAN ELECTRIC CO. LTD. 155 Charing Cross Road, London, W.C.2 and Branches  
Telephone: GERrard 8660 An A.E.I. Company Telegrams: Ediswan, Westcent, London



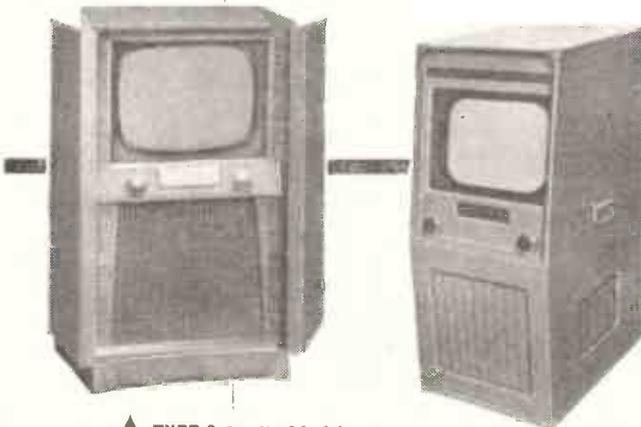
**PRECISION PICTURE MONITOR TYPE 1A**

**SPECIAL FEATURES**

- Scanning linearity within 1%
- For 405, 525 & 625 line systems
- Switch selection of Black Level Clamp or D.C. Restorer
- Will terminate or bridge a line and can be used with separate syncs.
- Video Amplifier Frequency Response: Flat to 6Mc/s  $\pm 0.5$ db.
- Will operate on low signal/noise ratios

**TELEVISION PICTURE MONITORS**

**PICTURE MONITORS TYPE 2, 2A & 2B**



These Monitors will give sound and vision outputs from any combination of R.F. and Line inputs. A 1-volt p-p. composite video waveform output is obtainable from an R.F. input. The video amplifier can be used to boost line signals.

The C.R.T. is operated at 16kV and gives 60 ft. lamberts on peak white modulation. Electrostatic focusing gives excellent resolution over the whole picture. Scan Non-Linearity < 3%. Type 2 has 17" presentation, Type 2A 14" and Type 2B 21".

**TYPE 2A**

An outside broadcast unit with weather proofed cabinet

▲ TYPE 2 Studio Model

For full particulars contact:—

**E.M.I. Electronics Ltd**

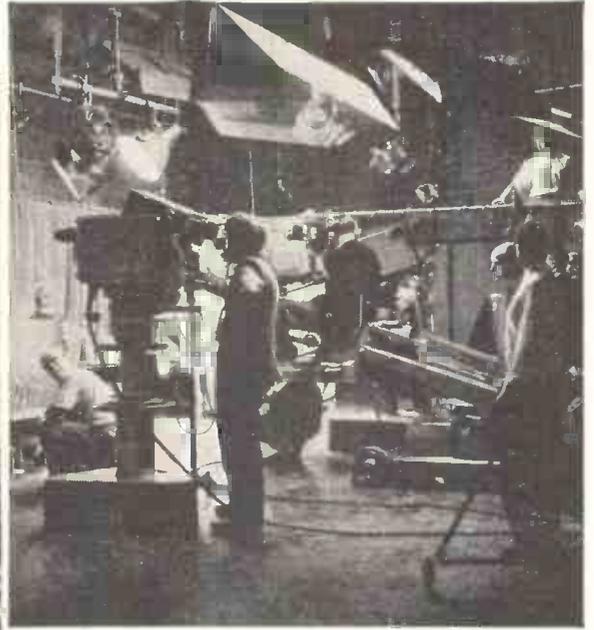
Instrument Division (Dept: 18F), Hayes, Middx., England. Tel: SOUthall 2468. Ext. 1071 & 1013



EE90

G

# From script to screen



## through Marconi's experienced hands

Every item of equipment which transforms a sound or television programme from a conception in the author's and producer's minds to what is ultimately audible and visible on the monitor can be provided by Marconi's. Whether it be for a studio or O.B. vehicle, Marconi's not only make it, they will install it (including constructing the building or vehicle to house it), maintain it, operate it (or train operators in its use) and completely co-ordinate it with the whole system of which it forms a part.



*75% of the world's broadcasting authorities rely on Marconi equipment. Marconi Television equipment is installed at all B.B.C. and I.T.A. Television Stations.*



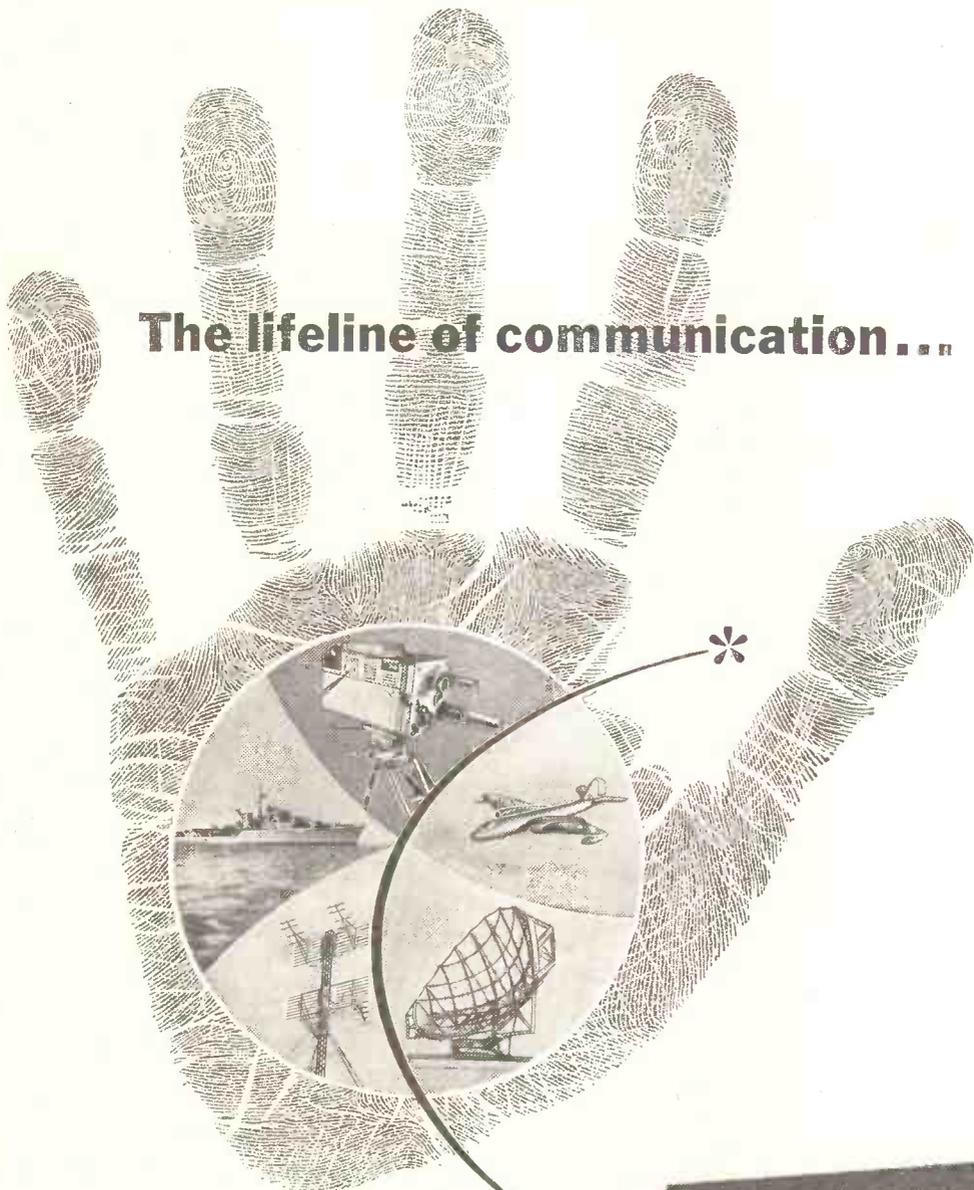
Lifeline of Communication

# MARCONI

## Complete Sound and Television Broadcasting Systems

MARCONI'S WIRELESS TELEGRAPH COMPANY LIMITED, CHELMSFORD, ESSEX

L88



**The lifeline of communication...**

- More than forty civil airlines and twenty air forces fit Marconi air radio equipment. Airports all over the world rely on Marconi ground installations • The services have entrusted radar defence networks, both at home and overseas, to Marconi's • 75% of the countries in the world operate Marconi Broadcasting or Television equipment • 80 countries have Marconi equipped radio telegraph and communications systems • All the radio approach and marker beacons round the coasts of Britain have been supplied by Marconi's.

**SYSTEM PLANNERS,  
ELECTRONIC ENGINEERS,  
DESIGNERS AND MANUFACTURERS  
OF AERONAUTICAL, BROADCASTING,  
COMMUNICATION AND MARITIME  
RADIO EQUIPMENT,  
TELEVISION EQUIPMENT,  
RADAR AND NAVIGATIONAL AIDS**

**MARCONI**

*on land, at sea and in the air*

# Wanted!

**QUALIFIED MEN AND WOMEN**

Industry & Commerce offer their best posts to those with the necessary qualifications—such posts that will bring personal satisfaction, happiness, good money and security. As part of a modern industrial organisation, we have skilled knowledge of what is required in industry to-day and the best means of training personnel for its present day and future requirements. We specialise also in teaching for hobbies, new interests or part-time occupations in any of the subjects listed below. Make your own choice and write to us to-day for further information. There is no obligation of any kind.

**PERSONAL & INDIVIDUAL TRAINING IN —**

- |                                       |                            |                              |                     |
|---------------------------------------|----------------------------|------------------------------|---------------------|
| Accountancy                           | Customs Officer            | Languages                    | Refrigeration       |
| Advertising                           | Draughtsmanship            | Management                   | Sales Management    |
| Aeronautical Eng.                     | Economics                  | Maintenance Eng.             | Sanitary            |
| A.R.B. Licences                       | Electrical Eng.            | Mathematics                  | Engineering         |
| Art (Fashion, Illustrating, Humorous) | Electrical Installations   | M.C.A. Licences              | Salesmanship        |
| Automobile Eng.                       | Electronics                | Mechanical Eng.              | Secretaryship       |
| Banking                               | Electronic                 | Metallurgy                   | Shorthand & Typing  |
| Book-keeping                          | Draughtsmanship            | Motor Eng.                   | Short Story Writing |
| Building                              | Eng. Drawing               | Painting & Decorating        | Short Wave Radio    |
| Business                              | Export                     | Police                       | Sound Recording     |
| Management                            | Heating & Ventilation Eng. | P.M.G. Certs.                | & Reproduction      |
| Carpentry                             | High Speed                 | Production Eng.              | Telecommunications  |
| Chemistry                             | Oil Engines                | Production                   | Television          |
| City & Guilds Exams                   | Industrial Admin.          | Planning                     | Time & Motion Study |
| Civil Service                         | Jig & Tool Design          | Radar                        | Tracing             |
| Commercial Subjects                   | Journalism                 | Radio Amateurs (C&G) Licence | Welding             |
| Commercial Art & Drawing              |                            | Radio & Television Servicing | Workshop Practice   |

Also courses for GENERAL CERTIFICATE OF EDUCATION, A.M.I.H.&V.E., A.M.S.E., A.M.Brit.I.R.E., A.M.I.Mech.E., A.M.I.E.D., A.M.I.M.I., A.F.R.Ae.S., A.M.I.P.E., A.M.I.I.A., A.C.C.A., A.C.I.S., A.C.C.S., A.C.W.A., City & Guilds Examinations, R.T.E.B. Serv.Cert., R.S.A. Certificates, etc.



*The only Home Study College operated by a world-wide manufacturing organisation*

# EMI INSTITUTES

**NEW! Courses with PRACTICAL EQUIPMENT in RADIO · TELEVISION · MECHANICS**

**CHEMISTRY · ELECTRICITY · DRAUGHTSMANSHIP PHOTOGRAPHY, etc., etc.**

**COURSES FROM 15/- PER MONTH**

**POST THIS TODAY**

Please send, without obligation, your FREE brochure, E.M.I. INSTITUTES, Dept. 127K, London, W.4.

NAME \_\_\_\_\_ AGE \_\_\_\_\_  
(if under 21)

ADDRESS \_\_\_\_\_

I am interested in the following subject(s) with/without equipment

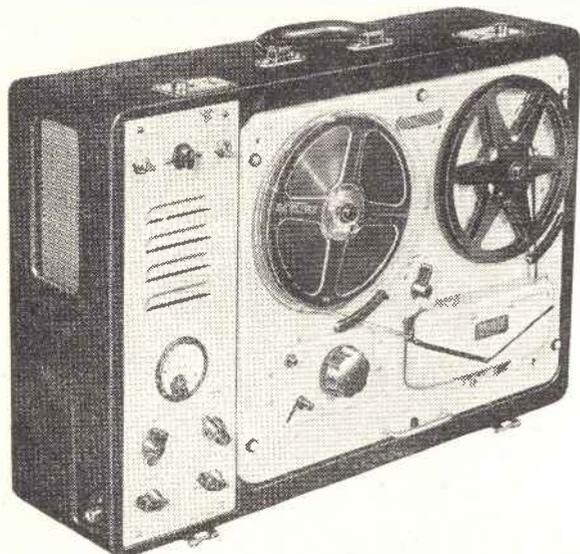
JUNE \_\_\_\_\_ (We shall not worry you with personal visits) \_\_\_\_\_ IC92



BLOCK CAPS PLEASE

*-Part of "His Master's Voice", Marconiphone, etc., etc.*

# Vortexion



The above recorder uses a synchronous capstan motor and for use on 12 volt car battery a 50 c/s  $\pm 1$  cycle 230 v., 120 w. power supply unit is available.

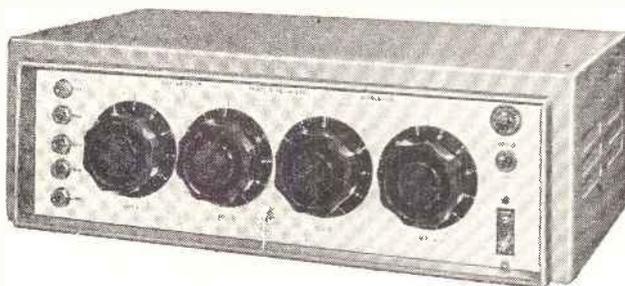
**T.R.G.10 MINIATURE AMPLIFIER AND VERSATILE PRE-AMPLIFIER.** A modern miniature amplifier, measuring only  $4\frac{1}{2}$  x 5 in. over front panel and projecting  $10\frac{1}{2}$  in. to the rear. Uses C core transformer material to obtain low external magnetic field and has less than 0.1% harmonic distortion at 10 watts output. The amplifier response is level 15 c/s. to 50,000 c/s. within 0.2 db. The 3-valve pre-amplifier will operate direct from recorder heads with correction networks for difficult tape speeds and switched inputs are provided for radio, microphone and gram. with correction for all recording characteristics.

**"SUPER FIFTY WATT" AMPLIFIER.** This heavy duty amplifier is available for long life under arduous conditions. The normal life being 5,000 hours without valve change.

## FOUR CHANNEL ELECTRONIC MIXER

An Electronic Mixer for four 30-50 $\Omega$  balanced line microphones or special to order. Normal output 0.5 v. on 20,000 $\Omega$  but 1 mV., 600 $\Omega$  balanced or unbalanced is available as an alternative.

The 3-CHANNEL MIXER and PEAK PROGRAMME METER is similar to the above but is fitted with a meter reading peak signals with 1 second decay time and calibrated in db's from zero level 1 mV., 600 $\Omega$  to +12 and -20 balanced or unbalanced output by means of switch.



*Full details and prices of the above on request*

**VORTEXION LIMITED, 257-263, The Broadway, Wimbledon, London, S.W.19**

Telephones: LIBerty 2814 and 6242-3

Telegrams: "Vortexion, Wimble, London."

## TAPE RECORDERS and AMPLIFIERS

★ The total hum and noise at  $7\frac{1}{2}$  inches per second 50-12,000 c.p.s. unweighted is better than 50 db's.

★ The meter fitted for reading signal level will also read bias voltage to enable a level response to be obtained under all circumstances. A control is provided for bias adjustment to compensate low mains or ageing valves.

★ A lower bias lifts the treble response and increases distortion. A high bias attenuates the treble and reduces distortion. The normal setting is inscribed for each instrument.

★ The distortion of the recording amplifier under recording conditions is too low to be accurately measured and is negligible.

★ A heavy mu-metal shielded microphone transformer is built in for 15-30 ohms balanced and screened line, and requires only 7 micro-volts approximately to fully load. This is equivalent to 20ft. from a ribbon microphone and the cable may be extended 440 yds. without appreciable loss.

★ The 0.5 megohm input is fully loaded by 18 millivolts and is suitable for crystal P.U.s, microphone or radio inputs.

★ A power plug is provided for a radio feeder unit, etc. Variable bass and treble controls are fitted for control of the play back signal.

★ The power output is 4 watts heavily damped by negative feedback and an oval internal speaker is built in for monitoring purposes.

★ The play back amplifier may be used as a microphone or gramophone amplifier separately or whilst recording is being made.

★ The unit may be left running on record or play back, even with 1,750 ft. reels, with the lid closed.

**CP20A AMPLIFIER.** This standard amplifier for extreme tropical use will operate from 230 v. A.C. mains or 12 v. car battery and give 15 w. output for a consumption of 5.5a. Inputs for 30 $\Omega$  balanced microphones, M.I. P.U. and Cr. P.U.

# Train for a wonderful future in ELECTRONICS...

## ...with E.M.I.

Every day the demand for the expert in electronics grows. Radio, television, radar and the whole field of industrial automation are rapidly expanding and the trained specialist assures for himself a well-paid career in this quickly developing profession. Here is your opportunity to enter for:

### 3 YEAR COURSE

**TELECOMMUNICATIONS**—Entrance standard G.C.E. Ordinary level or equivalent. This course trains Assistant Development Engineers to City and Guilds' Full Technological Certificate level. The course includes theoretical and practical instruction on computer (digital and analogue), process control and automation. Next course commences 10th September, 1957.

### SCHOLARSHIPS

Boys who are not academically suited to a Degree course may, through the training offered in the Three-Year Course, achieve interesting and lucrative careers as senior electronics technicians in industry. In order to encourage students of this calibre the E.M.I. College of Electronics has decided to offer *TWO SCHOLARSHIPS THIS YEAR FOR THE ABOVE COURSE* in Telecommunications Engineering.

Also 1 Year Course in Radio and Television commencing September 10th, 1957

## THE E.M.I. COLLEGE OF ELECTRONICS

Dept. 127, 10 Pembridge Square, London, W.2. Telephone: BAY 5131/2

The college is part of the E.M.I. Group . . . Britain's foremost electronic engineers . . . Pioneers of the world's first public television service.



IA60

**When you buy a  
tape recorder your  
choice will be governed  
by two factors—**

### PRICE AND SPECIFICATION

*The best tape recorder won't be cheap—  
but it will be good value for money.*

The Grundig 'Specialist' TK.820/3-D is the best value for your money. Its presentation, its versatility, its performance, its push-button track changeover, makes it the only possible choice for so many people. Provided the machine has the facilities, appearance and ease of control you demand, it remains to check whether or not its specification will stand up to your requirements.

*Here is the complete technical specification of the TK.820/3-D. Read it critically—and write to us if there is anything else you would like to know.*

## GRUNDIG

Makers of the finest tape recorders in the world.

**GRUNDIG (Great Britain) LTD., Dept. WW,**  
Advertising Dept. & Showroom:  
39-41, NEW OXFORD STREET, LONDON, W.C.1  
Sales Dept. & Works:  
KIDBROOKE PARK ROAD, LONDON, S.E.3.  
(Electronics Division, Gas Purification & Chemical Co. Ltd.)

### GRUNDIG 'SPECIALIST'

Mains voltage: suitable for A.C. only, 105–115, 190–210, 210–230, 230–250 volts, 50 cycles. Power Consumption: approximately 90 watts maximum. Mains Fuses: 2 amps (for 105–115 volts), 1 amp (for 190–250 volts). H.T. fuses: 500 m/A Surge Resisting, 120 m/A Surge Resisting. Valve line-up: EF 86, ECC 81, EL 84, EL 42, EM 71 + 2 metal rectifiers. Mains tapping panel and fuses instantaneously available. Two tape speeds—3½ ins/sec and 7½ ins/sec: speed change instantaneous by electrical means—heavy duty dual speed split phase induction motor: recording time (with 1,200 feet recording tape) 2 × 30 minutes at 7½ ins/sec—2 × 60 minutes at 3½ ins/sec: half track recording, track change without spool reversal: track changeover by press button approximately 2 seconds. Trackbutton remains down to indicate which track was played last: frequency range 50–9,000 cycles at 3½ ins/sec, 40–14,000 at 7½ ins/sec: noise is down at least 40 dBs and wow and flutter less than 0.3% at 7½ ins/sec, less than 0.5% at 3½ ins/sec.

Automatic stop foil at end of spools: fast forward and fast rewind time approximately two minutes per full spool. Illuminated precision place indicator: recording level meter by 'magic eye', tone control for treble or bass emphasis.

Loudspeakers: elliptical high-flux permanent magnet moving coil + two 2½ inch tweeters. Special four-position speaker control. Connections for low impedance extension speaker and high impedance external amplifier remote controls, earphones. Microphone, diode and radio input sockets.

Overall dimensions: 17 inches × 17½ inches × 9½ inches. Weight approximately 48 lb.

**Retail Price 98 gns.**



# Britain's finest Hi-Fi Equipment

We have devoted over 22 years entirely to the design and manufacture of audio equipment and we are proud of our position as leaders in this field. We were the first firm in the world to design and market Amplifiers having a total distortion content as low as 0.1%; a claim which was received with incredulity in 1945, but which was subsequently confirmed by the National Physical Laboratory and has become an accepted world-wide standard.

High engineering ideals have guided our efforts, and Leak Amplifiers have been the choice of the B.B.C., Commonwealth and foreign broadcasting authorities and Recording Studios. This acceptance by professional audio engineers has led to a demand for Leak equipment from music lovers throughout the world.

On the important question of prices it is appropriate to mention one of the basic principles of Leak design. From long experience and by extreme attention to design details during development work on the pre-production models, we enable our craftsmen to achieve a high output per man-hour. The labour costs thus saved offset the increased cost incurred for high-grade materials, components and finishes, and this, together with quantity production (made possible only by a world-wide market), explains how quality products may be sold at reasonable prices.

## An important Test Report . . .

Independent laboratory tests of the Garrard 301 transcription turntable were recently carried out by Audio Instrument Company Inc., New York, U.S.A., under the direction of Mr. C. J. Lebel (Chairman of one of the groups which prepared the NARTB Standards). It was necessary that the pick-up and amplifier system should conform in response to the RIAA-New AES-new NARTB response curve within  $\pm 1$ db, and in the tests of this excellent transcription unit the components selected for use as complying with this requirement were a Leak tone arm fitted with Leak cartridge and a complete Leak pre-amplifier and power amplifier Model TL/10.

The full test report appeared in the February, 1957 issue of "Wireless World," pages 22 and 23.

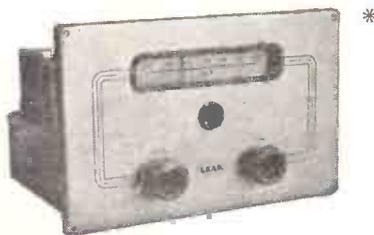


The First Name  
in High Fidelity

H. J. LEAK & CO. LTD., BRUNEL ROAD,  
WESTWAY FACTORY ESTATE,  
ACTON, W.3., ENGLAND.

Telegrams: Sinusoidal, Ealux, London

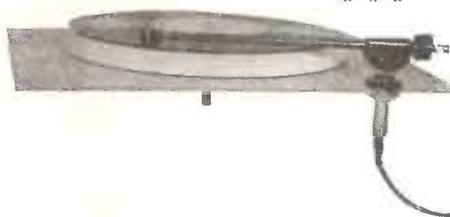
Telephone: SHEpherds Bush 1173/4/5 Cables: Sinusoidal, London



\*



\*\*



\*\*\*

If you were unable to visit the Audio Fair, we invite you to complete the coupon below and post it to us for details of Leak High Fidelity equipment.

Please send details of

- \*  FM Tuner
- \*\*  Amplifiers
- \*\*\*  Gram. pickup

Please send name and address of my nearest Hi-Fi dealer.

Name .....

Address .....

W.W.

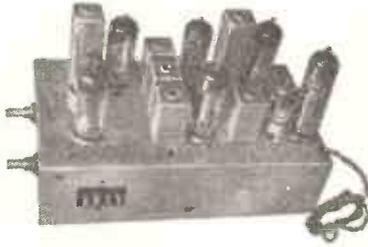
# TELEVISION UNITS

## The I.F. UNIT

This unit employs 8 miniature all-glass valves, the first two of which are common to sound and vision. After separation, sound and vision are amplified separately at 34/36 and 37.5 Mc/s respectively. Vision is then detected and passed to two stages of Video amplification, and sound is detected and further amplified by output valve to give over one watt of high-fidelity sound.

The circuit employs a variable peak white clipper to reduce vision interference and the second section of the audio detector is used to limit sound interference. The unit, which can be driven by any standard 34/37 Mc/s turret or other tuner is beautifully made and contained on a chassis size approx. 8in. x 4½in. x 2in.

The unit with valves made up, aligned and ready to work is available price £9/12/6.

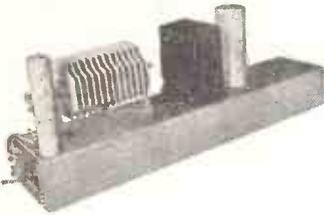


## The POWER UNIT

Intended for AC/DC working with 3 amp. valves, this unit contains all the necessary power components. Rectification is by metal rectifier, smoothing is by a 3 Henry choke, and large electrolytic condensers ensure freedom from hum and a clean picture.

The ballast resistor has ample tappings to compensate for HT voltage as well as heater current and a thermistor protects the circuit against initial current surges, fuses are fitted in the mains input lead.

There is a front control comprising a double pole on/off switch, this is attached to the sound volume control which, although not part of the power unit, is included for the sake of convenience and symmetry. The size of the unit is 15½in. x 3in. x 2in. It is all wired up and ready to work, price £3/5/-.



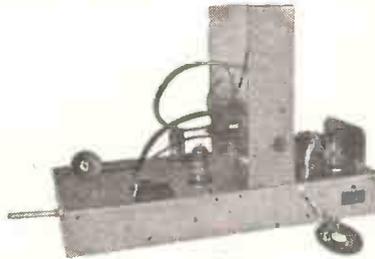
## The TIME BASE CHASSIS

This uses 6 valves and includes the sync separator, the focus magnet, scanning coils and ion trap.

The line time base is of the self-oscillating type employing an auto wound O.P.T. and efficiency diode to provide boost voltage for the line fly back E.H.T. transformer which gives about 12.5 kV, the frame time base is multivibrator type using an ECL.80.

The whole unit measures 15½in. x 6½in. x 2in. and the metal work includes tube support for chassis mounting a 14in. tube, but up to 21in. tube can be scanned but will require separate mounting.

Price for the unit with valves ready made up and tested is £12/15/-.



### NOTE

These three units, although quite separate and usable separately, may be joined together and then comprise a complete TV less only tuner unit and speaker (available if required). Demonstrations at all branches.

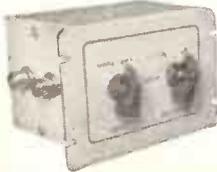
### T.V. SET FREE

The purchasers of the first edition of our publication "The Easier to build TV." stand a chance of winning a TV, so send 3/6 for your copy today.

### MULLARD AMPLIFIER

A Quality Amplifier designed by Mullard. Power output exceeds 10 watts. Frequency response almost flat from 10 to 20,000 C.P.S. For use with the Accos "Hi G" and other good pick-ups. Made up and ready to work is £12/10/- or £11/10/- down and 8 payments or £1/10/-, plus 10/- carriage and insurance.

**MULLARD PRE-AMP.** We are pleased to offer as a ready-made unit. It uses the low hum/noise high gain pentode type EP86. It takes its power supply from the amplifier and incorporates 2 switches to provide immediate compensation, for radio, microphone, I.P. and 78 records. The price of this unit is £4 Post and insurance 3/6 extra. Or 10/- down and 9 payments of 10/-. If purchased with above, combined price is £16 or 30/- down and 8 payments of £2.



### CRYSTAL MICROPHONE

Miniature crystal type has high gain and is suitable for all purposes—tape recorders—amplifiers. Price 4/9, post and ins. 9d.



### TRANSISTORS

A good range of transistor parts, miniature transformers, electrolytics, etc., available at all branches.

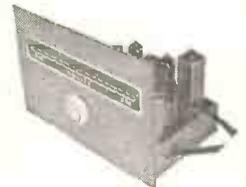
- Red Spot and audio . . . 10/-
- Blue Spot 1.6 Mc/s. . . 15/-
- White Spot 2.5 Mc/s. . . 20/-



### W.D. CIRCUIT DETAILS

Diagrams and other information extracted from official manuals. All 1/6 per copy. 12 for 15/-.

- |                           |                     |
|---------------------------|---------------------|
| American Service Sheets   | R.109               |
| A.1154                    | 78 receiver         |
| BC.348                    | 76 receiver         |
| BC.312                    | R28/ARC5            |
| R.103A                    | R1116/A             |
| B.C.342                   | RA-1B               |
| RA-1B                     | AR88D               |
| R-208                     | AN/APA-1            |
| R-1155                    | 78                  |
| R-1124A                   | 78                  |
| R-1132A/B-1481            | R.T.18              |
| R-1147                    | CAY-46-AAM-         |
| R-1224A                   | RADAR               |
| R-1082                    | A.S.B.-3.           |
| R-1855                    | Indicator 62A       |
| B.C.1200-A/B              | Indicator A.S.B.3   |
| B-455-A (or -B)           | Indicator 62        |
| B-454-A (or -B)           | Indicator 6K        |
| B-453-A (or -B)           | R.F. unit 24        |
| Transmitter T1154/        | R.F. unit 26        |
| B.D.J.N.                  | R.F. unit 25        |
| Fifty-eight walkie-talkie | R.F. unit 27        |
| Frequency meter           | Wireless set No. 19 |
| B.C.231.                  | Demobbed valves     |

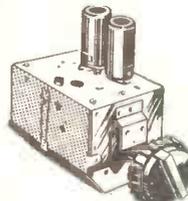


### F.M. TUNER

This is a high fidelity unit which although moderately priced has a performance equal to the highest priced. Its stability is very good and extremely good results have been received with the simplest of aerials as far away as Eastbourne. The unit is made up ready to work and has its own power supply for A.C. mains. Demonstration at all our branches. Price 12 gns. or £1/12/- down and 8 payments of 22. Post plus insurance 6/-.

### TURRET TUNER

Brand new stock, not surplus, with coils for Band I and III supplied complete with valves PCC84 and PCF80—I.F. Output 33/38 Mc/s with instructions and circuit diagram 99/6. With knobs 3/6 extra; post and insurance 2/6.



### THE "CRISPIAN" BATTERY PORTABLE

A 4-valve truly portable battery set with very many good features as follows:—

- Ferrite Rod Aerial.
  - Low consumption valve; (DK98 range).
  - Superhet circuit with A.V.C.
  - Ready built and aligned chassis if required.
  - Beautiful two-tone cabinet.
  - Guaranteed results on low and medium waves.
- All parts, including speaker and cabinet, are available separately or if all ordered together the price is £7/15/- complete. £1/15/- deposit and seven monthly payments of £1. Post and insurance 3/6. Ready built chassis 30/- extra. Instruction booklet available separately 1/6.



### TRANSISTOR RECEIVER 19/6



Makes ideal bedroom radio, uses one transistor and one crystal diode. Complete less case 19/6, case 5/- extra. post and ins. 1/6.

# SUMMER SALE

Goods on this page are offered at especially low prices for a 1 month period only.

## TWIN FEEDER



Sale price only 6d. per yard.

## 2 1/2" M/c METER

500 micro amp. Sale price 17/6.



## 400 WATT MERCURY LIGHTING UNIT



This is a suspended unit which gives a terrific light and in addition to ordinary lighting, can be used to sup-

plement a 4 daylight when growing plants during autumn and winter months. It is self-contained with glass enclosed ballast thus it can be fitted directly in place of an ordinary lighting fitting, no additional wiring is necessary. Few only available, complete and ready to work, sale price £4/10/-, non-callers add 7/6 carriage and insurance.

## MULTI TAPPED STEP DOWN TRANSFORMER

Rated at 250 watts continuous this transformer will easily carry twice this load for short periods. Primary: 200 v. to 250 v. in 10 v. steps, secondary: 115 v. to 155 v. in 3 v. steps. Robustly made (originally intended for Ministry), new and unused, sale price 37/5, carriage and insurance 7/6.

## VARIABLE RHEOSTAT



This is a heavy duty slider resistor rated at 25 amps, but easily capable of twice this load. Basic resistance is .4 ohms but by the removal of one wire this becomes .8 ohms, alternatively it can be rewired to suit individual requirements. Adjustment is by rotating a Bakelite knob which couples to a heavy duty slider, ideal for dimmer circuit. Price 8/8, post and insurance 3/6.

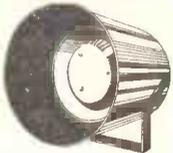
## SMALL CLOCK MOVEMENT



7-day mechanism beautifully made and fully jewelled, few only sale price 18/6 each.

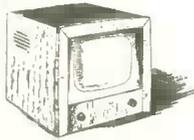
## LOUD HAILER SPEAKER

8 to 8 watt output, weight approximately 10 lb., size approximately 10in. x 7in. Solid steel case finished grey cellulose crackle, waterproof and complete with mounting bracket, sale price £3/15/-, carriage and insurance 6/-.



## MORGANITE POTENTIOMETERS

Standard size with good length spindle, most values, sale price 1/- each 10/- doz. your assortment.

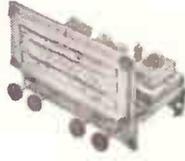


## 14" T.V. CABINET

14in. T.V. cabinet of the latest styling—beautifully veneered and polished—limited quantity—sale price 17/6 each. Carriage and packing 3/6 extra.

## ORGANTONE PARCEL 39/6

Here is an opportunity to build a fine set at a low figure, the parcel contains all the essential parts as follows:—Punched and prepared chassis with scale pan—coloured glass dial with fixing cushions—drum drive and spindle—mains transformer—volume control—tone control—5 valve holder—circuit diagram and instructions. Limited quantity only for 39/6 plus 3/6 post and ins.

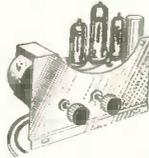


## AMPLIFIER CASE 62/-

A robustly made cabinet in the modern style of two tone fabrics, will comfortably house speaker and amplifier in the end compartment and has uncut motor board for tape recorder or record changer, lacquered fitting and plastic handle. Sale price 62/-, carriage in dans. 7/6.



## AMPLIFIER FOR THE ABOVE



Uses three valves one of which is low noise pentode E.F. 86 mains transformer isolates, chassis. Sale price £3/15/-, plus 2/6 post and packing.

## THIS MONTH'S SNIP

We are offering an out-of-season bargain—14 yards of waterproof electric blanket element, enough to make a full size blanket. Normally we sell at 20/-, Sale price is only 15/-, post free, complete with illustrated data.

## MAINS CONTACTOR



Double pole contacts suitable 15 amps D.C. or about 50 amps. A.C. Has closing coil wound 230 D.C., but quite suitable for A.C. Also has economy resistance and associated contactor mounted on same base board. Sale price 12/6, plus 1/6 post and insurance.

## BREAKDOWN UNIT

At present day prices the components, in this unit, would cost £10, contents are as follows:—

- 3 465 K/C IF Transformers.
- 1 Output transformer.
- 2 Iron cored transformers.
- 14 Valve holders mostly Octal.
- 1 Microphone transformer.
- 88 Resistors mainly 1/4 watt values from 47 ohms to 10 meg.
- 10 Tag strips assorted types.
- 29 .1 mfd. 500 v. Condensers.
- 36 Assorted mica condensers, 30pf to 2,000pf.
- 9 Trimmers.
- 1 4 gang variable condenser.
- 1 single gang condenser.
- 2 Ceramic fine tuners.
- 1 3 Bank switch.
- 14 Coils, some on ceramic formers
- 3 Pot meters.
- 3 switches.

Miscellaneous collection of nuts, screws, condenser clips, valve top caps and very fine metal chassis and case. All this for only 16/6, plus carriage 3/6.

## THERMAL DELAYSWITCH

Hermetically sealed with 4-pin base, heater resistance approx. 1,500 ohms. Approximately 17 milliamps through the heater coil will cause the contacts to close. By increasing and decreasing around 17 m/a. the contacts can be made to open and close faster or slower, the current variations can be obtained with a pot which you can calibrate in seconds. Thus a very efficient but low cost process timer can be made. The unit can also be used for overload protection and for applications such as delaying anode volts until the heaters are properly warmed up. Limited quantity Sale price 7/6 each, post and insurance 1/6.

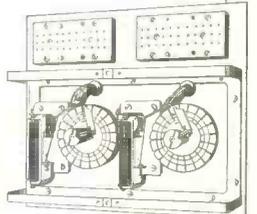


## FLUORESCENT LIGHTS



These are complete fluorescent lighting fittings. Built-in ballast and starters—stove enamelled white and ready to work. Ideal for the kitchen, over the workbench and in similar locations. Single 40. 4in. 3in. long, uses a 4 watt tube. Sale price 35/-, complete with tube. Twin 20. Uses 2 20-watt standard tubes. Sale price 35/-, with tubes. Carriage and ins. up to 150 miles, 5/6; up to 250 miles, 7/6

## TOWARDS AUTOMATION



Rotary switch—Ministry Ref. No. AP67579, this is a motor-driven switch, the driving motor being a synchronous type for working on 110 volts 60 cycles. The two switches have 20 positions each and are enclosed by a Perspex fronted lid, separately operated relays providing interlocks. Sale price 27/6 each; Carr. 3/6.

## VALVE HOLDERS

Amphenol type B7G-B9A and int.-octal, 5/- doz. your assortment. Nylon loaded, 7/8 doz.

## MANY OTHER BARGAINS

There will be special bargains for callers at all branches and it will definitely be worth your while to pay each branch a visit. Please include postage when ordering.

## IMPORTANT

The goods advertised on this page are not repeatable once cleared, so before journeying especially to collect an item please telephone to ensure that it is in fact in stock.

# ELECTRONIC PRECISION EQUIPMENT LTD.

266 London Road, Croydon. Phone: CRO. 6558 Half-day Wednesday.

249 Kilburn High Road, Kilburn. Phone: MAI 4921 Half-day Thursday.

42-46 Windmill Hill, Ruislip, Middlesex. Phone: RUISLIP 5780 Half-day Wednesday.

152-153 Fleet St., E.C.4. Phone: FLEET 2833 Half-day Saturday.

29 Stroud Green Road, Finsbury Park, N.4. Phone: ARCHWAY 1049 Half-day Thursday.

Post orders should be addressed to E.P.E. LTD., M.O. Dept. 2, SUTTON ROAD, EASTBOURNE. All enquiries to Eastbourne address and please enclose S.A.E., terms are cash with order.

# ADCOLA

PRODUCTS LIMITED  
(Registered Trade Mark)

SOLDERING INSTRUMENTS  
& ALLIED EQUIPMENT



### ILLUSTRATED

DETACHABLE  
 $\frac{1}{8}$ " BIT MODEL  
LIST No. 64

Protective  
Shield  
LIST No. 68

CATALOGUES HEAD OFFICE SALES & SERVICE

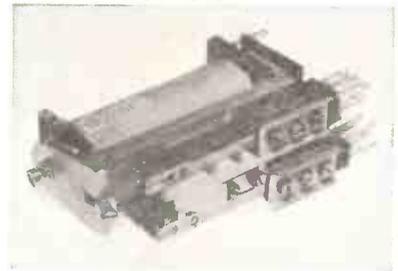
**ADCOLA PRODUCTS LTD.,**  
GAUDEN ROAD,  
CLAPHAM HIGH ST.,  
LONDON, S.W.4.

TELEPHONES:  
MACaulay 3101  
& 4272

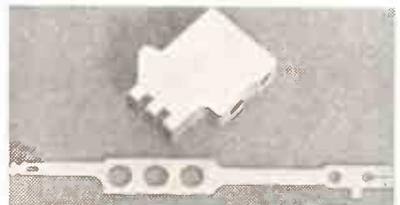
## KAYE



## RELAYS



### & COMPONENTS



Send now for our FREE six page relay information Folder, giving details of our 3000 and 6000 type relays, together with "one off" prices. Special quotes for quantities.

**KAYE ELECTRICAL MANUFACTURING CO.**  
Havelock Works, Havelock Place, Harrow, Middlesex.  
Grams: KAYE ELECTRICAL HARROW. Phone: HARROW 1432

Estd.

**L·R·S**

1925

EASY

TERMS

THE SPECIALISTS IN QUALITY EQUIPMENT

# LEAK

TL/10 and POINT ONE PRE-AMPLIFIER  
VARISLOPE PRE-AMPLIFIER  
F.M. TUNER, DYNAMIC PICK-UP etc.

Lowther • Chapman • Tuners  
Wharfedale • Goodmans • Kelly Loudspeakers  
Connoisseur • Garrard • Collaro  
Transcription Motors, etc.

All the above—in fact all QUALITY EQUIPMENT is available on EASY TERMS. Immediate delivery on most items.

**SMALL DEPOSIT** Secures, balance plus 5% interest payable in 9 equal monthly instalments

or

**50% DEPOSIT** and balance plus 10% interest payable over 18 months or 24 months if required.

we pay carriage and cratage on all items.

Send us your requirements. We will quote by return.

**The L·R· SUPPLY COMPANY, LTD.**  
BALCOMBE (Tel: 254) SUSSEX.

TV  
Manufacturers  
be certain  
your  
Purchase Dept.  
sees this

**MANUFACTURERS  
RENTAL COMPANIES  
MAINTENANCE  
COMPANIES**

you can now take advantage of our

## Bulk Buying Scheme

Many television sets use components such as Frame Oscillators, Line Oscillators, Line Output Transformers and Deflector Coils which are common to more than one particular make. When these transformers are being purchased in comparatively small quantities the price is naturally high and very often delivery slow. "Direct TV Replacements" has become the acknowledged specialist in TV Components, supplying many Set Manufacturers and Rental Companies. Buying in bulk and having a "short run" factory they can offer quick delivery and competitive prices.

### IGRANIC TRANSFORMERS

Please note we have purchased a large number of Igranic Wide and Narrow Angle Deflector Coils, Blocking Oscillator Transformers and Frame Output Transformers. Our Factory is also producing alternative replacements for most Igranic Line Output Transformers and these can be fitted without any circuit modifications.

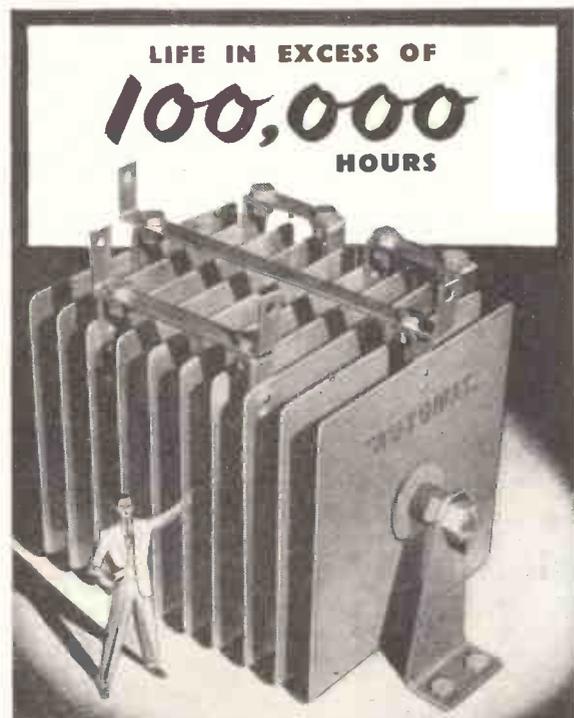
Write or 'Phone Your Requirements to:

CONTRACTS DEPT.



**REPLACEMENTS**

134/136 LEWISHAM WAY, NEW CROSS,  
S.E.14. TIDeway 3696-2330 Ext.10  
Telegraphic: FLIBAK, London, S.E.14



LIFE IN EXCESS OF  
**100,000**  
HOURS

EARLY DELIVERY OF HIGH STABILITY  
RECTIFIERS  
to any rating.

**AUTOMAT** MOORSIDE, SWINTON  
MANCHESTER. Tel.: SW1 4242  
CW 4352



## HARTLEY-TURNER SOUND EQUIPMENT LOUDSPEAKER ENCLOSURES

The Hartley-Turner "Baffle" is now available in either assembled or kit form, for use with 10in. or 12in. loudspeakers. The design, which utilises a special acoustic filter, provides an efficient loudspeaker enclosure, occupying the minimum of space (only 18in. cube) without sacrificing quality or introducing false coloration.

### PRICES

**In Kit Form** (with assembly instructions)

Type 1.K for 10in. diameter	
Loudspeakers .. ..	£8 10 0
Type 2.K. for 12in. diameter	
Loudspeakers .. ..	£8 10 0

### Assembled

Type 3A for 10in. diameter	
Loudspeakers .. ..	£9 0 0
Type 4A for 12in. diameter	
Loudspeakers .. ..	£9 0 0

*Carriage Paid in Great Britain.*

*Overseas Freight Charges Extra.*

**H. A. HARTLEY CO. LTD.**

66, WOODHILL, WOOLWICH, S.E.18.

Telephone : WOOLwich 2020 (Ext. CB.32)

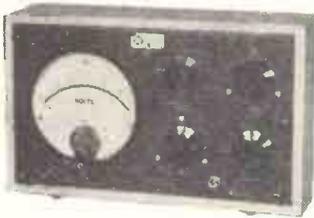
(An A.E.I. Company)



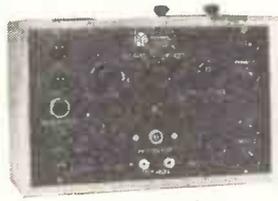
5, HARROW ROAD,  
PADDINGTON, W.2.  
PADDINGTON 1008/9 and 0401.  
CABLES: HENELEC, LONDON.

# PIRANI HIGH VACUUM TEST EQUIPMENT

Manufactured by "W. G. PYE LTD." for  
M.O.S. ATOMIC RESEARCH STATION



PIRANI CONTROL UNIT



PIRANI BRIDGE UNIT



PYE SCALAMP GALVANOMETER  
(SOLD SEPARATELY £12-10-0)

THIS COMPLETE VACUUM TESTING EQUIPMENT (5 ITEMS AS SHOWN)  
OFFERED BRAND NEW IN ORIGINAL CARTONS. WITH INSTRUCTION BOOK.



PIRANI GAUGE HEAD  
WITH CALIBRATOR

**£33-10-0** CARR. PAID.

(SPARE PIRANI GAUGE HEADS, EDWARDS TYPE M6, LESS CALIBRATOR, 15/- EACH.)

-towards perfection-

## LOWTHER LINEAR AMPLIFIERS

Exclusive Lowther Design and Build



Lowther Linear Amplifier  
LL.10 £25

The new range "Lowther Linear" amplifiers surpass all previous multi-loop feedback or basic ultra linear technique by the utilisation of the suppressor grid of the Mullard power pentode EL34 into the distributed load circuit which enhances the performance in all detail.

Generous in design, the amplifier's performance will remain at its high laboratory test specification throughout many years of use.

**THE LOWTHER MANUFACTURING COMPANY,**

LOWTHER HOUSE, ST. MARK'S ROAD, BROMLEY, KENT, ENGLAND.

Tel.: RAVensbourne 5225



(RADIO) LTD.

5, Harrow Road, Paddington, W.2

Opposite Edgware Road Station

PADDINGTON 1008/9 and 0401

OPEN MONDAY to SAT. 9-6. THURS. 1 o'clock

SEND 3d. FOR 28-PAGE CATALOGUE

## TRANSMITTER/RECEIVER

ARMY TYPE 17 MK. II

This well-known R/T Transceiver is offered complete with Valves, High Resistance Headphones, No. 3 Handmike and Instruction Book giving complete details and circuit, contained in strong cabinet. Variable tuning.

Frequency Range: 44.0 to 61 Mc/s  
Range approximately: 3 to 8 miles  
Power requirements: Standard 120 v. H.T. and 2 v. L.T.

Ideal for Civil Defence and communications.

BRAND NEW **59'6**

Calibrated Wavemeter for same 10/- extra

## QUARTZ CRYSTALS

TYPE FT243 fundamental frequencies. 2 pin pin. spacing. 120 TYPES. 5675 kc/s. to 9650 (in steps of 25 kc/s.). 80 TYPES. 5706 kc/s. to 8340 kc/s. (in steps of 33.333 kc/s.).

ALL BRAND NEW **10'/-** each.

Set of 120 £15. Set of 80 £10.

TYPE FT241A 54th harmonic Crystals. 2 pin pin. spacing. 80 TYPES AVAILABLE 20 Mc/s. - 27.9 Mc/s. (in steps of 100 kc/s.).

£10 set of 80.

Also	32.5 Mc/s.	36.4 Mc/s.
	32.6 Mc/s.	36.5 Mc/s.
	32.7 Mc/s.	36.6 Mc/s.
	36.3 Mc/s.	36.7 Mc/s.

ALL BRAND NEW **7'6** each.

FT241A 200 kc/s. 10/- each.  
Crystal Holders for both Types 1/3 each

## CATHODE RAY TUBES

VCR139A	£1 15	0
VCR139A Mu-Metal Screen	5	6
VCR97. Full T.V. picture (carr. 2/-)	£2	0
VCR17C. Full T.V. picture	£1 15	0
MU-METAL SCREENS for VCR97 or 517	10	0
VCR97. Slight-cut-off. Carr. 2/-	15	0
3PB1. Brand new	£1 10	0

## 62A INDICATOR UNIT

Containing VCR97 with Mu-Metal Screen. 21 Valves: 12-EF50, 4-9P61, 3-EA50, 2-EB34. Plus Pots, Switches, H.V. Cond., Resistors, Muirhead S/M Dial, Double Decic Chassis and Crystal. BRAND NEW. ORIGINAL CASES. 67/6. Carr. free.

## TRANSMITTER/RECEIVER SCR 522

Comprising the well known BC935 and BC924A. Units complete with 17 valves types 9-B32, 3-12A6, 3-12S07, 3-9003, 9002, 636G, 12130T, 12A17GT, 12C8, 6887. The complete unit is in very good condition having very useful parts including kelvars, Transformers, Condensers, etc. Less valves 45/- carr. 5/-. With valves £5/15/- carr. paid.

## TRANSISTOR PUSH-PULL AUDIO AMPLIFIER

(200 MILLIWATTS OUTPUT)

Build this Push-Pull Amplifier which is ideal for Crystal or Magnetic Pick-up Amplification, Baby Alarm, Microphone Amplifier, etc. Powered by 6-volt Dry Battery lasting for months. Complete Kit of Parts including 4 Transistors and all Components with Circuit (less Speaker), £4/10/-.

## TRANSISTORS

JUNCTION TYPE P-N-P

(British Manufacture)

RED-SPOT 800 kc/s Audio Frequency.....	10/-
BLUE-SPOT 1.6 Mc/s Mixer and Frequency Changer	15/-
WHITE-SPOT 2.5 Mc/s R.F. and I.F. Amp.....	20/-

All Transistors are Tested and Guaranteed

N.B. The Red-Spot is similar to Mullard OC71

### SPECIAL TRANSISTOR OFFER

THREE RED-SPOT & ONE BLUE-SPOT.....	42/6
FIVE RED-SPOT & ONE BLUE-SPOT.....	60/-

Also discount for quantities.

Over 300 different types of B.V.A. & American valves in stock. Send for Lists.

## Superseding The Popular "Pre-Selected Transistor-Seven"

## The New "TRANSISTOR-8"

Push-Pull Portable Superhet

Can be built for  
£12/12/-.

This Portable 8 Transistor Superhet is tunable for both Medium and Long Waves and is comparable in performance to any equivalent Commercial Transistor Set.

Simplified construction enables this set to be built easily and quickly into an attractive lightweight cabinet supplied.

### TEN STAR FEATURES

- ★ 8 Transistors including matched OC72's
- ★ 300 Milliwatts Output Push-Pull
- ★ Medium and Long Waves
- ★ Internal Ferrite Rod Aerial
- ★ 7 x 4 Elliptical High Resistance Speaker
- ★ Drilled Plastic Chassis 8½ x 2½ in.
- ★ Point to Point wiring and practical layout
- ★ Economical. Powered by 7½ v. battery
- ★ Highly sensitive
- ★ Attractive lightweight contemporary case

We can supply all these items including Cabinet for £12/12/-  
All parts sold separately

Send for circuit diagrams, assembly data, illustrations and instructions, and full shopping list 1/6.

Call & hear demonstration model.

## "EAVESDROPPER"

THREE TRANSISTOR POCKET RADIO

(No Aerial or Earth required)

Pre-selected to receive the Light and Home Stations. Total cost, as specified including Transistors, Transformers, Coils, Condensers and Battery, etc., with circuit and plastic case.

**77'6** POST FREE

All items sold separately. With single 'phone, 82/6. With Acos Mike, 90/-.

With Min. Hearing Aid, 92/6.

### COLLARO RC456

4-speed auto-changer. Latest type with crystal turnover pick-up. £9/15/-.

### TRANSISTOR SIGNAL TRACER

Complete Kit with 2 Transistors, Components. Phones with Circuit and plastic case. 42/6

### TRANSISTOR SQUARE WAVE GENERATOR

Complete Kit with 2 Transistors, Components, Circuit and plastic case. 25/-

### DIODES

B.T.H. GERMANIUM.....	1/6
MULLARD OA74.....	2/6
IN21.....	3/6
IN22, IN23, IN21A.....	5/-

### MODEL-MAKERS MOTORS

Two types available 12 or 24 v. with ¼" spindle ..... 10/- each.

### 6 v. VIBRATOR PACKS

Output 180 v. 40 m/a., 15/- Brand new.

### "HOMELIGHT"

#### ONE TRANSISTOR RECEIVER

Build this pre-selected set which is powered by No. 8 battery. Total cost including Transistor, Coils, Diode, Plastic Case and H/R single 'phone. 32/6.

### "HOMELIGHT"

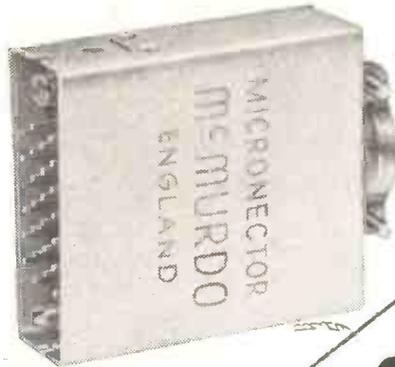
#### 2 TRANSISTOR PERSONAL PORTABLE

No Aerial or Earth Required  
Pre-selected 2 Stations Receiver  
We can supply all components including 2 Transistors, Diode, Resistors, Condensers and Miniature Hearing Aid and Plastic Case size 4½ x 2½ x 1½ and 1½ v. Battery. FOR 55/-  
All items sold separately.

R.F.24 10/- R.F.25 12/6 R.F.26 25/-  
Brand new with valves, carr. 2/8.

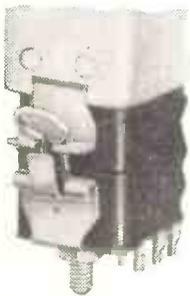
### COLLARO RC/3/554

3-speed single player with crystal turnover pick-up type "G". £6/15/6 carr. 3/6.  
Brand new in original carton.



9 WAY	18 WAY
26 WAY	34 WAY

Embody new improved features shown below



- Alternative long plug cover provides pin shroud.
- Strengthened extruded aluminium cover with rigid cable clamp, top or end cable entry.
- Optional latch prevents accidental disengagement. Available for all combinations.
- Mask to protect pins of panel mounted plug.
- Gold plated sockets and pins.
- Dowels provide mechanical alignment.
- Special alternative dowel socket for electrical connection.

Send for full details to :

THE McMURDO INSTRUMENT CO. LTD., ASHTEAD, SURREY. Telephone: Ashtead 3401



# PHOTO PRINTED CIRCUITS LTD.

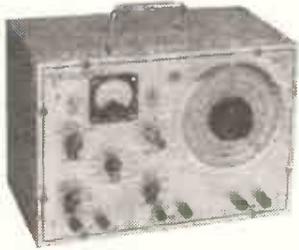
FOR  
BEST · CHEAPEST · EARLIEST · PRINTED CIRCUITS



GUILDFORD ROAD, BISLEY, SURREY

BROOKWOOD 2200-3297

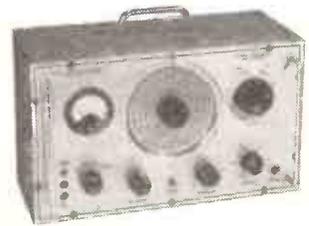
# Best Buy at Britain's



**COMPONENT BRIDGE Q/D211.** Brand new manufacturer's surplus in original packing 10 pFd to 100 mFd, 10 ohms to 100 megohms 1 H to 100 H. Leakage test 200, 400 and 600 v. Provision for polarising electrolytics on test, measuring against external standards, power factor measurements, etc. 8½ x 12½ x 6½ inches. Wt. 19lb. For 200-250 v. A.C. mains. Supplied tested and complete with instruction manual, £11/19/6, plus 7/6 carriage.



**AUTOMATIC MONITOR Q/D231.** Intermittent faults steal your profits. Employ one of these "Phantom Engineers"! Soak tests 3 receivers or amplifiers simultaneously and SILENTLY. If fault occurs, a buzzer sounds and a red pilot light indicates which set. Pressing "Intermittency Check" shows whether fault has cleared or is permanent. For 195-255 v. A.C. mains. Complete with 8 valves, all connecting leads, and Instruction Manual. 14½ x 8½ x 6½ inches, wt. 19lb. In original packing. £7/19/6, plus 7/6 carriage. S.A.E. for full details.



**SIGNAL GENERATOR Q/DO51.** 30 Kc/s. to 100 Kc/s. in 8 ranges. Internal mod. 30% at 400 c/s. Audio output 3 v. Provision for external mod. or external pattern mod. Double screening throughout. Force output of 1 v. or attenuator for 0-100 millivolts. Carrier level meter. Calibration accuracy ±1%. 14½ x 8½ x 6½ inches. Wt. 28½lb. A portable laboratory instrument for only £25, plus 10/- carriage.

**TEST METERS**  
American multirange, in handsome polished wooden case with leather carrying handle. Size 6in. x 6½in. x 3½in. 400 microamp. basic movement. A.C. and D.C. volts 0-2.5, 10, 50, 250, 1,000 and 5,000. (1,000 ohms per volt.) D.C. current 0-1, 10, 100 mamps., and 1 amp. Ohms 0-500, 100 K., and 1 meg. Decibels -10 to +69. Complete with test probes, leads, circuit, instructions, and battery. New condition, tested, £5/19/6.

**INSULATION TESTERS** by Record Electric. 0-50 Megohms. Test voltage 500. In perfect working order. Complete in leather carrying case, £9/19/6.

**OUTPUT POWER METERS.** Ex-W.D. No. 3, Mk. 2 (Windsor 150 A.). Impedance ranges 2.5 to 20,000 ohms in 40 steps. Power ranges 0-5, 50, 500, milliwatts, and 0-5 watts. Also scaled in dB. 3½in. M/C. meter. In oak case, 10½in. x 8in. x 5½in. In good condition. Tested. £15.

**AVO VALVE TESTERS** in Good Condition. with panel. For CALLERS only.

**MARCONI SIGNAL GENERATORS**  
TF390. 4-16 and 32-100 Mc/s. ... £25 0 0  
TF390. 16-150 Mc/s. ... £27 10 0  
TF517. 18-58 and 150-300 Mc/s. £35 0 0  
All complete with Instruction Book, spares, Calibration Charts, etc. In original transit case. Brand new. We have large stocks of similar quality Laboratory type equipment available to callers at very reasonable prices.

**JACK BOXES.** A small metal box fitted with 9 miniature insulated Igranic jack sockets. Brand new. SNIP. 12/6.

**5FT. P.O. TYPE 19in. RACKS.** "U" channel, heavy angle base, 59/6.

**HEAVY DUTY BLOWERS.** For 200-250 v. A.C./D.C. mains, 300 watts. With ½ inch diam. twin "V" shape outlets. 2 lengths of hose, 4 spare filters, and brushes. Suitable for industrial use, forges, etc. Brand new, £4/19/6.

**HEAVY DUTY LT TRANSFORMERS,** 230 v. A.C. mains input. Secs. 5-0-5 v. 5-0-5 v., and 5-0-5 v., all at 5 amps., each winding, 5, 10, 15, 20, 25, or 30 v. at 5 amps., or other possible combinations. 4½in. x 4½in. x 6in. high. Wt. 12lb. BRAND NEW, 29/6.  
U.S.A. potted type, input 210/220/230 v., 5 secondaries, 7.5 v. 4 a., 7.5 v. 4 a., 7.5 v. 8 a. and 2.5 v. 5 a., ALL centre tapped, and 6.3 v. 4 a. These can be connected to give many useful voltages up to 31 v. 4 a. Size 6in. x 5in. x 4in. Wt. 14½lb., price 35/-.

**HEAVY DUTY SLIDER RESISTORS.** 0.4 ohm, 25 amps., 250 watts, worm drive 7/6. 5 ohms, 7.8 amps., worm drive, 15/-, 10 ohms, 3.5 amps., worm drive, 10/6. 1 ohm, 12 amps, 150 watts, 7/6. 14 ohms, graded 1-4 amps, 7/6.

**MAINS DIMMERS.** 300 ohms, 1 amp, 300 watts, twin ceramic formers, 15/-.

**METER BARGAINS**

RANGE	TYPE	SIZE	PRICE
50 Microamp.	D.C. M/C	2½in.	Flush circ., scaled 0-100 59/6
100 Microamp.	D.C. M/C	2½in.	Flush circ., scaled 0-1,500 39/6
500 Microamp.	D.C. M/C	2in.	Flush circular 17/6
600-800 Micro-amp.	D.C. M/C	2½in.	Flush circular, scaled 100-0-100 V. 25/-
1 Millamp.	D.C. M/C	2in.	Flush square, Fe/NFe 22/6
1 Millamp.	D.C. M/C	2½in.	Flush circular 30/-
150 Millamp.	D.C. M/C	2in.	Flush square 7/6
200 Millamp.	D.C. M/C	2½in.	Flush circular 10/6
1 Amp.	Thermo-couple	2½in.	Projecting circular 6/8
4 Amp.	Thermo-couple	2in.	Flush square 6/8
20 Amp.	D.C. M/C	2in.	Projecting circular 7/6
30-0-30 Amp	D.C. M/I	2in.	Proj. circ., ear type 5/-
15 Volts	A.C. M/I	2½in.	Flush circular 8/6
300 Volts	D.C. M/C	2in.	Flush square 10/6

**METER RECTIFIERS.** Full wave bridge. Brand new. Salford 1/mA. 6/6. 5 mA., 6/6. 50 2 mA., 5/6.

**WIRELESS SET No. 19, Mk. 2.**  
Two transmitter-receivers and an intercomm. amplifier in one case. "A" set covers 2-8 Mc/s R/T and CW, and "B" set 240 Mc/s R/T only. Complete with dynamotor for 21 v. D.C. operation, 6 K7G, 2 6K8G, 2 6V6G, 6B8G, 807, EF50, EB34, and 500 microamp check and tuning meter. S.A.E. full specification. Technical data supplied. Made in U.S.A. First-class condition. AIR TESTED £5/10/- plus 15/- carr. and pkg. Or less dynamotor, £4/19/6.

## TOP BAND R1155 L's!

Superior version of the R1155 with super slow motion drive. 200 kc/s to 18.5 mc/s. in 5 ranges covering the 100-200 metre trawler and shipping bands. Although not packed in original transit cases, these are in every way equal to BRAND NEW, and are fully guaranteed. Never before available at the low price of ONLY £12/19/6. Carriage 10/6. R1155A equal to new and fully guaranteed. £10/10/- ALL R1155's are supplied with free booklet, re-aligned, and tested before despatch, and gladly demonstrated. Send S.A.E. for details of receivers and power packs, or 1/3 for 14-page illustrated booklet.

**A.C. MAINS POWER PACKS WITH OUTPUT STAGE.** Just plug in, NO modifications. Heavy duty quality job, guaranteed 6 months. Type A, £4/10/-, Type B, with 6½in. speaker, £5/5/-, Type C, in specially designed black crackle steel cabinet, with 8in. speaker de luxe. £6/10/-, SAVE ££££. DEDUCT 10/- WHEN PURCHASING R1155 AND POWER PACK TOGETHER.

**TUNING DRIVES.** Modernise your R1155 with this latest type drive as fitted to the model "L", "N", etc. Complete, and easily fitted, 12/6.

**RUNNING TIME METERS.** For life testing and process timing any A.C. mains apparatus. 200-250 v. 50 c/s. Indicates 1/10 to 10,000 hours on 5 scales. 4½ in. diam. Good condition, tested, 25/-.

**HIGH VOLTAGE POWER UNITS**  
Input 200-250 v. A.C. mains. Output 1200v. D.C., 200 milliamps. Fully smoothed. Metal rectifiers, £5/10/-, plus 15/- carriage.

**R109A RECEIVERS.** 8 valve superhet using 5 x ARP12's and 3 x AR8's covering 2-12 Mc/s. Contains vibrator pack and 3½in. speaker and operates from 6 volt battery, consumption 1½ amps. Housed in metal case 13 x 12 x 1½in. Complete with valves and circuit. Very good condition. Tested. £4/7/6, carr. pd.

**SCR522 TRANSMITTER/RECEIVERS.** 100-150 Mc/s. Comprises BC624A rec., and BC625 trans. All complete with valves, and in first-class condition. BC624A, less relay, 39/6. With relay, 49/6. BC625, 49/6.

**RT37/PPN2 BEACON TRANSMITTER-RECEIVER.** 214-234 Mc/s. Size 13in. x 10in. x 5in. Contains 5 3A5, 3 1S5, 1 IR5 and 2 2 v. synchronous vibrators. Operates from 2 v. accumulator via 2 built-in vibracaps. Complete with telescopic mast antenna system (9½ft.), lightweight headphones. Technical Manual, super quality carrying haversack, cords, co-ax cables, plugs, etc. Total wt. 28lb. BRAND NEW, boxed. American equipment, 72/6.

**PYE 45 Mc/s IF STRIPS.** Complete with 7 valves and CIRCUIT. New. ONLY 39/6.

**RF UNITS. ALL BRAND NEW AND BOXED.** RF24 7/6. RF25 12/6. RF26 25/-, Post 2/6

**TWO-WAY MORSE TRAINING SETS,** W/T Mk. 3. Consists of 2 valve oscillators (ARP12's) (one with pitch control), for 1 or 2 operators. Has provision for creating "atmospherics." In polished oak case 12½in. x 10in. x 8in., wt. 16lb. Complete with valves, leads, 2 keys, 7-way terminal board, circuit and instructions, but less batteries and phones. Ideal for Cadets, Scouts etc. SNIP. 19/6, carr. 7/6.

**COMMUNICATIONS RECEIVER CR100.** Covers 60 Kc/s. to 30 Mc/s. in 6 ranges, 2 RF's and 3 IF's, variable selectivity, B.F. Osc. etc. Operates from 210-250 v. A.C. mains. Size 16in. x 12½in. x 16½in. deep, wt. 82lb. S.A.E. for illustrated details. Overhauled, first class condition, £21. CR100/2 with side-tone facility, superb condition, £25. Plus £2 carr. and pkg. (£1 refund when pkg. case returned).

**VARIAC TRANSFORMERS.** Semi-variable input 200-240 v. 50 c/s. Output 7.5 amps., 1.65 KVA. 8 x 4½ x 4 inches. Wt. 14lb., 89/6.

**FIELD TELEPHONES.** Army type D, Mk. 5. Buzzer calling. Ideal for building sites, farms, workshops, etc. Complete with handset and batteries. Tested, 39/6 each.

PLEASE ADD POSTAGE OR CARRIAGE ON ALL ITEMS

**CHARLES BRITAIN (Radio) Ltd.**  
11 UPPER SAINT MARTIN'S LANE,  
LONDON, W.C.2. TEMPLE Bar 0545  
One minute from Leicester Square Station (up Cranbourn Street)  
Shop Hours: 9-6 p.m. (9-1 p.m. Thursday) Open all day Saturday

# R.S.C. BATTERY CHARGING EQUIPMENT

All for A.C. MAINS 200-250v., 50 c/s. Guaranteed 12 months  
Assembled 6v. or 12v. 4 amps.

## ASSEMBLED CHARGER

6 v. or 12 v. 2 amps.  
Fitted Ammeter and selector plug for 6 v. or 12 v. Louvered metal case, finished attractive hammer blue. Ready for use with mains and output leads. Double Fused. **47/9**  
Only Carr. 3/6.



### ASSEMBLED CHARGERS

6 v. 1 amp. 19/9  
6 v. or 12 v. 1 amp. 25/9  
6 v. 2 amps. 29/9  
6 v. or 12 v. 2 amps. 38/9  
6 v. or 12 v. 4 amps. 59/9  
Above ready for use. Carr. 2/9.

### HEAVY DUTY KIT

12 v. 30 amp Suitable for garage or firm with a number of vehicles. Mains input 200/250 v. 50 c/s. Outputs 12 v. 15 amp. twice. Consists of Mains Trans. 2 Metal Rectifiers. 2 Meters. 4 Fuses. 4 Terminals. 2 Rheostats and circuit. Only 9 gns. Carr. 15/-

## BATTERY CHARGER KITS

Consisting of Mains Transformer F.W. Bridge, Metal Rectifier, well ventilated steel case, Fuses, Fuse-holders, Grommets, panels and circuit. Carr. 2/6 extra.  
6 v. or 12 v. 1 amp. 22/9  
6 v. 2 amps. 25/9  
6 v. or 12 v. 2 amps. 31/6  
6 v. or 12 v. 4 amps. 53/9  
**BATTERY CHARGER KIT**  
Consisting of F.W. Bridge Rectifier 6/12 v. 5 a. Mains Trans., 0-9-15 v. 6 a. output, and ammeter. Only 49/9. Post 3/-



Fitted Ammeter and variable charge selector. Also selector plug for 6 v. or 12 v. charging. Double fused. Well ventilated steel case with blue hammer finish. **75/-**  
Ready for use with mains and output leads. Carr. 3/9. Or Deposit 13/9 and five monthly payments 13/9.

## SELENIUM RECTIFIERS

L.T. Types  
6/12 v. 1/2 a.h.w. 1/9  
6/12 v. 1/4 a.h.w. 2/9  
F.W. Bridge Types  
6/12 v. 1 a. 4/11  
6/12 v. 2 a. 8/9  
6/12 v. 3 a. 11/9  
6/12 v. 4 a. 14/9  
120 v. 40 mA. 3/9  
250 v. 50 mA. 5/9  
250 v. 80 mA. 7/9  
250 v. 150 mA. 9/9  
300 v. 250 mA. 12/11

CO-AXIAL CABLE. 75 ohms. 3/4 in., 8d. yard  
Twin screened feeder, 11d. yard.

5 CORE FLEX. Henleys circular rubber 14/36. Each lead colour coded. 1/6 yd.

DIAL BULBS. M.E.S., 8 v. 0.2 a., 6/9 doz.  
6.5 v. 0.3 a., 5/9 doz. 2.5 v. 0.3 a. 3/9 doz.

ELECTROLYTICS (current production). NOT Ex Govt.

Tubular Types		Can Types	
8 mfd. 450 v.	1/9	16µF 450 v.	2/9
8 mfd. 500 v.	2/6	16 mfd. 500 v.	3/9
16µF 450 v.	1/11	32µF 350 v.	2/11
16µF 350 v.	2/9	32 mfd. 450 v.	4/9
16µF 500 v.	3/9	100 mfd. 450 v.	4/9
8-16µF 500 v.	4/11	8-8µF 450 v.	2/9
25µF 25 v.	1/3	8-16µF 450 v.	3/11
50µF 12 v.	1/3	16-16µF 450 v.	3/11
50 mfd. 25 v.	1/9	32-32µF 350 v.	4/9
50µF 50 v.	1/9	32-32µF 450 v.	5/9
100 mfd. 12 v.	1/9	100-100 mfd. 350 v.	5/9
100 mfd. 25 v.	2/3		
3,000 mfd. 6 v.	3/9	64-120 mfd. 350 v.	7/6
6,000 mfd. 6 v.	3/11	100-200 mfd.	
		275 v.	6/11

Many other in stock.

VOLUME CONTROLS with long spindles, all values, less switch, 2/9; with S.P. switch, 3/9.

EX GOVT. STEP UP/STEP DOWN TRANSFORMERS. Double wound 80/100 watts. 10-0-100-200-220-240 v. to 5-0-75-115-125-135 v. or Reverse. Only 11/9, plus 2/9 post. 10-0-100-200-220-240 v. to 9-0-110-122-136-148 v. or Reverse. 200 watts, 35/9 plus 7/6 carr.

EX GOVT. METAL BLOCK PAPER CONDENSERS

4 mfd. 500 v. 2/3  
4 mfd. 1,000 v. 3/9  
4 mfd. 400 v. plus 2 mfd. 250 v. 1/11

EX GOVT. VALVES. VR137, EA50, EB34, 11d.; SP61 2/3; VS110 1/11; 6J5 3/9; 6V6G, 5U4G 7/9; 35Z4, 6X4 5/9; EF80 7/9.

EX GOVT. UNITS, type RDFI in original sealed cartons with 14 valves including 5Z4G, etc., trans., L.F. choke, Rectifier, etc., etc. We cannot enter into correspondence regarding these units which represent a really exceptional bargain at 29/9. Carr. 7/6.

## OIL FILLED BLOCK CONDENSERS

Bryce 11-7 mfd. 500 v. New unused Govt. surplus, only 5/9 each.

## THE SKY FOUR T.R.F. RECEIVER



A design of a 3 valve 200-250 v. A.C. Mains L. & M. wave T.R.F. receiver with selenium rectifier. For inclusion in cabinet illustrated above or veneered type. It employs valves 6K7, SP61, 6V6G, and is specially designed for simplicity in wiring. Sensitivity and quality is well up to standard. Point-to-Point wiring diagrams, instructions and parts list, 1/9. This receiver can be built for a maximum of £4/19/6 including cabinet. Available in brown or cream bakelite, or veneered walnut.

## EX GOVT. MAINS TRANSFORMERS

All 230 v. 50 c/s. input.  
120-0-120 v. 40 mA. 5/9  
250-0-250 v. 60 mA., 6.3 v. 3 a., 6.3 v. 1 a. Potted 4 1/4-3 1/4-in. 11/9

## HEAVY DUTY OIL FILLED MAINS TRANSFORMERS

Suitable welding or soil heating. With input of 200-250 v. 50 c.p.s., output is 12 v. 80-100 amps. Only £6/19/6, carr. 7/6.

## MANUFACTURERS SURPLUS TRANSFORMERS

Primary 200-240-250 v. Drop through type 250-0-250 v. 70 mA. 6.3 v. 3 a., 11/9. Postage 2/9.

## R.S.C. BATTERY TO MAINS CONVERSION UNITS

Type BM1. An all dry battery eliminator. Size 5 1/2 x 4 1/2 x 2 in. approx. Completely replaces batteries supplying 1.4 v. and 90 v. where A.C. mains 200-250 v. 50 c/s. is available. Suitable for all battery portable receivers requiring 1.4 v. and 90 v. This includes latest low consumption types. Complete kit with diagrams, 39/9, or ready for use, 46/9.



Type BM2. Size 8 x 5 1/2 x 2 1/2 in. Supplies 120 v., 90 v., and 60 v., 40 mA. and 2 v. 0.4 a. to 1 amp. fully smoothed THEREBY COMPLETELY REPLACING BOTH H.T. BATTERIES AND L.T. 2v. ACCUMULATORS when connected to A.C. mains supply 200-250 v. 50 c/s. SUITABLE FOR ALL BATTERY RECEIVERS normally using 2 v. accumulator. Complete kit with diagrams and instructions 49/9 or ready for use 59/6.

MINIATURE MOTORS. 24/28 v. D.C. or A.C. Size only 2 1/2 x 1 1/2 in. Spindle 1 1/2 in. long, 3/4 in. diam. Made by Hoover Ltd., Canada. Price only 9/9.

VIBRATORS. Oak 2 v. 7 pin. synchronous, 7/9.  
M.E. SPEAKERS. 2-3 ohms R.A. 8 in. Field 600 ohms, 11/9.

T.V. CABINETS. For 15 16 or 17 in. tube. Table model with doors, 79/6 carr. 7/6.

## R.S.C. TRANSFORMERS

FULLY GUARANTEED. INTERLEAVED AND IMPREGNATED.	
<b>MAIN TRANSFORMERS</b>	
Primaries 200-230-250 v. 50 c/s.	
<b>FULLY SHROUDED UPRIGHT MOUNTING</b>	
250-0-250 v. 60 mA., 6.3 v. 2 a., 5 v. 2 a., Midget type, 2 1/2-3-in.	17/6
350-0-350 v. 70 mA., 6.3 v. 2 a., 5 v. 2 a.	19/9
250-0-250 v. 100 mA., 6.3 v.-4 v. 4 a., c.t., 0-4-5 v. 3 a.	25/9
250-0-250 v. 100 mA., 6.3 v. 4 a., 5 v. 3 a.	23/9
250-0-250 v. 100 mA., 6.3 v. 6 a., 5 v. 3 a., for R1355 conversion	31/-
300-0-300 v. 100 mA., 6.3 v. 4 a., 5 v. 3 a.	23/9
300-0-300 v. 100 mA., 6.3 v. 4 v. 4 a. c.t., 0-4-5 v. 3 a.	26/9
350-0-350 v. 100 mA., 6.3 v. 4 a., 5 v. 3 a.	23/9
300-0-300 v. 130 mA., 6.3 v. 4 a., c.t., 6.3 v. 1 a., suitable for Mullard 510 Amplifier	33/9
350-0-350 v. 100 mA., 6.3 v.-4 v. 4 a., c.t., 0-4-5 v. 3 a.	26/9
350-0-350 v. 150 mA., 6.3 v. 4 a., 5 v. 3 a.	33/9
350-0-350 v. 150 mA., 6.3 v. 2 a., 6.3 v. 2 a., 5 v. 3 a.	33/9
425-0-425 v. 200 mA., 6.3 v. 4 a., c.t., 6.3 v. 4 a. c.t., 5 v. 3 a., suitable Williamson Amplifier, etc.	49/9
450-0-450 v. 250 mA., 6.3 v. 6 a., 6.3 v. 6 a., 5 v. 3 a.	69/6
<b>TOP SHROUDED DROP-THROUGH TYPE</b>	
260-0-260 v. 70 mA., 6.3 v. 2 a., 5 v. 2 a.	16/9
350-0-350 v. 80 mA., 6.3 v. 2 a., 5 v. 2 a.	18/9
250-0-250 v. 100 mA., 6.3 v. 4 a., 5 v. 3 a.	22/9
300-0-300 v. 100 mA., 6.3 v.-4 v. 4 a., c.t., 0-4-5 v. 3 a.	23/9
350-0-350 v. 100 mA., 6.3 v. 4 a., c.t., 5 v. 3 a.	22/9
350-0-350 v. 100 mA., 6.3 v.-4 v. 4 a. c.t., 0-4-5 v. 3 a.	23/9
350-0-350 v. 150 mA., 6.3 v. 4 a., 5 v. 3 a.	29/9
<b>E.H.T. TRANSFORMERS, 2,500 v.</b>	
5 mA., 2-0-2 v. 1.1 a., 2-0-2 v. 1.1 a., for VCR97, VCR517	36/6
<b>FILAMENT TRANSFORMERS</b>	
Primaries 200-250 v. 50 c/s.	
6.3 v. 1.5 a. 5/9	0-2-4-5-6.3 v 16/9
6.3 v. 2 a. 7/6	4 a. 16/9
0-4-6.3 v. 2 a. 7/9	6.3 v. 6 a. 17/6
6.3 v. 3 a. 8/11	12 v. 3 a. or 12 v. 1 a. 7/9
	25 v. 1.5 a. 17/6
<b>CHARGER TRANSFORMERS</b>	
All with 200-230-250 v. 50 c/s. Primaries:	
0-9-15 v. 1 1/2 a., 11/9; 0-9-15 v. 3 a., 16/9;	
0-3.5-9-17 v. 3 a., 17/9; 0-9-15 v. 5 a., 19/9;	
0-9-15 v. 6 a., 23/9.	
<b>ELIMINATOR TRANSFORMERS</b>	
Primaries 200-250 v. 50 c/s.	
120 v. 40 mA., 5-0-5 v. 1 a.	14/9
90 v. 15 mA., 6-0-6 v. 250 mA.	9/11
<b>OUTPUT TRANSFORMERS</b>	
Midget Battery Pentode 66:1 for 3S4, etc.	3/6
Small Pentode 5,000Ω to 3Ω	3/9
Standard Pentode, 5,000Ω to 3Ω	4/9
Standard Pentode, 8,000Ω to 3Ω	4/9
Push-Pull 8 Watts 6V6 to 5 ohms.	8/9
Push-Pull 10-12 Watts 6V6 to 3Ω or 15Ω	15/9
Push-Pull 10-12 Watts to match 6V6 to 3-5-8 or 15Ω	16/9
Push-Pull EL84 to 3 or 15 ohms.	16/9
Push-Pull 15-18 Watts, sectionally wound, 6L6, KT66, etc., to 3 or 15 ohms.	21/9
Push-Pull 20 Watt high-quality sectionally wound, 6L6, KT66, etc., to 3 or 15Ω	47/9
<b>SMOOTHING CHOKES</b>	
250 mA., 5 H., 100 ohms.	11/9
150 mA., 7-10 H., 250 ohms.	11/9
100 mA., 10 H., 200 ohms.	8/9
80 mA., 10 H., 350 ohms.	5/6
60 mA., 10 H., 400 ohms.	4/11
1 amp. 0.5 ohm. L.T. type	6/6

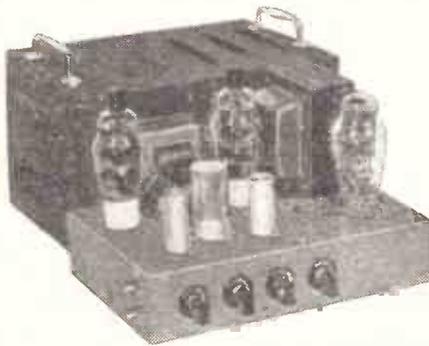
# R.S.C. A10 ULTRA LINEAR 30 WATT AMPLIFIER

NEW 1957 DESIGN. HIGH FIDELITY PUSH-PULL UNIT EMPLOYING SIX VALVES. Tone Control Pre-amp stages are incorporated. Sensitivity is extremely high. Only 12 millivolts minimum input is required for full output. THIS ENSURES THE SUITABILITY OF ANY TYPE OR MAKE OF MICROPHONE OR PICK-UP. Separate Bass and Treble controls give both "lift" and "cut" with ample tone correction for long playing records. AN OUTPUT SOCKET WITH PLUG IS INCLUDED FOR SUPPLY OF 300 v. 20 mA. and 6.3 v. 1.5 a. FOR A RADIO FEEDER UNIT. Price in kit form with easy-to-follow wiring diagrams.

An extra input with associated vol. control is provided so that two separate inputs such as "mike" and gram, etc., etc., can be simultaneously applied for mixing purposes.

Only **10** GNS. carr. 10/-.  
17/6 extra.

Cover as illustrated  
Or Factory built with 12 month's guarantee.  
£12/19/6. TERMS ON ASSEMBLED UNITS.  
DEPOSIT 28/9 and 9 monthly payments of 28/9.



Type 807 output valves are used with High Quality Sectionally wound output transformer specially designed for Ultra Linear operation. Negative feedback of 17 D.B. in main loop. CERTIFIED PERFORMANCE FIGURES ARE EQUAL TO MOST EXPENSIVE UNITS AVAILABLE. Frequency response  $\pm 3$  D.B., 30-20,000 c/c.s., 12 D.B. "lift" at 50 c/c.s., 12 D.B. "lift" at 12,000 c/c.s., Hum and noise 70 D.B. down. Good quality reliable components used. Chassis finish blue hammer. Overall size 12 x 9 x 9 in. approx. Power consumption 150 watts. For A.C. mains 200-230-250 v. 50 c/c.s. Outputs for 3 and 15 ohm speakers. EQUALLY SUITABLE FOR THE CONNOISSEUR OR FOR LARGE HALLS, CLUBS, or OUTSIDE FUNCTIONS. IDEAL FOR USE WITH MUSICAL INSTRUMENTS SUCH AS STRING BASS, ELECTRONIC ORGAN, GUITAR, etc. FOR DANCE BANDS, GARRISON THEATRES, etc., etc.

We can supply Microphones, Speakers, 12 v. Rotary Converters, etc., at keen cash prices or on terms with amplifiers.

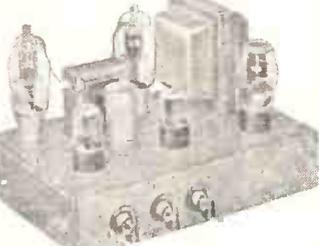
## EXPORT ENQUIRIES INVITED

**R.S.C. TAI HIGH QUALITY TAPE DECK AMPLIFIER**  
FOR ALL DECKS WITH HIGH IMPEDANCE RECORD/PLAYBACK AND ERASE HEADS. Such as Lane, Truvox, etc., or matched to low impedance erase heads as fitted latest COLLARO TAPE TRANSCRIPTOR. Chassis size 12-7-3in. Overall size 12-7-6in. For 230-250 v. 50 c/c.s. A.C. mains. Output for standard 2-3 ohm speaker. Only 15 millivolts input required for full recording. Only 2 millivolts minimum input required from recording head. Magic Eye recording level indicator. Provision for feeding P.A. amplifier. Can be used as gram. amplifier with input of 0.75 v. R.M.S. Negative feedback equalisation. Linear frequency response  $\pm 3$  D.B. 50-11,000 c/c.s. Facilities for recordings at 15in., 7 1/2in. or 3 1/2in. per second. Automatic equalisation at the turn of a knob. When switching from record to playback position automatic demagnetisation of heads is assured. PERFORMANCE IS COMPARABLE WITH UNITS AT OVER TWICE THE COST. LEAFLET 6d.

11 Ready for use  
GNS. Carr. 7/6.

heads is assured. PERFORMANCE IS COMPARABLE WITH UNITS AT OVER TWICE THE COST. LEAFLET 6d.

# R.S.C. ULTRA LINEAR 12-WATT AMPLIFIER



## NEW 1956 MODEL A8 HIGH-FIDELITY PUSH-PULL AMPLIFIER WITH "BUILT-IN" TONE CONTROL PRE-AMP. STAGES

High sensitivity. Includes 4 valves (807 outputs). High Quality sectionally wound output transformer, specially designed for Ultra Linear operation, and reliable small condensers of current manufacture. INDIVIDUAL CONTROLS FOR BASS AND TREBLE "Lift" and "Cut" Frequency response  $\pm 3$  db. 30-30,000 c/c.s. Six negative feedback loops. Hum level 71 db. down. ONLY 70 millivolts INPUT required for FULL OUTPUT. Suitable for use with all makes and types of pick-ups and practically all microphones. Comparable with the very best designs. FOR STANDARD or LONG PLAYING RECORDS. FOR MUSICAL INSTRUMENTS such as STRING BASS, GUITARS, etc. OUTPUT SOCKET with plug provides 300 v. 20 mA. and 6.3 v. 1.5 a. For supply of a RADIO FEEDER UNIT. size approx. 12-9-7in. For A.C. mains 200-230-250 v. 50 c/c.s. Output for 3 and 15 ohm speakers. Kit is complete to last unit. Chassis is fully punched. Full instructions and point-to-point wiring diagrams supplied.

Unapproachable value at £7/15/- or factory built. 45/- extra. Carriage 10/-. If required louvered metal cover with 2 carrying handles can be supplied for 17/6. Where an extra input socket with associated volume control is required for mixing purposes this can be provided for 13/- extra. TERMS OF ASSEMBLED UNITS with extra input as mentioned above. DEPOSIT 25/6 and nine monthly payments of 23/4.

**LINEAR "DIATONIC" 10-WATT HIGH FIDELITY AMPLIFIER.** Incorporating pre-amp. For A.C. Mains input 200-230-250 v 50 c.p.s. A compact attractively finished unit with two separately controlled inputs, and outputs for 3 and 15 ohm speakers. Separate Bass and Treble controls. Five latest type miniature Mullard valves. Only 12 Gns. Send S.A.E. for leaflet and credit terms.

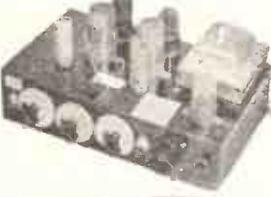
**W.B. "STENTORIAN" HIGH FIDELITY P.M. SPEAKERS.** HP1012, 10 watts, 15 ohm (or 3 ohm) speech coil. Where a really good quality speaker at a low price is required, we highly recommend this unit with an amazing performance. £4/10/9. Please state whether 3 ohm or 15 ohm required.

**P.M. SPEAKERS.** 2-3 ohm. 5in. Goodmans, 17/9. 7 x 4in. Elliptical, 19/6. 6 1/2 in. Rola, 16/9. 8in. Rola, 19/9. 10in. R.A., 29/9. 12in Plessey 3 ohms, 10 watts, 58/6.

## SUPERHET RADIO FEEDER UNIT

Design of a high quality Radio Tuner Unit (specially suitable for use with any of our Amplifiers). A Triode Heptode F/changer is used. Pentode I.F., and double Diode Second Detector. Delayed A.V.C. is arranged so that A.V.C. distortion is avoided. The W. Ch. Sw. incorporates Gram. position. Controls are Tuning, W. Ch., and Vol. Output will load most Amplifiers requiring 500 M.A. input depending on Ae. location. Only 250 v. 15 mA. H.T. and L.T. of 6.3 v. 1 amp. required from amplifier. Size of unit approx. 9-6-7in. high. Send S.A.E. for illustrated leaflet. Total building cost is £4/15/-. Point-to-point wiring diagrams and instructions, 2/6.

**RECORDING TAPE.** 1,200 ft. Reels, Puretone, Medium Coercivity, 15/9.



## LINEAR LG3 MINIATURE 3 WATT GRAM AMPLIFIER

For 200-250 v. 50 c.p.s. A.C. Mains. Chassis fully isolated. Fitted vol. (with mains switch) and Tone Control. Designed for use with any kind of single player or record changing unit. Output for 2-3 ohm speaker. Guaranteed 12 months (valves 3 months). Only 69/9, carr. 3/9.

**COLLARO RC456 4 SPEED AUTO-CHANGERS**  
With studio pick-up with turnover head. BRAND NEW. Cartoned, latest model. For 200-250 v. 50 c.p.s. A.C. mains. Very limited number at only £8/19/6. Carr. 5/6.

**COLLARO RC54 3 SPEED AUTO CHANGERS**  
As above unit but for normal 3 speed requirements. Brand new cartoned but for 110 v. 50 c.p.s. A.C. mains. So that the unit can be operated from normal, 200-250 v. A.C. mains we are supplying free with every changer a suitable auto-transformer with input and output voltages clearly marked. Limited number only. £7/19/6. Carr. 5/6.

**LINEAR L45 MINIATURE 4/5 W. QUALITY AMPLIFIER.** Suitable for use with Garrard, B.S.R. or any other record playing unit, and most microphones. Total negative feedback 12 db. Separate Bass and Treble Controls. For convenience when mounted in cabinet, mains switch is incorporated in control. For A.C. mains input of 200-250 v. 50 c.p.s. Output for 2/3 ohm speaker. Three miniature Mullard valves used. Size of unit only 6 x 5 x 4 1/2 in. Chassis is fully isolated from mains. Guaranteed 12 months. Only £5/19/6. Or Deposit 22/- and five monthly payments of 22/- Send S.A.E. for leaflet.

## R.S.C. 4-5 WATT HIGH GAIN AMPLIFIER TYPE A5

A highly sensitive 4-valve quality amplifier for the home, small club, etc. Only 50 millivolts input is required for full output so that it is suitable for use with the latest high-fidelity pick-up heads in addition to all other types of pick-ups and practically all mikes. Separate Bass and Treble controls are provided. These give full long playing record equalisation. Hum level is negligible being 71 D.B. down 15 D.B. of negative feedback is used. H.T. of 300 v. 26 mA. and L.T. of 6.3 v. 1.5 a. is available for the supply of a Radio Feeder Unit or Tape Deck pre-amplifier. For A.C. mains input of 200-230-250 v. 50 c/s Output for 2-3 ohm speaker. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with baseplate) with the blue hammer finish, and point to point wiring diagrams and instructions. Exceptional value at only £4/15/-, or assembled ready for use 25/- extra, plus 3/6 carriage. Or Deposit 22/- and five monthly payments of 22/- for assembled unit.



## R.S.C. A7 3-4 WATT QUALITY AMPLIFIER

A highly sensitive 4-valve amplifier using negative feedback and having an excellent frequency response. Pre-amplifier and Tone Control stages are incorporated with separate Bass and Treble controls giving full tone compensation for Long Playing records. Suitable for any kind of pick-up including latest high fidelity types. H.T. of 250 v. 20 mA. and L.T. 6.3 v. 1 a. available for supply of Radio Feeder Unit, etc. ONLY 40 millivolts input required for full output. Fully isolated chassis with baseplate. For A.C. mains 200-250 v. 50 cycles. Output for 2-3 ohm speaker. Complete kit of parts with point-to-point wiring diagrams and instructions. Only £3/15/-, carr. 3/6 or factory built 22/6 extra. Or Deposit 18/6 and five monthly payments of 18/6 for assembled unit.

**P.M. Speakers recommended for use with A7, A5 or L45 amplifiers.**

Plessey 12in. 3 ohm, 29/11. 6in. Celestion and Goodmans with high flux density magnet 19/9.

## PLESSEY DUAL CONCENTRIC 12 in. P.M. SPEAKERS

(15 ohms), consisting of a high quality 12in. speaker, of orthodox design, supporting a small elliptical speaker ready wired with choke and condensers to act as tweeter. This high fidelity unit is highly recommended for use with our A8 or any similar amplifier. Rating is 10 watts. Price only £5/17/6. Or Deposit 13/- and nine monthly payments of 13/-.



**Radio Supply Co. (LEEDS) LTD.**

**32 THE CALLS. — LEEDS, 2.**

Terms: C.W.O. or C.O.D. No C.O.D. under £1 Postage 1/9 extra on all orders under £2, 2/9 extra under £5 unless carriage charge stated. Full Price List 6d. Trade List 5d. Open to Callers: 9 a.m. to 5.30 p.m. Saturday until 1 p.m. S.A.E. please with all enquiries.

# G.W. SMITH & CO (RADIO) LIMITED

Phone: GERRARD 8204/9155  
Cables: SMITHEX LESQUARE  
3-34 LISLE STREET, LONDON, W.C.2

## AMERICAN LIGHTWEIGHT HEADPHONES

Magnetic type, resistance 50 ohms. Fitted with rubber earmoulds to fit inside the ear. Best quality, ideal for communication receivers, etc., supplied with lead, brand new, 15/- each. P.P. 1/6.

**BENDIX COMMAND TRANSMITTERS**  
Complete with all valves and crystal. Coverage 2.1 to 3 Mc/s., 29/6 each. P.P. 3/-.

**HEAVY DUTY L.T. TRANSFORMERS.**  
Input 230 volt 50 cycles. Output 17.5 volts 35 amps. (service rating, OK 50 amps). Brand new, 72/6 each. P.P. 5/-.

## 0.1 MA. METERS



Brand new moving coil meters, round flush mounting with 2½ in. scale, calibrated 0/300 volts, complete with rectifier. Price 25/- each. P.P. 1/-.

**8 MFD. PAPER CONDENSERS.** Brand new TCC. Visconol type, 750 volts working, 5/6 each. P.P. 1/-.

**COPPER AERIAL WIRE.** Ex-U.S.A., 300ft. reel, 3/6. P.P. 1/-.

**HEAVY DUTY SLIDER.** 1 ohm 12 amps. Brand new, 6/6. P.P. 1/9.

## HEAVY DUTY MAINS ISOLATING TRANSFORMERS

Specification:—Primary 230 volts 3 amps. Secondary 230 volts 3 amps. (Service rating, OK 5 amps.). Ideal for laboratory or workshop use. Supplied brand new in original transit cases, £6/10/- each. P.P. 10/-.

**INSTRUMENT POTENTIOMETERS.** Brand new Colvern type, 100,000 ohms, 10 watts, 3½ in. dia. Ideal for bridges, etc., 10/6 each. Ditto, twin gang, 5,000 ohms, 10/6 each. P.P. 1/6.

**460 KC/S B.F.O. UNITS.** Brand new and complete with IS5 valve, fully screened in aluminium case, only 8/6 each. P.P. 1/-.

## ROTARY CONVERTORS

Input 24 volts D.C. Output 230 volts 50 cycles, 100 watts. Supplied brand new, 92/6 each. P.P. 5/-.

## ALUMINIUM CHASSIS

Best quality, 18 s.w.g. Four sided, reinforced corners.  
6 x 4 x 2½ in. ... 3/6  
7½ x 5½ x 2½ in. ... 4/6  
11½ x 7½ x 2½ in. ... 6/-  
10½ x 7½ x 2½ in. ... 5/3  
13½ x 9 x 2½ in. ... 6/9  
Postage 1/- all sizes.

**POST OFFICE RELAYS AND KEY SWITCHES.** Extensive stocks available at "CHEAP" prices. All enquiries welcomed.

**MAINS NEON PANEL INDICATORS.** Chrome escutcheon. 200/250 v. Red, amber or clear, 3/9 each.

## A.G. MAINS BLOWER MOTORS

220/230 volts 300 watts. 1½ in. diameter outlet. Housed in metal box and fitted with dust filter pads. Supplied complete with 4 spare filters, 2 way outlet adaptor and 2 lengths of hose. Brand new only £4/19/6 each. P.P. 7/6.

## EX-NAVY SOUND POWERED TELEPHONES



This type requires no batteries to operate and can be fitted in moments. Uses hand generator for calling, giving an extremely loud buzzing note, and also a neon indicator. Ideal for field activities, factories, office, etc. Only 45/- each. P.P. 4/6.

## AMERICAN MULTI-RANGE TESTMETERS

1,000 ohms per volt, 400 microamp basic movement. Ranges as follows: A.C. and D.C. volts, 0 to 5,000 volts in 6 switched ranges. D.C. current, 1 mA., 10 mA., 100 mA., and 1 amp. Resistance measurement from 1 ohm to 1 megohm. Decibels from -10 db. to +15 db. The instrument is housed in a polished wood case, complete with leather carrying handle, test prods and battery. Guaranteed perfect order and tested before despatch. Price £5/19/6 each. P.P. 3/-.

## MODULATOR 67



These bargain instruments contain a COMPLETE A.C. MAINS POWER PACK. Input 230 volts 50 cycles. Output 350 volts. 120 mA. and 6.3 volts 5 amps. Choke and condenser smoothed and uses 5Z4 rectifier. (Transformer actually 200 mA.). Also included in the unit are 11 other valves, 5 SP61, 1 VR116, 2 EB34 and 3 EA50, and many other useful components, pots, resistors, switches, etc. Size of case 18 x 9 x 7 in., which is finished in grey. Supplied brand new, 49/6 each. P.P. 7/6.

## COSSOR DOUBLE BEAM OSCILLOSCOPE, TYPE 339A

Operation 110/200/250 volts A.C. Ten time base positions, 6 cps. to 250,000 cps. Input frequency range, 10 cps. to 2 Mc/s. Offered in perfect operational condition, fully tested, £27/10/- each. P.P. £1.

## AMERICAN GEARED MOTORS



American 24 volt D.C. motor with built-in precision gearbox giving twin outputs 20 r.p.m. and 6 r.p.m. Will also operate on 12 v. giving reduced outputs. Size 7 in. x 1½ in. Shaft dia. ½ in. Supplied brand new only 29/6 each. P.P. 3/-.

## MARCONI SIGNAL GENERATORS TYPE 390-G

Frequency coverage 16 to 150 Mc/s in switched ranges. 200/250 volt A.C. mains 50 cycle operation. Supplied brand new in original transit cases complete with calibration charts, instructions and complement of leads. £25 each. P.P. £1. Other types in stock.

## AMERICAN ROTARY GENERATORS

Input 12 volt D.C. Output 250 volts 80 mA. Fitted with blower attachment which can be easily removed if desired. Brand new 22/6 each. Ditto with 6 volt input 22/6 each. P.P. 3/-.



## AMERICAN BEACON TRANSMITTER RECEIVERS

RT 37/PPN-2. Brand new and boxed, complete with instruction book. Equipment comprises transmitter/receiver with 9 valves (5 3A5, 3 1S5 and 1 1R5), with built-in 2 v. vibrator power pack, spare vibrator, head-set, connector leads and 10ft. collapsible aerial. Frequency coverage 214/238 Mc/s. Price 72/6 each. P.P. 6/-.

**L.T. TRANSFORMER BARGAIN.** Input 200/250 volts. Output tapped, 3, 6, 9, 12, 24 or 36 volts 5 amps., 35/- each. P.P. 3/-.

**BARGAIN CABLE CLEARANCE.** 23/36 3-core rubber mains flex, silk maroon covered, 12 yds. 9/-, 100 yds. 59/6. Twin mains 10 amp., twisted, plastic or rubber, 12 yds. 9/-, 100 yds. 59/6, 75 ohm coax cable. ½ in. 6/6 12 yds. Twin transparent mains 3 amp. flex, 2/6 12 yds. Plastic 6 core flex, 15/- 12 yds.

## A.R.88 WAVECHANGE SWITCHES

Ceramic, 8 bank, 6 position, complete with screens. Brand new and boxed 17/6 each. P.P. 2/6.

**CRYSTAL MICROPHONE INSERTS.** Sensitive, ideal for amplifiers, tape recorders, etc., 4/6 each. P.P. 6d.

**SMOOTHING CHOKE SNIP.** Brand new parmeko chokes. 5 henry, 200 mA. Res. 50 ohms. Only 5/6 each. P.P. 1/6.

**MODULATION TRANSFORMERS**  
Collins type, potted. Push-pull 807 to parallel 807, 20 watts audio. Brand new, 12/6 each. P.P. 1/6.

## WESTON DUAL RANGE OHMMETERS

American test instruments by two famous manufacturers. Incorporates a 2½ in. moving coil meter, ranges 0-2,000 and 0-200,000 ohms. Price 39/6 each, brand new with leads and leather carrying case. P.P. 2/6.

**INSTRUMENT TRANSFORMERS.** Type 1.—Parmeko. Input 230 volts. Outputs 195 volts 85 mA. tapped 130 v. and 65 v. 6.3 volt 5 amp., 6.3 volt .3 amp. Price 14/6. P.P. 1/6. Type 2.—Midget. 220/240 volt input. Output 200 volts 25 mA. and 6.3 volt 1 amp. Price 10/6. P.P. 1/-.

## 6 VOLT VIBRATOR PACKS

6 volt D.C. input. Output 120 volts 30 mA. Fully smoothed, uses standard Mallory 4-pin vibrator. Compact in size. Supplied brand new and boxed, 12/6 each. P.P. 2/6.

**JACKSON SHORT WAVE VARIABLES.** 75 pF. with twin ended spindle, 2/- each. Twin gang 100 pF., 3/6. P.P. 1/-.

## HALLICRAFTER S.36A RECEIVERS

Frequency coverage 27 to 143 mc/s. A.M. or F.M. Built in "S" meter, operation 110/230 volt A.C. Supplied in brand new condition, £45 each. P.P. 15/-.

**HEADPHONE ADAPTORS.** Ex-U.S.A. High to low impedance matching, brand new 1/3. P.P. 6d.

## 50 MICROAMP METERS

A 2½ in. flush mounting meter housed in a grey instrument case, complete with a chrome handle. Resistance 800 ohms. Supplied brand new and tested, 59/6 each. P.P. 3/-.

HOURS OF BUSINESS: 9 a.m.-6 p.m. Thursday 1 p.m. Open all day Saturday.

Please print name and address clearly.

**WANTED. ALL TYPES OF COMMUNICATION RECEIVERS, TEST EQUIPMENT AND VALVES. HIGHEST CASH PRICES PAID.**

**POWER UNIT TYPE 3**

A complete A.C. mains power pack, input 200/250 volts. Output 250 volts D.C. 100 m/a. and 6.3 volts 4 amps. Fitted with H.T. voltmeter and current meter. Fully smoothed, choke and paper condensers. Housed in grey case for 19in. rack mounting. Supplied in brand new condition, 72/6 each. P.P. 7/6.

**CHARGING AND MODEL TRANSFORMERS**

1. Pri. 200/250 v. Sec. 3.5, 9 or 17 v. 1 amp., 9/9.
2. Pri. 200/250 v. Sec. 3.5, 9 or 17 v. 2 amp., 14/3.
3. Pri. 200/250 v. Sec. 3.5, 9 or 17 v. 4 amp. 16/6.
4. Pri. 200/250 v. Sec. 6.3 v. 3 amp., 8 v. 1.5 amp., 9/6.
5. Pri. 200/250 v. Sec. tapped, 3, 4, 5, 6, 8, 10 12, 15, 18, 20, 24 or 30 v. 2 amp., 18/6. P.P. 1/6 all types.

**L.T. METAL RECTIFIERS**

Full wave and bridged. 12 v 1 amp., 6/3; 12 v. 2 amp., 9/3; 12 v. 4 amp., 13/9; 24 v 4 amp., 22/6; 1/- P.P. all types.

**PANORAMIC ADAPTORS**

Brand new and boxed Ex-U.S.A. For use with receivers having an I.F. of 455/475 kc/s., giving a bandwidth of 200 kc/s. 110/230 volt A.C. operation. Price £30 each. P.P. £1.

**ELECTROLYTIC CONDENSER BARGAINS**

All new stock.  
 8 m. 450 v. 1/9 30 m. 450 v. 3/3 16 x 16 m.  
 8 m. 500 v. 2/4 40 x 8 m. 450 v. 3/9 450 v. . . 3/6  
 16 m. 450 v. 2/9 8 x 8 m. 450 v. 3/6 16 x 16 m.  
 16 m. 500 v. 3/3 8 x 16 m. . . . . 500 v. . . . . 4/3  
 32 x 32 m. . . . . 450 v. . . . . 3/6 32 x 32 m.  
 450 v. . . . . 4/8 50 x 50 m. . . . . 350 v. . . . . 4/3  
 25 m. 25 v. 1/9 275 v. . . . . 3/9 100 m. 25 v. 1/3  
 250 x 250 m. . . . . 50 m. 50 v. 1/9 6000 m. 8 v. 3/6  
 6 v. . . . . 2/6 500 m. 12 v. 1/3  
 1000 x 2000m. . . . . 8 x 16 m. . . . . 6d. P.P. on all  
 6 v. . . . . 3/6 500 v. . . . . 4/3 types.

**500 P.F. TUNING CONDENSERS**

Brand new 4 gangs, 7/6 each. Brand new 3 gangs, 6/6 each. Sub-miniature twin gang for transistors, 365 pf., 8/6. P.P. 1/-

**ADMIRALTY REFLEX RE-ENTRANT P.A. LOUDSPEAKERS**

Twin units. Impedance 3 ohms. Extremely sensitive and directional. Ideal for all outdoor work. Complete with 600 ohm line transformer. Price 32/6 each. P.P. 5/-.

**DEAF AID EARPIECES.** Brand new, 30 ohm res., 3/6. Lead, 1/- P.P. 6d. 1 megohm pots w/switch, 1/- Output transformer. 2/6. P.P. 6d.

**METER BARGAINS**

0/50μ amp. 2 1/2 in. Pj. M.C. . . . . 49/6  
 0/100μ amp. 2 1/2 in. F.M.M.C. . . . . 39/6  
 0/50 M/amps. 2in. F.M.M.C. . . . . 7/6  
 0/150 M/amps. 2in. F.M.M.C. . . . . 6/9  
 0/200 M/amps. 2 1/2 in. F.M.M.C. . . . . 9/6  
 0/1 amp. R.F. 2 1/2 in. Pj. T.C. . . . . 5/-  
 0/4 amp. R.F. 2in. F.M.T.C. . . . . 5/-  
 00/300 volt D.C. 2in. F.M.M.C. . . . . 10/6  
 0/300 volt A.C. 2 1/2 in. F.M.M.I. . . . . 25/-  
 0/1.5 amp. A.C./D.C. 2in. F.M.M.I. . . . . 6/6  
 20/0/20 amp. Lucas car type. . . . . 8/6  
 500/0/500μ amp. 2 1/2 in. F.M.M.C. . . . . 25/-  
**ALL NEW AND UNUSED**  
 2 m/a meter rectifiers S.T.C. . . . . 5/6

**R.1155 COMMUNICATION RECEIVERS, MODEL L**



Latest issue by the Ministry Similar to the model N, incorporating the trawler band. Frequency coverage, 200-500 kc/s., 600-1,500 kc/s., 1.5-3 mc/s., 3-7.5 mc/s., 7.5-18.5 mc/s. Supplied as new, aerial tested and complete with illustrated descriptive leaflet. Price £12/19/6 each. P.P. 10/-.

**R.1155 SUPERSLOW MOTION DRIVES**

Improved version as fitted to model L and N Supplied brand new and boxed, 12/6 each. P.P. 1/6.

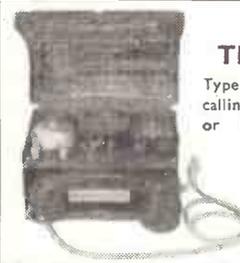
**373 MINIATURE 9.72 mc/s. I.F. STRIPS**

Supplied brand new, complete with 6 valves, 3 EF91, 2 EF92, 1 EB91. 42/6 each. P.P. 2/-.

**L.T. TRANSFORMER BARGAIN**

Input 200/250 volts. Output 12 volts 5 amps Brand new 12/6 each. P.P. 2/6.

**FIELD TELEPHONES**



Type Don Mk. 5. Buzzer calling. Ideal for inter office or house communication. Supplied complete with two 1.5 volt cells, tested and ready to operate. Price only 39/6 each. P.P. 3/-.

**MARCONI U.H.F. SIGNAL GENERATOR T.F.517, MODULATION GENERATOR T.F. 675**

Complete station comprising TF 517 signal generator, frequency coverage 16-58 mc/s. and 150-300 mc/s. and TF.675 pulse modulator, repetition speed 50-3,000 cycles, pulse width 2-12.4 μ sec. Supplied brand new in original transit case with instruction book and full complement of leads. £42/10/- each. P.P. 30/-.

**MARCONI CRYSTAL CALIBRATORS**

Frequency coverage 170/240 mc/s. Directly calibrated, accuracy .001%. Operation 200/250 volts A.C. Supplied complete with 5 mc/s crystal and spare set of 5 valves, in original transit case, brand new with instructions. £4/19/6 each. P.P. 10/-.

**TRANSMITTER/RECEIVER No. 19, Mk. II**



Equipment comprises 3 separate units built into one chassis and separate power pack. Specification: "A" set. Transmitter/receiver, Frequency coverage 2-4.5 mc/s. and 4-6.8 mc/s. For R.T. C.W. or M.C.W. Range on R.T. 15 miles, C.W. 50 miles. Superhet receiver, 465 kc/s. I.F., B.F.O., etc. R.F. Valve line-up: 6K7, RF, 6K6 mixer, 2 6K7 L.F., 6B8 det. A.F. phone output. Tx: 6K8 mixer, VFO, EF90 buffer, EB34 A.D.C. 807 P.A. "B" set. Transmitter/receiver 229/241 mc/s. Local use up to 1 mile. Valve line-up: CV6, 2 6K7 and 6V6. Inter Com. set, 2 valve A.P. amplifier for vehicle crew inter-communication. Valve line-up: 6K7 and 6V6. A 2 1/2 in. meter is built in reading L.T. and H.T. voltages, drive, etc. POWER UNIT. 12 volt D.C. input. Output 275 volts 110 m/a., and 500 volts 50 m/a. Equipment is of American manufacture and is supplied in good condition. Price, complete with power pack only 25/10/- each. P.P. 15/- Less power pack. 24/19/6 each.

**POWER UNIT 234**

A complete A.C. mains power unit in grey metal case for 19in. rack mounting. Input 200/250 volts A.C. Output 250 volts 150 m/a. and 6.3 volts 6 amps Double choke and condenser smoothed. Fitted with 2 1/2 in. moving iron meter for measuring A.C. input and D.C. output volts. Price 69/6 each. P.P. 8/6.

**VARIAC TRANSFORMERS.** Input 220 volts 50 cycles. Output variable from 200-240 volts 7.5 amps. Price 92/6 each. P.P. 5/-

**SOUND POWERED EARPIECES.** Can be used as a two-way communication, no batteries required. New, 3/6 each. P.P. 1/- Inserts only, 1/9. P.P. 6d. Brand new sound powered handsets, 19/6 each. P.P. 1/6.

**DYNAMO EXPLODER UNITS**

Used for detonating explosive charges. Operation is by hand generator, giving 1,800 volts D.C. across output terminals. Ideal also for use as photo flash generator. Supplied brand new only £3/19/6 each P.P. 5/-.

**HEATER TRANSFORMERS.** Brand new. 230 volt input. 6.3 volt output 1.5 amps. 5/9 each. P.P. 1/-

**SURPLUS SPEAKER BARGAINS**

All new and unused  
 Elac 5in. 3 ohm, 17/6; Elac 6 1/2 in. 3 ohm, 17/6;  
 Elac 8in. 3 ohm, 19/6; Elac 10in. 3 ohm, 27/6;  
 ROLA 7X4 elliptical 3 ohm, 18/6; Plessey 2 1/2 in. 3 ohm, 16/6; Plessey 10X7 elliptical 3 ohm, 27/6; Goodmans 3 1/2 in. 3 ohm, 17/6;  
 Std. pentode o/p transformer, 4/6.

**SMOOTHING CHOKES**

ALL NEW AND UNUSED  
 G.B. 20h 175 m/a., 10/6; Parmeko 8H. 250 m/a., 10/6; Parmeko 9H. 100 m/a., 7/6; Parmeko 8H. 50 m/a., 5/6; Parmeko C core, 4H. 22.5 m/a., 4/6; Collins 8H. 100 m/a., 8/6; Parmeko swingings choke, 3.6-4.2H. 250 m/a. 20H. no D.C., 10/6; 15H. 60 m/a., 5/6; STC 10H. 60 m/a., 4/6. 20H. 120 m/a., 10/6; 15H. 300 m/a., 10/6; Rich/Bundy 50H. 120 m/a., 15/6.

**"C" CORE E.H.T. TRANSFORMER.** Input 230 v. Output 3,850 volts 5 m/a. 4 v. 2.5 amps., 4 v. 1 amp. Supplied brand new and boxed, 52/6 each. P.P. 3/-.

**H.T. TRANSFORMER BARGAIN.** Inpu 200/250 v. Output 250/0/250 v. 200 m/a. 6.3 v 4 a. 5 v. 2 a. Brand new, 27/6 each. P.P. 2/6.

**G.P.O. BELL UNITS No. 1**

Supplied brand new in wooden box, complete with two bells, induction coil and condenser, 7/6 each. P.P. 2/6.

**ROTARY CONVERTORS.** Input 24 volts D.C. Output 50 volts A.C. 50 watts. Brand new, 29/6 each. P.P. 3/-.

**WAFER SWITCHES.** Small. 2 p. 2 w. 1/6. 3 p. 4 w. 2/6. 4 p. 3 w. 2/6. 2 p. 6 w. 2/6. 1 p. 12 w. 2/6. Meter switch 2 p. 11 w. 2 band. 2/6. Ceramic 4 p. 4 w. 2 bank, 3/6. Large Tx ceramic, 2 p. 6 w. 2 bank, 7/6.

**VALVE BARGAINS**

Large stocks held. Few examples:  
 5V4 8/6, 6AG5 3/6, DK96 9/6, EY51 10/6,  
 EF86 12/6, 6V6-6/6, DL96 9/6, EF80 10/6,  
 EL84 12/6, 5U4 8/6, 6X5 7/6, PX25 15/6,  
 DF96 9/6, ECF80 12/6, EZ81 10/6, 6H6  
 1/9, 6SN7 6/6, DAF96 9/6, ECF82 12/6,  
 ECC83 10/6, 6J6 3/6, KT66 12/6, DF91  
 7/6, ECC84 12/6, ECL80 11/6, 2D21  
 10/6, VU111 1/9, EF39 5/6, ECH42 10/6,  
 ECH81 10/6, EF37A 10/6.  
**ALL NEW AND GUARANTEED**

**GW SMITH & CO (RADIO) LIMITED**  
 Phone: GERRARD 8204/9155  
 Cables: SMITHEX LESQUARE  
 3-34 LISLE STREET, LONDON, W.C.2

# There is always a fine selection of equipment at

## LABORATORY RESISTANCE BRIDGE

A Standard Resistance Box containing 22 hand-wound non-inductive resistance coils of manganin (co-efficient of expansion .000006) which provides a 1 to 11,110 ohm standard at 60°F in 1 ohm steps for meter calibration, etc. The coils are connected to heavy machined brass blocks in which shorting plugs are arranged to form the two ratio arms and variable arm of a Wheatstone bridge.

The ratio arms of x 1/100, x 1/10, x 1, x 10 and x 100 enable the variable arm to measure by direct comparison unknown resistances between .01 and 1,111,000 ohms.

Heavy brass binding posts, an infinity plug, battery and galvo keys, and ratio arms isolating link incorporated. New in teak box with operating instructions and explanatory circuits. Size 5½ x 6 x 8in.: £2/10/-, plus 5/- p.p.



## AN/APN.1 TRANSDUCER

This Unit consists of Magnet and Coil which is attached to an aluminium diaphragm suspended freely and perforated to prevent air damping. Mounted on a Ceramic cover which sits over the diaphragm is a form of 2-gang capacitor which has a swing from 10-50 pF.

The above unit is used as part of Wobbulator described on page 252 of the June 1956 "Wireless World." Price 7/6 p.p.



## HEATER TRANSFORMERS

6.3 volt, 1½ amp.; brand new, 6/6, plus 1/- p.p.

## SMALL MAINS TRANSFORMERS

Input 230V. 50 cycles, output 250V. 40 mA., 6.3V. 1.5A. Size 3.9 x 2.4 x 2in. Ideal for TV converters. Price 12/6 each, plus 1/- p.p.

## CHARGER TRANSFORMERS

For 6 or 12 volt; 230 volt 50 cycles input, 9 and 17 volt 3 amp. output. Price 15/6 each, plus 1/- p.p.

## 5mA METER 8" CIRSCALE (Radio Altimeter)

5 mA. panel mounting meter, 3in. dia., 8in. circular scale. Large magnet. Scale easily removable leaving finished face-plate for re-calibration. Basis for sensitive portable multimeter. Brand new, boxed 7/6 post free.



## U.S.A. ALTITUDE SWITCHES

Totally enclosed incremental network of 14 x 2.5K ohms 10% 1 watt resistors on two bank 11 way Yaxley type switch unit. Insulated mounting range and handsome glass covered dial with large central switch knob covering 11 positions in steps of 25 "feet." Rear socket, 4 connections to network and earthing point for screening. 3in. dia. x 5in. long. Brand new, boxed 4/- post free.



## CHARGER RECTIFIER

12 volt 4 amp. full wave. Size 4½in. dia. by 2½in. Whit. fixing bolt protruding ½in. either side. Price 12/- each, plus 2/- p.p.



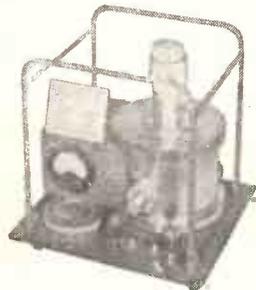
## I.F. AMPLIFIER UNIT

460 kc/s. with IT4. Brand new and boxed. Fully screened in plug-in box. Size 2½in. x 1in. x 4½in. Price, with circuit, 10/- each, plus 1/- p.p.

## 'S' BAND PRECISION WAVEMETER

2,900 to 3,150 Mc/s. TEST SET 288 A.M. Ref. 10SB/6161.

Comprising exceptionally rugged silver-plated Wavemeter Type 1665, resiliently mounted and directly tuned by 1¼in. dia. calibrated micrometer with 6¼in. thimble scale. Temperature correction for micrometer attached. Resonance indicated on 100 microamp meter. Equally suitable for laboratory using milliwatt powers or, with loose coupling, for high powers. UR21 connecting cable and coupling probe supplied. Brand new in robust moisture-proof case with jacking-off screws and tool. Price £15, plus £1 packing and carriage.



## 2in. MAGSLIPS

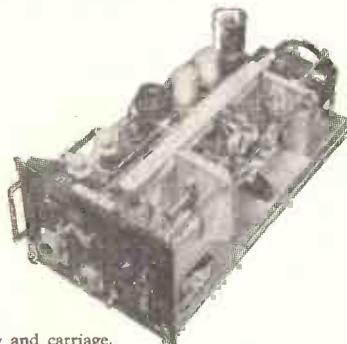
50 v. 50 cycle transmitter and receiver units. Accurate to 1/10th deg Guaranteed good working order, 35/- a pair, plus 3/- p.p.

## BENDIX INVERTER

Type 12123-1-A. 24 volt D.C. input. 115 volt 3 phase 400 cycle 5 amp. Size: 9in. long, 4in. dia. 6in. high including connector box and voltage regulator. Price £4 each, plus 5/- p.p.

## A.P.Q.9 RADAR JAMMING UNIT

Containing 913A Photo Multiplier Cell, complete with resistance network and lightproof box. Wide band amplifier (2) 6AC7 and 6AG7 driving a pair of parallel 807s which Grid modulate a pair of 8012s in push pull. Lecher lines, these cooled by blower motor. Cathode loaded by co-axial stubs which simultaneously guillotine tune anode and grid lines with a counter mechanism. Output is matched to aerial by a matching stub. Suitable for use in centimetric bands. Brand new. Price £5, plus 10/- packing and carriage.

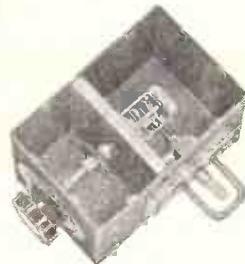


## INVERTERS

Miniature 3-phase (ex-compass unit) 24 v. input with 17 v. 3-phase 400 c/s. output. These have been used by model makers as motors and are known as the "5/- Motor." Will run quite successfully on 12 volts. 5/- plus 2/- p.p.

## ABSORPTION WAVEMETER

Easily converted to 2 metres or 70 cm. In Copper-plated metal case 3½ x 4½ x 5½in. with dial calibrated 0-100 and 80 v. Neon tube. Coverage approx. 190-210 Mc/s. New 6/6 each, post paid.



## RELAYS

Sensitive Single Pole change-over, 2,000 ohm Coil. 10 volt D.C. Mounted on insulated base 2½ x 2½ x ¼in. American manufacture. New and boxed. Price 12/6, p.p.

4 Pole change over. Miniature Relay 200 coil. 24-27 volt D.C. Size 1½ x 1½ x 1½in. American manufacture. Price 7/6, p.p.

## SPECIAL OFFER

### MALLORY VIBRATOR PACKS

12 volt, 150 volt 40 mA. Brand new and boxed, size 5½in. x 5½in. x 3in., 12/6 each p.p.

All these fine offers are on display at ➔

# PROOPS BROS. LTD. —

# The Walk-around Shop

## RECEIVER M.N. 26B

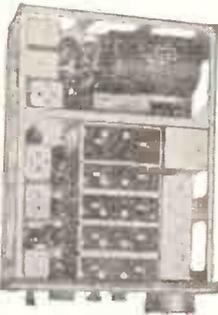
### BENDIX COMMUNICATIONS

A superb 12 valve receiver covering 150-1500 kc/s in 3 bands, 150-325, 325-695, 695-1500 kc/s.

I.F. frequency 112.6 kc/s.  
Valve line up: 6K7 1st and 2nd R.F. 6L7 Mixer. 6J5 Oscillator. 6K7 I.F. Amplifier. 6B8 1st and 2nd Det and A.V.C. 6J5 B.F.O. 6F6 Audio Output. Also Radio Compass output stage; 6N7 Compass Modulator. 6N7 Audio Oscillator. 6K7 Loop Amplifier. 6K7 Compass Output.

Power Supply 28 volt D.C. 1.6 amps to internal Motor Generator, which can be easily changed for 12 volt Generator as unit was designed for both supplies.

(Details available). THE PERFECT CAR RADIO size 15½in. x 11½in. x 6in. For A.C. mains operation, supply required: 6.3v. and 230 v. 100 mA. Circuit diagram and connection chart free with each unit. Price £3/10/- plus 10/- carriage.



## GYRO UNIT AND INVERTER

**Inverter:** 12 volt D.C. input, 3 phase 190 cycle output. (These inverters can be used successfully as 12 v. D.C. Motors for Models.)  
**Gyro Unit:** operates on 3 phase output from Inverter. Peak speed 11,400 r.p.m. Caged. Precision made equipment. These units are ideal for experimenting and demonstration purposes. Size: Inverter 4 x 3 x 3in.; Gyro 4in. dia. incl. cage. Price 12/6 per pair, plus 3/- p.p.



## R.F. UNITS

- R.F. 24 20-30 Mc/s. Switched Tuning. Valved ..... 9/6 each
- R.F. 25 40-50 Mc/s. Switched Tuning. Valved ..... 9/6 each
- R.F. 26 50-65 Mc/s. Variable Tuning. Valved. Damaged dials .... 20/- each
- Perfect dials .... 25/- each
- Packing and postage 3/- each type.

## MORSE SIGNALLING LAMPS

(Aldis type) 5in. dia. with sighting arrangement, 2 handles, keying switch, and 2 yards cable. In wood carrying case, 10/- plus 3/- p.p.

## STUD SWITCHES

20 segment 5/16in. studs, base 5in. square with handle and housing. New and boxed, 5/- each, plus 1/6 p.p.

## POWER UNIT Type 173

24 volt D.C. input, 120 v., 60 mA. output. Containing Vibrator Transformer, 12 volt Vibrator, two 120 volt Selenium Rectifiers. Chokes and Condensers. Size 10½in. x 6in. x 3in. Price 12/6 post paid.



## COMMUNICATIONS RECEIVER CG.46116

(General Electric U.S.A.) Highly sensitive receiver 1500 to 9000 kc/s. (200-232 metres) continuous coverage with overlaps in 4 channels. 3 I.F. stages, 2 R.F. stages and I.F. break-through trap. B.F.O. and O/P. Valve line up: 5 12SK7s, 12K8, 12SR7, 12A6. Neon static in antenna circuit. Fully valved £8/10/-, plus 10/- pack. and carr.

## SLIDE RULES

10in. carrying A, B, C, D, and Log-Log scales on face, with centimetre and inch scales on edges. Price 9/-, post paid, with instruction booklet.

## THROAT MICROPHONES



Type T30. U.S. Manufacture

Complete with elastic strap. Lead terminating at 2-pin plug PL.291 and socket JJ-048. New and boxed, 3/- each, post paid.

## RECEIVER UNIT Ex 1143A

10.72 Mc/s. I.F.s. Frequency 100-120 Mc/s., suitable for conversion to 2 metres and Wrotham.

Owing to a large purchase we can offer these units fully valved, with circuit diagram at 25/- each, plus 3/- post/packing. Valve line-up: (4) EF50, (1) EL32, (2) EF39, (1) EBC33, (1) EA50.



## MORSE KEYS No. 2

Mk. 3, 8 amp. ZA.16929. New and boxed. Size 3½in. x 1¼in. Price 2/6 post paid.

## CARBON HAND MICROPHONE

Type 3 with lead. New and boxed. 7/6 each plus 1/- post.

## BATTERY CHARGING LEADS

2 yds. of cab tyre twin cable, and 2 large crocodile clips; new and boxed. 3/- p.p.

## MAINS POWER UNIT

TYPE 234

(For use with Receiver R 1392)

Double Smoothed 200-250 v. 50c. Input. 240 V. 100mA. 6.3 at 6 amps. with Volt Meter reading input and output voltages. Size: 19in. x 10in. x 6½in. Standard Rack Mounting. Price £4/10/- each, plus 10/- carriage.



## RECTIFIERS

Chassis cooled, brand new, 125 volt, 80 mA., 4/9 p.p.; 250 volts, 50 mA. 8/3 p.p.



## BEACON RECEIVER BC1206A

Covering 200-400 kc/s. Valve line-up: 6K7 RF; 6SA7 frequency changer; 6SK7 I.F. amplifier; 6SQ7 det; 28D7 O/P. This was designed to run on 24/28V D.C. HT/LT. Excellent basis for car radio; size 6 x 5 x 4in. Good working order: £3/5/- each, plus 5/- carr.

## NICKEL IRON CELLS

1.2 volt size 3½in. x 2½in. x 1in., unfilled 5/- each. plus 1/- p.p.

## A room-to-room telephone . . .

Ideal for two-way conversation, house-to-garage or internal communication.

- No batteries required
- No soldering required
- Just connect it up and it works

The sets consist of 2 high-quality microphone/receivers (new and boxed) and 15 yards of twin wire

COMPLETE FOR **8/6**  
plus 1/6 postage



NOTE: Carriage prices quoted apply only to England and Wales.

# PROOPS

## BROS. LTD.

DEPT. 'W,' 52 TOTTENHAM COURT ROAD, LONDON, W.1

Shop hours 9 a.m. to 6 p.m.—Thurs.: 9 a.m. to 1 p.m.

Shop and Head Office: Telephone: LANgham 0141  
Mail order enquiries: Telephone: EUSton 8812

OPEN ALL DAY SATURDAY



# Stern's introduce...

## A "fidelity" TAPE RECORDER WITH EVERYTHING—EXCEPT A HIGH PRICE TESTED AND APPROVED AT THE TRUVOX LABORATORIES

IT INCORPORATES: The NEW TRUVOX Mk. IV TAPE DECK together with the "fidelity" MODEL HF/TR2 TAPE AMPLIFIER (both fully described on this page), and a Roia 10x6in. P.M. speaker.

● BEFORE CHOOSING YOUR TAPE RECORDER YOU SHOULD HEAR THIS MODEL—TRULY "Hi-Fi" RECORDINGS ARE OBTAINABLE and it is comparable to much higher priced Recorders.

Alternatively send S.A.E. for ILLUSTRATED LEAFLET.

PRICE . . . Including CRYSTAL MIKE and 1,200ft. reel of PLASTIC TAPE.

**£49.10.0.** (OR £3 EXTRA WITH REV COUNTER.)

(Plus £1/10/- carriage and insurance, of which £1 is refunded on return of Packing Case.)

CREDIT SALE: Deposit £12/8/- and 9 monthly payments of £4/10/8.

HIRE PURCHASE: Deposit £24/15/- and 12 monthly payments of £2/5/11.

## Home Constructors!

WE MAKE SPECIAL PRICES TO PURCHASERS OF TAPE EQUIPMENT (i.e. buyers of Deck and Amplifier together, etc.) SEND YOUR ENQUIRY TO US. H.P. and CREDIT SALE TERMS ARE AVAILABLE.

A COMPLETE KIT OF PARTS TO BUILD

### The "fidelity" TAPE AMPLIFIER Model HF/TR2 including POWER SUPPLY UNIT

FOR ONLY **£12.0.0.** (Plus 5/- carr and ins.)

This amplifier has been expressly designed to meet the requirements of the enthusiasts for High Fidelity reproduction. It is based on a new design, completed by the Mullard Technicians and only really high grade components are incorporated. Truly HIGH FIDELITY Recordings are obtainable whilst "Hi-Fi" reproduction is assured by use of a high quality Output Transformer by Gilson. It incorporates a "magic eye" Recording Level Indicator, a two position equaliser for 3 1/2 in. and 7 1/2 in. speeds, and an effective Tone Control arrangement. Monitoring and Extension Speaker Socket are incorporated and in addition a position is provided to enable it to be used as an independent Amplifier for Gramophone Records or Radio Tuning Unit. Overall size: 11in. x 6in. x 6in. high. Suitable for nearly all makes of Tape Decks. When ordering, please advise make of deck in use.



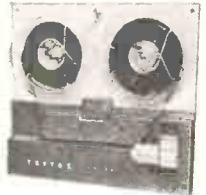
WE ALSO SUPPLY THE HF/TR2 ASSEMBLED and READY FOR USE FOR £18.0.0. (Plus 5/- carr. & ins.) H.P. TERMS: Deposit £8 and 9 monthly payments of £1. CREDIT TERMS: Deposit £4 and 9 monthly payments of £1/9/4.

## YOU CAN BUILD A PORTABLE TAPE RECORDER OR INCORPORATE "TAPE" IN YOUR RADIOGRAM.

### THE NEW TRUVOX MkIV TAPE DECK

THIS IS UNDOUBTEDLY ONE OF THE BEST TAPE DECKS ON THE MARKET WE HAVE A FEW ONLY AVAILABLE

PRICE **£27.6.0** (Plus 10/- carr and ins.)



CREDIT TERMS: Deposit £6/17/- and 9 monthly payments of £2/10/-.

H.P. TERMS: Deposit £13/13/- and 12 monthly payments of £1/5/4.

**SPECIFICATION:**—● 3 B.T.H. shaded pole motors with silent friction drive eliminating "wow" and "flutter." ● Push button controls, electrically and mechanically interlocked (patented). ● Patented electric type push button controlled brake. ● Inching to assist editing; tape loading on the drop-in principal accommodation for reels of 7in. diameter ● Tracking sense. To British and American standards. ● Playing times: Up to 3 hours with L.P. Tape or 2 hours with Standard Tapes. ● Two tracks, side by side, with safety gap. ● Play/az time indication by precision revolution counter or large visual type indicator plate, according to choice. ● Positive Azimuth adjustment of Record/Player Head. ● High Impedance Heads. ● The metal work is Gold Hammered finish. ● Overall size 14 1/2 in. x 12 1/8 in., from top of face of panel, overall depth 6in

The Mk. IV DECK CAN ALSO BE SUPPLIED INCORPORATING PRECISION REV. COUNTER for £30/0/- H.P. TERMS: Deposit £15/4/6 and 12 months of £1/8/3 CREDIT SALE: Deposit £7/12/3 and 9 months of £2/15/-.

### STERN'S "COMPACT 5" AMPLIFIERS



The "Compact 5-2"

EXPRESSLY DEVELOPED FOR VERY HIGH QUALITY REPRODUCTION OF GRAM. RECORDS AND PARTICULARLY SUITABLE FOR HIGH QUALITY REPRODUCTION OF THE F.M. TRANSMISSIONS.

A 2-stage high sensitivity amplifier having SEPARATE BASS and TREBLE CONTROLS and designed to give up to approx. 5 watts with very pleasing quality. PRICE £8/6/-, £6/16/-.

The "Compact 5-3" A 3-stage version of the "5-2" model but in this case having an additional stage and incorporating negative feedback. PRICE £12/10/-.

POWER SUPPLY. Is obtainable from a small separate Unit which apart from supplying power to either Amplifier, also has additional supply available for a Radio Tuning Unit PRICE (additional to above), £2/10/-.

### Stern's "fidelity" F.M. TUNING UNIT

A 5-Valve Tuner incorporating the latest Mullard Permeability Tuned Unit Price assembled less Power Supply: **£14.10.0**

(Plus 7/6 carr. and ins.)

TERMS: (a) H.P. Deposit £7/5/- and 9 monthly payments of 18/4; (b) Credit Deposit £23/12/8 and 9 monthly payments of £1/6/7. Provides "Hi-Fi" reproduction with any make of Amplifier and many Radio Receivers. It incorporates: ● The latest Valve line-up—ECC85, 2 type EF85, EF91 and EM80. ● A "Magic Eye" Indicator. ● Power consumption is 17 amps at 6.3 volts and 25 m/a. at 250 volts.

### STERN'S "fidelity" COMBINED A.M. and F.M. TUNING UNIT

THIS IS IDENTICAL to the Stern's F.M. Tuner illustrated above, but in addition incorporates the MEDIUM WAVE-BAND and thereby also provides a selection of foreign stations Price **£18.18.0** (Plus 7/6 carr and ins.)

TERMS:—(a) H.P. Deposit, £9/9/- and 10 monthly payments of £1/1/-; (b) Credit Deposit £24/15/- and 9 monthly payments of £1/2/4/7. Send S.A.E. if further data required.

### THE ARMSTRONG MODEL AF105 AM/FM RADIOGRAM CHASSIS

Developed to meet the needs of those who require really high quality radio and record reproduction but who, for reasons of expense or lack of room in existing or proposed cabinets, cannot consider the normal high-fidelity system. The A.F.105 is as good as, or better than, all but the most expensive Amplifiers, and Associated units. Independent and continuously variable Bass and Treble controls give a wide range of control. SEND S.A.E. FOR DETAILS.

PRICE **£37** (Plus 7/6 Carr. and Ins.)

CREDIT SALE TERMS: Deposit £9/5/- and 9 monthly payments of £3/7/10. HIRE PURCHASE TERMS: Deposit £18/10/- and 12 monthly payments of £1/14/4.

Open Monday to Friday 9 a.m.—6 p.m. Saturday 9 a.m.—1 p.m.

# STERN RADIO LIMITED

**AMPLIFIERS  
PRE-AMPLIFIERS** **TUNING UNITS  
RADIO RECEIVERS**

**—COMPLETE KITS OF PARTS FOR THE "Hi-Fi" ENTHUSIAST—**

QUALITY OF THIS NATURE HAS NEVER BEFORE BEEN OFFERED AT SUCH LOW COST.

**THE MULLARD '5-10' MAIN AMPLIFIER**



This is the very latest design and needs no recommendation from us. Our Kit is complete to Mullard's specification, including the latest GILSON ULTRA LINEAR OUTPUT TRANSFORMER and the entire MULLARD Valve line up. ALL SPECIFIED COMPONENTS are supplied.

**PRICE OF COMPLETE KIT OF PARTS (Plus 5/- carr. and ins.) £11/11/0**

THE full SPECIFICATION and BUILDING INSTRUCTIONS for these three Units are available for 1/6 each. THEY include COMPONENT PRICE LISTS and simple "wire-to-wire" PRACTICAL DIAGRAMS.

**STERN'S "fidelity" PRE-AMPLIFIER TONE CONTROL UNIT**

"A design for the music lover"



Briefly it has inputs for all types of MICROPHONES, HIGH and LOW GAIN PICK UPS and a RADIO TUNING UNIT. It incorporates (a) GRAM EQUALISING CONTROL; (b) STEEP-CUT FILTER; (c) Continuously variable BASS and TREBLE CONTROLS and a variable OUTPUT CONTROL which enables its use with any type of Amplifier.

**PRICE OF COMPLETE KIT OF PARTS WE ALSO OFFER IT ASSEMBLED READY FOR USE, £8/- (Plus 5/- carr. and ins.) £6/6/0**

**A COMPLETE KIT OF PARTS, STERN'S "HIGH-QUALITY" 8-10 WATT AMPLIFIER**



Has power supply available for Radio Tuning Unit. Price of COMPLETE KIT OF PARTS (plus 5/- carr. and ins.) **£7/10/0**

WE ALSO OFFER IT ASSEMBLED and READY FOR USE for **£9/10/0** (plus 5/- carr. and ins.).

This amplifier has proved one of the most popular models yet offered to the HOME CONSTRUCTOR. It provides really excellent reproduction up to 5 watts, employing 6V6's in push-pull and incorporating negative feedback. Provides for the use of both 3 and 15 ohm Speakers. The Complete SPECIFICATION and BUILDING INSTRUCTIONS are available for 1/6.

"Wire-to-Wire" Diagrams are included and all Components are available separately.

**SPECIAL PRICE REDUCTIONS . . . FOR PURCHASERS OF A COMPLETE "Hi-Fi" AMPLIFIER**

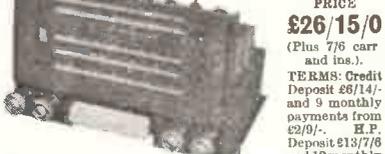
WE WILL SUPPLY (a) COMPLETE KIT OF PARTS to build THE MULLARD "5-10" MAIN AMPLIFIER and the STERN'S "fidelity" PRE-AMPLIFIER-TONE CONTROL UNIT for £16/16/- or we will supply THE TWO UNITS MADE UP and READY FOR USE for £19/19/-. Terms: Deposit £9/19/6 and 12 monthly payments of 18/7, or £5 Deposit and 9 monthly payments of £1/16/7.

**"MODERNISE YOUR OLD RADIOGRAM" IT IS MUCH CHEAPER THIS WAY!!**

THE LATEST DESIGN OF COMBINED AM/FM REPLACEMENT RADIOGRAM CHASSIS and a NEW 4-SPEED RECORD PLAYER

**STERN'S NEW "Fidelity" COMBINED AM/FM RADIOGRAM CHASSIS**

A genuinely hand-made chassis providing really high quality on both Radio and Gram.



**PRICE £26/15/0** (Plus 7/6 carr. and ins.)

TERMS: Credit Deposit £8/14/- and 9 monthly payments from £9/9/- H.P. Deposit £13/7/6 and 12 monthly payments of £14/10.

BRIEFLY IT HAS:— An 8 valve line up incorporating the latest MULLARD preferred-type valves. ● Provides complete coverage of the VHF/FM waveband plus the SHORT, MEDIUM and LONG waves. ● Has EL84's in Push-Pull, with negative feedback of 6 watts output. ● Employs "Piano Key" Selector Switch and a Variable Tone Control. ● Contains Gram Input socket for both Crystal and Magnetic Pick-ups. ● Provides for use of either 3 or 15 ohm Speakers. ● Has "Magic Eye" Tuning Indicator. ● Dimensions 13in. x 9 1/2in. x 8in. high, Dial size 1 1/2in. x 6 1/2in.

**THE NEW ARMSTRONG P.B.409 AM/FM RADIOGRAM CHASSIS**

A "de luxe" Chassis for those who want the highest possible quality



**PRICE £29/8/0** (Plus 7/6 carr. and ins.)

TERMS: Credit Deposit £7/7/- and 9 monthly payments of £2/14/- H.P. Dep. £14/14/- and 12 monthly payments of £17/3.

BRIEF SPECIFICATION:— A 9 valve line up employing the latest MULLARD preferred-type valves. ● Provides complete coverage of the VHF/FM Transmissions, plus the SHORT, MEDIUM and LONG waves. ● Has Push-Pull output, with negative feedback, for 6 watts Peak output. ● Quick action "Piano Key" Selectors and separate Bass and Treble Controls. ● Has "Magic Eye" Tuning Indicator. ● Two Gram Inputs are provided, one for Crystal Pick-ups and the other for Magnetic types. ● Dimensions 13in. x 9 1/2in. x 8in. high, Dial size 1 1/2in. x 5 1/2in.

**STERN'S "SUPER SIX"**

6 Valve 3 Waveband Superhet



Provides good selection of stations and really good reproduction on both RADIO & GRAM.

**PRICE ONLY £14.0.0** (Plus 7/6 carriage and ins.)

CREDIT TERMS: Deposit £3/10/- and 9 monthly payments of £1/5/8. H.P. TERMS: Deposit £7 and 10 monthly payments of 16/-.

BRIEF SPECIFICATION . . .

- ★ Delayed AVC on all wavebands
- ★ Preselection feedback
- ★ Modern valve line-up: 12AH5, 6BA6, 6AT7, two 6AQ5s and 5Z4 (or OCTAL VALVE equivalent)
- ★ Push-pull output gives approx. 6 watts
- ★ Connections on chassis for extension speaker, gram and mains supply to gram.
- ★ Coverage 18-50 metres, 190-560 and 900-2,000
- ★ Overall size 11 x 7 1/2 x 8 1/2in. high, Dial 8 x 4 1/2in.
- ★ A bronze dial escutcheon is available for 4/6

SEND S.A.E. IF FURTHER INFORMATION IS REQUIRED ON THESE CHASSIS . . . we recommend THE NEW COLLARO MODEL 458 4-speed Autochanger, and if a LOUDSPEAKER is required . . . we recommend THE 8- or 10-inch W.B. STENTORIAN "Hi-Fi" MODELS. We have SPECIALLY REDUCED PRICES for purchasers of a CHASSIS and RECORD PLAYER (and SPEAKER if required). SEND S.A.E. FOR DETAILS.

**CASH ONLY OFFER!!**

This latest B.S.R. MONARCH 4-SPEED AUTOCHANGER



**£7/19/6** (Plus 5/- carr. and ins.)

- These units will autochange on all three speeds, 7in., 10in. and 12in.
- They play MIXED 7in., 10in. and 12in. records of same speed.
- They have separate sapphires for L.P. and 78 r.p.m. which are moved into position by a single switch.
- Minimum baseboard size required 14 x 12 1/2in., with height above 5 1/2in., and height below baseboard 2 1/2in. A bulk purchase enables us to offer these BRAND NEW UNITS at this exceptional price.

**RECORD PLAYERS**

THE VERY LATEST MODELS ARE OFFERED AT GREATLY REDUCED PRICES

● TRANSCRIPTION UNITS. ● 3- and 4-SPEED AUTOCHANGERS ● AUTOCHANGERS with MANUAL CONTROL POSITION. Send S.A.E. for ILLUSTRATED and DESCRIPTIVE LEAFLET.

**PORTABLE CASE**

Ideal for Record Players

**Price £3.3.0** (Plus 3/- Carr. & ins.)

Only

Attractively finished in High Grade Rexine and Robustly constructed with initial measurements at 12 1/2in. x 15 1/2in. high. It will be seen therefore that it will accommodate all makes of Record Players including Autochangers. An uncut baseboard is also supplied.



**SPECIAL CASH ONLY OFFER!!**

**A PORTABLE AMPLIFIER CASE**

A good quality 2 Stage (plus Rectifier) GRAM AMPLIFIER together with a 6in. P.M. Speaker and this attractive PORTABLE CASE.



ALL FOR ONLY **£8.7.6**. The Amplifier incorporates the latest B.V.A. Valves, types ECC83, EL84, with E280 Rectifier and has separate BASS and TREBLE CONTROLS. THE CASE is attractively finished in Rexine, maroon and grey, and has space for almost any make of Autochanger

We also sell the two separately:

(a) AMPLIFIER and 6in. SPEAKER . . . . . **£4 12 8**  
 (b) PORTABLE CARRYING CASE . . . . . **£3 17 6**

**109-115 FLEET ST., LONDON, E.C.4.**

Phone: FLEet Street 5812-3-4

**FOR CALLERS ONLY**

We have in stock various KITS OF PARTS including F.M. Tuners, AM/FM Tuners, Midget Battery Portables and Mains Units, etc., etc. We also have the most comprehensive stock of WIRELESS and ELECTRICAL COMPONENTS.

# CLYNE RADIO LTD.



18, TOTTENHAM COURT ROAD, LONDON, W.1

MUSEum 5929/0095

(50 yards only from Tottenham Court Road Tube)

All post orders please to:—24-26, HAMPSTEAD RD., LONDON, N.W.1

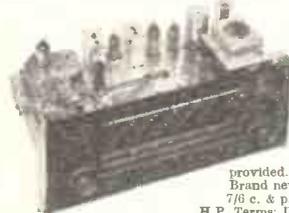
EUSton 5533/4/5

**THE JASON FM TUNER.** Based on the booklet by Data Publications Ltd., 2/- post free including our individually priced Parts List. Highly sensitive, free from drift. Incorporates 1 valve 6AM6 and 2 specially graded G.E.C. Crystals. The kit supplied includes drilled chassis with tuning condenser, scale calibrated in mc/s., and attractive bronze stove-enamelled front plate already mounted. Front plate size 8in. x 5in. Chassis 7in. x 4 1/2in. x 1 1/2in. Complete standard kit £8/15/- plus 2/6 P. & P. Fringe area kit £7/15/- plus P. & P.

**FM POWER PACK KIT.** We can now supply complete kit for power pack suitable for the above F.M. tuner or any other similar type. Price for the complete kit is 37/6 only or 52/6 for ready assembled unit. This pack is extremely small, incorporating valve rectifier type 6X4 and built on chassis size only 6 x 4 x 1 1/2in. Optional extra for power pack. Bulgin Octal Plug 2/3.

**THE T.S.I. FM TUNER**

We can now supply this FM/VHF adaptor either in kit form or fully assembled, wired and tested. Our price for the ready-built unit which incorporates its own power supply is £13/15/- only, tax paid, plus 5/- P. & P. or H.P. terms. Magic eye tuning indicator, just plug in, 19/- extra. Or the kit complete as specified £10/19/6 plus 3/6 P. & P. The Booklet "FM TUNER CONSTRUCTION" (32 pages) with full technical data and point-to-point wiring diagrams together with our separately priced parts list is available at 2/6 post free.



**THE EMPRESS.** A most attractive AM/FM chassis employing 9 valves with Push-Pull output. Covers Long, Medium, Short and F.M. wavebands. Valve line-up: 6Y3, 2-6BW6, 12AU7, EABC80, EF89, ECR81, EOC85 and EM81. Built-in Ferrite Rod Aerial for A.M. reception. Controls: 2 dials, Tuning/Wavechange and Volume ON/OFF/Tone, 6-8 watts output. Very attractive easily read dial in BLACK and GOLD. Size (overall) 15in. x 6in. Chassis dimensions: (overall) 15in. x 6in. x 7 1/2in. Indoor Aerial for F.M. provided. For use on A.C. mains 200/250 v. 50 cycles. Brand new and fully guaranteed. PRICE 28 gns. plus 7/6 c. & p. H.P. Terms: Deposit £13/13/- and 12 months at £13/4/-.

SEND FOR DETAILS OF OUR NEW AM/FM CHASSIS "THE CAVALIER." This wonderful offer includes THREE LOUDSPEAKERS at an ALL-IN price of ONLY £25, plus 7/6 C. & P. H.P. Terms available.

**RCFAM AM/FM RADIOGRAM CHASSIS**

A new style AM/FM Chassis employing a printed circuit F.M. Tuner section. Valve line-up: 8 valves: EOC85, 6BA6, 12AH8, 6BA6, 6AL5, 6AT6, EL84, 5Y3. Most attractive dial 12 x 5 1/2in. fully illuminated, with figures in green, red and white on black background. Four controls: Tuning, Volume, Wavechange and Tone/On/Off. Dimensions (overall): 13 x 9 x 6in. Frequency coverage (four wavebands): 1,900-2,000 m., 200-650 m., 15-50 m., 85-100 mc/s. This is an excellent and very efficient chassis. Price £23/19/6 plus 5/- P. & P.

**DULCI**

All Dulci products available ex stock. Illustrated leaflets and H.P. terms available. Dulci F.M. Tuner at £16/18/- AM/FM Tuner type H4T at £20/17/- AM/FM Chassis H4 at £24/8/6. Each plus 5/- p. & p. Demonstrating at Tottenham Court Road!

**ANNOUNCING OUR NEW F.M. TUNER KIT** (printed circuit)

This is our printed circuit version of the Osram 912 F.M. Tuner—using T.C.C. printed circuit and condensers, incorporating 5 valves and two germanium diodes. Attractive black and gold dial, with gold escutcheon plate. Dial aperture only 5 x 2 1/2in. Osram F.M. booklet plus our additional instructions and individually priced components list—2/6 post free or the Kit absolutely complete at £3/5/- plus 2/6 P. & P. Alignment service available if required. We are demonstrating at 18 Tottenham Court Road!

**TELEVISION TURRET TUNERS 12 CHANNEL—"BRAVEHEAD"**

We have six types now available from stock, to cover Bands I and III—fully illustrated and descriptive leaflet available on request. Each unit is fully aligned and thoroughly tested before despatch. Valves employed are PCF80, PCF84 for AC/DC and ECF80 and EOC84 for AC. Price complete £7/7/-, 2/6 P. & P. All channels available. Type Sound MC/Cs Vision MC/Cs Heater

36S	35.0	34.5	Series
16S	13.5	16.0	Series
16P	19.5	16.0	Parallel
10S	10.5	14.0	Series
10P	10.5	14.0	Parallel

We have a large selection of in-built converters for all areas from 92/6; also aerials, low-loss coaxial cable at 9d. per yd. Are you on our mailing list?

**ANOTHER CABINET BARGAIN—EXCLUSIVE!**

This cabinet as illustrated below was originally manufactured for Decca, Ltd., at a price well in excess of our selling price! Originally intended for Projection TV, lends itself to any conversion. Will accommodate all your equipment, up to 12in. P.M., record storage, and even cocktail cabinet! Handsome dark walnut veneer, two doors open in front. Measurements: 44in. high, 39in. wide, 19in. deep. Our price for strictly limited quantity is £11/19/6 plus 20/- insurance, packing and carriage. H.P. terms available.



Our advantageous H.P. terms are available on any single item over £5. Let us have your enquiries.

Please add postage under £1, or Cash with order, C.O.D. charge extra—open 9 a.m. to 6 p.m. Monday to Friday. Sorry but we close 1 p.m. on Saturday.

**TRANSISTORS!!!** Now available, manufacturers' surplus transistors. Suitable for use in Audio stages, etc., and for experimental purposes. P.N.P. type. Only 10/- each, post free. Blue spot type available for E.F. up to 1.6 mc/s., 15/- each. White Spot E.F. Transistors. 2.5 mc/s., 20/- each.

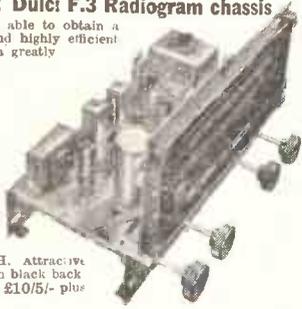
**TRANSISTORS—MULLARD TYPE O.C.71.** Available ex stock at new list price of 24/- each, also O.C.70 at 21/- and O.C.72 at 30/- BRIMAR T.S.I. 18/- All post free.

**SWITCH TUNED FOUR STATION RECEIVER CHASSIS (Manufacturers' Surplus)**  
A most attractive unit covering 4 pre-set stations in the medium waveband. A complete receiver (less cabinet) including built-in good quality 5in. loudspeaker, and frame aerial. Employs Universal Superhet circuit and miniature valves—UCH42, UAF42, UL41, UY41. Dimensions (overall)—3 x 9 x 5in. For use on AC/DC mains 200/250 v. Absolutely brand new. Few only at £25/5/- plus 2/6 P. & P.

**Splendid unrepeatable offer!! Dulci F.3 Radiogram chassis**

We have been very fortunate in being able to obtain a limited quantity of this well known and highly efficient chassis which we are able to offer at a greatly reduced price. Definitely the last few!

Specification:  
Three waveband: long 1,000-2,000 metres; medium 157-540 metres; short 16-50 metres. Valve line-up: X79, 6BA8 or WY47, 6AT6 or DB77, EL84 or N709, 6X4 or U79.  
Four controls, tone/on-off.  
Volume wavechange.  
Tuning: output 4 watts matched to 3-5 ohms. Incorporates an inset Ferrite Rod Aerial. Pick-up sockets and mains supply for Gram. motor. Overall dimensions: 12in. L. x 7in. D. x 7 1/2in. H. Attractive dial with red, gold and green lettering on black back ground. Size 1 1/2in. x 4 1/2in. Price only £10/5/- plus 3/6 P. & P.



**JUST RELEASED!! THE NEW R.C. TRANSISTOR/CRYSTAL RECEIVER KIT**

This receiver, covering medium waveband, which can be assembled in about 1 hour, will give amazing volume and tonal quality when used in conjunction with a good aerial and earth. Incorporating PNP Transistor and Germanium Diode. For headphone reception. Included with the kit of parts is a handsome plastic case h black and white, measuring 4 1/2 x 2 1/2 x 1 1/2in. This case accommodates the complete receiver, including battery. PRICE OF COMPLETE KIT: 25/- plus 1/3 P. & P. Lightweight high resistance headphones can be supplied separately at 15/- pair. If, however, the kit is purchased complete with headphones this will be supplied at a SPECIAL INCLUSIVE PRICE OF 37/6 plus 1/6 P. & P. Optional extra, 100ft. coil single 7/6 coloured P.V.C. covered wire, suitable for both aerial and earth. 2/6 only.



**VALRADIO TV TUNER**  
Limited stocks of this well-known unit available at much reduced price. An ideal pre-fabricated front end for any superbet T/V receiver with 16 mc/s I.F. Continuously variable tuning covering ALL bands, from 40-100 mc/s and 170-225 mc/s. Valve line-up—PCF84, PCF60 (series heaters). Whilst stocks last only £3/19/6 plus 2/- P. & P., brand new

**AM/FM KIT**

Introducing the JASON AM/FM KIT of medium waves and F.M.!

As illustrated this is a very high quality chassis incorporating 8 of the latest miniature valves, plus DM70 magic eye. Kits are available for chassis complete with output stage at £15/5/-. Also less output stage but with own built-in power pack at £13/19/6 only. These are highidelity units and exceptional value at these prices which include all required components and full constructional details. Fully illustrated Data Booklet with full construction details, plus individually priced component list, available per return of post at 2/- post free. Both plus 3/6 P. & P.



**PRE-SET TUNER UNIT**  
(Manufacturer's surplus)

This is a two valve (TH1, VP41) superbet tuner unit covering, in original state, two pre-set stations: Light and Home Service, with provision for adding a third station. Station selection is by means of an attractive illuminated Perspex knob. No modification is required to enable this unit to be used in conjunction with any amplifier or tape recorder capable of supplying the necessary power: 200 v. D.C. at 20 m.a. for 4 volts at 2 amps. heaters. Alternatively built-in power suppliers may be added. This is an exceptionally well made unit producing a "clean," good quality output. Dimensions of Tuner: 9in. L. x 3 1/2in. W. x 7 1/2in. H. overall. Unit only 45/- plus 2/6 P. & P. We can also supply all the components for built-in power pack with full modification details at 20/-.

**THE R.C.3/4 WATT AMPLIFIER KIT**  
Compare the advantages!

Treble, bass AND middle controls. For crystal or magnetic pick-up. A.C. Mains 200/250 v. Valve line-up: 6V6GT, 6BG7 metal 6X5GT. Negative feedback. Built on stove enamelled steel chassis, measuring only 8in. x 4in. x 1 1/2in. Four engraved cream knobs are included in the price of the complete kit with all necessary practical and theoretical diagrams at £4/5/- only plus 2/6 packing and post or Instruction Book fully illustrated for 1/- Post free. This amplifier can be supplied assembled, tested, and ready for use at £5/5/- plus P. and P. Hearing is believing.



THE FIRST AND STILL THE BEST!!



**THE "SUPERIOR FOUR"**  
**KIT.** Our superior four-valve receiver A.C. mains, 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components as supplied. Valve line-up: 2 6BG7, 6 X50T and 6 V6GT. Chassis ready drilled. Cabinet size 10 1/2 in. x 10 in. wide. Maximum depth at base 6 in. tapering to 3 1/2 in. at top. Sloping front. Very attractively finished in light walnut and peach. Each component brand new and tested prior to packing. Complete instruction booklet with practical and theoretical diagrams is provided. Booklet available at 1/6 post free. Our price for complete kit, £6/9/6. Please add 2/6 P. & C. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket wave-change switch, dial, pointer, drum pulleys drive spindle, drive spring and knobs, at 45/-, plus 2/6 P. & C. N.B.—Our kits are even supplied with sufficient solder for the job.

**THE R.C. RAMBLER ALL-DRY PORTABLE KIT**  
 Full assembly details with practical and theoretical diagrams, 1/6 post free. This is a truly professional 4-valve superhet—all dry—for medium and long waves. Cream plastic top panel, with dial engraved in red and green adds to the very imposing appearance of this model which is housed in attractive cream and grey leatherette covered attache-case type cabinet, measuring only 9 in. x 7 in. x 5 1/2 in. Weight less batteries 4 1/2 lb., with batteries 6 1/2 lb. This set really has everything. Built-in frame aerial, high quality, extremely sensitive, and very adequate volume from the 6 in. speaker. Valve line-up 8V4, 1R5, 1R5, 1T4. The required components, exactly as specified, including cabinet can be supplied from stock at the special inclusive price of £7/7/- plus 2/6 p. and (less batteries) the Ucea Ever-Ready 90 v. H.T. B126 at 10/-. Also L.T. 1.5 v. A.D. 35 at 1/6. **RAMBLER MAINS UNIT!** For using our popular all-dry "Rambler" on A.C. Mains. Complete kit, when assembled fits snugly into battery compartment, supplied at 4/7/6 plus 1/6 packing and postage. Includes all required components and full assembly instructions. 1/6 post free. This unit is completely self-contained in a metal box measuring 7 in. x 2 1/2 in. x 1 1/2 in. and is ideally suitable for ANY all-dry battery portable requiring 90 v. H.T. and 1.5 L.T.



**THE R.E.P. 1-Valve RECEIVER.** All-dry battery operation, for use with headphones. The complete kit is available at 42/-, less batteries plus 2/- P. & P. or full instructions at 9d. post free.

**N.B.—All our T.R.F. Kit circuits now include specially wound Denco "Marquid" coils on polystyrene formers, improved performances. Price remains the same.**  
**THE R.C. 2 AMP. BATTERY CHARGER KIT.** Includes handsome well-ventilated black stove-enamelled steel box, 8 1/2 in. x 7 1/2 in. x 3 1/2 in. Fully shrouded first quality transformer, brand new G.E.C. rectifier. Mains tuse, etc., for charging 6 or 12 v. batteries at 2 amp. **N.B.—**This unit is completely self-contained in a metal box measuring 7 in. x 2 1/2 in. x 1 1/2 in. and is ideally suitable for ANY all-dry battery portable requiring 90 v. H.T. and 1.5 L.T.

**ANOTHER WINNER SMALL PORTABLE GRAM AMPLIFIER.** This little amplifier is built around a PRINTED CIRCUIT and employs the very latest, highly efficient valve type ECL82. It is ideal for use where space is limited. Although of such small size, 7 in. x 5 1/2 in. x 2 in. (overall) with a control panel 3 1/2 in. x 1 1/2 in., reproduction is excellent. A wide range tone control is provided. Output approx: 3 watts. For use on A.C. mains 200/250 v. **NOTE THE PRICE: 59/6 plus 2/- p. & p.**

**THE "ECONOMY FOUR" T.R.F. KIT.** A three-valve plus metal rectifier receiver. A.C. mains 200/250 v. Medium and Long waves. We can supply all required components right down to the last nut and bolt. Valve line-up 6K7, 6I7 and 6V6. Chassis ready drilled. Cabinet size 12 in. long by 6 in. high by 5 in. deep—Choice of Ivory or brown Bakelite, or wooden walnut finish cabinet. Complete instruction booklet with practical and theoretical diagrams. Each component brand new and tested prior to packing. Our price £5/10/- complete—Remember this set is being demonstrated at our shop premises! We proudly claim that our fully illustrated instruction booklet is the most comprehensive available for this type of receiver—Booklet available at 1/6 post free. This is allowed if kit is purchased later. Plus 2/6 packing and carriage for complete kit.



**GRAMOPHONE MOTORS are in SHORT SUPPLY!**

**COLLARO AC.3/554:** Three speed, single player for A.C. mains 200/250v. cream finish, complete with turn-over crystal pick-up, incorporating the well-known high output "T" type head. Strictly limited quantity at £6/19/6 plus 3/6 p. & p.  
**COLLARO 456.** 4-speed AUTO!! Few only £9/15/- plus 3/6 P. & P.

**FOUR-SPEED CHANGERS.** The new B.S.R. 4-speed auto-changer in attractive cream and gold finish now available from stock at £8/15/- only plus 3/6 P. & P. H.P. terms available.

**RECORDER AMPLIFIER**

(Well known manufacturer's surplus.) This is a brand new amplifier designed for use with a famous wire recorder. A simple modification is all that is required to make this unit ideal for use with any Tape Deck. Specifications: Valve line-up 7C5, 12AU7, 6BR7, 6BR7, 6X4. Neon Record Level Indicator. Controls: Volume/Record Level, Tone Control, Record/Play/Switch. High and Low level inputs for Mike and Radio. External Speaker Socket. Built-in 5 in. Loudspeaker with High Flux magnet, separate Power Pack. Dimensions: Amplifier 6 1/2 in. H. x 1 1/2 in. W. x 2 1/2 in. D. Power Pack: 6 1/2 in. x 6 in. x 5 in. High (overall). Full modification details are supplied. Price £8/19/6, P. & P. 3/6.



**10 in. CABINET SPEAKER.** Ideal for P.A. etc. Comprises solid wood cabinet complete with carrying handle. Painted dark brown; with built-in good quality 10 in. P.M. speaker, 3 ohm speech coil, complete with lead and ligature Jack plug. Brand new. Price only 45/-, plus 3/6 P. & P.

**SURPLUS BARGAINS—METERS**

F.S.D.	Size	Type	Fitting	Price
50 microamp	D.C. 4in.	M.C.	Rectangular	110/-
50 microamp	D.C. 3 1/2 in.	M.C.	F.R.	95/-
100 microamp	D.C. 2 1/2 in.	M.C.	F.R.	45/-
200 microamp	D.C. 2 in.	M.C.	F.R. (Tropicalised)	30/-
200 microamp	D.C. 3 1/2 in.	M.C.	F.R.	65/-
500 microamp	D.C. 2 in.	M.C.	F.R.	18/6
1 mA.	D.C. 2 in.	M.C.	F.R.	17/3
1 mA.	D.C. 2 in.	M.C.	F. Sq.	22/6
1 mA.	D.C. 2 in.	M.C.	F. Sq. (1954 manufacture by Elliott)	25/-
1 mA.	D.C. 2 1/2 in.	M.C.	Desk Type	30/-
50 mA.	D.C. 2 in.	M.C.	F. Sq.	8/6
100 mA.	D.C. 2 1/2 in.	M.C.	F.R.	10/6
.5 amp.	R.F. 2in.	Thermo	F. Sq.	6/6
1 amp.	R.F. 2 1/2 in.	M.C.	F.R. (shunt required)	10/-
120-0-120 amp	D.C. 2 in.	M.C.	F. Sq. (shunt required)	15/-
150 amp.	A.C. 4 in.	M.I.	R.P.	45/-
1 amp.	R.F. 2 1/2 in.	Thermo	R.P.	7/6
3 amp.	R.F. 2 in.	Thermo	R.P.	6/6
20 amp.	D.C. 2 in.	M.C.	R.P. (with shunt)	10/6
30 amp.	D.C. 2 1/2 in.	M.I.	F.R.	12/6
30 volt.	A.C. 2 1/2 in.	M.I.	F.R.	10/-
15-0-15 volt	D.C. 2 1/2 in.	M.C.	F.R.	17/6
300 volt	A.C. 3 1/2 in.	M.C.	F.R.	35/-

**SPECIAL U.S. 0-1 mA. 2 1/2 in.** taken from equipment but perfect, 22/6 each. R.P. Round Projection. M.C. = Moving Coil. Thermo = Thermo-coupled. F. Sq. = Flush Square. F.R. = Flush Round. M.I. = Moving Iron.

**METER RECTIFIERS.** 1 mA. by G.E.C. at 6/6, also 5 mA. by G.E.C. at 6/6.

**METER SPECIAL.** We have a limited quantity of aircraft electrical thermometers. Brand new, by Weston, 2 in. moving coil meter, flush square fitting. These meters have a luminous scale graduated 40-140 degrees centigrade, but the full scale deflection is approximately 150 microamps! Price 12/6 each only, plus 1/- P. & P.

**SPECIAL PURCHASE!! LIMITED QUANTITY ONLY!**

**A.A. PREDICTOR MK. I—OSCILLOSCOPE No. 11.** This expert Govt. unit readily lends itself economically to conversion to oscilloscope for domestic use. For 115 volt or 230 v. 50 cycle A.C. mains—comprising 2 1/2 in. C.R.T. Type ACR10—4 EF91, EBC33, 6J5, 6X6GT, SU2150 A and EA50. Continuously variable and stepped attenuator on Y amplifier. Internal X and Y shifts. Brightness and focus controls. Time base speeds can be increased by simple modification to cover 3 c/s to 30 kc/s. Overall measurements of chassis as illustrated are 7 in. high, 12 in. deep and 19 in. long. This unit, which is of recent manufacture and absolutely brand new, is offered at £12/10/- plus 15/- packing and carriage. This is a fraction of original cost and a bargain not to be missed! Circuits and full details are supplied.

**SPECIAL PURCHASE FROM Ministry BRAND NEW No. 17 Mk. II TRANSMITTER/RECEIVER**

Built into strong wooden cabinet 15 in. x 14 in. x 9 in. Complete with headphones and microphone. Range 5-3 miles with simple aerial. Frequency coverage 44-61 mc/s. (5-7 metres). Uses standard 120 v. 2 1/2 and 2 volt L.T. batteries. Complete with full operating instructions. 59/6, plus 3/6 C. & P.  
 No. 17 Mk. II, as above, but secondhand, in good condition and complete. 45/-, plus 3/6 C. & P.

**MAINS TRANSFORMER—SPECIAL**  
 Removed from chassis but clean and guaranteed. 200/250 v. Input 350-0-350 at 250 mA. 6.3V. 8 amps. 6.3V. at 6 amps 5 at 3 amps. Only 30/- plus 1/6 P. & P.

**BEACON TX/RX.** (Mint condition.) Comprising: Transmitter/receiver unit, telescopic antenna, pair lightweight headphones, co-ax cable, connecting leads, plugs, etc., contained in excellent quality haversack. Supplied complete with valves: 6-3AS, 3-1R5, 1-1R5, 3-2V, vibrator packs, also comprehensive illustrated manual. Frequency coverage: 914-234 Mc/s. Size: 13 in. x 10 in. x 5 in. Weight: 98 lb. Limited quantity only at 72/6, plus 2/6 C. & P.

**THE "E.C. STALLION."** This is the latest addition to our range of gramophone amplifiers and is supplied complete with high flux 8 in. P.M. speaker and baffles.

Incorporating three octal-type valves, 6Q7, 6V6 and 6X5. This robust and well made unit is ideal for use in the larger type of record player and is equally suitable to use in conjunction with a radio feeder unit. Separate bass and treble controls are provided; also provision is made for an extension speaker and mains supplies to gram. motor. Output approx. 4 watts. Size overall: 13 in. x 4 in. x 9 in. high. For use on A.C. mains 100/200/280 v. Price £25/19/6, plus 2/6 P. & P. This amplifier will fit our portable cabinet type "G" without modification. Cabinet price £5/-, plus 6/6 P. & P. Will also accommodate any standard Record Changer/RECORD PLAYER CABINETS—to suit all types of single record and auto-changer units. Priced from 45/- Send stamp for fully illustrated list.

**VALVES.** We have perhaps the most up-to-date valve stocks in the trade. A stamp will bring complete list of brand new imported valve types, fully guaranteed. P.T. paid and all usual surplus types available such as 6V6GT, etc.

**CLYNE RADIO LTD.**



18, Tottenham Court Road, London, W.1.

# LASKY'S RADIO

SAVE POUNDS! ORDER BY POST IF YOU CANNOT CALL

## LASKY'S F.M. TUNER

PRINTED CIRCUIT VERSION OF G.E.C. 912 F.M. TUNER FOR HOME CONSTRUCTION



Note these star features:—

- ★ HIGH SENSITIVITY.
- ★ T.C.O. PRINTED CIRCUIT.
- ★ NEW T.C.C. CONDENSERS.
- ★ AERIAL COIL AND R.F. COUPLING COIL PRINTED ON CIRCUIT.
- ★ 5 VALVES AND 2 GERMANIUM DIODES.

By the use of a printed circuit the I.F. and R.F. amplifiers are extremely stable at maximum gain and results are consistent on all tuners. Valve line-up:—

- R.F. Amplifier, Z719 or EF80.
- Mixer and Osc., B719 or EOC85.
- 1st I.F. amp., W719 or EF85.
- 2nd I.F. amp., W719 or EF85.
- 2 Germanium Diodes GEX.34.
- Driver Limiter, Z719 or EF80.

CAN BE BUILT FOR **8 Gns.** (including valves)

G.E.C. F.M. Tuner Book plus our full data and shopping list 2/6 post free. All parts available separately.

### LASKY'S PORTABLE GRAM AMPLIFIER

4 watt. Will suit any type of crystal or magnetic pick-up. Uses 3 valves:—EL84 output, L63 and EZ80 rect., 7 × 4in. elliptical speaker. Speaker and controls are separate and can be mounted in cabinet where most suitable. COMPLETE with 3 valves, knobs and speaker, ready for use, Carr. 5/-. Details and circuit diagram on request.

**£5.96**

### LASKY'S PORTABLE GRAM AMPLIFIER KIT

For construction on printed circuit. 2 watts. Note small size:—approx. 6½ × 3½in. Maximum height 5in. Uses EL84 output and 6X4 rectifier, double-wound trans., tone control, output trans., and 7 × 4in. elliptical speaker. COMPLETE KIT including valves, T.C.C. printed circuit, speaker and full instructions. **77/6** Post 2/6.

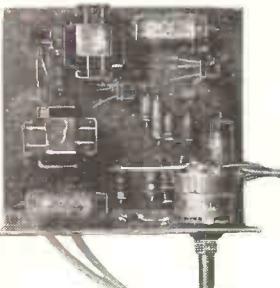
## NEW MINIATURE 200 milliwatt TRANSISTOR AMPLIFIER KIT

for construction on a Printed Circuit

Size: 3½ × 3½in. Height can be under 1in. Uses our new hermetically sealed Transistors and operates from 6-volt battery.

FULL DETAILS, CIRCUIT DIAGRAM AND SHOPPING LIST 1/- post free.

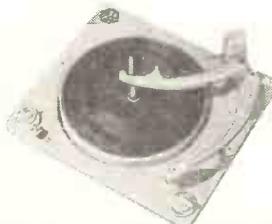
COMPLETE KIT including 4 Transistors, all brand new components, latest T.O.C. miniature condensers, printed circuit and full instructions, **86/6** Post 2/-.



DEMONSTRATIONS AT EITHER OF OUR ADDRESSES

All components available separately.

## AUTO-CHANGERS



LARGE SELECTION OF 4-SPEED AUTO-CHANGERS by Garrard, Collaro, etc.

Prices from **£9.15.6** post 3/6  
Our stocks are constantly changing. See us for your requirements or send for our list of Auto-Changeers. Post free.

**GARRARD RC.80.** 3-speed Auto-Changeer. Full length arm with two XMS heads or GC2 t.o. crystal head. Brand new in makers' cartons. List £20/15/-. **LASKY'S PRICE £13.19.6** Carr. 5/-.

**B.S.R.** 4-speed with t.o. crystal pick-up. Incorporates auto and manual control. Brand new in makers' cartons. **LASKY'S PRICE £8.15.0** Carr. 5/-.

## SINGLE RECORD PLAYERS

Collaro 3/554 3-speed Single Player with Studio T p.u., crystal cartridge and styl. **£6.19.6**

Carr. 3/6.  
Collaro 4/456 4-speed Single Player £9/7/-. Carr. 3/6.

## CABINETS AND CASES

Large selection for TV sets, radiograms, record players, tape recorders, etc. Your enquiries invited.

## PICK-UP BARGAIN

**B.S.R. PICK-UPS.** Long playing and standard, complete with HGP.59/3 t.o. crystal cartridge and styl. Cream finish. **37/6** Post 2/6.

## BAND III CONVERTERS

Large stocks. We have what you want. **£3.19.6** Price from

## SPECIAL OFFER! BAND I-III TUNERS



Covering Channels 8-4 or 1-9, with provision for 10 more coil sets. 2 valves:—Mazda 30L1 cascode r.f. amp., Mazda 30C1 triode/pentode f.c. Complete with power supplies for 200-250 v. A.O. I.F. output 16-19 Mc/s., easily modified to other outputs. Full circuit diagram supplied.

**LASKY'S PRICE £5 17 6**  
Post 2/-

Also available without power pack at 99/6.

## TRANSISTORS AT A REASONABLE PRICE

Lasky's now offer you a genuine R.F. TRANSISTOR P.N.P. Junction Type, suitable for medium and low frequency oscillators, frequency changers and I.F. amplifiers 1.5 to 8 Mc/s. **21/-** (double spot—yellow and red). Post Free

Also AUDIO TRANSISTORS, P.N.P. Junction Type, suitable for high gain and low frequency amplifiers, and for output stages up to 250 milliwatts, only **10/-** (double spot—yellow and green). Post Free

SPECIAL PRICES FOR 6 AND OVER

- ★ TESTED AND GUARANTEED EFFICIENT
- ★ HERMETICALLY SEALED and unaffected by temperature variations

Full operating data and circuit diagrams for a simple receiver, superhet, T.R.F., multi-vibrator, relaxation oscillator, audio amplifier, oscillators, signal tracers, etc., supplied with each Transistor.

### MULLARD TRANSISTORS

OC70 21/-.	OC71 24/-.	OC72 30/-.
---------------	---------------	---------------

### BRIMAR TRANSISTORS

TS1 18/-.	TS2 21/-.	TS3 24/-.
TP1 or TP2 40/-.		

## NEW BRENNEL MARK IV DECK

Now available! Entirely redesigned to permit of conversion to stereoscopic sound with 4 heads for dual channel operation when required.

DECK only.....**22 gns.**  
DECK WITH PRE-AMP. UNIT and magic eye indicator ready for use with any standard amplifier **38½ gns.**

COMPLETE MARK IV TAPE RECORDER, as illustrated **53 gns**



Come and inspect the new Brennell Mark IV and have a demonstration. Full details post free on request.

### TAPE DECKS

Collaro "Tape Transcriber," Mk. III, **£22.**  
Truvox Deck, Mk. III, **23 gns.**  
Truvox Deck, Mk. IV **£27.6.0**  
Lane Deck, **£18/10/-.**  
Wearite Decks, **£35 and £40.**

### TAPE RECORDERS

Leading makes—Elizabethan, Truvox, Sound, Vortexion, etc.

TAPE DECK MOTORS. Anti-clockwise, shaded pole. Collaro 25/- . B.T.H. 29/6. Post extra.

### RECORDING TAPE

All leading makes of recording Tape in stock, including the new thin long-playing. Also all types of Spools in stock.

MAGNETIC RECORDING TAPE, kraft base, on Oydon metal spool, 1,200ft. 10/6. 600ft. 7/9. Post 1/-.

PURETONE Tape on plastic spool, 1,200ft. 12/11. Post 1/- . All makes of tape stocked.

**RADIO · TELEVISION · HI-FI · ELECTRONICS · RECORDERS**

**LASKY'S BATTERY PORTABLE FOR HOME CONSTRUCTION ON PRINTED CIRCUIT**



Can be built complete with valves and case for only

**£7.7.0**

Post 3/6 extra.

Combines simplicity of construction with high quality performance. In particular, the PRINTED CIRCUIT greatly simplifies construction and eliminates the possibility of wiring errors. Build it NOW ready for your holidays!

**10 STAR FEATURES**

- ★ PRINTED CIRCUIT, size 7½ x 2½ in.
- ★ 4-valve Superhet, med. and long waves.
- ★ Low consumption Valves. Double Battery Life.
- ★ Ferrite Rod Internal Aerial.
- ★ 5in. P.M. Moving Coil Speaker.
- ★ Brand New T.C.C. Capacitors.
- ★ Automatic Volume Control.
- ★ New Style Contemporary Case.
- ★ Lightweight and Handsome Appearance.
- ★ Every Component available separately.

DEMONSTRATION MODELS AT BOTH OUR ADDRESSES

CIRCUIT DIAGRAM, data, instructions, and shopping list, 1/6 post free.

POWER UNIT for above, also suitable for other battery portables. For 200-250 v. A.C. mains. Complete Kit including printed circuit, 45/-.

**JASON F.M. TUNER**

Special parcel containing data book, chassis, front panel, dial, drive, tuning condenser, full sets of coils, I.F.'s ratio detector, etc. Post 2/6. DATA BOOK with price list 2/- Note: This tuner uses 4-6AM6 and 2 crystals and can be built for £6/15/-, plus 3/6 post.

**JASON "ARGONAUT"**

Super-sensitive Tuner for F.M. and medium waves. Complete parcel with power supplies. Post 3/6. **£13.19.6**

DATA BOOK 2/- post free. Chassis Assembly 57/9 post 2/6. I.F. and Coil Set 78/- post 1/6. All components available separately.

**OTHER F.M. TUNERS**

TSL F.M. TUNER..... £17/10/-  
DULGI F.M. TUNER £17/10/-  
DULGI AM/FM TUNER £20/17/-

**LASKY'S RADIO CONSTRUCTOR PARCELS**



**PARCEL No. 1**

Contains everything to build a 4-valve 3-wave superhet for 200/250 A.C. mains. Uses 6K3, 6K7, 6Q7, 6V6 valves. Attractive wood cabinet, walnut veneer, or plastic cabinet as illustrated. Size 12x6½x6½ in. deep. CAN BE BUILT FOR **£7.19.6** Carr. and packing 2/6.

**PARCEL No. 2**

Contains everything to build a T.R.F. 3-valve set for 200/250 A.C. mains, medium and long waves. Uses 6K7G, 6J7, 6V6 and metal rectifiers. Neat plastic cabinet, walnut or ivory finish, or wood cabinet. Size 12x6½x6½ in. deep.

CAN BE BUILT FOR **£5.10.0** Carriage and packing 2/6.

INSTRUCTION BOOK for either above sets 1/- post free.

CABINETS ONLY, plastic or wood, 17/6. Post 2/6.

All components available separately.

**5-VALVE RADIOGRAM CHASSIS COMPLETE WITH VALVES**

3-wave superhet, 16-50 in., 200-250 m. 1,000-2,000 m. Brand new Mullard and Mazda valves—6C9, 6F15, 6LD20, N108, U107. Overall dim: 18in. long, 6in. deep, 7in. high approx.

LASKY'S PRICE, **£7.19.6** complete with all valves.

Carr. & Pkg. 7/6 extra. Price without valves, £5/4/-.

**MOVING COIL P.M. SPEAKERS**

2½ in., 3 in. and 3½ in.	19/6
5 in. 19/6. 6½ in. 17/6. 8 in. 21/-	
10 in. 29/6. 12 in. 29/6.	
6½ in. with transformer.....	21/-
7 x 4 in. Elliptical.....	19/6
10 x 6 in. Elliptical.....	32/6

GOODMANS 12in. Audiom 50 P.M. Speakers, 10 watts. Few only left. List £8/15/- Lasky's Price 97/6 post free.

**HI-FI ELECTROSTATIC SPEAKERS ("TWEETERS")**

Easy to fit to any radio. TV receiver or amplifier. Full data and circuit diagram supplied.

LSH75. For outputs up to 6 watts, 8/-  
LSH518. For outputs of 10-12 watts, 12/6  
LSH100. For outputs up to 20 watts, 14/-

LPH65. MOVING COIL TWEETER. Imp. 5.5 ohms, freq. range 2,000-2,200 50 c/s. For outputs up to 6 watts. 2½ in. diameter, 39/6. All post free.

**HI-FI SPEAKERS**

Large stocks—Goodmans, Wharfedale, G.E.C., Lorenz, etc., including Wharfedale 8-speaker system. Ask for demonstration.

**HI-FI AMPLIFIERS**

Full range to choose from, Quad, Rogers, Leak, R.C.A., Pamphonic, Uniflex, W.B. etc.

**H.P. TERMS AVAILABLE** on certain goods.

Write stating your requirements.

**LASKY'S RADIO**

**NEW AND PERFECT 16" METAL CONE C.R.T.**



Type T801. Note: Not "seconds" but perfect tubes in original cartons. Gives large 11 x 14½ in. picture. Guaranteed by us for 3 months. See our previous adverts in "W. World" or send for details.

Carr. and Insur. 22/6 extra.

Masks, Anti-Corona, Bases and Ion Traps available.

LISTED AT **£23.9.10**

LASKY'S PRICE **£8.9.6**

**MAKERS' SURPLUS TV COMPONENT BARGAINS**

Line E.H.T. trans., ferrox-cube core, 9-16kV.....	25/-
Scanning Coils, low imp. line and frame.....	25/-
Ferrox-cube cored Scanning Coils and Line Output Trans., 10-15 kV, BY1 winding. Line Trans. Complete with circuit diagram, the pair Frame Output Transformer.....	50/-
Scanning Coils, low imp. line and frame.....	8/6
Frame or line blocking oec. transformer.....	17/6
Focus Magnets Ferrox-dure.....	4/6
P.M. Focus Magnets, Iron Cored.....	19/6
Duomag Focallisers.....	19/6
300 m/a. Smoothing Chokes.....	22/6
Electromagnetic focus coil with combined scan coils.....	15/-
.....	25/-

**STANDARD 85 mm.**

Line Output Transformers 6.9 kV, E.H.T. and 6.3 v. winding. Ferrox-cube.....	19/6
Scanning coils. Low imp. line and frame.....	12/6
Ditto by Igranic.....	14/6
Frame or line blocking oscillator transformer.....	4/6
Frame output transformer.....	7/6
Focus Magnets: Without Vernier.....	12/6
With Vernier.....	17/6
Focus Coils, Electro-magnetic.....	12/6
200 m/a. Smoothing Chokes.....	10/6

**MAINS TRANSFORMERS**

All 200-250 v. 50 c.p.s. primary. finest quality, fully guaranteed.	
MBA/3. 350-0-350 v. 80 mA., 6.3 v. 4 a. 5 v. 2 a. Both filaments tapped at 4 volts.	19/6
MBA/7. 250-0-250 v. 80 mA., 6.3 v. 3 a., 5 v. 2 a. Both filaments tapped at 4 volts.	19/6
AT/3. Auto trans. 0-10-120, 200-230-240 v. 100 wats.....	19/6
MT/340. Tapped input 200-250 v. 300-0-300, 100 mA., 3 v. 3 amp., 6.3 v. 1.5 amp.	16/6
MT/341. Tapped input 250-0-250, 120 mA., 6.3 v. 5 amps, fully shrouded.....	27/6

**FILAMENT TRANSFORMERS**

All 200-250 v. 50 c.p.s. primary. finest quality, fully guaranteed.	
6.3 v. 1.5 amp. ....	5/11
6.3 v. 3 amp. ....	9/6
6.3 v. 1 amp. ....	4/6
0-30 v. 2 amp. tapped voltage.....	19/6

**ALL-DRY POWER UNITS**

By Decca. Suitable for any battery radio using IR5 IT4, etc. 67½ volts H.T., 1½ volts L.T. Mains input 200-250 adjustable. In metal chassis with rubber feet and black plastic cover. Size: 7 x 5 x 1½ in. Mains lead and on/off switch. Complete with two metal rectifiers, ready for use. List £14/15/-.

LASKY'S PRICE **35/-** Post 3/6

If too large to fit into your portable, stand it on or by it.

**GERMANIUM CRYSTAL DIODES**

GEX.00 1/6. GEX.34 3/6. WG5, 3/6. GEX 54 and OA7-5/-.

**FERRITE ROD AERIALS**

Med. and long waves, wound ready for use. Each 6/9, post 1/-.

**FERRITE ROD**

5in. long ½ in. diam., with full instructions for making a Ferrite rod aerial 2/6, post 1/-.

**STANDARD 2-GANG CONDENSERS**

.0005 mfd., with fixing feet. Each 5/11 Post 1/6.

SPEAKER COVERINGS. Large stock of Tygan and "Someweave" Speaker Coverings. Any size piece cut. Send for sample and prices.

**R1155 RECEIVERS**

Few only left. Let us have your enquiry. Prices from £7/19/6.

**TRUVOX 'SENIOR' SPEAKER DRIVING UNIT**

(pressure type)

New and unused in makers cartons. Power handling cap. 15 watts peak. With 12ft. cinema horn reproduces down to 17 cps. List £7/15/- Lasky's Price **59/6** Carr. 5/-.

**20,000 VALVES IN STOCK**

Brand new surplus and imported valves, also full stocks of B.V.A. valves and C.R. Tubes. COMPLETE LIST POST FREE.

LASKY'S (HARROW RD.) LTD

**42 TOTTENHAM COURT ROAD, W.1.**

Nearest Station Goudge Street MUScum 2605.

**370 HARROW ROAD, PADDINGTON, W.9.**

Opposite Paddington Hospital LAD 4075 and CUN 1979.

Open all day Saturday. Early closing Thursday (both addresses)



ALL MAIL ORDERS TO HARROW ROAD PLEASE

## SUMMER SALE

**RECTANGULAR T.V. TUBES used with 12 MONTHS GUARANTEE**  
 17in. £7/10/-, 14in. £5/10/-.

We are now able to offer this wonderful guarantee. 6 months full replacement, 6 months progressive. Made possible only by improved quality of our tubes. Carr. and Ins. 15/6.

**CONVERT YOUR 9in.-10in.-12in. to 14in.-15in.-17in.**

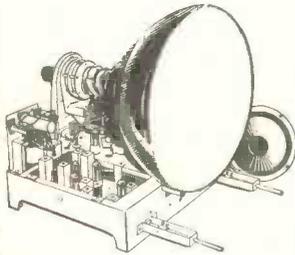
Our pamphlet is FREE, and on many sets it costs only the tube to give you these giant pictures. SPECIAL OFFER: 14in., 15in., 17in. T.V. tubes £5. See them working in our shops.

**12in. T.V. TUBES £6**

Shortage may cause delay, enquire first and save petrol. We may have alternative and can tell you if delay any, 15/6 Carr. and Ins. on all tubes.

**14in. T.V. CHASSIS £13.19.6**

**Famous Turret Tuner Fitted 50/- extra.**



Complete with tube and speaker, modified ready working. Fully guaranteed for 3 months. These are demonstrated in our shops. LESS valves. As above with 5 valves £15/19/6. With all the valves £19/19/6. Ins. Carr. incl. tube 25/-. CHANNELS 1.5 but please state ONE required and second if Turret required. 17in. TUBE RECTANGULAR on adapted chassis. LESS valves, £19/19/6. With 5 valves £21/19/6. Or complete with all valves, £25/19/6. Ins. Carr. 25/- Free drawings with order, or 3/6. State B.B.C. Channel (and I.T.A. Channel if Turret required).

### T.V. CONSTRUCTOR CHASSIS

**SOUND AND VISION STRIP.** 35/6. Tested working. Complete vision strip. LESS valves. FREE drawings. P. & P. 2/6. I.F.'s 16.5-19.5 m/cs. **POWER PACK.** 39/6. R.F. E.H.T. unit, tested working LESS valves. FREE drawings. Ins., Carr. 5/- 7KV. 6v6 output. **TIME BASE.** 25/6. Tested working. Complete with focus unit. LESS valves. FREE drawings. P. & P. 3/6.

FREE CATALOGUE OF SUMMER SALE

### T.V. CHASSIS 79/6

Complete chassis by famous manufacturer. Easily converted to I.T.A. R.F. E.H.T. Unit included. A.C. s/het. 3 separate units (power, s/vision, t/base inter-connected). 8in. P.M. speaker and drawings FREE with each order. I.F.'s 16.5-19.5 m/cs. Carr. and Ins. 10/6. Drawings 2/6.

### ARGOSY RADIOGRAM CHASSIS 99/6

6 valve. Latest models. 3 w/band and gram. switched. Well over 4 watts output. 4 control including full tone range. A beautiful chassis LESS valves. Drawings FREE with order or 3/6. Ins. Carr. 5/6.

### ARGOSY PUSH/PULL R/GRAM CHASSIS 139/6

8 valve. Latest models. 3 w/band and gram. switched. Over 10 watts output. Full tone range, 4 knob controls. Ins. Carr. 5/6. LESS valves.

### IDEAL RADIO or R/GRAM CHASSIS 39/9

3 w/band and gram. S/het 5 valve (octal). Ideal for table gram, but still giving high quality output. 4 knob control. 8in. P.M. speaker 7/9, with order. Set of knobs, 2/- Chassis 15in. x 6in. x 7½in. Ins. Carr. 4/6.

### RADIOGRAM CHASSIS 29/9

5 valve s/het. Including 8in. speaker. 3 w/band. A.C. mains. Complete less valves. Front drive. Chassis size 12in. x 10in. x 8in. Free printed dial. Ins. Carr. 4/6.

**COIL PACKS.** 3/9. 3 w/band, including 2 gang condenser, pair of I.F.'s. Printed dial. P. & P. 2/3.

**8in. P.M. SPEAKER.** 8/9. Stocks cannot last. Let the lady of the house listen to that T.V. or Radio programme. P. & P. 1/9.

**MAINS TRANSFORMERS.** 3/9. 4 v.- 4 v. heaters. 200-250 v. prim. P. & P. 2/3. 350-0-350v. sec.

**MAINS TRANSFORMERS.** 2/9. 12 v.- 4 v. heaters 200-250 v. prim. P. & P. 2/3. 350-0-350v. sec.

**O.P. TRANSFORMERS.** 1/3. 2-5 ohms. Standard size. Salvage guaranteed. P. & P. 1/- 20 for £1. P. & P. on 20 5/6.

**T.V. MASKS.** 3/9. 12in. New. White rubber. Postage 1/6.

**T.V. MASKS.** 1/9. 12in. Soiled. Needs washing. Postage 1/6.

**V.H.F. R.F. UNIT 24.** 7/9. Including valves (SP61's-VR65.) Chassis approx. 10in. x 8in. x 4in. Postage 2/6.

**V.H.F. R.1125 RECEIVER.** 7/9. Including valves. Chassis approx. 12in. x 8in. x 3in. Drawings FREE with order. Postage 1/9.

LIVERPOOL ST., to MANOR PARK STATION—10 mins.

**DUKE & CO. (W.W.)** 621/3 Romford Rd., Manor Park, London, E.12

GRA. 6677-8—2791

## MODERN ELECTRICS LTD.

164 CHARING CROSS ROAD  
 LONDON W.C.2

Telephones:  
 TEMPLE BAR 7587  
 COVENT GARDEN 1703

Cables:

MODCHAREX  
 LONDON

EXPORT ENQUIRIES WELCOMED

PROMPT ATTENTION TO POST ORDERS

## WE OFFER A COMPLETE TAPE RECORDER SERVICE

CONTINUOUS DEMONSTRATIONS

LONG PLAY AND STANDARD RECORDING TAPES  JOINTING TAPE & COMPOUND	<b>FERROGRAPH</b> <b>VORTEXION</b> <b>GRUNDIG</b> <b>BRENELL</b> <b>GELOSO</b> <b>PHILIPS</b> <b>SIMON</b>	EMI AND BIB SPLICERS  WEARITE DEFLUXERS	DIAMOND AND SAPPHIRE STYLI  THE DUST BUG AURIOL P/U CONTROL	<b>CONNOISSEUR</b> <b>GARRARD</b> <b>COLLARO</b> <b>LENCO</b> ETC.	<b>PICK-UPS</b> LEAK LENCO COLLARO GOLDRING CONNOISSEUR BURNE-JONES
--	--	---	---	--	---

### SPEAKERS

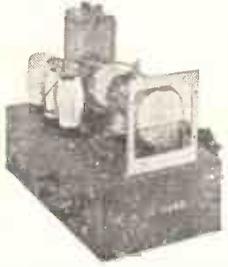
WHARFEDALE PHILIPS GOODMAN'S  
 STENTORIAN GEC TANNOY

### AMPLIFIERS

QUAD LEAK AVANTIC  
 PAMPHONIC ROGERS RCA

## INDICATOR UNIT

SLC No. 5



(Illustrated with cover removed)

Consisting of VCRI39A with mu-metal H.T. band. Time base with 2-SP61, 1-VR66. Electrolytic condenser 24 MFD 550 V. PK. WKG. Test point for each stage. Completely enclosed in steel cabinet with lift-up front window. Chassis dimensions 11 x 6 x 3in., cover dimensions 11 x 6 x 5½in., total height 8½in. This unit is easily converted at a cost of a few shillings to an oscilloscope for modulation monitoring or linear sweep generator and horizontal amplifier. Brand new in original cartons. Price, complete with suggested modification circuit, only 65/- plus carr. 7/6.

**MINIATURE I.F. STRIP TYPE "373."** 9.72 Mc/s. Valve line up 3-EF, 91, 2-EF 92, 1-EB 91. Size 10½in. by 2½in. by 3 in., completely valved with screening cans. 8-way Jones socket 50 K output potentiometer co/ax output socket. Ideal for modification to F.M. Tuner as described on page 107 of the April "Practical Wireless." Price 45/-.

**DIPOLE AERIAL No. 4A.** 52ft. hard drawn 7/22 copper wire with centre insulator, fitted with feeder sockets. Both ends have 3-link insulators and slotted wire adaptors. Brand new. Price 9/-, post and packing 2/-.

**BENDIX RADIO COMPASS MN 26 Y.** A 12 V. receiver covering 3.4-7 Mc/s, 325-695 kc/s. 150-325 kc/s. Valves used: 5 6K7, 2 6N7, 2 6J5, 1 6L7, 1 6F6. Complete with 28 V. dynamotor and switching motor. In good condition. 70/-. Plus carriage 8/6.

**INDICATOR UNIT TYPE 182A.** Unit contains VCR 517 6in. cathode ray tube with mu-metal screen, 1 5U4G, 3 EF50, and 4 SP61, 9 wirewound volume controls, H.T. mains transformer, numerous resistors, condensers and other components. Fully smoothed. Brand new. 65/-. Plus carriage 7/6.

**LOW PASS FILTER NETWORK WESTERN ELECTRIC.** Shrouded. 4 ceramic insulated terminals. Oil filled, mica insulation. Case fully isolated. Ideal for mains suppression up to 5 amps. 3½in. x 3½in. x 3in. 17/6 each, P.P. 1/6.

**HOOVER ROTARY TRANSFORMERS.** Input 6 v. output 300 v. at 65-75 m/a. Guaranteed and tested, only 27/6, post & packing 2/6.

**VIBRATOR POWER PACK.** Input 12 V., output 150 V. at 100 milliamps. 2 bias packs 50 V each. Complete with screen lead for battery. Completely smoothed. Brand new. Price 25/-. Postage and packing 3/-.



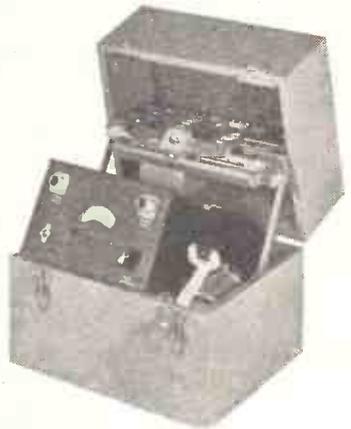
Price 25/-. Postage and packing 3/-

Hours of business.  
8.30 a.m. to 6 p.m.  
Monday to Saturday  
**OPPOSITE**  
**BRITISH MUSEUM**  
(Callers welcome)

## WHY SUFFER STANDING WAVES? COMPLETE STANDING WAVE RATIO METER

110 V. A.C. operated. From 60 c/s-1,000 c/s with all co/ax coupling and probe finder. To match all feeder line impedances and lengths. Calibrated matching bar. Direct standing wave ratio readings are shown on meter 50 micro amp movement. This magnificent instrument is precision built, complete with all spares and housed in oak carrying case. Brand new in original packing.

£14 each. Plus carriage 10/-.

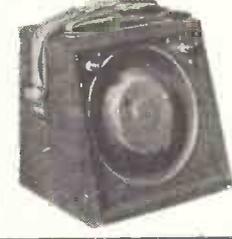


## TRANSMITTER and RECEIVER BC-1267-A

This unit contains a transmitter, a receiver and an antenna matching section mounted on a common chassis. The transmitter, of the line oscillator type, consists of pulse generator, r.f. oscillator, and monitor circuits. It has a tuning range of 187-187 megacycles. The tuning is controlled entirely from the front panel. The receiver is of the superheterodyne type with two stages of radio frequency amplification, a pentode first detector, a separate oscillator, five stages of intermediate frequency amplification, a diode second detector, a video amplifier, a cathode follower output stage, and a tuning indicator eye. The radio-frequency stages, the intermediate frequency stages, and the oscillator are permeability tuned. The intermediate frequency amplifier is a staggered system with a mean frequency of 11 megacycles. Valves used: 2 6J5, 1 6V6GT, 1 6SN7GT, 2 2C26, 1 3E29, 1 9009, 1 6B16, 1 6E5, 7 8A66, 3 6AK5, 1 6C4. Size 24 x 18 x 10in. Brand new. Price £40 each.

## LOUD HAILER SPEAKERS

Sound powered with output transformer, impedance of speech coil 7 ohm, handling capacity 8 watts. Ideal for inter-communication. Complete with carrying strap. Price 27/6. Packing and carriage 5/-.



**Save £££'s on your Beam Antenna** Aerial whip antenna sections. 4ft. lengths can be utilized for beam antenna construction. Brand new. Six for 12/6. Plus carriage 2/-, Twelve for 24/-, Plus carriage 3/-.

## American GEARED MOTORS

24 v. D.C. MOTOR with built-in precision gearbox. No. 1 drive 24 R.P.M. No. 2 drive 8 R.P.M. On 12 v. No. 1 drive 16 R.P.M. No. 2 drive 4 R.P.M. Overall size of motor and gearbox 7½in. x 3½in. x 3in., weight 1 lb. 14 oz. Brand New. Only 29/6. P. & P. 2/-.

## 12 v. D.C. REVERSIBLE GEARED MOTOR

Precision built motor geared by fibre sprocket with cam at one end operating micro-switch, slotted drive fitted on other end. Motor 3,000 R.P.M., reduction drive 60 R.P.M. Limited quantity only. Brand new and fully tested. 30/-. P. & P. 2/6.

## Latest MINISTRY release-Magnifloct INSPECTION LAMP

Universal clamp fitting, adjustable reflector giving any angle beam, works off 6 v., 12 v., and mains. 26ft. of lead cable.



Unrepairable offer. Brand New in original packing. 15/6 P & P Only 2/6.

## TRANSISTOR BARGAINS!

All hermetically sealed, fully tested and guaranteed.  
**R.F. TRANSISTOR.** P.N.P. Junction type, suitable for medium and low frequency oscillators, frequency changers and I.F. amplifiers (up to 2 Mc/s). Double spot—yellow and red. Only 21/- each, post paid.  
**AUDIO.** P.N.P. Junction type, suitable for high gain or low frequency amplifiers and for output stages up to 250 mW. Double spot—yellow and green. Only 10/- each, post paid (Sub Standard.)

## FM WOBULATOR CAPACITOR

Excellent for Sweep Generator Frequency modulation unit permanent magnetic field and a moving mechanism driving a metal diaphragm supported at its rim. This diaphragm acts as a moving plate of the frequency modulator capacitor. Tested. Price 7/- each.

### R.F. UNITS

R.F. 24, 20-30 Mc/s, 8/6 each  
R.F. 25, 40-50 Mc/s, 8/6 each  
R.F. 26, 50-65 Mc/s, 25/- each

All valved, brand new in original cartons. Postage 3/- on each.

**PYE 45 Mc/s I.F. STRIPS.** Complete with seven valves, 6-EF50, 1-VR92, 6 tunable I.F. transformers. Only 35/- post paid.

## B.C. 733-D RADIO RECEIVER.

Consists of 6 crystals—5,700 kc/s, 5,722 kc/s, 5,733 kc/s, 5,744 kc/s, 5,755 kc/s, 5,777 kc/s—which can be ground to your requirements or used as overtone crystals. 10 valves—3 VT269, 1 12AH7, 2 12SR7, 2 12SG7, 1 12SQ7, 1 12A6. 3 output transformers. 3 I.F. transformers. 6 miniature 12 V. relays. 8 ceramic Aladdin coils slug tuned and numerous resistors and condensers of various values. NEW. A snip at £5 each. Carriage 7/6.

## LOW IMPEDANCE PADDED HEADPHONES TYPE D.L.R.

Complete with cord and plug. Brand new. Price 9/-, post & packing 1/6.

**VHF Klystron CV92, Tested, 12/-.**  
**VHF Klystron VT90, Tested, 12/-.**

## COMPLETE No. 1 HEADGEAR ASSEMBLY.

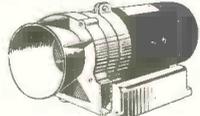
Consisting of headphones with padded earpiece and No. 7 moving coil hand microphone with cord and plug. Brand new. Price 25/-.

## AMERICAN THROAT MICROPHONES Type T. 30.

Complete with elastic strap, lead with 2 pin plug PL291. New and boxed, 2/6 each.

## AMERICAN ROTARY CONVERTERS

With cooling Fan. Input 12 V. D.C. Output 300 V. at 90 mA.



Completely suppressed. Brand new. 19/- each. Plus P. & P. 3/-.

**Pelda Radio Ltd.**  
(Dept. "W") 32A, Coptic Street, London, W.C.1. Phone: MUSEum 9607

Carriage charges apply to England and Wales only.

Terms: Cash with order.

All orders despatched same day.

EXPORT ENQUIRIES INVITED.

# RADIO TRADERS LTD.

23 WARDOUR ST., LONDON, W.1 (Coventry Street end)  
Phone No. GERrard 3977/8 Grams: "Radiotrade"

**MANUFACTURERS PLEASE NOTE YOUR ENQUIRIES ARE INVITED FOR ERIE RESISTORS TYPE 0, 1, 2, 8, 9, 16, 7b AND 5b.**

**WV RESISTORS.** 5 watt 1/6; 10 watt 2/6; 15 watt 3/-; 20 watt 3/6. We carry stocks of resistors from 2 watt to 150 watt W.V. Your enquiries invited.

**HIGH STABILITY RESISTORS.** 1/2 watt 5% 6d.; 1/2 watt 5% 9d.; 1 watt 5% 1/-. A few values in 1% and 2% still available.

ALL ORDERS FOR RESISTORS C.O.D. PLEASE, AS WE CANNOT GUARANTEE TO STOCK ALL VALUES.

**W.V. V/CONTROLS.** ALL WELL-KNOWN MAKES. Pre-set types 2/6; Slide types 3/-; Carbon type, less switch spindle and pre-set 2/-. With switch 3/6 each.

**CRYSTAL DIODES.** Westinghouse WG5B 2/6 each, B.T.H. 1/3 each. Special price for large quantities.

**SEMI-MIDGET 2-GANG.** .0005 Condenser, size 2 1/2 x 2 x 1 1/2 in. 6/9 each.

**AM/FM GANG CONDENSER.** Double 500 pf, double 27 pf size 3 1/2 x 1 1/2 in. 9/6 each.

**SPECIAL OFFER OF CURRENT MANUFACTURE ELECTROLYTIC CONDENSERS**

8 mfd. 450 v. 2/6 each; 16 mfd. 450 v. 3/-; 32 mfd. 450 v. 4/-; 8 x 8 mfd. 450 v. 3/9; 8 x 16 mfd. 450 v. 4/-; 16 x 16 mfd. 450 v. 4/6; 32 x 32 mfd. 350 v. 5/-; Bias Condensers: 25 mfd. 25 v. 1/6; 50 mfd. 50 v. 1/9. Please note we can offer special discounts for quantities.

**ELECTROLYTIC CONDENSERS.** Manufacturers' Surplus, in perfect condition. 100 mfd. x 200 mfd. 350 v. surge 5/6 each; 100 mfd. 425 v. surge 5/6 each; 150 mfd. 450 v. wkg. 5/6 each.

**BIAS CONDENSERS.** 3,000 Mfd. 6 v. 3/6 each; 2,500 Mfd. 3 v. 3/6 each; 1,000 mfd. 12 v. 1/6; 25 mfd. 25 v. 1/3; 50 mfd. 12 v. 1/-.

**BLOCK PAPER CONDENSERS.** 12 mfd. 250 v. 7/6; 8 mfd. 600 v. 7/6; 4 mfd. 400 v. 3/6; we carry a large stock of block paper type condensers. We invite your enquiries.

**MIDGET MICA CONDENSERS.** .0001, .0002, .0003, .0004, .0005 5/- per dozen.

200 Assorted Moulded Mica Condensers, popular values £2 10 0  
200 Assorted Silver Mica Condensers, popular values £2 10 0  
200 Assorted Carbon Resistors, 1/2, 1 and 1 watt. Good selection £1 10 0

**PAXOLIN SHEET.** 18 v., 4 1/2 x 1 1/2 in. 1/6; 10 x 10 x 1/2 in. 1/6; 20 x 20 x 1/2 in. 3/-; 10 x 10 x 1/4 in. 2/-; 20 x 10 x 1/4 in. 4/-. Minimum P. & Pkg. 1/6.

**BARGAIN OFFER OF BATTERIES**

4 1/2 v. Heavy Duty Bell Battery. Size 6 1/2 x 4 1/2 x 2 1/2 in.	2/6
72 v. H.T. 1.5 v. L.T. Size 6 x 5 x 1 1/2 in.	2/6
150 v. H.T. Size 2 1/2 x 5 1/2 x 1 1/2 in.	5/6
60 1/2 v. Size 2 1/2 x 3 1/2 x 2 1/2 in.	6/6
67 v. H.T. 1.5 v. L.T. 3 1/2 x 3 1/2 x 1 1/2 in.	4/6
All batteries sealed and unused. All plus 1/6 post and pkg. Special reduction for quantities.	

- 4-way Push Button Units 2/6 each. Knobs for same 3/- per doz.
- 5-way Push Button Units 5/6 each, complete with knobs.
- WEARITE COILS.** PA4, PO4, PA5, PO5 1/3 each.....doz. 12/-
- VALVE HOLDERS.** Moulded B9A 7/6; B7G 6/-; Int. Oct. 9/-; Eng. Oct.....doz. 4/6
- VALVE HOLDER FITTED WITH LOWER CAN** 1/6 per doz. extra. Screening cans for B7G and B9A.....doz. 6/-
- Paxolin V/H Int. Oct. B9A, B7G, 5/- per doz.; Eng. Oct., 5-pin 7-pin.....doz. 3/-
- BELLING-LEE PLUGS AND SOCKETS,** 5 pin 1/9; 7 pin 2/-; 10 pin.....each 2/6
- AIR-SPACED TRIMMERS,** 5, 10, 15, 20, 25, 50; and 75 of pre-set and spindle types 2/- each.....doz. 21/-
- PYE PLUGS AND SOCKETS** 1/6 per pair, " Tee " pieced...each 1/9
- GROMMETS,** 1 grs. assorted grommets, 1/2 in. to 1 in.....gross 8/6
- POST OFFICE LAMP JACKS** No. 10 1/- each.....doz. 9/-
- Lamp Covers for same.....doz. 3/-
- P74 2-pin and sockets are now available 3/6 each.
- OUTPUT TRANSFORMERS.** Multi-ratio 5/- each.
- WESTECTORS.** WX6, WX12, W4 1/- each.....doz. 9/-
- SIGNAL LAMP HOLDERS.** Panel mounting, complete with adjusting lampholder 2/- each.....doz. 21/-
- TAG STRIPS.** 3-way 2/-; 4-way 2/6; 5-way 3/-; 7-way 4/-; 28-way.....doz. 12/-

Special offer Westinghouse Rectifier 14A1116 1/2 wave 300 ma. 10/6 each.

- POINTER KNOBS.** Small black with white line, standard 1/2 in. spindle.....doz. 7/6
- WANDER PLUGS.** Red and black.....doz. 2/-
- PHILIPS TRIMMER TOOLS** 1/- each.....doz. 10/6

**CASH WITH ORDER OR C.O.D. ALL ORDERS DEPT. W.1. ALL ORDERS FOR LESS THAN £2 ADD POSTAGE**

We invite your enquiries for items not listed  
Trade Counter open 9 to 6 Monday to Friday  
Also 9 to 1 Saturdays. Callers welcomed.

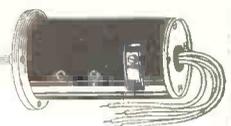
WHOLESALE MANUFACTURERS' AND EXPORT ENQUIRIES INVITED

# MIDLAND INSTRUMENT CO.

**CHASSIS, U.S. mfr., all aluminium, size 12 1/2 in. x 8 in. x 5 1/2 in., complete with top cover, some items have been removed, remaining are:-** 25 An phenol midget ceramic v-holder, B7G type, complete with cans, over 70 resistors, all 5% colour-coded, also many capacitors and other conds., trimmers, padders, fixed and variable inductances, transformer v-control etc., etc., new unused, bargain 10/-, post 8/-.

**MOTOR GENERATORS, U.S. mfr., totally enclosed, 4 1/2 in. long, 2 1/2 in. dia., input 27 v. 1.5 amps., output 285 v. at 60 ma., output from 13 v. supply is approx. 150 v., new, unused, 12/6, post 2/-.**

**HUGHES 12-VOLT D.C. SHUNT MOTORS,** taking 1.25 amps., up to 3-amps. on load, speed 5,000 r.p.m., external reversing terminations; size 3 1/2 in. long, 1 1/2 in. dia., 1/2 in. shaft, weight 20 oz., oil impregnated bearings, balanced armature, a very superior powerful motor, original cost over £7, our price new unused 10/-, post 1/2, 2 for 20/-, post paid. Ditto, fitted reduction gears, giving final drive of either 320 or 160 r.p.m. (state which required), 12/6, post 1/6, 2 for 25/-, post paid.



**MAINS BLOWERS, 200/250 v. A.C./D.C. 1/2 amp., 5,000 r.p.m., consists of the motor with attached enclosed fan, and tunnel intake 1 1/2 in. dia., side outlet 1 in. x 1 in., plinth base 5 in. x 4 1/2 in., finish black crackle and die cast aluminium, size overall 9 in. long, 4 1/2 in. wide, 5 in. high, weight 7 1/2 lb., a very superior blower, offered at a fraction of original cost, new, unused, 25/-, Post 3/-.**

**BATTERIES, radio layer type, by famous maker, fully guaranteed by us, 120-v. size 3 in. x 2 1/2 in. x 1 1/2 in., new unused 2/6, post 1/-.** Cartons of 6 batteries. 12/-, post 2/6. Ditto, 224 v. size 3 1/2 in. x 2 1/2 in., new unused, 1/6, post 1/-. Cartons of 3 batteries, 4/-, post 1/9.

**SHADED POLE MOTORS, 12 v. 50 cycles A.C., size 3 in. x 2 in. x 1 1/2 in., complete with 3 in. fan, made for lamphouse cooling, silent running, unused and perfect, 10/-, post 1/4.**

**HEATER MATS, 250/250 v. 1,000 watts, open mesh with asbestos insulation, size 12 in. x 10 in., border 1 in. wide each end for fixing, 2 in series (500 watts) are ideal clothes drying or airing cupboards, also suitable for convector, photo drying, etc., new unused 5/6, post 9d., 2 for 10/-, post 1/4.**

**MERCURY SWITCHES, 250 v. 10 amp., glass tilt type fitted brackets, specially made to give 3-second delay make after 1/4, new, boxed 5/-, post 7d.**

**TELEPHONE SETS, consists of 2 combined microphones and receivers, which when wired up with ordinary twin flex, provide perfect 2-way communication, excellent results up to 1 mile have been reported, self-energised, no battery required, price the 2 instruments new unused, 7/6, pos. 1/3 twin P.V.C. 14/36 flex up to 300ft. lengths at 1d. per ft.**

**LOUDSPEAKERS** by Pye, Phillips and other makers, 10in. P.M. less transformer, 3-ohm speech coil, fitted in a smart brown finish wood case with carrying handle, size 17 in. x 17 in. x 6 1/2 in. deep, front metal grill with four rear smaller ones, rear compartment houses 50ft. superior twin lead fitted jackplug, ideal for amplifier public address extension speakers, etc., new in sealed cartons, 45/-, carriage (in mind) 3/6.

**TRANSMITTER RECEIVERS No. 17 Mk.II, complete with valves high res. headphones hand microphones and instruction booklet, frequency 44 to 61 Mc/s., range with simple aerial 5-8 miles, requires ordinary 2-v. accumulator and 120-v. battery. These are brand new, in sealed cartons, our price 50/-, carriage 5/-.**

Many other Bargains; send stamped addressed envelope for lists.  
**MIDLAND INSTRUMENT CO., MOORPOOL CIRCLE, BIRMINGHAM, 17**  
Tel.: HAR 1308

## SAMSON'S SURPLUS STORES

**Exclusive Purchase!!**



**S.T.C. RECTIFIER SUPPLY UNIT No. 11 TYPE ZB 10235**

Specification:—A.C. input 100-260 volts, 45-65 cycles. D.C. output 24 volts 11 amps. and 130 volts 600 m.a. very conservatively rated, L.T. and H.T. completely smoothed. All circuits fused. Mains on/off switch. Built in grey metal cabinet as illustrated. Height 5ft. 0in., width 1ft. 7 1/2 in., depth 1ft. 1 1/2 in. Weight 200lb.

These units were originally designed to supply L.T. and H.T. power in conjunction with Bay Power No. 3 to S.O.S./T 3 channel telephone system, but are ideal heavy duty L.T. and H.T. supply units for the electronic industry research laboratories, schools, etc., etc. Complete with instruction Book and circuit. Supplied brand new at a fraction of the maker's price.

**£17.10.0** ex-warehouse

If further technical details are required, Instruction Book will be forwarded against a deposit of One Pound. Export enquiries are welcomed.

169/171 Edgware Road, London, W.2. Tel.: PAD 7851  
125 Tottenham Court Road, W.1. Tel.: EUS 4982  
All orders and enquiries to our Edgware Road branch, please. This is open all day Saturday.

C.R.T. ISOLATION TRANSFORMERS

For Cathode Ray Tubes having Heater/Cathode short circuit for C.R. Tubes with falling emission. Type A. Low leakage windings. Ratio 1:1.25 giving a 25% boost on Secondary. 2 volt ..... 10/6 each 4 volt ..... 10/6 each with Tag 6.3 volt ..... 10/6 each Panel and 10.8 volt ..... 10/6 each Solder Tags 13.3 volt ..... 10/6 each Ditto with mains primary 12/6 each Type B. Mains input 220/240 volts. Low Capacity. Multi Output 2, 4, 6.3, 7.3, 10 and 13 volts. Input has two taps which increase output volts by 25% and 50% respectively. This transformer is suitable for all Cathode Ray Tubes. With Tag Panel 21/- each. Type C. Low capacity wound transformer for use with 3 Ray Tubes with falling emission. Input 220/240 volts. Output 2-21-21-21-3 volts at 2 amps. With Tag Panel 17/6 each. All Isolation Transformers are individually boxed, labelled and clearly marked with relevant data. NOTE:—It is essential to use mains primary types connected with T.V. receivers having series coupled heaters.

RESISTORS. All values. 10 ohms to 10 meg. 1 w. 4d.; 1/2 w. 6d.; 1 w. 8d.; 2 w. 1/-.

HIGH STABILITY. 1/2 w. 1%. 2/-.

WIRE-WOUND RESISTORS. 1/3 15 watt } 25 ohms—10,000 ohms ..... 2/- 15,000 ohms—50,000 ohms, 5 w., 1/8; 10 w., 2/3

WINDING POTS. 3 WATT LAB. GOVERNOR, ETC. Potentiometer T.V. Type Standard size Pots, 2 1/2 Knurled Slotted Knob. Spindle High Grad. All All values 25 ohms to 30. Values, 100 ohms to 50 K. K. 3/- ea. 50 K, 4/- 5/6; 100 K, 6/6.

Ditto Carbon Traok 50 K. W/W EXT. SPEAKER to 2 Meg. 3/- CONTROL 100, 3/-

O.P. TRANSFORMERS. Heavy Duty 50 mA., 4/6. Multi-tap Push-pull, 6/6. Tapped small pentode, 3/6. Hygrade Push-Pull 7 watts, 15/6. L.F. CHOKES 15/10 H. 60/65 mA., 5/-; 25/20 H. 100/120 mA., 11/6; 20/15 H., 120/150 mA., 12/6; 5 H. 250 mA., 15/-

MAINS TRANS. 350-0-350, 80 mA., 6.3 v. tapped 4 v. 4. 5 v. tapped 4 v. 2 a., ditto 250-0-250 80 mA., etc., 21/-

I.F. TRANSFORMERS 7/6 pair 465 Kc/s Slug tuning Miniature Can 2 1/2 x 1/2 x 1/2 in. High Q and good band width. By Pye Radio. Data sheet supplied.

WEARIE M800 IF Transformers 465 Kc/s, 12/6 pair.

HEATER TRANS. Tapped 200/250 v. 6.3 v. 11 amp. 7/6 ALADDIN FORMERS and cores. 4in., 8d., 11in., 10d. 3in. FORMERS 5937/8 and Cans TV12. 2in. sq. x 2 1/2 in. and 3in. sq. x 1 1/2 in., 2/- complete with cores. SLOW MOTION DRIVES. Epicycloid ratio 6:1, 2/3.

TYANA. Midget Soldering Iron. 200/220 v. or 230/250 v., 16/9. SOLON MIDGET IRON. 25 w., 24/-

MAINS DROPPERS. 2 x 1 1/2 in. Three 4 1/2 in. Sliders, .3 amp. 750 ohms, 4/3. 2 amp. 1,000 ohms, 4/3.

LINE COED. 3 amp., 60 ohms, per foot, 3 amp., 100 ohms, per foot, 2 way, 6d. per foot, 3 way, 7d. per foot.

CRYSTAL MIKE INSERT by Acos Precision engineered. Size only 1 1/2 x 1 1/2 in. Bargain. Price 6/6. No transformer required.

MIKE TRANS. Ratio 50:1, 3/9 ea.; 100:1, 10/6. LOUDSPEAKERS P.M. 3 OHM. 2 1/2 in. square 17/6 5in. R.A. 17/6 7in. x 4in. Gilmans 21/6 3 1/2 in. Square Blac. 21/- 8in. Blac. 22/6 6 1/2 in. Goodmans 18/6 10in. R.A. 30/- TEL. TWEETER LS75, 8/6 12in. Plesey 30/- 8in. M.E. 2.5 k. field tapped O.P. transformer, 24/6

CRYSTAL DIODE. G.E.C., 2/- GEX34, 4/- 40 Circuits, 3/-

CRYSTAL SET CONSTRUCTION. Kit 12/6. Book 1/- H.R. HEADPHONES. 4,000 ohms, brand new, 16/6 pair. SWITCH CLEANER Fluid, squirt spout, 4/3 tin. TWIN GANG CONDENSERS. 385 pf. Miniature, 18in. x 1 1/2 in. x 1 1/2 in., .0005 Standard with trimmers, 9/-; less trimmers, 5/-; Midget, 7/6; 3-gang 500 pf., 7/6.

SUPERHET COIL PACK 27/6 Miniature size 2 1/2 x 2 1/2 in. High Q dust cored coils. SHORT, MED., LONG. GRAM switching with connection diagram and circuit. 475 Kc/s L.F.

VALVE HOLDERS. Pax int. Oct., 4d. EF50, EA50, 6d. B12A, CRT, 1/3. Eng. and Amer. 4, 5, 6, 7 and 9 pin. 1/-

MOULDED Mazda and Int. Oct., 6d. B76, B8A, B8G, B9A, 6d. B76 with can, 1/6. WCR97, 2/6. B9A with can, 2/6. GERM. EF50, B76, Int. Oct., 1/- B76 with can, 1/9. SPEAKER FRET. Gold Cloth 18in. x 2 1/2 in., 5/- 25in. x 3 1/2 in., 10/- Expanded metal, Silver 15 1/2 x 9 1/2 in., 2/- each. 14 1/2 in. x 12 in., 3/- each.

TYAN 4H. 6in. wide, 10 1/2 in. ft., 2ft. 3in. wide, 5/- 2/-

WA VCHANGES 3 p. 2-way, short spindle ..... 2/6 5 p. 4-way 2 waffer, long spindle ..... 6/6 2 p. 6-way, 4 p. 2-way, 4 p. 3-way, long spindle ..... 3/6 3 p. 4-way, 1 p. 12-way, long spindle ..... 3/6

Wave change "MAKITS" 1 waffer 3/6; 2 waffer 12/6; 3 waffer 16/-; 4 waffer 19/6; 5 waffer 23/-; 6 waffer 26/6. TOGGLE SWITCHES. 3 p., 2/-; D.F. 5/6; D.P.D. 4/- NUTS, BOLTS. 12 of each, 2, 4 or 6 A. .... 1/-

KNOBES GOLD ENGRAVED. Walnut or Ivory. 1 1/2 in. diam., 1/6 each. "Focus," "Contrast," "Brilliance," "Brilliance-On-Off," "On-Off," "Volume," "Volt-On-Off," "Tone," "Tuning," "Treble," "Bass," "Wavechange," "Radio Gram," "S.M.L. Gram," "Record-Play," "Brightnes," ditto, not engraved, 1/-



1957 RADIOGRAM CHASSIS THREE WAVEBANDS FIVE VALVES S.W. 16 m.—50 m. LATEST MULLARD M.W. 200 m.—550 m. ECH42, EF41, EBC41, L.W. 800 m.—2,000 m. EL41, ELZ40 12 month Guarantee. A.O. 200/250 v., 4-way switch. Short-Medium-Long-Gram. A.V.C. and Negative feedback. 4.2 watts. Chassis 13 1/2 in. x 5 1/2 in. x 2 1/2 in. Glass Dial 10 x 4 1/2 in. horizontal or vertical available. 2 Pilot Lamps. Four Knobs, Walnut or Ivory, aligned and calibrated. Chassis isolated from mains.

BRAND NEW £10.10.0 Carr. 4/6. TERMS: Deposit £5/5/- and 6 monthly payments of £1. MATCHED SPEAKERS FOR ABOVE CHASSIS: 5in., 19/6; 10in., 25/-; 12in., 30/-.

RECOMMENDED FOR ABOVE CHASSIS

R.C.S. SCOOP HIGH FIDELITY AUTOCHANGER 1957 MODEL RC456

For 7", 10", 12" Records 16, 33, 45, 78 r.p.m. 4 SPEEDS — 10 RECORDS WITH STUDIO "O" PICK-UP BRAND NEW IN MAKER'S BOXES OUR PRICE £9.15.0 Post free.

B.S.R. MONARCH 4-SPEED AUTOMATIC RECORD CHANGERS 1957 MODELS

Brand new and fully guaranteed 12 months. NOT JOB LINE REJECT STOCK

Designed to play 16, 33, 45, 78 r.p.m. Records 7in., 10in., 12in. Lightweight Lift pick-up, turnover head, two separate sapphire styli, for Standard and L.P. Each plays 2,000 records. Voltage 200/250 A.C.

OUR PRICE £8.15.0 each. Post free. Terms: Deposit £5 and 5 monthly payments of £1. Space required 14in. x 12 1/2 in. 5in. above and 3in. below.

TRANSISTORS 10/- ea. JUNCTION TYPE AUDIO (P.N.P.) R.F. 2 Mc/s 21/- ea.

B.S.R. MONARCH. 3-speed Motor and Turntable with selecting switch for 33, 45 and 78 r.p.m. records. 100-120 v. and 200-250 v. A.C. 50 c.p.s. Also B.S.R. MONARCH Lightweight Pick-up with Acos H.A. Miniaturized head, separate Sapphire styli for L.P. and standard records. SPECIAL OFFER. THE TWO £4/12/6, post 2/8. 14 x 12 1/2 in. Out Out board 6/6.

Teleton Band III Converter

London, Midland and Northern for all T.V. Makes. T.R.F. or Superhet Ready wound coils, two EF80 valves, all components, punched chassis, circuit diagram, wiring plans. COMPLETE KIT for mains operation. 200-250 v. A.C. £3/10/-. AS ABOVE less POWER PACK. Requires 200 v. 20 mA. H.T. 6.3 v. 0.6 a. L.T. £2/5/-.

GARRARD RC 90m 3 speed Autochange Universal A.O-DC 100-250 volts. List price £27/10/-.

OUR PRICE £15.15.0 carr. & ins. 5/-.

NEW AND ENLARGED SHOWROOMS NOW OPEN

T.V. PRE-AMP. (McMICHAEL) Will amplify output of your Teleton Converter, etc. Tunable Channels 1 to 5. Midget size. High gain fringe model. B.V.A. Valve. Instructions supplied. READY FOR USE (E.L.T. 200V L.T. 6.3V., 3 amp. required). PRICE 25/- each. BRAND NEW. SPECIAL MAINS POWER PACK for above, 25/- extra.

Volume Controls 80 ohm CABLE Coaxial

Midget size Semi-air spaced Polythene Long spindles. Guaranteed 1 year. All values 10,000 ohms to 2 Mgr. 3/- 4/- 4/9 1in. Coaxial ..... 8d. yd. 3in. or Log Tracks

COAXIAL PLUGS 1/- DOUBLE SOCKET 1/3 SOCKETS 1/- OUTLET BOXES 4/6 BALANCED TWIN FEEDER per yd., 6d. 80 ohm or 300 ohm TWIN SCREENED BALANCED FEEDER 1/- yd., 80 ohms. TRIMMERS. Ceramic, 30, 50, 70 pf. 9d. 100 pf., 150 pf., 1/3. 250 pf., 1/6. 600 pf., 750 pf., 1/9. Finials 1/- ea.

ALUMINIUM CHASSIS. 18 s.w.g. Plain, un drilled, with 4 sides, riveted corners and lattice fixing holes, with 2 1/2 in. sides. 7 x 4 in., 4/6; 7 x 5 in., 5/6; 11 x 7 in., 6/6; 13 x 9 in., 8/6; 14 x 11 in., 10/6; 15 x 11 in., 12/6; and 18 x 16 x 3 in., 16/6.

BLACK GRACKLE PAINT. Air drying, 3/- tin. P.V.C. CONN. WIRE. 10 colours, single or stranded, 2d. yd. 5in. RADIO SCREWDRIVERS. 6d. each. NEON MAINS TESTER SCREWDRIVERS. 5/6. MULTICORE SOLDER 60/40, 18 s.w.g., 3d., 18 s.w.g., 4d. yd.

PURETONE RECORDING TAPE, 12/6

1,200ft on standard fitting 7in. Plastic reels Brand new, boxed, 12/6. Spare Spools 5in. metal, 1/6. 7in. Plastic, 4/3. FERROVOICE PLASTIC TAPE, 25/- First Quality. Highly recommended. Brand new. Boxed, 1,200ft. on 7in. Plastic Reels, 25/-.

SENTERCEL RECTIFIERS. E.H.T. TYPE FLY-BACK. VOLTAGES. K3/25 2 kv., 5/-; K3/40 3.2 kv., 7/-; K3/45, 3.8 kv., 7/6; K3/60 4 v., 8/-; K3/100 5 v., 14/6. MAINS TYPE, RM1, 125 v.; 60 mA., 5/-; RM2, 100 mA., 6/-; RM3, 120 mA., 8/-; RM4, 250 v. 275 mA., 16/- MINIATURE CONTACT COOLED RECTIFIERS. 250 v. 50 mA., 8/6; 250 v. 85 mA., 9/6.

COILS. Write in "P" type, 3/- each. Osmor Midget "Q" type adj. dust core, 4/- each. All ranges. TELETRON. L. & Med. T.R.F. with reaction, 3/6. FERRITE ROD AERIALS. M.W., 8/9; M. & L., 12/6. T.R.F. COILS A/H/P, 7/- pair. H.F. CHOKES, 2/6.

JASON E.M. TUNER COIL SET. 22/6. H.F. coil, aerial coil, Oscillator coil, two I.F. Transformers 10.7 Mc/s., Detector transformer and heater choke. Circuit and component book using four 6AM6, 2/-; J.B. Chassis and Dial, 19/6. Complete Kit, £5/18/6. With Jason superior calibrated dial, £6/15/-.

CONDENSERS. New stock. .001 mfd. 7 kv. T.C.C., 5/6. Ditto 20 kv., 9/6; 100 pf. to 500 pf. Micass, 6d.; Tubular 50 v. .001 to .01 mfd., 9d.; .05, 1, 1/-; 25, 1/6; 5, 1/9; 10, 1/6; 100, 1/6; 1,000 v., 1/3; 1 mid., 2,000 v., 2/6. CERAMIC CONDS. 800 v. 1/3; 1,000 v., 1/6. SILVER MICA CONDENSERS. 10% 5 pf. to 500 pf., 1/-; 600 pf. to 3,000 pf., 1/3. DITTO 1% 1.5 pf. to 500 pf., 1/9; 515 pf. to 5,000 pf., 2/-.

NEW ELECTROLYTICS. FAMOUS MAKES.

Table with columns: TUBULAR, TUBULAR, CAN TYPES, GAN TYPES. Values range from 1/350 v. 2/- to 8-16/450 v. 5/-.

FULL WAVE BRIDGE SELENIUM RECTIFIERS. 2, 6 or 12 v. 1 1/2 amp., 8/9; 2 a., 11/3; 4 a., 17/6.

GEARBOX TRANSFORMERS. Tapped input 200/250 v. on charging at 2, 6 or 12 v. New. 13/6; 4 amp., 21/-.

Table with columns: All Boxed VALVES, New & Guaranteed. Lists various valve types and prices like 1B5 8/6, 6X8 8/6, EABC80 8/6, etc.

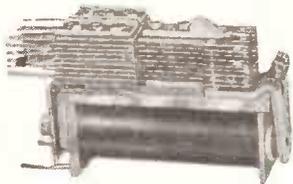
We have no connection with a ny other firm. Please address all Mail Orders correctly as below.

RADIO COMPONENT SPECIALISTS 337 WHITEHORSE RD., WEST CROYDON

OPEN ALL DAY—(Wed. 1 p.m.) 10-page list 3d. C.O.D. Service 1/6

Tel. THO 1665. Buses 133 or 68 pass door. S.R. Stn. Selhurst. 48-hour postal Service. P. & P. 1/-, £2 orders post free (Export extra.)

# RELAYS P.O. TYPE 3000



**BUILT TO YOUR SPECIFICATION**  
**QUICK DELIVERY**  
**KEEN PRICES**  
**CONTACTS UP TO 8 CHANGE OVER**

## METERS GUARANTEED

F.S.D.	Size	Type	Price
100 Microamp	2 1/2 in.	MC/FR	50/-
250 " (multirange scale)	3 1/2 in.	MC/FR	55/-
500 " (scaled 0/15) KV	2 in.	MC/FR plug type	18/6
1 Milliamp	2 in.	MC/FS Elliot 5Q/87	27/6
30 "	2 1/2 in.	MC/FR	12/6
100 "	2 1/2 in.	MC/FR	12/6
20 Amp	2 1/2 in.	MI/FR	25/-
25 "	2 1/2 in.	MI/FR DC	7/6
50 "	5 in.	MI/PR	60/-
50-0-50 Amp.	2 in.	MC/FS	12/6
15 Volt	2 1/2 in.	MI/FR	15/6
20 "	2 in.	MC/FS	10/6
40 "	2 in.	MC/FS	10/6
300 "	2 in.	MC/FS	10/6
300 "	2 1/2 in.	MI/FR	25/-
300 "	5 in.	MI/PR	60/-

**METER RECTIFIERS.** Full wave bridge 1m/a or 5m/a 7/6 each, 50m/a 5/- each, post 6d.

**P.M. SPEAKERS.** 12in. Goodman 15 ohms. A High class unit at a low price £5/10/0, post 3/-.

**P.M. SPEAKERS.** 12in. Plessey 3 ohms. Special price 32/6, post 2/-.

**P.M. SPEAKERS.** 10in. in portable case with flex and plug 50/-, carr. 5/-.

**TANNOY LOUD HAILERS** enclosed in slope front wood case, with 180 ohm line transformer and blocking condenser. Speech coil impedance 7.5 ohms, 25/-, post 3/-.

**TRIMMING CONDENSERS.** Air spaced miniature 1.5 to 8 pf., 1.5 to 20 pf., 2 to 32 pf., 20 pf. All at 1/- each or 9/- per doz.

**CONDENSERS, METALMITE,** 350 vt. wkg., .001, .002, miniature, 12/- doz. .005, .01, .02, 10/- doz., .05, 12/- doz., .1, 13/6 doz., .25 Metalpack, 16/- doz., 1.0 Metalpack, 24/- doz. Post 1/-.

**GROSS POINTER METERS.** With 2 separate 100 microamp movements. Brand new 22/6. Post 2/-.

**PORTABLE BLOWERS** 200/250 v. AC/DC 300 watts with switch and leads 1 1/2 in. outlet £5, carr. 7/6.

**VOLTAGE REGULATORS.** Input 230 v. A.C., 21 amp. Output 57.5 v. to 228 in 16 steps with current limiting reactor. These variable transformers are brand new and not removed from equipment, £12/10/- each, carriage 10/-.

**CIRCUIT TESTER** in wood case 9in. x 6in. x 4in. 2 1/2 in. Flush Round meter, 50 milliamps, basic movement 10 M/A with leads, 10£ potr. provision for 1.5 v. batt. Ideal for conversion 17/6, post 2/6.

**BATTERY CHARGERS.** Output up to 23 v. 10 amps., controlled by two 4-position rotary switches for fine and coarse control. Input 200/250 v. A.C. 50 cy., fused for A.C. and D.C., clear scaled ammeter. Brand new, made by S.T.C. £17/10/-. Carr. 15/-.

**CHARTBOARDS.** With pantograph arm, perspex scale, protractor head, as used in the R.A.F. for navigation purposes, 17in. square. Brand new, will make a useful drawing board. 25/-, Post 3/-.

**RADIATION MONITORS.** Philips Type 1092C. A portable self-contained unit in haversack, measuring Gamma Radiation. Scaled 0 to 10 millirontgens per hour, using Mullard Geiger Counter MX115. £25.

**HEADPHONES.** Balanced Armature Type DHR, 17/6 per pair. Post 1/6.

**HEADPHONES.** High resistance 4,000Ω Type CHR, new, 12/6 pair, post 1/6.

**VARIAC TRANSFORMERS.** Oil filled type. 80 CO 7.5 amps enables 230 v. A.C. mains to be kept constant, 130/-, Carr. 7/6.

**RACKS-POST OFFICE STANDARD.** 6ft. high with U-channel sides drilled for 19in. panels, heavy angle base. 4ft. 10in. also in stock.

**PHOTOMULTIPLIER No. 931A.** Ideal for film scanning, spectography, Alpha counting, colorimetric measurement etc., supplied complete in lightproof chamber with lamp, wired with the resistor network, 70/-.

**VERNIER DRIVES.** Muirhead scaled 0/180 deg. Ratio 38 to 1. Diam. 3in. 10/6. Post 1/6.

**TELEPHONE SETS.** For perfect communication between 2 or more positions. Wall Type, one, pair of units, £5. Batteries 5/6. Twin wire 5d. yard. Desk Type, now available, latest modern style. Two complete units ready for use, £8/17/6. Wire 5d. per yard. Post 3/-.

**VENT-AXIA FANS-EXTRACTION OR INTAKE.** 230/250 volts A.C. 6in. diam. blades 130/-, 12 volt D.C. 90/-, post 2/9.

**RATIO ARM UNITS.** Sullivan. 600 ohms + 600 ohms, 50/-, Post 2/-.

**WHEATSTONE RESISTANCE BRIDGE.** 1 to 10,000 ohms. Plug type £5.



### ELECTRO MAGNETIC COUNTERS

Post Office type 11A, counting up to 9,999, 2 to 6 volts D.C. 3 ohm. coil, 12/6 each. High Speed Type, 2,300 ohm 30/-, Post 1/6.

**ROTARY CONVERTERS.** Input 24 volt D.C. Output 230 volt A.C. 50 cy., conservatively rated at 100 watts, 92/6. Also available in a strong ventilated metal case with switch, input plug and output socket, 105/-, Carr. 7/6.

**CHARGING RECTIFIERS.** Full wave Bridge 12 volts 2 amps., 13/6, 4 amps., 22/6, suitable transformers 2 amp., 24/-, 4 amp., 27/3, post 2/-.

**VARIABLE RESISTANCE.** 160 ohms, 2 amps., on 10 1/2 in. Twin formers, gearing with control handle. Suitable for dimming, 35/-, post 2/9, also 500 ohms, 1.5 amp. LOG 50/-.

**TERMINAL BLOCKS** 2-way fully protected. No. 5C/430. 4/- doz. or box. of 50 for 16/-, 3-way, 8/- doz., post 1/6.

## L. WILKINSON (CROYDON) LTD.

19, LANSDOWN ROAD, CROYDON

Phone: CRO. 0839

Telegrams: "WILCO," CROYDON

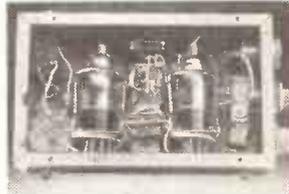
# -ARMY SIGNALLING LAMPS-

12 volt, in metal container with carrying strap. Contents: 3 spare bulbs, operator's lamp and spare bulbs, morse key, plugs and 3 coloured screens (red, green, amber).

12/6 P. & P. 2/6



## 12 VOLT RECEIVERS type 1125d



Contents: two 9D2 valves, 3-1 intervalve transformer, one mu-metal multi-ratio transformer, etc.

10/- P. & P. 2/-

## POWER FACTOR CONDENSERS

160 μF 290 V.r.m.s. 50 cycles. Fitted with discharge resistance. In manufacturer's cases.

£2 P. & P. 5/-

We can still supply the "Complete Radar Transmitter and Receiver Indicator" and "Transmitter/Receiver pack, Complete Table and Equipment" as per March advt. p.142.

## A. PRESTON & SONS

186 Sussex Way, London, N.19. Phone: ARChway 5951



(REGD. TRADE MARK)

### PRECISION HIGH-FIDELITY MAGNETIC SOUND HEADS

Announcing our New Miniature Magnetic Sound Heads. These heads incorporate all the features of our well known standard heads being of the same type of construction but are only 15 mm. in diameter.

Types available:

Type M6RP (Record/Play)  
 M5R (Record)  
 M5E (Erase)

Full details on application

BRADMATIC for hi-fi tape recording apparatus

Tape Desks, Magnetic Heads, Amplifiers & accessories

Write for details. Private or Trade supplied.

**BRADMATIC LIMITED**

Station Road, Aston, Birmingham 6

Telephone: East 2881-2 Telegrams: Bradmatic, Birmingham.

## QUARTZ CRYSTALS AS OSCILLATORS AND RESONATORS

by

D. FAIRWEATHER A.M.I.E.E., A.M.I.A.I.,  
 AND R.C. RICHARDS ASSOCIATE I.E.E.

This book is essentially practical and covers the basic principles governing the design of quartz crystal oscillators and resonators without entering into unnecessary detail. Information is provided on crystal cuts, temperature coefficient and mounting methods as well as practical circuit design information.

The authors have been directly concerned with all aspects of the subject.

A valuable reference book for circuit designers. Price 7/6d.

Enquiries to: The Manager, Technical Information Division, Marconi's Wireless Telegraph Co., Ltd., Chelmsford, Essex, England.



# FOR VALVES—GUARANTEED NEW AND BOXED

0Z4	5/6	6A7	13/-
1A3	3/6	6A8G	10/6
1A6GT	6/-	6A07	6/6
1A7	12/6	6A65	5/6
1C2	9/6	6AK5	6/6
1H5GT	10/6	6AK7	
1L4	6/6	6AG7	9/-
1LD5	3/6	6AL5	6/6
1N5	10/6	6AM5	7/6
1R5	8/-	6AM6	9/-
1R5	7/6	6AQ5	7/6
1T4	7/6	6AT6	8/6
2X3	4/6	6B4	5/-
3A4	7/-	6B8	4/-
3D6	5/-	6BA6	7/6
3Q4	9/6	6BB6	8/-
3Q5	9/6	6BB6	9/-
3B4	8/6	6BR7	11/6
3V4	9/6	6BW6	8/6
4D1	3/-	6BW7	10/-
4Z	8/-	6C4	7/-
5R4G	9/6	6CSGT	6/6
5U4G	8/-	6C5	5/-
5Y3G	8/-	6C9	10/6
5Y3GT	8/-	6D6	5/-
5Z4G	10/6	6F6G	7/6

6F6M	7/6	6U5	8/6	956	3/6	25L6GT	9/6	ECC91	9/-	H30	5/-	PCF82	12/6
6F13	14/-	6U7G	8/6	10F9	11/6	25Y5	9/6	ECCF80	14/6	HLL320	4/-	PCL83	12/6
6F15	14/-	6V6G	7/-	12A6	6/6	25Y5G	9/6	ECCF82	15/-	HP4101	6/-	PL82	10/-
6GGG	4/6	6V6GT	7/6	12AH7	8/-	25Z4G	9/6	ECH35	11/6	HR210	4/6	PL83	12/-
6H6	2/6	6X4	7/6	12AH8	11/6	25Z5	9/6	ECH42	10/6	KBC32	8/-	PP225	3/11
6J5G	5/-	6X5G	7/6	12AT7	9/-	25Z6GT	9/6	ECH81	11/-	KF35	8/-	PX25	15/-
6J5GT	5/6	6X5GT	7/6	12AU7	9/6	36L6GT	9/6	ECL80	10/6	KK32	8/-	PY80	10/-
6J5M	6/6	7B6	11/-	12AX7	10/-	36W4	9/6	EFL80	10/6	KL35	8/6	PY81	10/-
6J6	6/-	7B7	8/6	12BA6	9/-	35ZGT	8/6	EF22	2/6	KT21	5/6	PY82	9/-
6J7G	6/-	7C5	8/6	12BE6	10/-	35Z5	9/6	EF40	12/6	KT2	4/6	PY83	12/-
6K6G	7/-	7C6	8/-	12C8	7/-	60L6GT	8/6	EF41	11/-	KT33C	10/-	QP21	7/6
6K7G	5/9	7H7	9/6	12E6	3/6	AC6/PEN	6/6	EF55	8/-	KT36	15/-	SP220	3/11
6K7M	6/9	7Q7	9/-	12J5	4/6	ATP4	3/6	EF85	12/6	KTW61		U10	10/-
6K8G	8/9	7R7	9/6	12J7	12/6	DAF96	10/6	EF86	12/6	(KLTW62)	8/6	U92	8/-
6K8GT	9/6	787	9/6	12K7	9/-	DF96	10/6	EF89	12/6	KTW63	8/6	U95	13/6
6L6G	9/-	7Y4	8/6	12K8	13/-	DH78M	10/6	EP92	8/6	KTZ41	6/-	U929	15/-
6L7	7/6	75	11/6	12Q7	9/6	DK98	10/6	EL32	8/6	LP220	5/6	U404	11/6
6N7	7/-	77	8/-	12R7	2/6	DL96	10/6	EL41	10/6	MH4	7/6	UAF49	9/6
6Q7GT	9/-	78	8/6	12S7	7/6	DM70	8/6	EL42	11/6	MH41	7/-	UB41	11/6
6R7	9/-	80	8/6	12SH7	5/6	EABC80	10/6	EL84	11/-	N37	13/6	UBC41	10/-
6SA7GT	8/-	807	2/6	12SJ7	8/-	EAC91	7/6	EM34	11/-	N78	13/6	UBC42	10/-
6SG7	7/6	8D2	2/9	12SK7	6/-	EAF42	12/6	EM80	11/-	P61	3/6	UBF80	11/-
6SH7	6/-	9D8	3/9	12SL7	7/6	EB41	9/-	EY51	11/6	P215	3/11	UCH42	12/6
6SL7	8/-	9001	5/6	12SQ7	8/6	EBC41	10/-	EY86	12/6	PEN44	15/-	UCH81	12/6
6SN7	8/-	9003	5/6	12SR7	7/6	EBF50	11/-	EY91	6/-	PEN25	5/-	UF41	10/6
6SQ7	9/3	9004	5/6	1A87	13/6	EC91	9/6	EZ40	10/-	PEN46	4/-	UL41	11/-
6S87	8/-	9006	5/6	15D2	7/9	ECC40	12/6	EZ80	10/-	PEN220A	7/-	UY41	10/6
6U4GT	15/-	984	2/-	20L1	12/6	ECC84	12/6	E1148	2/-	PC084	10/-	UY85	9/6
6U5G	8/6	985	4/9	20P5	11/6	ECC85	10/-	GZ32	12/6	PCF80	11/-	VR21	2/9

Collaro Rim Drive electric gramophone unit, Model 3/554, fitted pick-up 8TUD10 "T" 3 speed, £6/19/6 each. Postage 3/.

Yaxley Switches assorted. All unused. Many with long locating splindles. Ideal for making up. Special switch units 9/- doz.

Toggle switches. Brand new, various types. Single pole, double pole, etc. 12/- doz.

Marconi Type Metal Strip Dropper. Resistance. 3 voltage tappings. App. 8in. long, 2/- each.

Filament transformer. 230 v. input with 2x6.3 v. Secondary windings 7/6 each.

Osmor Band I Filter. Designed to reject the Band I B.B.C. signal when break through is noticeable. 10/- each.

Portable Case 8 1/2 x 8 1/2 x 4 1/2 in. grey finish, reline covered, complete with chassis, dial, and speaker fret. 25/- each.

Metal Rectifiers. 12 v. 1/2 amp. 1/6 each. 250 v. 45 m/a. 6/9 each. 250 v. 75 m/a. 7/6 each. 12 v. 1 amp. 5/3 each. 12 v. 3 amp. 9/- each. 12 v. 3 amp. 13/6 each.

"Tyana" Soldering Iron. 40 watts, standard voltage ranges, weight app. 4 oz. The perfect small soldering instrument. Price 16/9 each.

"Apex" Tuned Filter Unit. A crossover box for use with combined or separate Band I and Band III aerials. The unit is completely shrouded. 7/6 each.

"Teleton" Ferrite Rod. Long and medium wave, 12/9 each.

"Teleton" Ferrite Rod. Medium wave. 8/9 each.

**TRANSISTORS**  
Red spot for audio stages. PNP type, 10/- each.  
Blue spot for RF up to 1-6 MC/6, 15/-.

**SCOPE TUBES**  
Type 3EP1 removed from U.S.A. equipment. Complete with base and screens. 15/- each. Post 2/6.

**COLLARO AC3/554**  
Three speed, single player, for A.C. mains. 200/250 volts, cream finish, complete with turn over crystal unit. "Studio T" type. 28/19/6 each, postage, etc., 3/6 ea.

**IMPLOSION GUARD**  
For 17in. tube. Overall size. 17 1/2 in. x 12 1/2 in. 7/- each. post 3/-.

**BATTERY PORTABLE CASE**  
Suitcase type size 8 1/2 in. x 8 1/2 in. x 4 1/2 in. covered lizard grey, fascia board, cut for a 5in. speaker, lid insert for frame aerial, complete with chassis, dial, etc. 25/- each. Post 3/-.

**HEADPHONES**  
CLR 120 ohms..... 7/6 pair  
CHR 4,000 ohms..... 13/6 pair  
DHR Quality Phones..... 16/- pair

**FOCUS UNITS**  
12in. tube type 12/6 each. {Both fitted with vernier adjustments.  
17in. tube type, 15/- each.

**BAKELITE KNOBS**  
Large purchase—Good quality.  
Type JK1, cream, 1 1/2 in. diameter, spring fixing, fluted grip.  
Type JK2, brown, 1 1/2 in. diameter, spring fixing, fluted grip.  
Type JK3, brown, 1 1/2 in. diameter, spring fixing, plain grip.  
(This one has white ring on knob face.)  
All have a small finger flange to avoid marking cabinets.  
Offered at a fraction of original cost. Price 6d. each, 5/- doz. Any types.

All these and many other interesting radio and T.V. components are listed in our **CURRENT CATALOGUE** which is available to you now. Send 1/- in stamps for your copy.

**PUBLICATIONS, ETC.**  
No. 134. P.M. Tuner Construction 2/6  
No. 135. How to Make Aerials for TV (Bands 1 and 3) and V.H.F. (Band 2) 2/6  
No. 135. All-dry battery Portable Construction 2/6  
No. 100. A Comprehensive Valve Guide Book No. 1 5/-  
No. 121. A Comprehensive Valve Guide Book No. 2 5/-  
No. 103. Radiofolder "A" 1/6  
No. 114. Radiofolder "E" 2/6  
No. 128. Practical Transistors and Transistor Circuits 3/6  
No. 140. TV Servicing for Beginners 4/6  
No. 142. Modern TV Circuitry and General Fault Finding Guide 4/6  
Servicing the Modern Radio Receiver 1/6  
(Please include 4d. postage per copy.)

"Loudspeakers," by G. A. Briggs. The why and how of good reproduction 7/6  
Mullard-High Quality Reproduction 3/6  
"Wearite Manual of the Tape Deck" 2/6

**TWO HIGHLY INFORMATIVE PUBLICATIONS**  
The G.E.C. Nine One Two Plus, 4/-  
The FM plus Tuner for the Nine One Two, 2/6.

**ALPHA 3 VALVE T.R.F. KIT**  
£5. 10. 0



★ Easy to build.  
★ Valves 6J7, 6K7, 6V6GT plus metal rectifier.  
★ Walnut cabinet.  
Full instructions, point to point wiring diagram, Circuit diagram, and full shopping list 1/-. All components may be purchased separately.

**TELEVISION ELECTROLYTICS**  
100 mfd. 450 v. T.C.C. .... 2/- each  
60-120 mfd. 300 v. B.E.C. .... 5/- each  
100-200 mfd. 275 v. B.E.C. .... 5/- each  
60-250 mfd. 275 v. B.E.C. .... 5/- each

**WAX TUBULARS**  
.001 mfd. 350 v. .... 5d. each or 4/6 doz.  
.002 mfd. 400 v. .... 5d. each or 4/6 doz.  
.002 mfd. 1,000 v. .... 9d. each  
.005 mfd. 600 v. .... 9d. each  
.01 mfd. 500 v. .... 5d. each or 4/6 doz.  
.05 mfd. 350 v. .... 9d. each  
.1 mfd. 500 v. .... 6d. each  
.25 mfd. 350 v. .... 5d. each or 4/6 doz.

**LOUDSPEAKERS**  
ALL P.M. TYPES LESS TRANSFORMER

Waterhouse 5in. unit	17/6 ea.	Leotrona 5in. unit	17/6 ea.
Plessey 6 1/2 in. unit	18/6 ea.	Goodmans 6 1/2 in. unit	18/6 ea.
R. & A. 8in. unit	18/6 ea.	Goodmans 8in. unit	19/6 ea.
Plessey 12in. unit	35/- ea.	Goodmans 4 x 7in. unit	19/6 ea.
R. & A. 8 1/2 in. unit, mains energised, 600 ohms field	17/6 ea.	Plessey 8in. unit, mains energised, 600 ohms field	21/- ea.
Goodmans or Leotrona 8in. unit with output transformer	21/6 ea.		

**ALPHA**  
RADIO SUPPLY CO.

103, LEEDS TERRACE,  
WINTOUN STREET,  
LEEDS, 7.

**TERMS:** Cash with order or C.O.D. Postage and Packing charges extra, as follows: Orders value 10/- add 1/-; 20/- add 1/6; 40/- add 2/-; £5 add 3/-; unless otherwise stated. Minimum C.O.D. fee and postage 3/-.  
For full terms of business see inside cover of our catalogue.  
Personal Shoppers 9 a.m. to 5 p.m. Mon. to Friday.

## COMMERCIAL TELEVISION CONVERTER

SUITABLE ANY T.V.  
using lower side band

NO ALTERATIONS TO SET

Complete with built-in power supply, 230-250 v. A.C. mains. Case 5½ in. long, 3½ in. wide, 4½ in. high. Incorporating gain control and band switch.

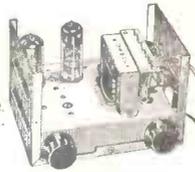
£3/19/6

Plus Post & Packing 2/6.

Illustrated with cover removed.

**SPECIAL OFFER FOR ONE MONTH ONLY**

3 element folded di-pole aerial. 12 yards co-ax cable & 2 co-ax plugs. If purchased together with converter 12/6. Plus P. & P. 2/6.

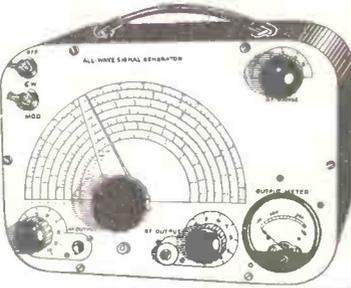


Coverage 120 Kc/s.-230 Kc/s., 300 Kc/s.-900 Kc/s., 900 Kc/s.-2.75 Mc/s., 2.75 Mc/s.-8.5 Mc/s., 8 Mc/s.-28 Mc/s., 16 Mc/s.-56 Mc/s., 24 Mc/s.-84 Mc/s. Metal case 10 in. x 6½ in. x 4½ in. Size of scale, 6½ in. x 2½ in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation or 400 c.p.s. to a depth of 31 per cent., modulated or unmodulated R.F., output continuously variable 100 milli-volts. C.W. and mod. switch, variable A.F. output and moving coil output meter. Grey hammer finish case and white panel. Accuracy plus or minus 2%.

£4/19/6

or 34/- deposit and 3 monthly payments 25/-. P. & P. 4/6 extra.

## COMPLETELY BUILT SIGNAL GENERATOR



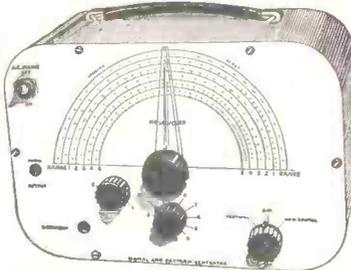
## SIGNAL & PATTERN GENERATOR

Coverage 7.6 Mc/s.-210 Mc/s. In five bands, all on fundamentals, slow motion tuning, audio output, 8 vertical and horizontal bars, logging scale. In grey hammer finished case with carrying handle. Accuracy ± 1%. A.C. mains 200-250 v..

£6/19/6

P. & P. 5/6.

Or £3 deposit, P. & P. 5/6 and 3 payments of 30/-.



## COMPLETELY BUILT PORTABLE AMPLIFIER

approx. size 6½ x 2½ incorporating 2 valves, contact-cooled metal rectifier, bass and treble lift controls and double wound mains transformer 39/6 Plus P. & P. 230-250 v. 2/6.

6½" P.M. SPEAKER AND O.P. TRANSFORMER

if purchased with the above 18/6. Plus P. & P. 1/6.

## COLLARO 4-SPEED AUTOMATIC CHANGER

Model 456. A.C. Mains 200/250v. Turnover crystal head. Brand new. £8.19.6 Fully guaranteed. (Suitable for use with above amplifier.) P. & P. 5/-.

## BATTERY CHARGER 6 or 12 v. 4 amp.

A.C. Mains 200-250 v. Fitted ammeter, selector switch, fuses battery clips, indicator lamp. Incorporating G.E.C. Metal Rectifier. Ready for use. In grey hammer finish case. Wall fixing, 59/6. P. & P. 3/6.

## T.R.F. KIT IN PLASTIC CABINET

3 valve plus metal rectifier, A.C. mains 200-250 v. Medium and long waves. In pastel blue or brown. Valve line-up V1R5S and VT52. Size 15½ in. long by 9 in. high by 7 in. deep.

£3/19/6

P. & P. 4/6.

A point-to-point wiring diagram, 1/6. Free with complete kit.

All parts supplied separately.

1,200 ft. Recording tape on plastic spool, 12/6. P. & P. 1/-.  
Mains transformer, Primary 110-250. Secondary 0-120-180-200 v. 60 mA, 6.3 v. 2 amp., 10/6. P. & P. 2/-.  
8 mfd. 450 wkg. can. size 2" x 2". 1/3 each. 12/- doz.

## RADIO AND T.V. COMPONENTS (ACTON) LTD.

23 ACTON HIGH STREET, LONDON, W.3

GOODS NOT DISPATCHED OUTSIDE U.K.



**CR50 BRIDGE** measures 10 pF to 100 mF and 1 ohm. to 10 Megohms in fourteen ranges, with a total scale length of over 120 inches. This instrument was specially designed for bench use, having a sloping front panel and extra heavy gauge steel case, finished in black crackle. The controls are arranged so that quick and accurate readings may be taken. Balance indication is by a magic eye fed from a high gain amplifier. A leakage test is incorporated for condensers. Internal standard are 1% accuracy. Complete with all valves and instructions, ready for use from 200/250 volt A.C. mains, £7/18/-, plus 4/6 carr./pack.

**SG50 SIGNAL GENERATOR** covers 100 kc/s to 80 Mc/s in six continuous ranges on fundamentals with internal modulation or CW. In silver grey case size 9 in. x 13 in. x 4 in. with scale of engraved Perspex in contrasting shade of green. A really handsome generator and still only £8/10/-, plus 6/- carr./packing.

**VV50 VALVE VOLTMETER** measures up to 250 volts D.C., A.F. and R.F. Complete with valves and probe unit ready for operation from mains. Brand new and boxed at £7/19/6, plus 4/6 carr./pack.

Hire Purchase and Credit Terms now available.

Further details will be sent by return of post on receipt of self addressed and stamped envelope.

Send your order to:—

## GRAYSHAW INSTRUMENTS

126 SANDGATE HIGH STREET, FOLKESTONE, KENT

Phone: Folkestone 78618

## ... LOUD AND CLEAR!

The message of the Audio Fair was clear to all—even higher fidelity—even better techniques. Goodmans have played a vital part in recent advances, and we can now demonstrate their new loud-speaker unit—the "315".

This outstanding unit has been made to the most exacting standards and gives extremely accurate sound reproduction. The superbly finished cabinet houses three loudspeakers covering the frequency range of 30 c/s to 16,000 c/s, while the power handling capacity is 15 watts.

Price complete £86 5 0



## NOW CONTROLLED "Q"

Another speaker which has only recently appeared on the market is the Controlled "Q" Reproducer. This is a rather novel slot-loaded enclosure. It gives a truly amazing performance for a unit that is so small and so modestly priced. Finished in medium oak, the prices are:

Controlled "Q" Reproducer (Standard) £12 12 0  
Controlled "Q" Reproducer (Senior) £16 16 0

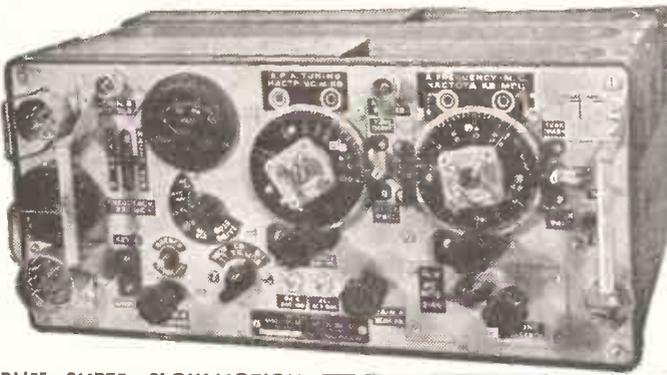
The copiously illustrated and highly authoritative HI-FI YEAR BOOK has just been published.

Price 10/6 and 1/- postage.

## QUALITY MART

8 DARTMOUTH PARK AVENUE, LONDON, N.W.5

GULLiver 1131



# WIRELESS SET

No. 19 MK II

The famous Army Tank Transmitter-Receiver. Just released by the Ministry of Supply. Incorporates "A" set (TX/RX covering 2.0-8.0 Mc/s., i.e. 37.5-150 metres); "B" Set (VHF TX/RX covering 230-240 Mc/s., i.e. 1.2-1.3 metres), and Intercomm. Amplifier. Complete with 15 valves as follows: 6 of 6K7G, 2 of 6K8G, 2 of 6V6G, and 1 ea. 6B8G, 6H6, E114B, EF50, 807, and booklet giving circuits, notes, etc.  
Size 17½ in. x 8½ in. x 12½ in. Magnificently made by famous American firms.

**IN BRAND NEW CONDITION. ONLY £4/19/6** (carriage, etc., 10/6), OR with 12-volt power unit **£5/10/-** (carriage 15/-).

**R1155 SUPER SLOW-MOTION TUNING ASSEMBLY.** As used on all late model 1155s. Easily fitted to "A" sets, etc. **ONLY 12/6.**

**RF UNITS TYPE 26.** For use with the R.1355 or any receiver with a 6.3 v. supply. This is the variable tuning unit which uses 2 valves EF54 and 1 of EC52. Covers 65-50 Mc/s. (5-6 metres). Complete with valves, and BRAND NEW IN MAKER'S CARTONS. **ONLY 25/-** each. Brand New Type RF 24, 5 positions covering 15-30 Mc/s., **ONLY 7/6** (postage 2/6).

**MARCONI BAND III CRYSTAL CALIBRATORS.** Frequency range 170-240 Mc/s. Incorporates 5 Mc/s. crystal for better than .001 per cent. accuracy. Directly calibrated dial, internal A.C. mains pack. Complete with spare set of valves and instruction manual in maker's transit cases. **BRAND NEW. ONLY £4/19/6.**

**CLASS D WAVEMETER**  
Another purchase of this famous crystal-controlled wavemeter which has been repeatedly reviewed and recommended in the "R.S.G.B." Bulletin as being suitable for amateur transmitters. Covers 1.9-8.0 Mc/s., and is complete with 100/1,000 kc/s. crystal, 2 valves ECH35, two 6-volt vibrators and instruction manual. Designed for 6 v. D.C. operation, but simple mod. data for A.C. supplied. **BRAND NEW IN MAKER'S TRANSIT CASES. ONLY £5/19/6.** Transformer for A.C. modification, 7/6.

**A.C./D.C. BLOWERS.** 220/250 volts, 300 watts. 1½ in. diam. outlet. Complete with filter pads. **BRAND NEW. ONLY £4/19/6.**

**INSULATION TESTERS (MEG- GERS).** Read up to 20 meg. at 500 volts pressure. Overhauled, and in perfect order. With leather carrying case. **ONLY £9/19/6, OR less case £8/10/-.**

**POWER UNIT TYPE 3.** Primary 200/250 v. 50 cycles. Outputs of 250 v. 100 mA. and 6.3 v. 4 amps. Fitted with H.T. current meter, and voltmeter. For normal rack mounting and has grey front panel size 19 in. x 7 in. **ONLY 70/-** (carriage, etc., 7/6).

**EHT TRANSFORMERS.** 5.5 kV. (Rect.) with 2 v. 1 a., 79/6. 7 kV. (Rect.) with 2 v. 1 a., 89/6. 2.5 kV. (Rect.) with 2-0-2 v. 1.1 a., 2-0-2 v. 2 a. (for VCR 97 tube, etc.), 42/6 (postage 2/- per trans.).

**6 v. VIBRATOR PACKS.** Output approx. 130 v. at 30 mA., fully filtered and smoothed. Complete. **ONLY 12/6.**

## TRAWLER BAND R1155s.

The latest version of this famous Communications Receiver to be released by the Air Ministry. Covers 5 wave ranges: 18.5-7.5 Mc/s., 7.5-3.0 Mc/s., 3.0-1.5 Mc/s., 1.5 Mc/s.-600 kc/s., 500-200 kc/s. As used by Coastal Command, Air-Sea Rescue Launches, etc. All sets thoroughly tested and in perfect working order before despatch, and on demonstration to callers. Have had slight use, but are in excellent condition. **ONLY £12/19/6.**

**A.C. MAINS POWER PACK OUTPUT STAGE,** in black metal case, enabling the receiver to be operated immediately, by just plugging in without any modification. Can be supplied as follows: WITH built-in 6½ in. P.M. speaker, £5/5/-, LESS speaker, £4/10/-, With 8 in. P.M. speaker, £6/10/-, DEDUCT 10/- IF PURCHASING RECEIVER AND POWER PACK TOGETHER.

Send S.A.E. for illustrated leaflet, or 1/3 for 14-page booklet which gives technical information, circuits, etc., and is supplied free with each receiver. Add carriage: 10/6 for Receiver, 5/- for Power Unit.

## FREQUENCY METERS TYPE L.M.



The United States Navy version of the BC221. Frequency range 125-20,000 kc/s with better than 0.01% accuracy. Contains a Crystal Controlled Oscillator, a Heterodyne Oscillator, and an Audio Frequency Amplifier. Can be used as Signal Generator, having CWV-MCV control. **BRAND NEW and UNUSED.** Quotation on request.

## METERS

F.S.D.	SIZE AND TYPE	PRICE
50 microamps D.C.	2½ in. Flush circular .....	59/6
100 microamps D.C.	2 in. Proj. circular .....	35/-
100 microamps D.C.	2½ in. Flush circular .....	39/6
250 microamps D.C.	2 in. Proj. circular .....	30/-
500 microamps D.C.	2 in. Flush square .....	27/6
500-0-500 micro D.C.	2½ in. Flush circular .....	27/6
1 mA D.C.	2 in. Flush square .....	22/6
2 mA D.C.	5½ in. Flush circular .....	45/-
10 mA D.C.	2½ in. Flush circular (blank scale)	10/6
150 mA D.C.	2 in. Flush square .....	7/6
200 mA D.C.	2½ in. Flush circular .....	12/6
8 amps A.C.	3 in. Flush square moving iron	25/-
10 amps D.C.	3½ in. Proj. circular .....	20/-
20 amps D.C.	2 in. Proj. circular .....	7/6
40 amps D.C.	2 in. Proj. circular .....	7/6
15-0-15 amps D.C.	3½ in. Flush square .....	25/-
30-0-30 amps D.C.	Car type moving iron ...	5/-
15 volts A.C.	2½ in. Flush circular moving iron	8/6
300 volts A.C.	2½ in. Proj. circular .....	25/-
2 Kilovolts A.C.	2½ in. Proj. circ. electrostatic ...	22/6
300 volts D.C.	2 in. Flush square .....	10/6

**MARCONI SIGNAL GENERATOR TF144G.** Frequency coverage 85 kc/s. to 25 Mc/s., and known as a Laboratory Standard. For normal A.C. mains, and complete with all leads. Reconditioned AS NEW. **ONLY 75/-.**

**AMERICAN COMMAND RECEIVERS.** A few still available. Top band model (1.5-3.0 Mc/s.). Used, good condition, 65/-, OR BRAND NEW IN CARTONS, 75/-. BC453 Model, the famous "Q Fiver" (190-550 kc/s.). Used, good condition, 59/6.

**MARCONI SIGNAL GENERATORS TF-390G**  
Frequency coverage 16-150 Mc/s. BRAND NEW IN MAKER'S ORIGINAL TRANSIT CASES, with instruction manual. For normal A.C. mains operation. A unique opportunity to acquire Laboratory Equipment at a fraction of original cost. **ONLY £27/10/-.**

**AVO ALL WAVE OSCILLATORS.** A few only of these famous Signal Generators in first-class order. Covers 95 kc/s.-80 Mc/s., and has large directly calibrated dial. For normal AC mains use. **ONLY £8/10/-.**

**L.T. HEAVY DUTY TRANSFORMERS.** Ex-Admiralty, with 230 v. 50 cycles primary. 1. Secondaries 5, 10, 15, 20, 25, 30 volts at 5 amps. **ONLY 29/6.** 2. Secondaries 7, 14, 21, 28 volts at 12 amps. **ONLY 42/6.** (Postage on either 2/9.)

**12-WAY SCREENED CABLE.** In 10ft. lengths, fitted with plugs, originally made for use with the 19 Set. **UNUSED. ONLY 17/6** per lead.

**POCKET VOLTMETERS.** Not ex-Govt. Read 0-15 v. and 0-300 v. A.C. or D.C. **BRAND NEW and UNUSED ONLY 18/6.**

**WALKIE TALKIE TYPE 18.** Covers 6.0-9.0 Mc/s. Transmitting and receiving units in metal case, complete with valves. In excellent condition. **ONLY 79/6.**

**CRYSTALS.** British Standard 2-pin 500 kc/s. 15/-, Miniature 200 kc/s. and 465 kc/s. 10/- each.

**AMERICAN 14 v. DYNAMOTORS.** Output 225 v. 60 mA. Ideal for car radio or running electric shaver from car battery. **ONLY 45/-.**

**CHOKES.** 10H 60 mA., 4/-; 5H 200 mA., 7/6.

Cash with order please, and print name and address clearly

PLEASE ADD POSTAGE OR CARRIAGE COSTS ON ALL ITEMS

# U.E.I. CORPORATION

Radio Corner, 138 Gray's Inn Road, London, W.C.1. Phone: TERMINUS 7937

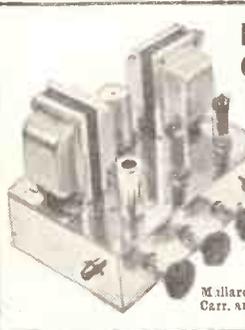
Open until 1 p.m. Saturdays. We are 2 mins. from High Holborn (Chancery Lane Station) and 5 mins. by bus from King's Cross

**RADIO-GRAM CHASSIS 5 VALVE SUPERHET, LATEST B.V.A. MIDGET SERIES VALVES**

3-WAVEBANDS:— L.W. 800m-2000m, M.W. 200m-550m, S.W. 16m-50m. Chassis size 13 1/2 x 5 1/2 x 2 1/2 in. Attractive Glass Dial 10 x 4 1/2 in. edge lit by 2 pilot lamps. Horizontal or Vertical Station Names and 4 control knobs, walnut or ivory to choice, 4 position W/C switch, L.M.S. and Gram. P.T. sockets. Modern circuitry, all coils adjustable, dust cored and only quality components used throughout. Delayed A.V.C. and neg. feedback. A.C. mains 200-250 v. Double wound trans. isolates chassis from mains. Aligned and calibrated ready for use.

**BRAND NEW & GUARANTEED £9.19.6 Carr. and ins. 4/6**  
8" and 10" speakers suitable for this chassis available.

7-Valve De Luxe, push-pull version 7 watt output £12.10.0. Carr. & ins. 5/-



**MULLARD "3-3" QUALITY AMPLIFIER**

An ideal companion unit to the JASON Tuner. A really first-class 3-valve 3-watt Amplifier giving Hi-Fi quality at a reasonable cost. Mullard's latest circuit. Valve line up: EF88, EL84, EZ81. Extra HT and LT available for Tuner Unit addition.

Variable treble cut and bass boost controls, sensitivity 100 MV for 3-watt output. Frequency response + or - 1 db, 40 cps to 25 kc/s.

Complete amplifier wired and tested with quality sectionalised output transformer to Mullard specification (less speaker) **£8.8.0** Carr. and ins. 4/6.

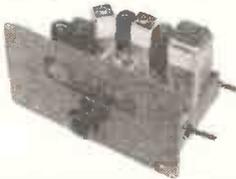
**ELECTROLYTICS Leading Makes New Stock**

TUBULAR	CAN TYPES	80 ohm CO-AXIAL
25/25 v. 50/12 v. 1/8	8+8450 v. ... 4/6	<b>SPECIAL</b> —Semi-air spaced polythene standard jin. diam. Stranded core. Feeder losses cut 50%, 9d. yard.
50/50 v. 4/500 v. 2/-	8+16/450 v. ... 5/6	Standard jin. Grade A, 8d. yard.
100/250 v. ... 2/19	16+16/450 v. ... 5/6	<b>COAX PLUGS 1/2 SOCKETS 1/-</b>
8/450 v. ... 2/19	16+16+8/350 v. ... 5/6	<b>COUPLERS 1/3. OUTLET BOXES 4/6</b>
8+8/500 v. ... 4/6	32+32/350 v. ... 4/6	<b>BALANCED TWIN FEEDER</b> per yd., 6d.
8+16/450 v. ... 3/16	50+50/350 v. ... 6/6	<b>SPECIAL 300 ohm. TWIN FEEDER 8d.</b>
16+16/450 v. ... 5/6	60/350 v. ... 6/6	<b>TWIN SCREENED FEEDER</b> per yd., 1/3.
32/350 v. ... 4/-	60+250/275 v. 12/6	<b>50 OHM COAX CABLE 8d. per yd., jin.</b>
32/500 v. ... 5/-	64+120/275 v. 11/8	<b>ATTENUATORS 6db, 12db, etc., from 4/6.</b>
32+32/350 v. 5/6	100+200/275 v. 12/6	<b>Band 1-3 Cross-over filter unit from 7/6.</b>
32+32/450 v. 6/6	100/270 v. ... 6/6	

**CONDENSERS**—Mica, Silver Mica. All pref. values, 3 pf. to 1,000. 6d. each. Dito ceramics 9d. each. Tubulars, 450 v. Hints and T.C.C. .001 mid-.01 and 1/350 v., 9d. each. .02-1/500 v., 1/- each. .25 Hints, 1/6. .5 Hints, 1/9.

**JASON F.M. TUNER UNIT 87-105 m/cs**

Kit of parts to build this modern and highly successful unit complete with drilled chassis and J.B. dial, wound coils and screening cans, 4 PVA miniature valves and all necessary quality components, etc., for only £6/10/- post free. Superior dial calibrated m.c/s, edge lit by 2 pilot lamps, 12/6 extra, as illustrated. Power Pack components kit including double wound mains transformer, £2/5/- extra. Tested and approved by "Radio Constructor," etc. Illustrated handbook with full details, 2/-, post free.



**RESISTORS**

Carbon type. Pref. values 10 ohms-10 megohms, 20% Tol. 1/4 w. 3d.; 1/2 w. 5d.; 1 w. 6d.; 2 w. 9d.; 10% Tol. 1/4 w. 9d.; 5% Tol. 1/4 w. 1/-; 1% Hi-stab. 1/4 w. 2/-.

**WIRE WOUND TYPES**

Wire ends. Silicone coated. 25 ohms-10,000 ohms, 5 w., 1/3. 10 w. 1/6, 15 w. 2/-.

**LIME CORD** .3a, 60 ohms per ft., .2a, 100 ohms per ft., 2 way 6d. per ft., 3 way 7d. per ft.

**LOUDSPEAKERS**

P.M. 3 OHM, 5in. Celes., 17/6; 6in. Celes., 18/6; 7 x 4in. Goodmans Elliptical 18/6; 8in. Dia., 20/-; 10in. B. and A. 25/-; 12in. Plessey, 35/-; 23in. Plessey, 16/6; Goodmans 12in. Audiom 50, 15 ohms, £4/15/-.

**T.R.S. RADIO COMPONENT SPECIALISTS**

70 BRIGSTOCK RD., THORNTON HEATH, SURREY



Phone: THO 2188. Hours 9 a.m.—6 p.m., 1 p.m. Wed. Open all day Saturday. By THORNTON HEATH STATION. Buses 130A, 133, 169, 166, 190.

Terms: C.W.O. or C.O.D. Kindly make cheques, P.O.s, etc., payable to T.R.S. Post and Packing up to 4lb. 7d., 1lb. 1/1, 3lb. 1/6, 5lb. 2/-, 10lb. 2/9. Bargain Lists, 3d.

**TECHNICAL TRADING CO.**

GORLA F.M. KITS, consisting Tuner/1st I.F., 2nd I.F. and Discriminator transformers with 465 k/c A.M., bargain, £3/15/-. B.S.E. L.F. SIGNAL GENERATORS. Type L059A. 0-600 c/s. and 0-16,000 c/s., tested good cond., £12/10/-. TFS177/L SIGNAL GENERATORS. Good cond., £12. CAMBRIDGE GALVANOMETERS. High sensitivity, 2,200 mm. per micro-amp. at 100 c/m. 45 sec. swing, heavy gunmetal cases, with spares, transit cases, unused, £5. CR100 RECEIVERS, good cond., untested, £12/10/-. COSSOR D.B. 'SCOPES, tested, maker's transit cases, £18. VCR97's, 12/6, carr. 2/6.

13 CHANNEL CONVERTERS (1 tuneable Band I, 2 tuneable Band III), famous make, with PC84, PCF80, beaut. bakelite cabinet, adjustable all I.F. freqs., £3/15/-.

GOODMANS P.M. SPEAKERS, 5in., 17/-, 6 1/2in., 18/-, 7 x 4, 17/6. 8in. (P.M. Quality), 22/6. 10 x 6, 26/6. 10in., 25/-. SPECIAL BARGAIN! 12 v. 4 amp. rectx., 9/6 each, £5 doz. Full wave iron selenium heavy compact type. GERMANIUM CRYSTAL DIODES, famous make, tested, general purpose, polarity marked, 10d., p. & p. 3d., 3/6 doz., post free. 1,000 OHMS, 10 WATT, wire-wound resistors, 1/-, TBS AMERICAN TRANS-CEIVERS, £12. RECORDING TAPE, known make, 1,200ft., 16/-, 1 MEGA FOS. D.P. switch, small, 3 1/2in. sp. 3/6. NEW THROAT MIKES, 2/6. AMPHENOL HOLDERS, Octal, Mazda, Novak, B7G, B9A, 6/- doz. B9G w/accresc, 1/6 each. Tube Holders, Octal, 6d. Duodecal, 1/-, Ditto, lin. spindle, 2/6. RESISTANCES, ASSORTED, 1/3w., 4.7Ω-10MΩ, 2/- doz., 10/- 100. MIDGET CERAMIC CONDENSERS, 10, 20, 50, 300, 1,000, 3,000. 6/- doz.

AMPRO 16 MM. TALKIE PROJECTORS. Senior type UA, 13 watt sound, 12in. spkr., 750 w. lamp, 110/250 A.C. Ex. cond. and finish, £59.

**GUARANTEED RADIO VALVES, BOXED, 24 HR. SERVICE.**  
*Less 5% and post free for a dozen or more.*

5U4G 6/8	6K7GT 5/8	12AT7 8/-	ECC84 11/6	HVR2A 6/-
6Y3GT 6/8	6K7M 6/-	12AU7 7/-	ECC85 9/-	KTW63 6/-
6AC7 5/6	6HG 2/-	12AX7 8/6	ECF80 12/-	KT81 8/6
6AS 9/6	6L6G 8/-	12EY7 7/6	ECF82 12/-	PE1 2/6
6AG5 4/9	6L6M 9/6	12Q7GT 7/6	ECH42 9/6	PC84 2/6
6AK5 4/-	68A7M 7/-	25L6GT 8/6	ECL80 8/6	PC85 11/6
6AM6 7/-	68G7M 5/6	35Z4GT 7/6	EP36 4/-	PC89 10/-
6B7 8/8	68J7M 7/6	80 7/6	EP37 7/-	PEN35 5/6
6BA6 6/6	68K7GT 5/-	80 7/6	EP39 8/-	PL52 8/6
6BE5 7/-	68L7GT 6/6	80T(BB) 3/9	EP39 5/-	PY52 8/6
6C4 4/9	68N7GT 5/9	80T(AM) 5/-	EP80 8/-	PY81 8/6
6C5GT 6/6	6V6G 6/-	CI 9/6	EP85 7/6	PY82 7/6
6C6 5/6	6V6GT 6/-	C10 9/6	EP89 9/6	SP4B 9/6
6D6 5/6	6V6M 6/6	EA50 1/6	EP91 6/-	SP41 2/6
6E8G 6/6	6X4 6/-	EB34 1/6	EP95 8/6	SP81 2/6
6F33 9/6	6X6GT 6/-	EBC33 7/-	EL32 5/-	SP210 3/6
6J5M 5/-	7B7 7/9	EC25 5/-	EL84 10/-	U22 7/6
6J56T 4/8	7C6 7/9	EC31 9/6	EL91 4/-	U50 6/6
6J56J 3/-	7D9 6/-	ECC31 8/3	EY51 10/-	U52 8/6
6J6 5/-	12A6 4/-	ECC82 7/3	EZ40 8/-	UCH42 9/6
6J76 5/-	12A7M 8/6	ECC83 8/9	EZ80 7/6	UY41 8/6
				866A 11/6

Postage 1/- in £1 (1/9 in £10 Speakers/Trans.) Min. 6d. No C.O.D. 100 TELEVISION SET BARGAINS TO CALLERS AT—  
**350/352, FRATTON ROAD, PORTSMOUTH**  
**PORTSMOUTH'S RADIO, TV AND TOOL SHOP**

**TELEVISION INSTRUMENTATION DEVELOPMENT ENGINEERS**

**DUTIES:** To undertake the design and development of test equipment for television and including work on special television camera applications. Considerable personal responsibility and freedom is given and there are no set rules regarding the number of people engaged on a project, the allocation of project leaders, etc.

**QUALIFICATIONS:** The ability to design and develop equipment, and aggressively progress a project through to the stage where a model is made and the information is available for a production drawing office. Candidates should preferably be of degree standard, or Corporate Members of one of the Professional Institutions, but consideration will be given to others who have considerable practical experience in the field. The ability to progress the project through to a satisfactory conclusion is the prime requirement. Due to expanding activities men with drive and initiative can be sure of progressive advancement.

Comprehensive pension and assurance schemes are in operation and Canteen and Social Club facilities are provided.

On well-served transport routes.

HOLIDAY ARRANGEMENTS MADE CAN BE MAINTAINED.

Write for interview to—

DEPT. C.P.S. 336/7 STRAND, W.C.2,  
quoting Reference WW2970L,

or call any day including Saturday mornings at—

**MARCONI INSTRUMENTS LTD.**

Longacre, Hatfield Road,  
ST. ALBANS, HERTS.

Hours of Business :  
9-6 Weekdays  
9-1 Saturday

# GEE ros RADIO Ltd.

ADJOINING  
LEICESTER SQ.  
TUBE STATION

15, LITTLE NEWPORT STREET, LONDON, W.C.2. Telephone : GERrard 6794/1453

**For QUALITY—CIVILITY—RELIABILITY and VALUE!**

**BAKER SELHURST** 12in. P.M. 15 ohms. 15 watts loudspeakers, 30-14,000 c.p.s. Brand new, £4/10/-.

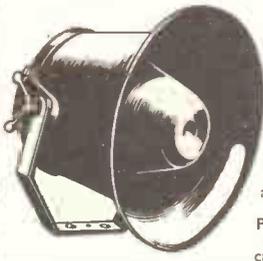
**HEAVY DUTY TWIN** 12in. P.M. 15 ohms **SPEAKERS.** Housed in H/D lin. thick Cabinet (slightly soiled). Size 36in. x 18in. x 12in. Felt padded inside. As used by Admiralty P.A. Ideal for portable amplifier, etc. Limited quantity only, £12/10/-, carr. 10/-.

**RCA BRAND NEW.** 15in. 15 ohms 30 watt P.M. speakers, £9/19/6, carr. 12/6.

**VITAVOX PRESSURE UNITS.** Heavy duty. P.M. 20 watt. Brand new, £4/9/6. Also ditto, second-hand, in good working order, 40/-, carr. 7/6.

**50-WATT EX-GOV'T. AMPLIFIER.** Type III with 4-KT66/s in paralleled push-pull, Standard 200-250 v. A.C. input. Output impeded, 600 ohms line. High imp. gram. and mike input. Bass boost control fitted. Quality amplifier housed in strong metal case, ready for use. Terrific performance, £28, carriage paid.

**RE-ENTRANT LOUD-HAILERS.**



Heavy duty 20 watt all-metal. 15 ohms. Diameter 18in., length 12in. (approx.). By Parmeko, £6/10/-, carr. 10/-.

**SELENIUM METAL RECTIFIERS.**

FULL BRIDGE

6 or 12 v. 1 amp. ....	7/6	24 v. 1 amp. ....	13/6
12 v. 2 amp. ....	10/-	24 v. 2 amp. ....	20/-
12 v. 2½ amp. ....	15/-	24 v. 2½ amp. ....	25/-
12 v. 4 amp. ....	16/6	24 v. 4 amp. ....	30/-
12 v. 6 amp. ....	23/6	24 v. 6 amp. ....	35/-
12 v. 10 amp. ....	40/-	24 v. 10 amp. ....	80/-

**SPEEDY DELIVERY OF L.T. RECTIFIERS TO ORDER.**

**COMMAND TRANSMITTERS.** 2.1 to 3 meg. Complete with valves and crystal. New and boxed, 35/-, P. & P. 3/-.

**APQ7 TRANSMITTER.** Containing 931a Photo Electric cell (complete with network), 2-6AC7s, 1-6AG7, 2-807s and 2 blower-cooled 8012s. With rev. counter. Brand new, 89/6, carr. 12/6.

**TEST METER.** Model 420 S.P. (by Radio City Products, U.S.A.). 3in. sq. meter in polished wood carrying case, covering a wide range of voltage at a sensitivity of 1,000 ohms per volt for both A.C. and D.C. tests. In addition to this, the instrument will measure resistances up to 1 meg. and D.C. current up to 1 amp. Complete with full instruction data and test prods. Tested before despatched, £5/19/6 only, carr. etc., 7/6.

**VALVE TESTER** (by Radio City Products, U.S.A.), model 314, Brand new, unused, with instruction manual. 110-220 v. A.C. 50 c/s. Will test most American valves from 1.1 v. to 200 v., £10, carr. 5/-.

**AVO TEST BRIDGE.** No. 1 M.K.I for 230 v. A.C. mains operation. Will test all condensers from .0001 to 50 mfd., also resistances from 5 ohms to 50 megohms. A very useful instrument, tested before despatched, £8/19/6, carriage, etc., 7/6.

**PARMEKO MOVING COIL HAND MICROPHONE.** 200 ohm imp. Fitted on/off switch, complete with 12 yds. flex, 30/-, P.P. 2/6.

**DON "8" TWIN TELEPHONE CABLE** on 1 mile drums, £5 per mile, ¼ size drums 25/-, carr. extra.

**AVO VALVE TESTER.** Complete with Rotary Panel in good order, £7/19/6, carriage and pack ing 7/6.

**AIRCRAFT RADIO RECEIVER (BY RCA Model No. CRV 46151).** Freq. 195 kc/s to 9,050 kc/s. (33-1,500 metres) continuous. For 28 v. D.C. input with built-in dynamotor. This 6 valve receiver with 2 R.F. stages and 2 I.F. stages with B.F.O. and C.W. £10, or complete with A.C. mains power unit for loudspeaker or phones. Ready to use £15/10/-, Carriage 10/-.

**RCA AR-88 L.F. RECEIVER (C.R.91).** In very good condition. Freq. range: 550 kc/s. to 31.9 Mc/s. continuous on 6 wavebands, £50, carr. paid U.K. only.

**R.109A RECEIVERS.** Freq. range 2-12.0 megs. In good working order. £4/7/6, carr. 10/-, A.C. mains 200/250 v. power packs available, £4, carr. 5/6.

**R.1155A RECEIVERS.** In good condition. Aerial tested, £8/10/-, carr. 10/-, Power packs for the above containing output stage, complete with speaker, built-in attractive polished 8in. extension speaker cabinet. Ready for use on A.C. mains 200-250 v., £5/10/-, carr. 5/6.

**TRANSMITTER-RECEIVER No. 19.** Mk. II complete with 15 valves. Frequency range A set 2-8 meg., B set 230-240 Mc/s. in good condition, £3/19/6, carr. 10/6. **12-VOLT ROTARY POWER UNIT** for above, 20/-, carr. 5/-.

**RECEIVER R1132A.** In good condition. Freq. range 100-124 Mc/s., £3/15/-, carr. 10/-.

**COLLINS RECEIVERS,** Type 46159A. Freq. range 1,500-12,000 kc/s. In good condition. 12 v. or 220 v. D.C. input (less crystal), £10, carr. 15/-.

**COMMAND RECEIVERS.** B.C. 454, 3-6 Mc/s. Brand New, 35/-, Ditto 455, 6-9 Mc/s., 35/-, P. & P. 3/- each.

**RECEIVER R1392/P 104.** 15 valve sup-het set 95-150 Mc/s., (2 to 3 meters) slow motion tuning, normally crystal controlled or tunable over 95-150 Mc/s. Receiver front panel made to fit 19in. Rack Mounting. External Power supply required, good order. Only £5/19/6, carr. 15/-.

**E.H.T. TRANSFORMER.** 20 kv. at 140 m/a. 230 v. 50 cycles primary. New and unused. Ex-Gov't. Built to the highest specification. £22, carr. 10/-.

**L.T. TRANSFORMERS.** Pri. 200-250 v. 50 cycles A.C., Sec. 17.5 v. at 35 amps., £4/15/-, carr. 10/-.

**VARIABLE VOLTAGE REGULATOR TRANSFORMERS.** Input 230 v. A.C. at 21 amps. Output 57.5 volts in 16 equal steps to 230 v. at 21 amps. Ex-Gov't., in perfect condition, £12/10/-, carr. 15/-.

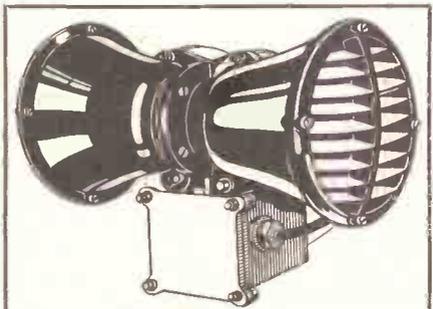
**CAR RADIO VIB. TRANSFORMERS.** 6 v. Input 280 v. at 80 mA. H.T. (Ex-Philco). New in perfect condition, 12/6. P.P. 2/-, Ditto 12 v., same price.

**ROTARY CONVERTERS.** 24 v. D.C. to 230 v. A.C. 50 cycles. 100 watts. Fully tested, £4/12/6, carr. 7/6.

**TRANSFORMERS.** 110-230 v. Primary. Sec. 26 v. tapped to 41 v. at 14 amps. New and boxed, £3/10/-, carr. 5/-.

**E.H.T. TRANSFORMER.** 8 kv. at 150 m/a 230 v. 50 cycles primary. New and unused. Good quality. £9/17/6, carr. 10/-.

**TRANSFORMER.** 2.8 kv. E.H.T. at 5 mA., with additional 4 v. heater supply for 230 v. input. A sound job built to the highest specifications. Tested before despatched, 47/6. Carriage, etc., 5/-.



**PARMEKO TWIN BAKELITE LOUD-HAILERS** (Ex-Admiralty), with line transformer, 15 ohms voice coil, horns mounted on metal base. Length 15in., height 9in., dia. of horn 8½in., 50/-, carr. 7/6.

**SPECIAL TERMS FOR QUANTITIES EXPORT ORDERS PROMPTLY EXECUTED**

**METERS**

0-300 v. A.C. 2½in. Flush mounting, 25/- each  
0-200 v. A.C. 3½in. Flush mounting, 25/- each  
0-300 v. A.C. 3½in. Flush mounting, 25/- each  
S. METERS. 2in. circular calibrated in decibels 5 mA. FSD. 25/- each

All brand new and boxed, P. & P. 1/- each.

**VOLTMETER.** 0-160 v. AC/DC. 6in. mirrored scale, in portable wooden case with carrying handle. Good order 55/-.

**SWINGING CHOKE** 8/40 henrys—3/03. m/a. 110 ohms D.C. resistance. 15/-, post 3/6.

**MAGNETIC MARCHING COMPASS MK.1.** Pocket size 2½in. x 2½in. Black bakelite case, mirrored lid. Perfect condition, 15/-, P.P. 9d.

**SOLO** 25-watt instrument soldering iron for 220/40 v. A.C./D.C., 22/-, P.P. 1/-.

**BENDIX DYNAMOTORS.** 28 v. D.C. Input, 230 v. D.C. output at 100 mA. New and boxed, 19/6, P.P. 2/6.

**UNISELECTOR SWITCH.** 5c/3761, 5 bank 25 way, full-wipe, 37.5 ohm Twin coil D.C. resistance (75 ohm total). Brand new in maker's cartons, 59/6, P.P. 2/6.

**ACCUMULATORS.** Bakelite cased. 2 v. 100 ampere. 75 actual. Ex-Gov't. New and unused. Complete with carrying handle. Ideal for coupling 6 or 12 v. storage batteries. Size 6½in. x 6½in. x 3½in., 15/- each. Carr. 3/6, 3 sent for 50/- or 6 for £5 carr. paid.



**10-AMP. BATTERY CHARGERS,** for 200-250 volt 50 cycles input, will charge 12 lead acid cells or 20 alkaline cells, metered, switched and fused. As new, £12/10/-, carr. and packing 20/-.

**RCA CRYSTAL MULTIPLIERS MI-19-468** with valves. New and boxed in maker's cartons, 39/6, carr. 5/-.

**AC-DC RECTIFIER POWER SUPPLY UNIT.** 230 v. A.C. 50 cycles input 100 v. D.C. output max. 10 amps. £12/10/-, carr. 20/-, Ditto at 2½ amp., £4/10/-, carr. 7/6.

**MICROPHONE STANDS** 3 sections of 18½in. per section. Extends to 56in. Stands securely on 3 legs which fold together for carrying. A robust job, only 21/-, P.P. 2/6.

**DRY BATTERIES.** H.T. 90 v. + 60 v. L.T. 4½ v. Suitable for No. 18 or 38 set. Heavy duty layer built in good condition (Ex-Gov't.) only 6/-, P.P. 3/-, A box of six sent for 30/-, carr. 9/-.

**MARCONI CRYSTAL CALIBRATOR.** Frequency coverage 170/240 Mc/s. Directly calibrated, accuracy .001%. Operation 200/250 volts A.C. Supplied complete with 5 Mc/s. crystal and spare set of 5 valves, in original transit case, brand new with instructions, £4/15/6 each, carr. 10/-.

**CARBON HAND MICROPHONES.** Type 3 with switch in handle, lead and plug, only 6/11, P.P. 1/3.

**C.M.G. 25 PHOTO CELLS (OSRAM).** Brand new. 15/-, P.P. 1/-.

**TANNOY LOUD HAILERS (EX GOV'T.)** New and boxed. Impedance 7½ ohms. Handling capacity 8 watts. Price 25/-, Post 3/6. 2 sent for 50/- carr. paid.

**T.C.C. 8 Mfd. 750 v. D.C. Wkg. condensers** paper block Type 92. Upright mounting. Brand new, 8/6, P.P. 1/9.

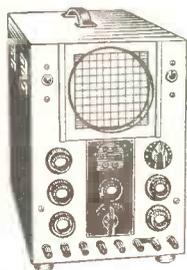
**SOUND POWERED HEADPHONES.** Very sensitive, 15/- per pair. Moving coil ditto, 12/6 per pair. D.L.R. low resistance, good quality, complete with lead, 8/6, P.P. 1/6.

**WAVEMETER TYPE W 1310 (Marconi Ex-Gov't.)** coverage 155-230 Mc/s. continuous. Complete with chart and test prods. As new for 200-250 v. A.C. main operation, £4/15/-, carr. 10/-.

# UNIVERSAL ELECTRONICS

Whether new or used, all equipment is guaranteed to be in perfect condition

## COSSOR Double Beam Oscilloscope



Type 339. **IMPROVED VERSION** of the **OBSOLETE** Type 3339.

**Time Base Frequency.** 6 to 250,000 c.p.s. **Amplifier.** 43 mV RMS/mm. 10 to 100,000 c.p.s., 3dB. 1.3 mV, RMS/mm. 10 to 100,000 c.p.s., 3 dB (2 stage).

10 mV RMS/mm. 10 to 2,000,000 c.p.s., 3dB (2 stage).

**Deflector Coils.** 2 mm/mA RMS.

**Power Supply.** 110-250V A.C. 120 watts.

**Sensitivity.** Y1, Y2, 3.1V D.C. 1.1V RMS (volt/mm.) X2.25V D.C. 0.8V RMS (volt/mm).

**Screen Diameter.** 114 mm. **PRICE £30**

In good working condition.

**Also supplied Rebuilt to Laboratory standard and guaranteed for 3 months. Prices on request.**

## HALLICRAFTERS

**S27** Range 27.8-143 Mc/s. AM and FM detectors. For 110/230 volts A.C. mains. In working order, **£35.**

**S27CA** 135-235 Mc/s **£50**

Also supplied rebuilt to laboratory standard and guaranteed for 3 months. Prices on request.



## TEST EQUIPMENT

### AVO

Model 7 meter ..... **£14 0 0**

Model 40 meter .... **£12 0 0**

### G.E.C.

Type BW232, Signal Generator

500-1,000 Mc/s .... **£65 0 0**

### MARCONI

Type TF144G range 85 kc/s-25

Mc/s ..... **£85 0 0**

TF390G range 16-150 Mc/s.

**£25 0 0**

TF517 range 150-300 Mc/s.

**£35 0 0**

'Q' Meter type 329F **£85 0 0**

Output meter, type TF340.

**£35 0 0**

### GENERAL RADIO

Type 804 Signal Generator,

30-300 Mc/s. .... **£65 0 0**

**SULLIVAN** Mutual Capacitance Bridge

**£175 0 0**

**AVO** Valve Testers Roller Panel Types .. ..

**£8 15 0**

Resistance Capacity Bridges .. ..

**£7 10 0**

**British and U.S.A. V.H.F./U.H.F. 10cm., 3cm., 1.5cm. Test Equipment** available from stock, see our advert. "Wireless World" Feb.

### EVERSHED

500V Wee Megger .. **£12 10 0**

250V Wee Megger .. **£10 0 0**

Bridge Meggers available 250V-500V.

### R.C.A.

Signal Generator type 701A, 370-

550 Mc/s, price ..... **£35 0 0**

### U.S.A. BRAND NEW

### HICKOCK

Valve Voltmeters; unused, ranges

2.5-250 A.C.V. 2.5 1,000 D.C.V.

2.5-1,000 mA. D.C. Resistance

0-1,000 megohms. Frequency up to

100 Mc/s. Voltage 110 A.C.

Price, each ..... **£30 0 0**

## FREQUENCY METERS

**BC221** Range 125 kc/s — 20 Mc/s  
In perfect condition

Also in stock: **U.S.A. BENDIX LM SERIES**  
Aircraft version of BC221.

**TS174** 40—250 M/cs.

**TS175/U** 85—1000 M/cs.

Prices upon written request.

## MANUALS

for Communication Receivers **£1.7.6 each.** AR88D-LF, AR77E, HQ120, HQ129X, R107, S20R, SX24, SX28, B2, TX/RX. HRO's, etc.

## REALIGNMENT SERVICE

Realignment, Servicing and Reconditioning of all types of British and U.S.A. Communication Receivers and Laboratory Test Equipment. Every receiver stripped recrackled and realigned at a moderate figure by our skilled staff. Work guaranteed and figures supplied.

## RECEIVERS in stock

**COLLINS . G.E.C. . HALLICRAFTER . HAMMARLUND NATIONAL . MARCONI CR100 & CR150 . R.C.A., etc.**

Please note: the above prices do not include packing and carriage.

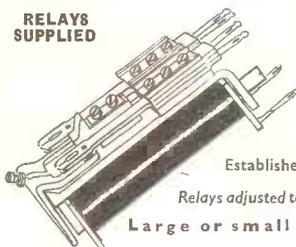
22/27 LISLE STREET, LEICESTER SQUARE, LONDON, W.C.2

Write, Call or Telephone GERrard 8410

Shop hours, 9.30 a.m. to 6 p.m. Thursday 9.30 a.m. to 1 a.m. OPEN ALL DAY SATURDAY

## TELERELAYS LTD.

RELAYS SUPPLIED



**SPECIALISTS in**  
**ADJUSTMENT AND CALIBRATION**  
**OF ALL TYPES OF RELAYS**

Established with Members of the A.E.I.

Relays adjusted to full A.I.D. and I.E.M.E. Standards

Large or small contracts undertaken

ENQUIRIES INVITED

**3 DENNIS PARADE, WINCHMORE HILL ROAD, SOUTHGATE, LONDON, N.14** Phone: PALmers Green 1686

## NEW ZEALAND

Radio Mechanics

Applications for posts with the New Zealand Post and Telegraph Department are invited from fully experienced single men between 21 and 30.

Excellent pay and conditions. Free passages are granted to successful applicants. For full information apply to New Zealand Migration Office, Adelphi Building, John Adam Street, W.C.2, quoting this advertisement.



# SOLARTRON

## Electronic Engineers

The rapidly expanding Solartron Group of Companies is seeking outstanding engineers to join teams engaged on two advanced projects at its new Research Laboratories in Dorking, Surrey.

### RADAR SIMULATOR

*To work on the design of electronic and electro-mechanical computers, pulse circuits, and time bases.*

#### a. Team Leader

With experience in leadership and proven ability in original circuit design work of an advanced nature in any of the following fields—lower power pulse techniques, A.C. servo mechanisms or video amplifiers.

This appointment offers an opportunity for an outstanding man to take complete responsibility for a very stimulating project.

#### b. Senior Engineer

With circuitry design experience in the above fields.

#### c. Junior Engineer

A sound theoretical background essential with limited experience.

### ELECTRONIC READING MACHINE

*To work on the development of pulse and time-base circuitry to production stage, including investigation of transistor and ferrite devices.*

#### a. Senior Engineer

A minimum of three years' experience of circuitry in one or more of the following fields—digital computers, T.V. systems, radar or pulse circuitry—together with a working knowledge of production design requirements and a good eye for detail.

#### b. Junior Engineer

A minimum of one year's laboratory experience together with a sound theoretical background.

These are unusual career opportunities to join research teams leading in their field. We are a young and vigorous organisation offering a fresh and stimulating atmosphere and we encourage maximum individual responsibility.

*Salaries will be relatively high to match the standard required.*

Apply in writing, giving full information, to the PERSONNEL DIRECTOR.

**THE SOLARTRON ELECTRONIC GROUP LTD.,**

Queen's Road, Thames Ditton, Surrey.

# RANK PRECISION INDUSTRIES LIMITED

*have the following vacancies  
in their Research Laboratories  
at Shepherds Bush:*

## ELECTRONIC ENGINEERS

for the design and development of:—

1. Electronics associated with Xerography, the new fast dry electrostatic copying process.
2. Machine Tool Control including precision gauging and serve mechanisms.

## LABORATORY ASSISTANTS

to assist the above engineers in these fields.

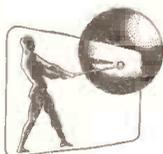
## ELECTRONIC DESIGN DRAUGHTSMEN

covering a wide variety of projects including the above.

*Opportunities are available to all for rapid advancement, depending only on real ability, intelligence and energy.*

*A Pension Scheme is in operation above the age of 25.*

*Please apply giving full details of experience and qualifications to:—*



**The Laboratory Manager,  
Research Laboratories,  
Rank Precision Industries  
Limited,  
52a, Goldhawk Road,  
London, W.12.**

## MARCONI INSTRUMENTS LTD., TEST ROOM PERSONNEL REQUIRED

**DUTIE** : Testing and calibrating of wide range of telecommunication and industrial electronic instruments.

**QUALIFICATIONS**: We shall be pleased to receive applications from any man with, or, without academic qualifications who is able to demonstrate suitable experience and training.

Comprehensive pension and assurance scheme is in operation and Social and Sports Club facilities are provided.

On well served transport routes.

*Write for interview to:—*

DEPT. C.P.S., 336/7 STRAND, W.C.2,  
quoting Reference WW2970M,

or call any day including Saturday mornings at:—

**MARCONI INSTRUMENTS LTD.,  
LONGACRES, HATFIELD ROAD,  
ST. ALBANS, HERTS.**

## BELLING & LEE RESEARCH LABORATORIES

want keen, enthusiastic engineers to fill the following vacancies in a progressive and expanding Research department:

**ELECTRICAL ENGINEER** to work on Aerial development in the range 30 Mc/s to 200 Mc/s. This is a senior appointment and applications are invited from graduate engineers although consideration will be given to all applicants with suitable experience.

**ELECTRICAL ENGINEER** to investigate problems associated with interference suppression. Knowledge of filter networks is necessary.

**PROJECT ENGINEERS** required for:

- (a) development and design work in connection with high grade electronic components.
- (b) design of V.H.F. aerials and accessories from experimental stage to prototype. For these posts a knowledge of materials and finishes is essential.

Attractive commencing salaries are offered which will be based on experience, qualifications and age in each individual case. A Pension Scheme is in operation and all applications, giving full details of career so far, should be sent to the Secretary,  
**BELLING & LEE LTD., 540 GREAT CAMBRIDGE ROAD, ENFIELD, MIDDLESEX.**



## A. V. ROE & CO., LIMITED

Weapons Research Division (Guided Missiles)  
WOODFORD CHESHIRE

Applications are invited for the following positions in the TRIALS DEPARTMENT:

1. **SENIOR ENGINEERS**—To lead Trials Teams at Woodford and in West Wales and Australia.
2. **SENIOR ENGINEERS**—To design and develop telemetry and monitoring systems at Woodford.
3. **SENIOR FLIGHT OBSERVERS**—For work based on Woodford and Australia.
4. **TECHNICIANS**—For trials teams and development teams controlled by the Senior Engineers in Posts 1 and 2 above.
5. **LABORATORY ASSISTANTS**—For general assembly and wiring of prototype equipment.

### QUALIFICATIONS

POSTS 1, 2 and 3 H.N.C. or equivalent preferably in electronic engineering.

POST 4 O.N.C. in electrical engineering would be an advantage.

The Weapons Research Division is situated in rural Cheshire, with the Derbyshire Hills and Manchester within easy reach. The Company provides excellent canteen facilities and a Superannuation Scheme.

Applications as follows:

**Post 1. The Chief Engineer,**  
Weapons Research Division,  
A. V. Roe & Co., Ltd.,  
Woodford, Cheshire.

**Posts 2-5. The Personnel Manager,**  
A. V. Roe & Co., Ltd.,  
Greengate,  
Middleton, Manchester.

quoting Reference WRD/HWL/R231/W

**SALFORD ELECTRICAL INSTRUMENTS LTD.**  
(A SUBSIDIARY OF THE GENERAL ELECTRIC CO. LTD. OF ENGLAND)  
INVITE APPLICATIONS FOR POST OF:-

### **CHIEF DEVELOPMENT ENGINEER QUARTZ CRYSTAL DEPT.**

In Factory situated 8 miles North East of Manchester.

Candidates should hold a good degree in Physics or Electrical Engineering, and have had subsequent experience in telecommunications or in the design of electronic measuring equipment. Experience of Quartz Crystal manufacture, or in a similar field, would be a material advantage.

This post is permanent, pensionable, and offers scope for drive and initiative. A worth-while salary commensurate with qualifications and experience will be paid to the successful candidate.

### **DEVELOPMENT ENGINEERS**

Applications are invited for the position of Development Engineer in Quartz Crystal Development Laboratory.

The Company has vacancies for both Senior and Junior Engineers and can offer good prospects for promotion.

The posts are permanent and pensionable.

Write in confidence, stating age, salary required, and details of career, etc., to Personnel Manager

**SALFORD ELECTRICAL INSTRUMENTS LIMITED**

(Components Group) School Street, Hazel Grove, Cheshire.

## THE M.O. VALVE COMPANY LIMITED

Manufacturers of Valves  
for G.E.C.

Require **ELECTRONIC CIRCUIT ENGINEERS** for their transmitting valve applications laboratory. The work concerns the development of amplifier and oscillator circuits followed by practical measurements in order to test prototype valves and to obtain performance data for publication.

Opportunities exist for work on both high and low power transmitting valves at all frequencies up to 1,000 Mc/s.

Graduate qualifications and experience in the use of valves in radio transmitters or R.F. heating equipment would be an appropriate background.

Apply quoting TE/1 to Personnel Department, Brook Green, Hammersmith, W.6.

## MECHANICAL DESIGNERS

The following staff are required for interesting, new development work on:—

Cathode Ray Tubes  
Electronic Valves  
Microwave devices

- (1) **M E C H A N I C A L D R A U G H T S M E N** for C.R.T. Microwave and valve design. Qualification O.N.C. (Mech. or Elect.) in Inter. B.Sc.
- (2) **M E C H A N I C A L D E S I G N E R S** to work on special purpose machines, jigs and tools. Qualification H.N.C. (Mech. or Elect.) or equivalent.

Progressive, pensionable positions with opportunities for advancement in an expanding field. Previous experience of electronic vacuum devices is preferred but not essential. 5 day week with Canteen and Social Club facilities.

Write, giving full details and quoting DO/3, to **Personnel Officer, M.O. Valve Co. Brook Green, Hammersmith, London, W.6.** Manufacturers of Cathode Ray Tubes and Valves for G.E.C.

## ENGINEERS

Mechanical and Electrical  
and

## PHYSICISTS

Required for work on development, circuit application and manufacturing of special radio valves including micro-wave devices.

A degree or H.N.C. is required and some experience would be an advantage but is not essential. Initial training at The Research Laboratories of The G.E.C. will be available for selected candidates. These positions offer good opportunities for progress to senior posts.

Apply quoting T/3 to:

**M.O. Valve Co.,  
Hammersmith, W.6.**

**MANUFACTURERS OF  
VALVES FOR G.E.C.**

## Television Development and Test Equipment Engineers

A well known West London manufacturer requires Engineers for the development of black and white and colour television receivers and associated test equipment.

Vacancies exist for both Senior and Junior Engineers in the Television Development Department and for Junior Engineers in the Test Equipment Department.

Senior Engineers should have academic qualifications and several years' development experience. Junior Engineers require either academic qualifications or experience in development or equipment calibration and maintenance.

Progressive salary policy ensures rapid advancement for Engineers who show exceptional initiative and responsibility. All posts are permanent and carry the benefit of the Firm's Pension Scheme.

Please write fully, in confidence, stating age, qualifications and experience to Box No. 7441.

## ELECTRONIC DEVELOPMENT ENGINEERS

A leading electrical engineering firm has vacancies for qualified Development Engineers for work in the following spheres:

- (i) Development of printed circuit and transistor techniques as applied to radio and television receivers. A degree or its equivalent together with development experience are essential for this post.
- (ii) Development of electronic equipment for the services. Development experience is preferred but engineers otherwise suitably qualified will be considered.
- (iii) Design and development of coils and small transformers. This is a junior position and would suit an engineer whose experience in design is limited.

Those interested in any of the above posts are invited to write, in confidence, giving brief details of qualifications and experience to Box No. 7275, c/o W.W.

## R. B. PULLIN & CO. LTD.

have vacancies to offer in their steadily expanding organisation for **ELECTRONIC DEVELOPMENT ENGINEERS** to be concerned with the design of a variety of equipment including specialised instruments and **TELE-COMMUNICATIONS SYSTEMS.**

The appointments offer various degrees of seniority, and, therefore, qualifications ranging from O.N.C. to Degree standard are acceptable; applicants should have had appreciable previous experience of valve circuit design. For some of the appointments experience of transistor circuit techniques is also an advantage.

All appointments are permanent and carry attractive salaries. To engineers of ability and initiative they offer excellent prospects and the opportunity to work in a very well-equipped Laboratory on a variety of interesting long-term projects which involve considerable technical responsibility.

A comprehensive pension scheme is in operation; Canteen and Social Club facilities are available.

Existing Holiday arrangements will be respected.

Applications will be treated in strict confidence and should be made to:

**THE SUPERINTENDENT,  
ELECTRONIC DEVELOPMENT  
DIVISION,  
R. B. PULLIN & CO. LTD.,  
GREAT WEST ROAD,  
BRENTFORD, MIDDLESEX.**

**Advanced Theory of Waveguides**

By L. Lewin

Sets out the various methods that have been found successful in treating the types of problems arising in waveguide work. The author has selected the number of topics as representative of the field in which the micro-wave engineer is at present engaged.

30s. net. by post 30s. 10d.

**The Oscilloscope at Work**

By A. Haas and R. W. Hallows, M.A.(CANTAB.) M.I.E.E.

Explains the characteristics of the cathode-ray oscilloscope and its many uses in servicing radio receivers, amplifiers and television equipment. Special attention is given to the correct interpretation of oscillograms, and the work is profusely illustrated by practical examples of oscillograms and circuits.

15s. net. by post 15s. 10d.

for students  
and  
technicians

**Short Wave Radio and the Ionosphere 2nd Edition**

By T. W. Bennington

Long-distance communication by means of short waves is dependent on the state of the ionosphere, which changes during the day and at different seasons of the year. This book explains simply the ionosphere when signalling between different points of the earth's surface.

10s. 6d. net. by post 11s. 2d.

**Studio Engineering for Sound Broadcasting**

General Editor: J. W. Godfrey

This text-book explains the principles underlying current operational procedures at B.B.C. studio centres. Covers the whole range of equipment used in B.B.C. studios and deals with studio acoustics, placing of microphones, recorded programmes and outside broadcasting facilities.

25s. net. by post 25s. 10d.

from leading  
booksellers

Published for "Wireless World"

ILIFFE & SONS LIMITED, DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1.

**VACANCIES FOR SKILLED CRAFTSMEN IN GOVERNMENT SERVICE AT CHELTENHAM**

Experienced in one or more of the following:—

1. Maintenance of radio communication receivers.
2. Sub-assembly lay-out, wiring and testing of radio type chassis.
3. Cabling, wiring and adjustment of telephone type equipment.
4. Fault finding in, and maintenance of, electronic apparatus.
5. Maintenance of Teleprinters or Cypher Machines and associated telegraph equipment.

**BASIC PAY:** £8/11/4 plus up to £2/10/- merit pay, assessed at interview and based on ability and experience.

Opportunities for permanent and pensionable posts.

Five-day week, good working conditions, single accommodation available.

Apply to: **Personnel Officer, G.C.H.Q. (FOREIGN OFFICE), 53 Clarence Street, Cheltenham.**

**MARCONI INSTRUMENTS LTD.**

This Company has immediate vacancies at St. Albans in its **Technical Literature (Telecommunications) Section;**

Applicants should have electrical engineering qualifications and/or experience in the design, or, development of electronic equipment.

The duties are varied and interesting and the posts provide permanent and pensionable positions in a well-established Company.

Apply to Dept. C.P.S. 336/7 Strand, London, W.C.2, quoting reference WW 2970P.

**MARCONI INSTRUMENTS LTD. TECHNICAL PERSONNEL REQUIRED**

**SENIOR AND JUNIOR ELECTRICAL DESIGN ENGINEERS**

**SENIOR AND JUNIOR MECHANICAL DESIGN ENGINEERS.**

**DUTIES:** To undertake the design of Test Equipment covering practically the whole electronic field, including, Telecommunication, Guided Weapons and Nuclearics. Considerable personal responsibility and freedom is given and there are no set rules regarding the number of people engaged on a project, the allocation of project leaders etc.

**QUALIFICATIONS:** The ability to design equipment, and aggressively progress a project through to the stage where a model is made and the information is available for a production drawing office. Senior engineers are usually of B.Sc. standard with practical experience in measuring techniques, while Junior engineers are often Graduate Members of one of the Professional Institutions or, have similar qualifications, but this is in no way mandatory. The ability to progress the project through to a satisfactory conclusion is the prime requirement. Due to expanding activities men with drive and initiative can be sure of progressive advancement.

Comprehensive pension and assurance schemes are in operation and Canteen and Social Club facilities are provided. On well served transport routes.

**HOLIDAY ARRANGEMENTS MADE CAN BE MAINTAINED.**

Write for interview to:—

**DEPT. C.P.S. 336/7 STRAND, W.C.2,**

quoting Reference WW2970N,

or call any day including Saturday mornings at:—

**MARCONI INSTRUMENTS LTD., LONGACRES, HATFIELD ROAD, ST. ALBANS, HERTS.**

**MULTITONE ELECTRIC CO. LTD.**

invite applications from  
Intermediate and Junior

**ELECTRONIC ENGINEERS**

for work on the development and testing of an interesting range of new electronic projects. There are vacancies for engineers with a wide range of qualifications and experience up to and including H.N.C. standard. Experience of development work or fault-finding advantageous. Preferred age range 20/30 years but applications will also be considered from young men who have recently left school with Higher School Certificate in Science. Apply stating age and giving particulars of education, training and experience to 12/20, Underwood Street, London, N.1.

**DRAUGHTSMEN**

Seniors and Juniors required by The B.T.H. Co. Ltd., in Rugby, for development and production of Electrical Control Gear and its associated equipment.

Interviews arranged to suit applicant, including Saturday mornings.

Men with Electrical and/or Mechanical Draughting experience are invited to apply to:—

**Engineer-in-Charge, Control Gear Drawing Office, The British Thomson-Houston Co. Ltd., Rugby.**

**ELECTRONIC ENGINEERS**

Are you looking for an interesting job?

We are looking for circuit engineers to design and develop test equipment for all types of cathode ray tube and allied devices. Experience in pulse, radar or television techniques would be an advantage, but it is not essential in the case of applicants with the right aptitude.

We offer absorbing work in an expanding well-equipped department of the Cathode Ray Tube Division. The company has a progressive salary policy, good holidays, and provides facilities for further study.

If this looks attractive to you and you are a graduate of a university or a professional institute or have a H.N.C. with suitable background apply in writing to THE MULLARD RADIO VALVE CO. LTD., New Road, Mitcham Junction, Surrey, quoting reference JFG/E.

Tester trouble shooters and electro-mechanical inspectors with experience of transmitters and receivers required for quality control work of considerable complexity in connection with Ministry equipment. The vacancies will provide interesting work for men who should be capable of issuing a comprehensive and intelligent report. Applicants should have a knowledge of and have worked to R.C.S. 1000 and D.T.D. specifications. Good rates of pay to the selected candidates. Eastern suburbs of London. Please reply, giving full details of experience to Box No. 7829 c/o W.W.

**SALES ENGINEER**

A unique opportunity has arisen in the leading Company supplying measuring instruments to the Communications Industry for a Sales Engineer of high calibre to cover the South of England. Good educational background with a technical qualification and practical experience essential. Age between 30 and 35 years. Salary according to qualifications. Apply to Dept. C.P.S., 336/7, Strand, W.C.2 quoting Ref. W.W. 2970R.

**MAINS RADIO**

require

**DEVELOPMENT ENGINEER**

for the design of Television and Radio Receivers and associated Test Gear.

Applicants should write to the

**Personnel Officer,**

**Beckside Works, Lidget Green, Bradford.**

Tel. : 72694.

**PLESSEY**

Has vacancies for:—

Tester/Trouble Shooters and Electro-Mechanical Inspectors for interesting work in connection with services equipment.

Attractive rates of pay according to experience and ability.

Please write or call :

Employment Bureau,  
Vicarage Lane,  
Ilford,  
ESSEX.

Leading Electrical Firm  
requires

**ENGINEERS**

to take charge of projects and assist in development and design of industrial electronic valves, radar valves, and the latest semiconductor devices.

The desired qualifications are a degree or appropriate equivalent with training or experience in physics or chemistry. The posts offer scope for interest and experience coupled with appropriate salaries, prospects and a pension scheme.

The newly equipped works and laboratories are situated in a pleasant cathedral city in the Midlands with no housing difficulties.

Apply with full details to Box 7999, c/o "Wireless World."

**INDIVIDUALITY IN THE SMALLER FIRM**

If you don't wish to be a "number" perhaps we can offer the job you are looking for!

**DRAUGHTSMEN****TRACERS****TECHNICIANS (Prototype)****TESTERS****ETC.**

If there is not a vacancy for you now we shall be pleased to file your name. Send full details in confidence

Manager, **ELCONTROL LTD.**  
(Industrial Electronics),  
Wilbury Way, Hitchin, Herts.

**SIEMENS BROTHERS & CO. LIMITED**

(an A.E.I. company)

**TELECOMMUNICATION TRANSMISSION ENGINEERS** required for vacancies on the specialised development staff engaged on work connected with:—

(a) **ELECTRONIC CIRCUITS** based on the use of transistors.

(b) **NETWORK DEVELOPMENT** including the design of filters and transformers.

The vacancies offer good prospects of advancement and opportunities for wide experience in a small group experimenting with and applying important new techniques. Senior and junior positions available. Qualifications of Honours degree standard in Electrical Engineering, Mathematics or Physics required but actual possession of an Honours degree not essential. Starting salaries in accordance with age and experience from £950 upwards for senior engineers with several years' practical experience in appropriate fields, and from £600 upwards for assistant engineers.

As the MAIN WORKS are in LONDON technical staff can participate in the activities of professional institutions and attend a wide range of lectures and courses.

Liberal pension scheme. Assistance with housing difficulties, if required, may be available in approved cases. Excellent Sports Club and canteen facilities.

Applications giving preliminary outline of qualifications should be sent to the Staff Officer, Ref. 744/72, SIEMENS BROTHERS & CO. LIMITED, WOOLWICH, S.E.18.

**SENIOR AND INTERMEDIATE DRAUGHTSMEN**

**LEO COMPUTERS LIMITED**

Senior and Intermediate Draughtsmen with experience of electro-mechanical work or electronic circuitry are required in the Drawing Office of LEO Computers Ltd., manufacturers of large-scale digital computers. As the Company expands, the Drawing Office staff is being augmented, and there is work covering all aspects of digital electronic computers.

There is a five-day week, canteen, social and sports club facilities, and a Pension Fund. The Company's factory is at Minerva Road, Park Royal, London, N.W.10.

Applications, giving full details, should be sent to:

The Personnel Office, LEO Computers, Ltd., Elms House, Brook Green, London, W.6.

**THE MULLARD RADIO VALVE CO. LTD.,** requires

a number of Junior and Senior Engineers for its Receiving Valve Division. Posts are available in:

1. PRODUCTION.
2. DEVELOPMENT.
3. QUALITY CONTROL.
4. APPLICATIONS.

Candidates for the Junior posts should possess an O.N.C. or G.C.E. (advanced) in Science Subjects. For the Senior posts candidates should possess a degree in Engineering or H.N.C. or equivalent qualifications and/or experience in this field. A feature of employment is the opportunity to undertake early responsibility in connection with projects developing in this field.

Commencing salaries will be according to qualifications and experience. The Company operates schemes for pensions, sickness benefits and offers some opportunities for further education.

Applications in writing should be addressed to The Personnel Officer, The Mullard Radio Valve Co. Ltd., New Road, Mitcham Junction, Surrey, quoting reference JFG/RVD.

**PYE LIMITED** are enlarging their field of development and are in a position to offer very attractive employment to SENIOR and JUNIOR DRAUGHTSMEN with experience in general electronic engineering or instrumentation. Remuneration will be progressive and in keeping with qualifications and experience. Working conditions are good. Apply to Chief Draughtsman, Trout Road, West Drayton, Middlesex.

**UNIVERSITY OF SOUTHAMPTON**

Technical Department  
**FULL-TIME COURSE IN TELECOMMUNICATIONS ENGINEERING**

A two year full-time day course in Telecommunications Engineering is now available. The course prepares candidates for the Intermediate, Final, and Full Technological Certificate Examinations of the City and Guilds of London Institute. It includes Physics for candidates who wish in addition to obtain full exemption from the Graduateship Examination of the British Institute of Radio Engineers.

The next course commences in September, 1957, and early application for entry is desirable. Application forms and further particulars may be obtained from the Technical Officer, the University, Southampton.

**VACUUM PHYSICS RESEARCH GROUP**

A VALVE ENGINEER is required for work on special Klystrons and microwave oscillators. Applicants should possess a degree (physics or engineering) or equivalent qualification, together with some experience. The appointments are to a fast developing team engaged on advanced research. Applications are also invited from persons with Inter B.Sc. or O.N.C. for appointment as a TECHNICAL ASSISTANT in this field. Please write to the Personnel Manager (ref. 280), Elliott Brothers (London) Limited, Borehamwood, Herts.

**RADIO TECHNICIANS IN CIVIL AVIATION**

A number of appointments are available for interesting work providing and maintaining aeronautical telecommunications and electronic navigational aids at aerodromes and radio stations in various parts of the United Kingdom.

Applications are invited from men aged 19 or over who have a fundamental knowledge of radio or radar with some practical experience. Training courses are provided to give familiarity with the types of equipment used.

Salary £561 10s. at age 25 rising (subject to a practical test) to £671. The rates are somewhat lower in the Provinces and for those below age 25. Prospects for permanent pensionable posts for those who qualify.

Opportunities for promotion to Telecommunications Technical Officer are good for those who obtain the Ordinary National Certificate in Electrical Engineering or certain City and Guilds Certificates. The maximum salaries of Telecommunications Technical Officers are Grade III £790, Grade II £925, Grade I £1,160.

Apply to the Ministry of Transport and Civil Aviation (ESB1/RT), Berkeley Square House, London, W.1, or to any Employment Exchange (quoting Order No. Westminster 5788).

**NORTHAMPTON COLLEGE of Advanced Technology LONDON**

St. John Street, London, E.C.1.

Grade II or Grade III Laboratory Technician required in Electrical Engineering Department. In addition to holidays with pay totalling up to five weeks per year, part-time day release is granted for studies in approved National Certificate or degree courses. Standard L.C.C. conditions, salary and superannuation. Letters of application to Head of Electrical Engineering Department.

**ELECTRONICS IN SCOTLAND**

**BARR & STROUD LTD., ANNIESLAND, GLASGOW, W.3,** have vacancies in their Research and Development Department for:—

**ELECTRICAL ENGINEERS AND APPLIED PHYSICISTS**

to engage in work on

1. Micro-wave circuit and aerial development.
2. Servo-mechanisms.
3. Guided weapons projects.

The laboratories and works are modern, well equipped, and pleasantly situated on the outskirts of Glasgow.

Applicants should write to Managing Director, giving details of qualifications and experience.

# Z & I AERO SERVICES LTD.

## COMMUNICATION RECEIVERS

**HALLICRAFTER S-27 RECEIVERS**, 27.8-143 mc/s., FM/AM, for 115 V. and 230 V. A.C. Mains, Aerial Tested. .... £25 0 0  
**HALLICRAFTER S-36 RECEIVER**, improved and tropicalised version of the above, aerial tested. .... £30 0 0  
**MARCONI CR-100 RECEIVER**, 60 kc/s. to 30 mc/s., for 230 V. Mains, aerial tested. .... £20 0 0  
**EDDYSTONE 358X RECEIVER**, 40 kc/s. to 31 mc/s., complete with 10 Plug-in Coils and Mains Power Pack ..... £25 0 0  
 N.B. All the above Receivers can be supplied completely overhauled to manufacturer's Specification and fully guaranteed. Prices on application.  
**MARCONI CR-150 RECEIVER**, 2 to 60 mc/s; dual superhet; Crystal filter; Calibrating Crystal; "5" Meter; Power Requirements 300 V., 65 mA. H.T., 6.3 V., 3.7 A. L.T.; Completely overhauled and guaranteed ..... £50 0 0  
**MAINS POWER UNIT** for the above ..... £10 0 0  
**HALLICRAFTER S-27C RECEIVER**, 130 to 210 mc/s, FM/AM, for 117 V. A.C. Mains; Completely overhauled and guaranteed ..... £70 0 0

## INSULATION TESTERS

**EVERSHED 1,000 V.** 200 megohms Bridge Megger ... £55 0 0  
**EVERSHED 500 V.** 40 megohms Megger ..... £22 10 0  
**EVERSHED 1,000 V.** 100 megohms Megger ..... £27 10 0  
**EVERSHED 250 V.** "WEE" Megger ..... £11 10 0  
**EVERSHED 500 V.** "WEE" Megger ..... £12 10 0  
**RECORD "MINOR"** Insulation Tester, 500 V. .... £10 0 0

**BOONTON MODEL 79 PULSE GENERATOR**, 60 to 100,000 p.p.s., 5 to 40 sec. wide, amplitude 150V; Synchronizing Pulse 3 sec. wide, 35V amplitude.  
 PRICE, fully overhauled and guaranteed ..... £50 0 0

We buy high class British and American Test Equipment, American Communication Equipment, particularly: Transmitters ART-13, Transmitter-Receivers ARC-1 and ARC-3, Radio Compass Receivers ARN-6 and ARN-7, Communication Receivers BC-312, 342 and 348 etc. The above prices are ex our warehouse; packing and carriage extra Please write for full details, prices etc. to:

# Z & I AERO SERVICES LTD.,

19 Buckingham Street, London, W.C.2

Cables : ZAERO, LONDON.

Telegrams : ZAERO, RAND, LONDON.

Telephone : TRAlgar 2371/2/3.

**APN-9 "LORAN" RECEIVER/INDICATOR UNITS.** Motor Generator 800-I-D for the above.  
**RADIO COMPASS INSTALLATIONS** SCR-269G and AN/ARN-7.  
**RADIO COMPASS RECEIVERS** BC-433A, BC-433F, BC-433G, R-5/ARN-7.  
**CONTROL BOXES** BC-434.  
**LOOPS** LP-21-A and LP-21-AM.  
**PLUGS** for SCR-269G and AN/ARN-7 INSTALLATIONS, including PL-108, PL-112, PL-118 and PL-122.  
**MARKER BEACON RECEIVERS** BC-357, BC-1333.

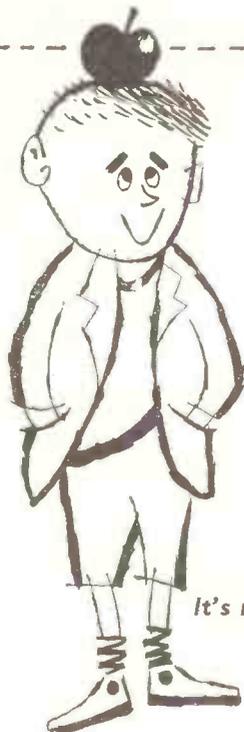
**WIRELESS SETS** No. 19 Mk. 2 and Mk. 3, complete with Standard Kits.  
**WIRELESS SETS CANADIAN** No. 29, interchangeable with W/S No. 19, but having "A" and "B" Receivers in separate units, complete with Standard Kits.

**COMMUNICATION RECEIVERS** BC-342.  
**COLLINS T.C.S. TRANSMITTING AND RECEIVING EQUIPMENT**, 1.5 to 12 mc/s, with Power Units for 12 V., 24 V., 115 V. D.C. or 230 V. A.C. operation. Original cases of brand new spares for the above.

**SPARE PARTS** for BC-375 and BC-191 TRANSMITTERS.  
**SPARE PARTS** for UC 10-line Switchboards.

**BD-71 AMERICAN 6-LINE SWITCHBOARDS.**  
**EE-8 AMERICAN FIELD TELEPHONES AND SPARES.**

**T-1154/R-1155 INSTALLATIONS**, comprising R-1155L or R-1155N Receivers (covering trawler band), complete with Loops, Aerial Switches, Visual Indicators, Plugs, Sockets, etc. The following Power Units are available: Type 32, 33, 34, 35, 45, 46 for 12 V., 24 V. D.C. or 230 V. A.C. operation.



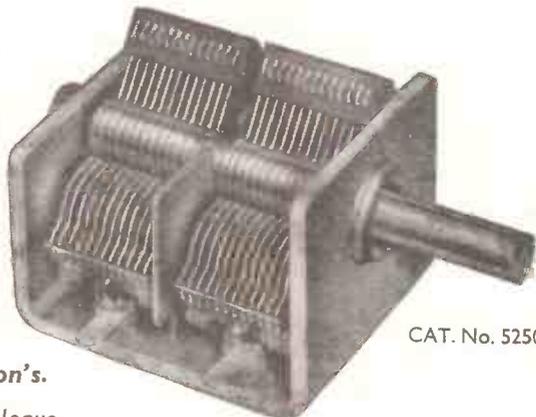
precision built components

## JACKSON "O" GANG CONDENSER

Miniature model in 1 or 2 gang, capacities up to 365pf swing, front area 1 3/8" x 1-17/32" including sweep or vanes, length 1 Gang 1", 2 Gang 1 1/4", Spindle 1/4" dia. x 3/4" long.  
 Aluminium vanes, cadmium plated steel chassis.

Price

1 Gang 7/6      2 Gang 11/6



CAT. No. 5250

It's reliable—if it's made by Jackson's.

Write for fully illustrated catalogue.

**JACKSON BROS.**  
 LONDON LIMITED



KINGSWAY · WADDON · SURREY. Telegrams: Walfico, Souphone, London. Telephone: CROydon 2754/5.

# Wireless World Classified Advertisements

Rate 7/- for 2 lines or less and 3/6 for every additional line or part thereof, average lines 6 words. Box Numbers 2 words plus 1/-. (Address replies: Box 0000 c/o "Wireless World" Dorset House, Stamford St., London, S.E.1.) Trade discount details available on application. Press Day July 1957 issue, Wednesday, May 29th. No responsibility accepted for errors.

## WARNING

Readers are warned that Government surplus components and valves which may be offered for sale through our displayed or classified columns carry no manufacturers' guarantee. Many of these items will have been designed for special purposes making them unsuitable for civilian use, or may have deteriorated as a result of the conditions under which they have been stored. We cannot undertake to deal with any complaints regarding any such items purchased.

**NEW RECEIVERS AND AMPLIFIERS**  
**SHIRLEY LABORATORIES, Ltd.**, 3, Prospect Place, Worthing, Sussex. Tel. 30536  
**TRE TWA/15** stereoscopic tape recording and replay amplifier, separate meter monitoring on record and playback on both channels, 13watts O/P each channel, 96gns; **TWA/15** tape recording and reproducing amplifier, 15watts O/P, for Wearite and Collaro decks, 45gns; **TW/1** recording and replay pre-amplifier, 30gns; both with valve voltmeter monitoring; type **SB/1-15E** high-fidelity amplifier, exceptionally wide tone-control system, 40mv sensitivity, 20gms; with two inputs and 3-position gram filter, 22gms; specialized amplifiers for the musical and scientific industries including the Mullard 20watt. [0095]

**LEAK TL/10** amplifiers with point one pre amp; **TL/5** deposit and 9 payments of 57/7 monthly.  
**ROGERS** junior with control unit; £23/18 deposit and 9 payments of 52/10 monthly; cash prices **Leak £28/7**, **Rogers £26**.

**A. L. STAMFORD (Dept. LR.2)**, 20, College Parade, Salisbury Rd., London, N.W.6. [6915]

**BB PRODUCTS**—Our latest Model **AF634** now available; an 8 valve AM/FM radio gram chassis, separate channels employed for AM and FM, variable N.F.B. tone control, attractive 3-colour floodlit dial; also Model **AF73.A** 7 valve AM/FM feeder unit; 2wd stamp for illustrated leaflet; trade enquiries invited. **Bayly Bros.**, 46, Pavilion Drive, Leigh-on-Sea, Essex. [16959]

**RECEIVERS AND AMPLIFIERS—SURPLUS AND SECOND-HAND**  
**HRO** Rx's and coils in stock, also **AR88**, **BC548R**, **CR100** etc.—Requirements please to **R. T. & I. Service**, 254, Grove Green Rd., London, E.11. Ley. 4986. [10053]

"**WIRELESS WORLD**" 7-valve F.M. tuner, unused, with cathode follower, magic eye, and power supply for use on 200-250 volts A.C., fitted with latest type F.M. components of the highest grade including specified temperature compensating capacitors; price £14/15 including 7 valves; accurately aligned and tested ready for use; approx. half original price, exceptionally good reproduction, ideal for the high fidelity amplifiers and recorders; as above but including high-grade cabinet 14 1/2 x 9 1/2 x 9 in., £18/10, limited number; bargain, above are despatched by passenger train in boxes lined with foam rubber to ensure safety in transit. [7061]

**RECEIVERS AND AMPLIFIERS—SURPLUS AND SECOND-HAND**  
**PROJECTION** TV chassis, working, £12/10; similar, needs repair, £7/10.—**Hall**, 24, Nevron Mansions, Warwick Rd., S.W.5. Fremantle 19631. [7052]

**LOUDSPEAKERS—SURPLUS AND SECOND-HAND**  
**LOWTHER** PM2 in Volt type domestic corner horn; £30 o.n.o.—**Baldwyns Park**, Bexley, Tel. Bexleyhead 8880. [7026]

**DYNAMOS, MOTORS, ETC.—SURPLUS AND SECOND-HAND**  
**LARGE** Bridge connected rectifier units, H.D. charging cut-outs, H.D. starter relays & starter pushes, complete vaporiser equipment for Villiers Mark 10, 20 & 25 petrol engines, to run on paraffin, ex stock  
**T.W. PEARCE**, 66, Great Percy St., W.C.1. [7040]

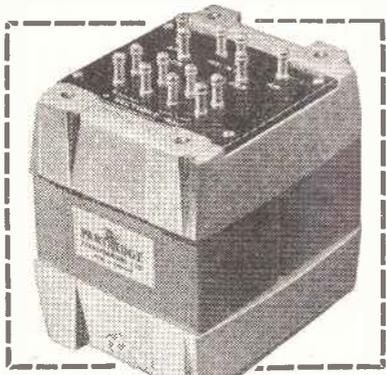
**TRANSMITTING EQUIPMENT—SURPLUS AND SECOND-HAND**  
**PORTABLE** transmitter/receiver type 68 in new, unused condition, complete with kits; ideal for short range communications; quantities available at keen prices.—**Industrial Suppliers (Cambridge)**, Ltd., 15a and 17, Brecknock Rd., N.7. Tel. Gulliver 5891. [7040]

**TEST EQUIPMENT—SURPLUS AND SECOND-HAND**  
**AVO** Electronic Test Meter complete, bargain; £23/10.—**Courtenay Davis**, Harpenden. [7060]

**AMATEUR** selling test equipment, etc., bargain prices; send stamped addressed envelope for list.—**Gilford**, 22, Pembury Rd., Tonbridge, Kent. [6949]

**SIGNAL** generators, oscilloscopes, output meters, valve voltmeters, frequency meters, multi-range meters in stock; your enquiries are invited.—**Requirements to R. T. & I. Service**, 254, Grove Green Rd., London, E.11. Ley. 4986.

# HIGH FIDELITY AUDIO TRANSFORMERS by PARTRIDGE



## P5000 Series

A range of truly "high fidelity" output transformers with superior performance—yet economical design—has enabled a price reduction over transformers with less exacting specification. These units are especially suited to the well-known Osram and Mullard amplifier designs. The primaries are tapped for ultra-linear connection at 43%, and on certain models at 20% to give optimum performance at various power levels up to 50 watts for operation with such valves as KT88, KT66, EL34, N709, EL84, etc. Illustrated above is the 20-watt model, price 95/-.

The series includes a mains transformer of similar styling with specification to suit the Mullard 5-10 and Osram 9-12 amplifiers.

### P5353

An output transformer of advanced design especially suitable for use in connection with the 50 watt amplifier design incorporating two KT88 valves as described in the article on page 158 "Wireless World," April, by W. Ian Heath, B.Sc.(Eng.) (G.B.C. Research Laboratories) and G. R. Woodville (M.O. Valve Co. Ltd.). Price 115/-.

### P4076

Specified for the Bazandall Amplifier design described in "Wireless World," March and April. Price 36/-.

**PARTRIDGE TRANSFORMERS LTD**  
 Tolworth, Surrey

Please send me  
 (a) Details of P5000  
 (b) Price List

Name .....

Address .....

.....WVW/657

**NEW COMPONENTS**  
**TRANSISTOR** transformers, interstage push-pull, 8/-; output ditto, 7/6, from manufacturers, **Osmabet, Ltd.**, 14, Hillside Rd., Tottenham, London, N.15. [00020]

**CRYSTAL** microphone inserts (Cosmocoord Mic 6/4), still in steady demand by Hams and Sound Engineers; guaranteed newly made and boxed; 15/6 post free.—**Radio-Aids**, Ltd., 29, Market St., Watford, Herts. [0169]

**COMPONENTS—SURPLUS AND SECOND-HAND**  
**RADIO CLEARANCE, Ltd.**, 27, Tottenham Court Rd., London, W.1. Tel. Museum 9188. MAINS transformers, pri. 110v; 200-240v, sec. 300-0-300v, 4v 2amp, 6.5v 2.5amp, 13v 1-2-gang condenser, .0005, var. size, 2 1/2 in x 2 1/2 in x 1 1/2 in spindle, 4/-; P.M. focus rings, 7/6; T.V. metal rectifiers, 250v 250ma, size 2 1/2 in x 4 in, 12/6; C.T.V. I.F.S. 35mc/s, 2nd, 3rd, 4th vision caps, 1 1/2 in x 1 1/2 in x 2 1/2 in, slug tuned, set of 3, 5/6; 2-gang var. 1.5pt, size 2 1/2 in x 1 1/2 in x 1 1/2 in, 2/-.

**VIBRATORS**, 6v synchronous, 7-pin, 7/6; vibrator trans., 6v, 7/6  
**WIND-UP** pots, 100Ω, 1 in spindle, 2/6; speakers, P.M., 5in 5Ω speech coil, 16/6; sheet aluminium, large variety of sizes in stock. **SUB-MINIATURE** electrolytics for transistor circuits, 6mfd, 8mfd, 3v and 6v, size 1/2 in x 1/2 in, 2/9; 16mfd, 30mfd, 5v and 6v, size 1/2 in x 1/2 in, 2/9.

**ELECTROLYTICS**, capacity, voltage, size, type of mounting: 50mfd, 25v, 1 1/2 in x 1/2 in, tag, 1/6; 100mfd, 12v, 1 1/2 in x 1/2 in, tag, 1/6; 500mfd, 12v, 1 1/2 in x 1/2 in, tag, 2/-; 10mfd, 25v, 1 1/2 in x 1/2 in, tag, 1/6; 150v, 1 1/2 in x 1/2 in, tag, 1/3; 8mfd, 150v, 1 1/2 in x 1/2 in, tag, 1/3; 2mfd, 350v, 2 1/2 in x 1/2 in, clip, 1/9; 8mfd, 500v, 3 1/2 in x 1/2 in, clip, 2/6; 16mfd, 350v, 2 1/2 in x 1/2 in, prong, 1/9; 20mfd, 450v, 2 1/2 in x 1/2 in, clip, 2/-; 24mfd, 275-350v, 2 1/2 in x 1/2 in, clip, 2/-; 32mfd, 275-350v, 2 1/2 in x 1/2 in, clip, 2/6; 32mfd, 450v, 2 1/2 in x 1/2 in, prong, 2/6; 40mfd, 150v, 3 1/2 in x 1/2 in, prong, 1/6; 40mfd, 350v, 2 1/2 in x 1/2 in, prong, 2/6; 40mfd, 450-525v, 2 1/2 in x 1/2 in, 2/9; 50mfd, 350v, 2 1/2 in x 1/2 in, W/E, 3/-; 100mfd, 270-350v, 2 1/2 in x 1/2 in, clip, 3/3; 100mfd, 350-425v, 3 1/2 in x 1/2 in, prong, 1/6; 125mfd, 350-425v, 3 1/2 in x 1/2 in, prong, 3/6; 200mfd, 25v, 1 1/2 in x 1/2 in, tag, 2/0; 200mfd, 250-325v, 3 1/2 in x 1/2 in, 2/6; 200mfd, 275-350v, 3 1/2 in x 1/2 in, prong, 3/-; 250mfd, 25v, 2 1/2 in x 1/2 in, 1/-; 250mfd, 150v, 3 1/2 in x 1/2 in, prong, 2/-; 500mfd, 6v, 2 1/2 in x 1/2 in, clip, 4/3; 500mfd, 25v, 2 1/2 in x 1/2 in, clip, 2/6; 1,000mfd, 6v, 2 1/2 in x 1/2 in, clip, 2/-; 1,000mfd, 25v, 3 1/2 in x 1/2 in, clip, 1/6; 2,000mfd, 12v, 2 1/2 in x 1/2 in, W/E, 3/6; 2,000mfd, 25v, 3 1/2 in x 1/2 in, clip, 3/6; 2,000mfd, 50v, 4 1/2 in x 1/2 in, clip, 5/6; 2,500mfd, 50v, 4 1/2 in x 1/2 in, clip, 5/6; 3,000mfd, 25v, 1 1/2 in x 1/2 in, clip, 5/6; 4,000mfd, 6v, 3 1/2 in x 1/2 in, clip, 5/6; 5,000mfd, 25v, 4 1/2 in x 1/2 in, clip, 5/6; 5/8+8mfd, 450v, 2 1/2 in x 1/2 in, W/E, 4/-; 15-15mfd, 450v+20mfd, 25v, 3 1/2 in x 1/2 in, prong, 4/-; 16-16mfd, 275v, 2 1/2 in x 1/2 in, clip, 3/-; 20+10mfd, 450-525v, 3 1/2 in x 1/2 in, clip, 3/6; 20+20mfd, 350-425v, 2 1/2 in x 1/2 in, prong, 4/-; 20+20mfd, 150v, 2 1/2 in x 1/2 in, clip, 2/-; 20+20mfd, 150v, 2 1/2 in x 1/2 in, W/E, 2/3; 20+20mfd, 350-425v, 2 1/2 in x 1/2 in, W/E, 3/9; 20+20mfd, 450v, 3 1/2 in x 1/2 in, prong, 3/9; 30+30mfd, 150v, 2 1/2 in x 1/2 in, clip, 2/6; 32+16mfd, 200v, 2 1/2 in x 1/2 in, prong, 1/6; 32+32mfd, 275-350v, 3 1/2 in x 1/2 in, clip, 3/-; 32+32mfd, 275-350v, 3 1/2 in x 1/2 in, prong, 3/9; 32+32mfd, 350-425v+50mfd, 25v, 2 1/2 in x 1/2 in, prong, 4/3; 40+40mfd, 150v, 2 1/2 in x 1/2 in, clip, 2/6; 40+40mfd, 350v, 3 1/2 in x 1/2 in, clip, 3/6; 40+40mfd, 450v, 3 1/2 in x 1/2 in, prong, 4/3; 40+40mfd, 150v, 2 1/2 in x 1/2 in, clip, 2/6; 50+50mfd, 275-350v, 3 1/2 in x 1/2 in, clip, 4/6; 50+50mfd, 300-350v, 2 1/2 in x 1/2 in, clip, 4/6; 50+50mfd, 350-425v, 3 1/2 in x 1/2 in, prong, 4/6; 60+100mfd, 275-350v, 3 1/2 in x 1/2 in, clip, 4/6; 60+200mfd, 275-350v, 4 1/2 in x 1/2 in, clip, 5/6; 60+250mfd, 250-325v, 4 1/2 in x 1/2 in, clip, 5/6; 100+200mfd, 250-325v, 3 1/2 in x 1/2 in, prong, 4/6; 100+200mfd, 350-425v, 4 1/2 in x 1/2 in, clip, 5/6; 150+200mfd, 350-425v, 4 1/2 in x 1/2 in, clip, 7/-; 200+100mfd, 275-350v, 4 1/2 in x 1/2 in, clip, 6/6; 200+200mfd, 275-350v, 4 1/2 in x 1/2 in, clip, 7/6; 1,000mfd+1,000mfd, 6v, 3 1/2 in x 1/2 in, clip, 3/6; 12+12+24mfd, 275-350v, 2 1/2 in x 1/2 in, prong, 3/6; 16+8+4mfd, 275-350v, 2 1/2 in x 1/2 in, prong, 3/6; 16+24+8mfd, 2 1/2 in x 1/2 in, clip, 5/-; 20+20+10mfd, 275-350v, 2 1/2 in x 1/2 in, prong, 3/6; 20+20+20mfd, 150v, 2 1/2 in x 1/2 in, prong, 2/9; 30+25+20mfd, 150v, 2 1/2 in x 1/2 in, clip, 2/9; 32+32+2mfd, 275-350v, 3/6; 32+32+8mfd, 275-350v, 2 1/2 in x 1/2 in, clip, 3/-; 32+32+8mfd, 350-425v, 2 1/2 in x 1/2 in, clip, 3/6; 40+30+20mfd, 275-350v, 3 1/2 in x 1/2 in, prong, 3/6; 40+30+20mfd, 275-350v, 3 1/2 in x 1/2 in, prong, 4/6; 50+50+50mfd, 350v, 3 1/2 in x 1/2 in, prong, 5/6; 200+250+250mfd, 275-350v, 4 1/2 in x 1/2 in, clip, 8/-; 40+20+10+10mfd, 350-425v, 2 1/2 in x 1/2 in, clip, 5/-.

ALL prices include packing and postage.  
**RADIO CLEARANCE, LTD.**, 27, Tottenham Court Rd., London, W.1. Tel. Museum 9188. [0015]

**FOR SALE & WANTED ADVERTISEMENT**  
 FORM TURN TO PAGE No. 165

## LONDON CENTRAL RADIO STORES

**PUSH BUTTON HAND CONTROLS.** Complete with indicator lamp, with heavy duty 3-way switch, 8 yds. 15 amp. 6-core cable. Brand new. £1/15/-.

**SPIRIT COMPASSES.** Brand new and boxed. P.11 4 1/2 in., £1/1/-; P.10, 6 in., £1/5/-.

**WESTERN ELECTRIC** extending mike with single earpiece. Has heavy base fixing rod and extends approx. 22in. 38/6.

**AVO UNIVERSAL TEST METER.** Model 40 reconditioned as new. In perfect working order. £10/10/-.

**0-50 MICROAMPMETER.** 2 inch flush mounting. Brand new and boxed. 50/-.

**VENNER 8-DAY CLOCKWORK TIME SWITCHES.** 230 volt, 1 amp. 3 1/2 x 2 1/2 in. 25/-.

**VENNER 8-DAY CLOCKWORK TIME SWITCHES.** 230 v. 15 amp. In iron-clad case. Size 8 x 7 x 4 in., weight 12 lb. 55/-.

**5in. P.M. SPEAKERS.** 3 ohm. In good working order, 11/6.

**EX-NAVAL SOUND POWERED TELEPHONES** with hand generator calling and neon indicator, in iron clad case size 9 x 7 x 7 in. 45/-.

**EX-G.P.O. RELAYS.** 500 ohm coil, 10 leaves. 4/6.

**AVO VALVE TESTER.** Roller panel type in wooden carrying case. Perfect order. £9/10/-.

**UNISELECTOR SWITCHES.** Have many applications including automatic tuning, circuit selection, etc. Operates on 25-50 v. Full wipe 4-bank, double coils. 32/6. Half wipe 6-bank. 12/6.

**MEGGER CIRCUIT TESTING OHMMETER** in leather carrying case, as new. £3/5/-.

**CARBON HAND MIKE.** Type No. 4. 3/6.

**MOVING COIL HAND MIKE.** Type No 7. 8/6.

**SINGLE FLARE RE-ENTRANT SPEAKERS.** Bakelite 15 ohm impedance. Suitable for P.A. work and all outdoor functions. Size 18 x 18 x 1 1/2 in. 22/6.

**TWIN FLARE RE-ENTRANT SPEAKERS.** 15 ohm. Similar to above. Size 24 x 18 x 1 1/2 in. 32/6.

**AMERICAN I.F.F. SETS** with ten valves 24 v. D.C. generator and many useful Components. Valves consist Six 6BH7s, Two 6H6, Two 7198. 27/6.

All prices include carriage.

23 LISLE ST. (GER. 2969) LONDON, W.C.2

Closed Thursday 1 p.m. Open all day Saturday

## COMPONENTS—SURPLUS AND SECONDHAND

**SOUTHERN RADIO SUPPLY, Ltd.,** 11, Little Newport St., London, W.C.2. See our displayed advertisement, page 159.

**ILLUSTRATED Catalogue No. 13,** containing over 450 items of Government surplus and model radio control equipment. 2/- post free, refunded on purchase of goods. 2/6 overseas seamount.—Arthur Sallis Radio Control, Ltd., 93, North Rd., Brighton, Tel. 25806. [0193]

**MAGNETS** at low prices, fully guaranteed, 5 in. Resolver No. 5 (AP 1062) 50v, 50c/s, unused, each in tin, 35/-, post 2/1; large stocks of these and other types.—P. B. Crawshaw, 94, Pixmore Way, Letchworth, Herts. Tel. 1851. [0087]

## NEW GRAMOPHONE AND SOUND EQUIPMENT

**TRANSISTOR** Hi-Fi amplifiers, 4 watts, 4 shorts; Reflectograph Tape Decks, £33; Hi-Fi R.P. Amplifiers, 6 watts, U.L. output, 25gns.

**COLLARO Mk. III** decks £22, Amps. 23 and 25gns. Phone Gladstone 1770.

**HARDING ELECTRONICS**, 120a, Mora Rd., Cricklewood, London, N.4.2. [0032]

**GLASGOW**—Recorders bought, sold, exchanged; cameras, etc., exchanged for recorders or vice versa.—Victor Morris, 406, Argyle St., Glasgow, C.2. [0201]

**RECORDERS** by Ferrigraph, M.S.S. and the new Brenell Mark IV Leavers Rich; Recorder Mastertape, as used in our studio; extra-play tape, mics., including the "Cadence" mic., disk recorders, blank disks, deflexers.

**TAPE/DISK** service, especially L.P.; full studio and mobile facilities.

"EROICA" RECORDING SERVICES (1949), Recorder House, Peel St., Eccles, Manchester. Eccles 1624. Director: Thurlow Smith, A.R.E.C.M. [0232]

**Tape** Recorders, Ferrigraph, 75gns; Reflectograph, £87; Brenell, 48 gns; tape decks, Wearite, Collaro, Truvox; microphones, Reslo, S.T.C., Acos; amplifiers, Leak, 27gns; Quad, £42; hire purchase facilities available; high fidelity tape to disc service.—Lambda Record Co., Kimberley Ave., Liverpool, 23. [6884]

**CINE-VOX** disc recording equipments, type C7J, for high-quality recordings from existing microphone equipment; price from 28gns; also available as a complete channel inclusive of mic., amplifier and playback equipment, at 70gns; type C7 for highest quality professional requirements—recorder mechanism at 48gns, or complete channel at 110gns; demonstrations arranged in London.

**PLEASE** write for details to K.T.S. Ltd., "Coplow", Park Rd., Braintree, N. Devon Tel. Braintree 224. Callers by appointment only

**TRUE** Hi-fidelity: have you heard Vortexion tape recording equipment in use with the latest Wharfedale and Goodman's Hi-Fi speakers? Why not arrange a personal demonstration, when we can give you our undivided attention and help you with your Hi-Fi problems? Write or phone for appointment.

**GRIFFITHS HANSEN (RECORDINGS), Ltd.,** 32-3, Gosfield St., Langham St., W.1. Mus. 2771/0642. [0233]

**GRAMOPHONE AND SOUND EQUIPMENT—SURPLUS AND SECONDHAND—**

**FERROGRAPH 2A/N** little use accessories, 20 tapes also avail.; £70.—Box 8249. [0194]

**CONNOISSEUR** 3-speed unit, undrilled, in maker's carton: £25/10.—Schofield, 8, Silmill Hall Rd., Solihull, Warwickshire. 7/036

**CONNOISSEUR** Varigroove 3-speed disc recorder Dec. '56, little use, excellent condition. £145 o.n.o.—Box 8108. [07038]

**E.M.I.** 2500 disc recorder, as new, with 10 blank; £100 o.n.o.—Lawson, 264, Pine Gdns., Eastcote, Middx., or Field End 7223. [6978]

**TAPE** recorder, C.J.R., type D5, replay monitoring, large spools; £75 including microphone.—Thomson, 112, Looster Rd. South, Birmingham, 14. Highbury 1314. [6992]

**CABINETS** LEWIS RADIO have the best selection and finest finish.—See page 161. [0224]

**UNUSED** 100 TH VALVES 30/- each.—Barber, 11, Cliffe Rd., Holmfirth, Yorks. [6979]

**VALVES WANTED** ALL types of valves British or American, transmitting and receiving; keenest cash prices paid. What have you to offer?—Write or call Lowe Bros., 9a, Diana Place, Euston Rd., N.W.1. [6985]

**WANTED, EXCHANGE, ETC.** WANTED, receivers A.P.R.4, also T.N.16, 17, 18, 19, etc. and any radio test gear.

**LESLIE DIXON & Co.,** 214, Queenstown Rd., Battersea, S.W.8. Macaulay 2159. [0176]

**WANTED,** modern standard or portable typewriter, good make, perfect, reasonable.—Box 815. [07049]

**WINDING** machines, Douglas No. 1 or No. 7 or other similar machines, to wind flat resistance cards.—Box 7832. [0705]

**WANTED.**—Valve voltmeter capable of measuring from 1 mV to 1,000 mV; from 50 to 10,000 cycles.—Box 8065. [07025]

**WANTED.** H.F.C. coils, Res., etc., A.R.88s, BS348s, S27s, etc.—Details to R. T. & Service, 254, Grove Green Rd., London, E.11. Lev. 4986. [0163]

**SPENT** cash ready for purchase of surplus and bankrupt stocks of new valves and components: we sell plain valve cartons; list on request.—R. H. S., Ltd., 155, Swan Arcade, Bradford. [0190]

## AN INTRODUCTION TO THE CATHODE RAY OSCILLOSCOPE

By Harley Carter, A.M.I.E.E.

Price 12/- Postage 6d.

**The Radio Amateur's Handbook.** By the A.R.R.L. 32/6, 1957. Postage 1/6.

**Variable Capacitors and Trimmers.** Vol. 4. By G. W. A. Dummer. 32/6. Postage 1/6.

**Television Receiving Equipment.** By W. T. Cocking. 30/- Postage 1/6.

**An Introduction to Junction Transistor Theory.** By R. D. Middlebrook. 68/- Postage 1/6.

**The Gramophone Handbook.** By P. Wilson. 15/- Postage 9d.

**Radio Valve Data.** Compiled by "W.W." 5/- Postage 6d.

**Handbook of Sound Reproduction.** By E. M. Villchur. 52/- Postage 1/6.

**Maintaining Hi-Fi Equipment.** By J. Marshall. 23/- Postage 1/6.

**Handbook of Line Communication.** Vol. 1. H.M.S.O. 30/- Postage 1/6.

## THE MODERN BOOK CO. 19-23 PRAED STREET LONDON, W.2

BRITAIN'S LARGEST STOCKISTS OF BRITISH AND AMERICAN TECHNICAL BOOKS

Please write or call for our catalogue. PADdington 4185. Open 6 days 9-6 p.m.

## SURPLUS

● **AERIAL EQUIPMENT.** Poles, Masts, Dipoles, Yagi, Microwave arrays, Whips, 12in. Whips to 90ft. Masts.

● **CABINETS AND RACKS.** 36in. to 96in. high, standard 19in. wide.

● **CONDENSERS** up to 10,000 mfd. and 50 kV.

● **FUSES.** Cartridge and E.S. 1/2 amp. to 600 amps.

● **INSULATORS** 80 different patterns.

● **LOUDSPEAKERS** 3in. dia. to 50 watt Theatre Systems.

● **METERS.** 2in. to 12in. dia. 120 different types.

● **POWER SUPPLIES.** Generators, Rectifiers, Vibrators, Inverters, Dynamotors from 2 volts 100 amps. to 36,000 v. 1/2 amp.

● **RECEIVERS.** 80 types available from 15 Kc/s. to 600 mc/s. including portable, D.F., Table, Rack and Pedestal.

● **TEST GEAR,** American over 100 different types, Meters, Calibrators, Signal Generators, etc.

● **TELEPHONE AND TELEGRAPH EQUIPMENT.** Single and multi channel apparatus, filters, switchboards, power supplies.

● **TRANSFORMERS** Audio and Power, 200 types from 2 volts to 18,000 volts and up to 15 kVA.

● **TRANSMITTERS,** 60 different types from UF-1 Handie Talkie to G-50, 2,500 watts.

FULL LISTS AVAILABLE

Send your requirements. All packing and shipping facilities.

**P. HARRIS, ORGANFORD, DORSET**

Telephone: LYCHETT MINSTER 212

## OPPORTUNITIES IN RADIO



Get this FREE Book!

'ENGINEERING OPPORTUNITIES' reveals how you can become technically qualified at home for a highly paid key-appointment in the vast Radio and Television Industry. In 144 pages of intensely interesting matter, it includes full details of our up-to-the-minute home study courses in all branches of TELEVISION and RADIO, A.M. Brit. I. R. E., City & Guilds, Special Television, Servicing, Sound Film Projection, Short Wave, High Frequency and General Wireless Courses.

We definitely Guarantee

"NO PASS—NO FEE"

If you're earning less than £15 a week this enlightening book is for you. Write for your copy today. It will be sent FREE and without obligation.

**BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY**

388b COLLEGE HOUSE, 29-31, WRIGHT'S LANE, LONDON, W.8.



# GALPIN'S ELECTRICAL STORES

408, HIGH STREET, LEWISHAM, S.E.13  
Tel.: Lee Green 0809      Nr. Lewisham Hospital

TERMS: CASH WITH ORDER  
(No C.O.D.)

All Goods sent on 7 days' approval against cash

P.M. EXTENSION SPEAKERS. 8in. 3 ohm speech coil, in good condition, 10/-, p/p. 1/6.

SMALL ROTARY REOSTATS, point nine ohms at 8 amps. high quality 6/- p/p.

EX-GOVT. ROTARY CONVERTERS. 24 volts D.C. Input 50 volts 50 cycles, 1 phase at 450 watts. OUTPUT (complete with Step Up Transformers) from 50 volts to 230 volts £13/10/- each or CONVERTOR only £9/10/- each.

EX-NAVAL ROTARY CONVERTERS. 110 volts D.C. Input. Output 230 volts 50 cycles 1 phase 250 watts, capable of 50 per cent. overload, in good condition, guaranteed weight approx. 110 lb., £13/10/- each.

HIGH FREQUENCY 2 VALVE AMPLIFIERS. New, two EF37A valves, 32/6, c/p.

4 E.P. D.C. MOTORS, 110 volts, 3,000 r.p.m., new 35/-; starters to suit N.V.R., 25/-.

MAGSLIP MOTORS, 50 volts, A.C., large size, as new, 8/6 p/p. 1/6 each. Trans. Type, 15/-, p/p. 1/6.

LARGE METER Movements, fairly low F.S.D. average 6 inch deflection, very high quality, 7/6, p/p. 1/6 each.

MOVING COIL Meters, all 2 to 3 inches dia., damaged cases or glasses, 3 for 10/- guaranteed one sound meter, 6 for 18/-, two sound meters, no junk, all are or suitable for M/amp. meters.

MAINS TRANSFORMERS, all 200/250 volts primaries (New) Heavy duty. Output combination of 0/6/12/18/24/30/36 volts 4/5 amps. 33/6 each. Ditto 0/8 amps, 51/6 each. Ditto 15 amps. output, 75/- each. Another combination of 0/6/12/18/24 volts 6/8 amps, 51/6 each. Ditto 10/12 amps., 58/6 each. Ditto 25/30 amps. output, 85/- each.

MEDIUM SPOT WELDER TRANSFORMERS Input 200/250 volts. OUTPUT combination of 0/2/4/6/8/10/12 volts at 60/70 amps. 55/7/6 each. Ditto 120/150 amps. output. £8/10/- each.

GOOD AMPLIFIERS, complete with valves in working order. 5 watt £5/10/-; 12 watt £10; 30 watt £20; 50 watt with No valves £10

ELECTRIC LIGHT OR POWER CREDIT METERS 10 amp. load 25/-; 20 amp. load, 47/6; 30 amp. load, 57/6. Fully guaranteed, carriage paid.

PREPAYMENT METERS, 1/- slot, set at 2d. per unit, 10 amp. load, 24/2/6; 20 amp. load, 25/2/6.

6d. SLOT ONLY PREPAYMENT METERS. 5 amp. load only, set at 4d. per unit, 52/6 each.

LARGE RANGE OF VOLT, AMP. AND MILLIAMP. METERS, from 7/6 each to 50/- each, sizes from 2in. dia. up to 7in. dia. Please state requirements for price.

AUTO WOUND Voltage changer TRANSFORMERS. Tapped 0/110/200/230/250 volts 200 watts, 43/6 each; 350 watts, 57/6 each; 500 watts, 76/6 each; 1,000 watts, 265/5/- each; 2,000 watts, £10 each; 3,000 watts, £15 each.

Any TRANSFORMERS made to order within 7 days from date of order. Please ask for quote. Numerous other items

MAINS TRANSFORMERS. 110/250 volt input 300/0/300 volt 70/80 M/amps., 12 volt 1 A. 0-4 volt 2 A. Useful for Wireless, Model Trains, Chargers, etc., or as an 80-watt Auto Transformer 110/250 volts, 10/9 each. Guaranteed.

HIGH QUALITY INDUCTION MOTORS, New, 1-80 H.P., 230 v., 50-1, 1,500 r.p.m., 50/- p/p.

FILM PROJECTOR BY G.B. Type A.N. Sound or silent, pre-stage, sound head, lens, film boxes, 35 mm., no lamp-house. £30.

STRIP PROJECTOR. 35 mm. Complete in case. £6/10/-.

GOOD FILM for cutting into plate size, etc. guaranteed sound, very fast. Spools 8 1/2 in. by 47 feet, 12/6; ditto 8 1/2 in. by 24 feet, 7/6, p/p.

SELENIUM RECTIFIERS. Full wave, bridge connected, 6 or 12 v. output, 2i amps, 15/6; 4 amps. 25/-, Transformers to suit, 25/-, all p/p.

DITTO RECTIFIERS. 6 amps. 37/6; 8 amps. 50/-, Transformers to suit, 51/-, all p/p.

EX-NAVAL TWIN FLARE MOVING COIL SPEAKERS. 10 watt 45/-, carr. 5/-; Single Flare, 10 watt, 22/6, post 3/-.

MORSE SOUNDERS. Ex-G.P.O. As new, in case, 15/-.

THREE-PHASE TRANSFORMER. 110-400 volts. Step up or down. 2 KVA. New, double wound. £25.

Clients in Eire and Northern Ireland please ask for quotation as to carriage charges. The above charges apply only to England.

SPLENDID ODD BARGAINS FOR VISITORS.

OPEN ALL DAY SATURDAY

PLEASE PRINT YOUR NAME AND ADDRESS.

CASH WANTED, EXCHANGE, ETC. for second-hand tape recorders, amplifiers and Hi-Fi equipment. Top prices paid.—Sound Tape Vision (Dept. W.W.), 71, Praed St., London, W.2. Paddington 2807.

WANTED, BC610 Hallicrafters, E.T.4356 transmitters, BC512 receivers, BC221 frequency meters and spare parts for all above; best cash prices.—P.C.A. Radio, Beaver Lane, Hammersmith, W.6. [0079]

URGENTLY required, scrap platinum wire, contacts, etc.; spot cash for any quantity; £30 per oz. try.—The Scientific Metal Co., 50, Old Brompton Rd., London, S.W.7. Tel. Kni 2534.

WANTED.—Surplus and redundant stocks of aircraft radio, electrical and instrument equipment; details to—Stewart Aeronautical Supply Co., Ltd. Adastral House, Lowfield Heath, Crawley, Sussex. [6997]

URGENTLY wanted, manuals or instruction books, data, etc., on American or British Army, Navy or Air Force radio and electrical equipment.—Harris, 93, Wardour St., W.1. Gerrard 2504. [6263]

WANTED, good quality communication RYS tape recorders, test equipment, domestic radios, record players, amplifiers, valves, components, etc., estb. 18 years.—Call, send or phone Ger. 4538 Miller's Radio, 38a, Newport Court, Leicester Sq. W.C.2.

COMMUNICATIONS sets, TR1934, TR1935, TR1936, also carrier terminals S-4-DX, 1+1, 1+4, and 3CHDX, teleprinter and telegraph equipment on 5-hole system.—R. Gill-Fillan & Co., Ltd., 7, High St., Worthing, Sussex. Tel. Worthing 3081.

WANTED, signal generators, types TF144G, TF762A, TF867, frequency meters types BC221, TS174, TS175, also receivers types R1359 and R1294.—Send price and details to Hatfield Instruments, Ltd., Crawley Rd., Horsham, Sussex. Tel. Horsham 3232/3. [0037]

WANTED, tape recorders, domestic radios, amplifiers, record players, communications receivers; also the above taken in part exchange for new equipment; call, send or phone Gerrard 2613.—Radio Exchange, Newport Place (car park), Leicester Square, W.C.2. [0189]

PROMPT cash for the purchase of surplus stocks of televisions, tape recorders, radios, amplifiers, and domestic electrical appliances of every description; substantial funds available.—Spears, 14, Watling St., Shudehill, Manchester. Blackfriths 1916. Bankers Midland Bank, Ltd. [6696]

ALL U.S.A. V.H.F. test and communication equipment; TS174, TS175, TS47, B.C.221 freq. meters; receivers 1294, 1359; Hallicrafters S.27, S27CA U.S.A.; APR4 and tuning units TN16, 17, 18 and 19, RCA AR88D-LF, Hallicrafters SX228, valves 707A-707B, 2K29, 2K39, 2K35, 2K41; highest offers given by return.

Ger. 8410 and 4447—Universal Electronics, 22, Lisle St., Leicester Sq., London, W.C.2. [0229]

DYNAMOTORS, all D.C. in and out; type DI02 or similar, 13.5v 3.5amp in, 285v .075amps out, type DI01 or similar, 27v 1.75amps in, 225v 0.75amps out; type unknown or similar, 14v 10 amps in, 575v 16 amps out; type DM33A or similar, 28v 5amps in, 575v .16 amps out; type 29 or similar, 24v 16amps in, 1230v .2 amps out; also 2in square m/ammeter 100m/a FSD marked 0-300 MA6 Feed. Quotes required for quantities over 24, will take up to 200 of each item, if price is right.—Box 8107. [7039]

REPAIRS AND SERVICE  
MAINS transformers rewound, new transformers to any specification.

MOTOR rewinds and complete overhauls; first-class workmanship; fully guaranteed.

F.M. ELECTRIC Co., Ltd. Potters Bldgs., Warser Gate, Nottingham, Est. 1917. Tel. 47-58. [0113]

USE Jefco coil winder, cheapest machine on the market.—Details, 170, London Rd., Southend-on-Sea. [0174]

MAINS transformers, E.H.T.s, chokes, field coils, etc., promptly and efficiently rewound or manufactured to any specification.

LADBROKE REWIND SERVICE, Ltd., 320a, Herrow Rd., London, N.W.10. [0222]

TRANSFORMER rewind service mains, T.E.H.T. transformers and chokes, prompt delivery, range of replacement types ex-stock or manufactured to your specification.

RETROPOLIAN RADIO SERVICE Co., 75, Kilburn Lane, London, W.10. Ladbroke 2296.

D. C. BOUTLON for repairs to any loudspeaker; specialists on heavy and P.A. types; cone assemblies, field coils, repair accessories, pressure units, microphones; transformers, returned and to specification; motor rewinds.—134, Thornton Rd., Bradford, 1. Tel. 22338. [0171]

MISCELLANEOUS  
SURPLUS stock.

MEDICAL hypodermic syringes, 2cc, with two needles, ideal for delicate oiling, glueing, etc.; individually boxed, approximate value £1.00, 5/6 including postage; spare needles 6/- dozen.—Whetstone Luminations, 40, Stafford St., Liverpool, 3. [7054]

TAPE to disc; 12/6.—Mobile Recording Services, 5, New Brown St., Manchester [6555]

TAPE to disc, Queensway Recording Studios, 123, Queensway, W.2. Bay. 4992. Recorders serviced and for hire. [6994]

METALWORK, all types cabinets, chassis, racks, etc., to your own specification; capacity available for small milling and capstan work up to 1in bar.

PHILIPOTS METAL WORKS, Ltd., Chapman St., Loughborough. [0208]

# Armstrong

High Quality VHF Radiograms incorporating

- AF 105 10 watt push-pull amplifier
- 5 Wave bands including VHF
- Independent Bass & Treble boost and cut controls
- High Flux Speakers
- Wide range Pick-up



THE TWIN £74.16.6

The TWIN has been designed to suit the smaller type of room without sacrificing quality of reproduction. This has been achieved with a compact cabinet (31in. high, 27 1/2in. wide and 14 1/2in. deep) soundly constructed, and finished in elegant Walnut veneer. Twin 10in. P.M. Speakers give faithful reproduction, free from distortion and resonance, and the latest 4 speed COLLARO Auto-changer is fitted. The radio chassis is housed in a unique "hopper" arrangement permitting armchair control over all operations.



THE STANDARD £88.4.6

The STANDARD is a full size Radiogram (35in. high, 41in. wide and 19in. deep) constructed to give the best possible tonal quality, and fitted with an Adjustable Bass Reflex Chamber. It is beautifully finished in two tone Walnut, and has exceptionally generous record storage capacity (200 records). The other components have been selected to maintain this high standard. The Record Player is the latest COLLARO 4 speed fully mixing autochanger fitted with the Studio Turnover Crystal Pickup head. The Speaker is a 10in. GOODMAN P.M. having a very high flux density (12,000 lines).

DEMONSTRATIONS at our Holloway Showrooms every weekday (inc. Saturday) 9-6 p.m.

HIRE PURCHASE facilities are available.

ARMSTRONG WIRELESS & CO. LTD.  
Walters Road, London, N.7.

Telephone: NORth 3213

# DUODE SOUND UNITS NEVER DIE



Apart from their unique ability to give the most NATURAL sound you have ever heard, and to bring you lasting joy in your listening, Duodes are a very good investment!

No Duode, unless it is the victim of a really violent accident, ever dies! It can be brought up-to-date, to the latest Duode standards, at a fair and reasonable cost every few years, and even overseas this can be done on the spot. It can in most cases be repaired if a wire breaks, or in the extreme, very easily be fitted with a new frame assembly.

In fact, a Duode is that ideal we all look for—something which pays us first class dividends for years and keeps its value better than any comparable holding.

## DUODE-THE BEST LONG TERM SOUND INVESTMENT.

Write to-day for details from

### DUODE LTD.

3, Newman Yard, London, W.1

# LOCKWOOD

makers of

## Fine Cabinets

and woodwork of every description for the Radio and allied trades

### LOCKWOOD & COMPANY

(WOODWORKERS) LTD.

Lowlands Rd., Harrow, Middlesex. Byron 3704

# QUARTZ CRYSTAL UNITS



Type  
B7



The type B7 unit is mounted in the standard B7G valve envelope and is hermetically sealed and fully evacuated.

Available for the frequency ranges from 100 kc/s to 500 kc/s and from 3 Mc/s to 16 Mc/s. Gold electrodes applied by cathodic sputtering give permanence of calibration. Normal adjustment accuracy 0.01%, Max. adjustment accuracy 0.003%.

Early delivery can be given of some frequencies, and we will be pleased to quote for your specific requirements

### THE QUARTZ CRYSTAL Co. Ltd.

63-71, Kingston Road,  
NEW MALDEN, SURREY.

Telephone: MALden 0334 Cables, etc. QUARTZCO NEW MALDEN

### MISCELLANEOUS

**TAPE** to disc recording—LP (30 mins.), 25/-; 78's 12/-; 48-hour service: s.a.e. leaflet.—Marsh, Little Place, Moss Delph Lane, Aughton, Ormskirk, Lancs. Aug. 3102.  
**USE** Britain's oldest full-time tape/disc transfer service for LPs and Mark 78s (still 1952 rates).—Sound News Productions, 59, Bryanston St., London, W.1. Amb. 0091.

**SWITCH UNITS.** Type 270B, these beautiful electronic devices measure 14x7x6 approx. and contain a host of useful equipment, the main items being a precision double wound pot 4 1/2 in dia., 6 standard tropical pots, 4 Yaxley type switches, 3 P.O. lamp holders with bulbs, 2 toggle switches, 3 push switches, an assortment of knobs, multiway sockets, precision resistors, gear wheels, etc., etc., have cost pounds to manufacture; our special price 7/6; rail charge and packing, 5/- England and Wales only; wonderful value.  
**WALTON'S WIRELESS STORES,** 48, Stafford St., Wolverhampton, Staffs. [0145]

### NOTICES

**BRITISH SOUND RECORDING ASSOCIATION.** Details of membership, open to the professional sound recording engineer and all others interested in high quality reproduction and other branches of audio engineering, together with details of the London lecture programme and the Manchester, Portsmouth and Cardiff Centres, may be obtained from the Hon. Membership Secretary, H. J. Houlgate, A.M.I.E.E., 12, Strongbow Rd., Eltham, S.E.9. [0031]

### CAPACITY AVAILABLE

**CUT** wires, pins, special rivets, formed wires, manufactured to specification by Wire Products & Machine Design, Ltd., No. 18, Bridge Rd., Haywards Heath, Sussex, Tel. 1907.

**CHASSIS** work, instrument cases, embossed panels, in all usual metals. Special group-boards in S.R.B.P. etc. Long or short runs. Precision work at keen prices. Extensive range of stock tools for radio and electronics industry, special tooling at favourable rates.—Metalwork Dept., Unitelex (London), Ltd., Pagnell St., London, S.E.14. Tideway 5842. [6966]

### BUSINESS OPPORTUNITIES

**TELEVISION** aerial masts, rotatable on ball bearings, British Patent No. 772,926; sold with great success in Europe; Belgian factory seeks British firm with highest references for exclusive sale or manufacture under licence.—Write to Eilt, 40, rue de la Loi, Brussels, Belgium. [7024]

**WELL-KNOWN** firm of precision engineers and instrument makers (London area) are desirous of entering into a licence agreement or purchasing outright, patents relating to electrical and/or mechanical devices of a precision instrument character, or of a consumer goods nature; adequate capital and production facilities are available to produce and market suitable devices.—Communications should be addressed, in the first instance, to Box 7247. [6936]

### WORK WANTED

**ELECTRONIC** wiring, prototype or small batch work to A.I.D. standard, south-west district.—Box 8137.

**WORK** wanted, P.T.F.E. supplied and machined, A.I.D. approved.—Bel Sound Products, Marlborough Yard, London, Archway, N.19. [0187]

**TRANSFORMERS,** chokes, relays, etc., fabrication to electronic instruments design and production enquiries will receive prompt attention.—Box 7584. [6972]

**PRINTED** circuits: draughtsman will prepare black and white, assembly drawings, circuit and punching diagrams from your sketch layouts, very moderate charges.—Box 8094. [7037]

**CONSULT** us for prototype manufacture of anything electronic; we also have a television and electronic service laboratory. Enquiries invited.—Park Television Service, Ltd., 5, London St., W.2. Pad. 9618. [0215]  
**IMMEDIATE** capacity available for all sub-assembly work of all radio and electronic apparatus, tag panel wiring, cable forms, chassis assembly, etc.—Anglex Electric, 24, Manor Close, N.W.9. [7062]

### SITUATIONS VACANT

**STANDARD TELEPHONES & CABLES, Ltd.** DEVELOPMENT Engineers are required for development on a wide range of high frequency testing equipment associated with the design of telephone and television cables. Applicants must have practical experience of electronics, with advanced technical studies to degree or equivalent standard. Well-equipped laboratory with all facilities of a large organisation. Permanent pensionable position with generous benefits. Write career to date to Personnel Manager, Standard Telephones & Cables, Ltd., North Woolwich, London, E.16. [7002]

**OPPORTUNITIES** in Essex for Engineers and Draughtsmen.

**FIRST-CLASS** positions available for qualified Engineers in the design of Electronic Instruments or Constant Voltage Transformers, Power Supplies, etc.; there is also a vacancy for an experienced Designer-Draughtsman for the layout of Electronic Equipment.

**PROGRESSIVE** posts in a growing Company. ADVANCE Components, Ltd., Hainault, Essex. [7051]

**TECHNICAL** authors with knowledge of M.O.S. equipment required for electronic handbook.—Studio Irwin Technical, Ltd., 8, Brems Buildings, E.C.4. Chancery 4141. [6934]

# Fidelia

## HAND-BUILT EQUIPMENT

Our present range of high fidelity equipment includes the following models giving VHF/FM reception.

**Fidelia de Luxe.** An 11-valve chassis with 7-watt triode push-pull output stage, it has the normal wavebands plus VHF reception, an N.F.B. low distortion tone control circuit with separate bass and treble controls, C/R tuning indicator, etc. Price £33/12. (Little more than the price of a mass-produced chassis.)

**Fidelia Imperial.** VHF reception plus a high fidelity power amplifier, pre-amplifier and tone control unit. Input circuit to suit nearly all types of gramophone pick-ups, switched record compensation, separate bass and treble tone controls from low distortion N.F.B. circuit. 3 position steep cut filter. Available with alternative power amplifier units. Prices £32/10 and £37/10.

**Fidelia Major.** A 12-valve model. L.M.S. and VHF wavebands. Tuned R.F. stage on all bands, gramophone pre-amplifier for low impedance pickups. Separate 9-watt power amplifier. 20-20,000 cycle audio response. Price £44.

**Fidelia Standard.** 9 valves. The smallest unit of the Fidelia. AM/FM range, all the Fidelia features and a 6-watt output stage. £30.

Full technical details willingly on request.

Note. Existing Fidelia Hand-built chassis can be modified to give VHF reception.



ELECTRO  
Acoustic  
DEVELOPMENTS

2 AMHURST ROAD,  
TELSCOMBE CLIFFS,  
Nr. Brighton,  
SUSSEX

Tel.: Peasehaven 3166

## PRECISION SHEET METALWORK

We specialise in manufacturing of Chassis in all metals, large or small quantities to your own specifications.

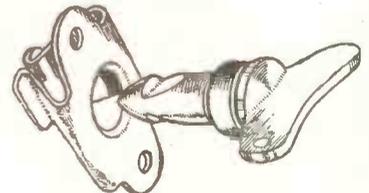
### V. W. BEAMISH

Shardeolos Garage, Shardeolos Rd., New Cross  
London, S.E.14.

Telephone: TIDeway 4795

# ODDIE FASTENERS

Pat. 507249



THIS FASTENER WITH ENDLESS APPLICATIONS—SIMPLE—POSITIVE SELF-LOCKING. MADE IN A VARIETY OF TYPES AND SIZES. SPECIAL FASTENERS TO SUIT CUSTOMERS' REQUIREMENTS. WIDELY USED IN THE RADIO INDUSTRY.

Illustrated brochure and other information will be gladly sent on request. DEPT. "W.W."

Oddie, Bradbury & Cull Ltd., Southampton  
Tel.: 55883 Cables; Fasteners, Southampton

**B**ENSON'S  
BETTER  
ARGAINS

**BUILD A CAR RADIO, CHEAPLY & SIMPLY**

The basis is the Command Receiver tuning 0.52-1.5 mc/s. (medium wave), comprising RF 12SK7, FC 12K6, 2x IF 12SK7, Demod/amp. 12SR7, Output 12A6. Size 11 x 5 1/2 x 5 1/2 in. New, black crackle finish. Price list: brand new receiver, with valves 97/6; miniature speaker trans., 4/6; gain potentiometer, with switch, 3/6; speaker jack 1/6; jack-plug 1/6; speaker, 5in., 18/6; dynamotor (filings) 2s. v. 10/6; or non-fitting 12 v. Input, 10/6. Modification data and circuit diagram 1/6. Total £7/2/- (postage 5/-). Transformers: Vibrator 12-0-12 v. to 300 v. 100 mA., potted, 10/6; VIBRATORS. Malloy G620C 12 v. 4 pin. 7/6. THERMOT MICS, new, 2/6. COMMAND RXS. Brand new, with valves. 1.5-3.0 mc/s., 55/-; BC454. 3-6 mc/s., 45/- (post 3/-). Flex. Drives for these 7/6. Condensers, var. spindled ceramic, 16, 25 or 50 pfs. 1/3; 76 pfs. 1/6; butterfly 25 pfs. 1/6. SUPPRESSORS, radio interference, ex-A.M., 5/6 (post 2/-). BRAND NEW RF25, 27, 27/6 (postage 2/6); RF25, 10/6. DYNAMOTORS (post 3/-): 12 v. to 250 v. 65 mA., and 6.3 v. 2.5 A., 10/6. EDDY-STONE, 12 v. to 190 v. 76 mA., cased, 15/- 11 v. to 300 v. 200 mA., cased, 15/- (carr. 2/6). METAL RECTIFIERS: 700 v. 50 mA., 9/6. 500 v. 500 mA., 10/6. 240 v. 30 mA., 3/6. 1,300 v. 30 mA., 7/6. RL155 Coilpacks, used, 9/6. RL155 S.M. Tuning DRIVES "N" type, brand new, 10/6. CHOKES, L.F. Ferranti, 10H, 120 mA., Screened, 7/6. 10H, 200 mA., 8/6; 5H, 200 mA., 4/6. "C" core 10H, 130 mA. 12/6. VIBRACAGES, 12 v. to 150 v. 30 mA., smoothed, filtered, 12/6; 2 v. to 480 v. and 150 v. (dual-vibrator), smoothed, filtered, 25/- (post, each, 3/-). BOND TESTERS (Record). 0-0.1Ω, 30/- . POWER PACKS, input A.C. 230 v. Outputs 150 v. 16 mA. D.C. and 4 v. 1.1 A., A.C., 17/6 (P.P. 3/-). Be/Lease spigoted plugs, 6 pin, Fern. 64; mated 7 pin, 1/6 pf., 10 way, 2/6. SWITCHES, water; 1 pole 6 way, 1 bank, 1p 11w 1b, 1p 8w 1b, 1 p 3w 3b, 2p 3w 2b, 4p 2w 1b, 1p 6w 5b, 1p 6w 2b, 2/6; 1p 11w 2b, 6p 2w 4b, 3/6. CERAMIC-SP4W2B, 2P5W1B, 4/6. Stud type, 1p 10w 2b, 4/6 Stud. Winder-Painton type 1P24W2B, 7/6. Transformers: "C" core: 230 v. In outputs: 316-0-316 v. 60 mA., 5 v. 2 a., 6.3 v. 1.5 a., 20/- (p.p. 3/-). 285/315 v. 350 mA., 790/850 v. 480 mA., 40/- (carr. 7/6). Potentiometers, w/wound 20k, 3 1/2 in. dia., ceramic, 4/6. List and enquiries, S.A.E. please! Terms: C.W.O. Postage extra. Immediate despatch.

Callers and post: W. A. BENSON (WW),  
136, Rathbone Road, Liverpool, 15. S.F.F. 6853  
Callers: SUPERAUDIO (W)chapel LTD.,  
116, Whitechapel, Liverpool, 2. ROY 1130

All the  
experts  
use —

**HENLEY**  
**SOLON**  
ELECTRIC SOLDERING IRONS

- ★ Reliable
- ★ Speedy
- ★ Long-lasting



65 watt round pencil bit

A model for every purpose

Leaflets on request from  
**W. T. HENLEY'S TELEGRAPH**  
**WORKS CO. LTD.**  
51-53 Hatton Garden, London E.C.1  
Tel: CHAncery 6822

FOR 25 YEARS THE BEST

**SITUATIONS VACANT**  
INSTRUMENT mechanics are required by

THE United Kingdom Atomic Energy Authority, Industrial Group, at Windscale Works, Sellafield, and Calder Hall Works, Calderbridge, Cumberland.

DUTIES cover maintenance of instrumentation in reactors and chemical plants, plus a wide range of specialised electronic equipment. CANDIDATES must be experienced in industrial instrumentation or electronics, either through apprenticeship or equivalent training.

TRAINING in maintenance of specialised instruments will be provided as necessary. BASIC pay for a 44-hour week is 189/-; additional payments of 50/-, 35/- and 14/- are made according to grade of work.

MARRIED applicants living outside daily travelling distance of the works will be given consideration for housing within a reasonable period after recruitment.

APPLICATIONS, giving details of qualifications and experience, to the Works Labour Manager, Windscale Works, Sellafield, Calderbridge, Cumberland. [7029]

**WEST SUFFOLK EDUCATION COMMITTEE**

**BURY ST. EDMUNDS Technical Institute.**  
GRADE A Assistant required for September, 1957, to teach initially 1st year City and Guilds Radio Service Work and eventually all subjects in the Course to Final level. Preference will be given to a person qualified to teach also to Final City and Guilds Television Servicing. Whilst the Course is developing the person appointed will be expected to teach some of the subjects, such as Science, Maths and/or Drawing, in the Senior Craft Courses. Salary £475 X £25 to £900 per annum. Forms of application and further details obtainable from the undersigned (stamped foolscap envelope) to whom they must be returned as soon as possible.

R. F. A. CARTER, M.A.,  
CHIEF Education Officer,  
MANOR HOUSE,  
BURY St. Edmunds. [7028]

**NEW ZEALAND Civil Aviation Administration.**

The Civil Aviation Administration of New Zealand has several vacancies for Radar technicians; applicants should have had recent experience in the maintenance of S and X band ground radar equipment. Appointees will be required to undergo a few months' training in the United Kingdom in the operation of radar equipment of the type to be installed in New Zealand; the minimum qualification for the post is the 1st Class P.M.G. Certificate, City and Guilds Radio 2 and Tels 2 or equivalent, salary payable on appointment will be up to £700 per year depending on experience and qualifications with advancement on merit to £820 a year, and thereafter promotion is by competition for advertised posts; salary will be paid from commencement of training in the United Kingdom.

FURTHER information and application forms may be obtained from the High Commissioner for New Zealand, 415, Strand, London, W.C.2, mentioning this paper and quoting reference No. 5/47/66; completed applications to be lodged not later than 8th. 1957. [6963]

APPLICATIONS are invited for pensionable posts as **EXAMINERS** in the **PATENT Office** TO undertake the official scientific, technical and legal work in connection with Patent applications.

AGE at least 21 and under 35 years on 1st January, 1957, with extension for regular Forces' service.

CANDIDATES must have (or obtain in 1957) 1st or 2nd Class Honours in Physics, Organic or Inorganic Chemistry, Mechanical or Electrical Engineering or in Mathematics, or an equivalent qualification, or have achieved a professional qualification, e.g., A.M.I.C.E., A.M.Ech.E., M.I.E.E., A.R.I.C. For a limited number of vacancies candidates with 1st or 2nd Class Honours degrees in other subjects—scientific or otherwise—will be considered. Exceptionally candidates otherwise qualified by high professional attainments will be considered.

STARTING pay for 5-day week of 42 hours in London between £605 and £1,120 (men) according to post-graduate (or equivalent) experience and National Service. Maximum of scale £1,345. Women's pay above £605 slightly lower but is being raised to reach equality with men's in 1961. Good prospects of promotion to Senior Examiner rising to £2,000 (under review) and reasonable expectation of further promotion to Principal Examiner.

APPLICATION form and further particulars from Civil Service Commission, Scientific Branch, 30, Old Burlington Street, London, W.1, quoting S123/57 and stating date of birth. INTERVIEW Boards will sit at intervals, as required. Early application is advised. [7032]

**LABGEAR OF CAMBRIDGE** announce the following vacancies:—

- (1) TEST gear (Radio and T.V) designer.
  - (2) TEST gear engineer with a flair for writing service manuals, etc.
  - (3) Draughtsman for service manual illustration work.
- THE posts are permanent for the right men and offer attractive remuneration with plenty of prospects for advancement.—Apply, giving relevant personal history, to: The Technical Director, Labgear (Cambridge), Ltd., Willow Place, Cambridge. [6988]

for  
use  
with  
KT 88



**TRANSFORMER**  
**TYPE 4N1**

Capable of full output of 50 watts  
from 25~ to 35,000~

**PRIMARY**  
6,000Ω C.T. tapped 43% and 25%.

**SECONDARY**  
0.45Ω, 1.8Ω, 4Ω, 7Ω, 11Ω, 22Ω  
and 30Ω to handle 50 watts.

**Approximate characteristics:**  
Primary resistance: 50Ω+50Ω.  
Primary inductance: 50 Hys.

**Leakage Reactance:**  
Primary to secondary: 6 m/Hys.  
Half primary to secondary: 3 m/Hys.  
Half primary to half primary: 6 m/Hys.

**Open type:**  
5 1/2 in. x 4 1/2 in. x 5 3/4 in. high.  
Fixing Centres: 4 3/8 in. x 3 3/4 in.  
Weight: 14 1/2 lbs.

**Potted type (Hammer Grey finish):**  
5 in. x 5 1/2 in. x 6 1/2 in. high.  
Fixing Centres: 3 3/4 in. x 5 in.  
Weight: 15 lbs.

Transformer type 4N1 is designed to handle 50 watts in the Ultra Linear Circuit where cathode bias is employed.

A 100w. model is available if required.

**SAVAGE**  
**TRANSFORMERS LTD.**

DEVIZES, WILTS.

Tel.: Devizes 932.

*Excellence in design..*

Specialists in Sub-miniature Telecommunication Components.



Actual Size (Approx.)



**TEMPATRIMMER**

Nominal capacity 6.5pF—Temperature Coefficient continuously adjustable from + 2000 to - 2000 parts per million per degree Centigrade. Length 1.31" Width .670" Height .5"

Details from—

**OXLEY**

**DEVELOPMENTS CO. LTD.**  
**ULVERSTON, NORTH LANCs**  
Tel: ULVERSTON 3306

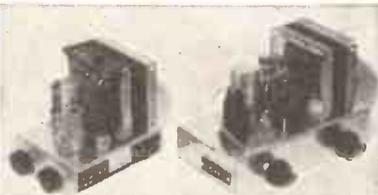
**COVENTRY RADIO COMPONENT SPECIALISTS SINCE 1925**

We have now trebled the size of our premises in order to supply a larger range of Components, Amplifiers and HI-FI Equipment.

Send your enquiries to:

**189-191, DUNSTABLE ROAD, LUTON, BEDS.**

New Telephone No.:— LUTON 7388-9



**3-VALVE QUALITY AMPLIFIERS**

Suit modern crystal P.U.s; for 200-250 v. A.C.; neg. feedback, volume and tone controls; new Components and PLAYING TESTED.

B7g £4/7/6, INT. OCTAL £4/2/6, B9A £4/12/6. Carr. 3/6 all types.

**E.K.E. 47, Arksey Lane, Bentley, Doncaster**

**SITUATIONS VACANT**  
**PETO SCOTT ELECTRICAL INSTRUMENTS, Ltd.,** Adlestine Rd., Weybridge. THERE are vacancies for several experienced engineers with suitable qualifications for the design of domestic television receiving equipment, or transmission equipment, as appropriate to their experience. GOOD salaries are offered and employment would be at our Weybridge Factory, where there are excellent working conditions and all normal facilities; there is an adequate train and Green Line service and many local housing projects for those who are interested in living in the neighbourhood.

**APPLY:** Chief Engineer. [7030]  
**R**ADIO and television engineer, permanent position.—Hamnants, Henley-on-Thames. [7022]

**A** YOUNG design project engineer is required for the development of production machine tool sub-units. APPLICANTS should have drawing office experience as well as practical knowledge of simple electronic and pneumatic servo systems, and should be capable of carrying out design work and progressing it through the initial development stages. PLEASE apply stating age, qualifications and salary required to:

THE Technical Director, English Racing Automobiles, Ltd., London Rd., Dunstable. [7058]

**T**ELEVISION Engineers, the drive, required by leading Murphy dealers' permanency, first class salary and conditions.—Singer's 211, Kilburn High Rd., N.W.6. Mal. 6408. [6222]

**F**ULLY experienced technical author required in City office to lead and expand a section preparing servicing literature for electronic equipment.—Write giving details of career and salary required to Box 8119. [7041]

**A**UDIO Engineers required for progressive positions in expanding organisations; men with experience of development test and service work apply to Personnel Manager, E.A.R., Ltd., The Square, Isleworth. Tel. Hou. 6256. [7053]

**D**RAUGHTSMAN required for layout of electronic instruments. Experience and ability to work with minimum of supervision essential. Good salary and excellent opportunity for advancement in expanding company. LABORATORY Assistant (Male and Female) required for carrying out physical projects associated with electronic components. Scope for ideas and initiative. Good salary and excellent prospects for rapid advancement.

**ELECTRONIC** Engineer required for development of instruments. Scope for ideas and initiative. Good salary and excellent prospects for rapid advancement.

**RIVLIN** Instruments, Ltd., Doman Rd., Camberley, Surrey. Tel. Camberley 2507-8. [7003]

**ELECTRONIC** Engineers or Physicists required for basic study projects concerned with communications, microwave and new modulation methods, at the company's new research laboratories.

THE work is novel and provides opportunities for initiative and original thought.

APPLICANTS should possess a good honours degree or equivalent and preferably have had some years' experience of research or development in the field of electronics.

SALARY according to qualifications and experience up to £1,300 per annum.

APPLICATIONS, stating age, qualifications and experience, to The Administrative Officer, The Plessey Co., Ltd., Roke Manor, Romsey, Hampshire. [6986]

**ELECTRONIC** Wireman Fitter required for production and prototype work in small factory; house available.—Write, with full details, to Hirst Electronic, Ltd., Gatwick Rd., Crawley, Sussex. [7035]

**A** SENIOR appointment is now available for a Production Engineer to take the production of special purpose electronic valves from pilot line stage to eventual large-scale manufacture.

PREVIOUS knowledge of valve manufacture is not essential, but considerable knowledge and experience of the production of small intricate devices would be a distinct advantage.

THE successful applicant would be required to have a minimum of H.N.C. standard, knowledge and experience in the organisation, build up and running of a production unit, engineering workshop practice, quality control, application of incentive, and would be expected to undergo a period of training on the existing pilot line.

THE post is permanent and pensionable; a generous commencing salary will be paid, with excellent prospects for advancement.

APPLY in writing to: The Managing Director, Leigh Electronic Developments, Ltd., New Lane, Havant, Hants. [7019]

**SUPERVISOR** required by leading manufacturer of high quality loudspeakers and microphones, previous experience in this field and ability to control female staff essential; full particulars and wages required.—Box 8134. [7045]

**INDUSTRIAL** Electronics Lab. Assistant; staff appointment open for keen and capable man; varied and interesting work in small factory; house available.—Write, with full details to Hirst Electronic, Ltd., Gatwick Rd., Crawley. [7034]

**T**ELEVISION development engineer (senior) with administrative experience required, capable of carrying out development projects with minimum supervision up to production stage.—Write giving full personal details, Chief Engineer, Rediffusion (Wired Radio Service, Ltd.), Fullers Way, Chessington, Surrey. Tel. Elmbridge 5524. [6875]

**NEW S.T.C. AND "WESTALITE" SELENIUM RECTIFIERS.** Largest L.T. range in Great Britain. Latest Current Products. NOT Surplus.

**REDUCED PRICES (1st APRIL)**

**S.T. & C. E.H.T. K3/15, 4/9; K3/45, 8/10; K3/50, 9/4; K3/100, 15/10; all post 4d. extra.**  
**BRIDGE CONNECTED FULLWAVE.**  
17v. 1a., 12/8; 1.5a., 25/-; 2.5a., 31/-; 3a., 29/-; 4a., 35/-; 5a., 36/6; all post free.  
33v. 0.6a., 21/3; 1a., 21/9; 1.5a., 43/-; 2a., 51/-; 3a., 51/-; 4a., 61/-; 5a., 65/-; all post 1/6.  
54v. 1a., 31/6; 1.5a., 59/-; 2a., 70/-; 3a., 70/-; 5a., 92/-; 72v. 1a., 40/-; 1.5a., 74/-; 2a., 90/-; 3a., 90/-; 5a., 118/-; 100v. 1a., 58/-; 1.5a., 106/-; 2a., 128/-; 3a., 128/-; 5a., 172/-; all post 1/10.

**BRIDGE CONNECTED WITH 7 1/2 in. SQUARE COOLING FINS.** 17v. 6a., 51/-; 10a., 58/-; post 2/3.

**BRIDGE CONNECTED HEAVY DUTY FUNNEL COOLED OR 7 1/2 in. SQUARE COOLING FINS.** Both types, same price.  
17v. 12a., 90/-; 20a., 114/-; 30a., 164/-; 50a., 265/-; 33v. 6a., 85/-; 10a., 98/-; 12a., 168/-; 20a., 194/-; 54v. 6a., 118/-; 10a., 138/-; 72v. 6a., 152/-; 2a., 178/-; 100v. 6a., 217/-; 10a., 255/-; all post 3/-.

**REVISED PRICES (7th FEB)**

**"WESTALITE" (BRIDGE).** 12-15v. D.C. 0.6a., 12/-; 1.2a., 30/-; 2a., 32/6; 2.5a., 49/-; 3a., 37/6; 10a., 64/6; 20a., 117/6; 30a., 171/-; 50a., 278/-; 24v. 1.2a., 30/-; 2.5a., 49/-; 5a., 60/-; 10a., 109/6; 20a., 208/-; 36v., 1.2a., 47/6; 2.5a., 84/-; 5a., 82/6; 10a., 154/6; 100v. 1.2a., 82/6; 2.5a., 154/6; 5a., 195/6; 10a., 391/-.  
All post extra from 1/6-3/-; E.H.T. Rects., LAD134, 25/-; 36EHT60, 35/10, post 4d. 1 m.a. A.C./D.C. meter-rects., 14/6.

Wholesale and Retail

Special Price for Export and Quantity

**T. W. PEARCE**

66 Great Percy Street, London, W.C.1  
Off Pentonville Road. Between King's Cross and Angel

**METERS**  
All types  
Any make



Single and Multi-range repaired and recalibrated

We can convert or supply meters to your requirements.

PROMPT DELIVERY

**E.I.R. INSTRUMENTS LTD.**

329 Kilburn Lane, London, W.9.

Tel.: LADbroke 4168

**Morse Code operating as a PROFESSION**

The essential qualification of a Radio Officer at sea, in the air or ashore is EXPERT MORSE OPERATING. The Candler method of teaching Code is known the world over.

45 years of teaching Morse Code is proof of the efficiency of the Candler system.

Send 2d. stamp for Payments Plans and full details of all Courses.

**THE CANDLER SYSTEM CO.**

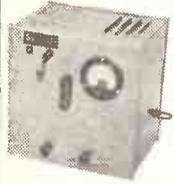
(55W) 52b ABINGDON ROAD, LONDON, W.8

Candler System Co., Denver, Colorado, U.S.A.

**"AUTOMAT" CHARGERS and POWER PACKS**

as supplied to Ministries; Airlines Co.s, etc., up to 600 watts. Correct design, best materials and workmanship.

Selenium rectifier stacks, 40 ma. to 10 amp., with or without transformers.



**"AUTOMAT" SELF REGULATING CHARGERS**  
"Export" model as illus. for 6 v./12 v. 5 amps. using S.T.C. selenium rectifier, damp-proof, ultra reliable. £ wt. 16lb., for 215/245 v. A.C., £6/5/- Carr. 4/6 extra. Gtd. 12 months. Also our well-known 12 v. 3 amp. charger with protective ballast and glow indicator, 69/6, ditto, 6 v. 2 amp./12 v. 2 amp., 69/6.

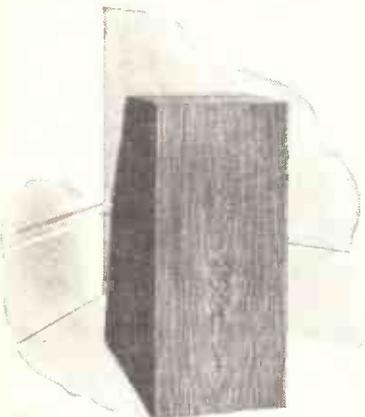
ditto, 12 v. 1 amp., 42/6, postage 1/10, wt. 8lb.

**FOOLPROOF CHARGER KITS.** Genuinely trouble free and ultra reliable. As sold for 11 years through "W.W." with full data sheet and instructions. No. 1 Kit. Westalite 3 amp. rectifier, 65 watt tapped, impregnated trans., ballast bulb, for 2 v., 6 v., 12 v. charger, all rectifier troubles eliminated, 46/-, p.p. 1/10. Handsome steel case, ready punched, louvred, enamelled, 12/6. No. IA Kit. 3 a. rectifier, 65 watt. trans., ballast res., ammeter for 2 v., 6 v., 12 v., 3 a., 52/6, p.p. 1/10. No. 2 Kit. 12 v. 2 amp. rect., 46 watt trans., ballast/indicator bulb for 2 v., 6 v., 12 v. charger, 36/6. Case 12/6, p.p. 1/10. Wt. 8lb. with case. Minor Kit, 6 v. 2 amp., 32/-, p.p. 1/10, case 12/6 extra. Senior Model, for 6 v./12 v. at 4 to 5 amp., 12 v. 5 amp. S.T.C. rect., 85 watt trans., ballast bulb, 64/-, p.p. 2/- Slider Kit, 130 watt trans., 14 v. 6 amp. large finned type rect., slider res., high grade ammeter, wt. 17lb., for 6 v./12 v. charger, 24/13/-, carr. 4/-.

**SELENIUM RECTIFIERS,** new stock not surplus, 6 v., 1 a., 4/-, 2 a., 7/6, 4 a. 15/-, 12 v. 0.5 a., 5/-, 1 a., 7/6, 2 a., 9/6, all p.p. 6d. 12 v./14 v. 3 a., to 3.4 a., 15/6, 5 a., 27/-, Large finned 6 a., 32/-, p.p. 10d. 24 v., 50 mA. 2/9. 24 v. 0.3 a., 9/-, 1.5 a., 15/-, 3 a., 27/-, 5 a., 42/-, 8 a., 62/-, all p.p. 10d. 50 v. 1 a., 24/-, 2 a., 27/-, 250 v. 1 a., 97/-, p.p. 1/8. H.T. rectifiers 120 v., 30 mA. R.M.2, 3/4, 135 v. 30 mA. elim. 5/8, 250 v. 60 mA., 7/-, 250 v. 100 mA. bridge, 14/6. All p.p. 6d. Many other L.T. and H.T. types in stock.

**CHAMPION PRODUCTS**

43, Uplands Way, LONDON, N.21. Phone: LAB 4457.



**Davey**

**CORNER REFLECTOR Loudspeakers**

At once the most civilised and the most natural way of listening. No ugly speaker apertures or grilles to be seen from any part of the room. Source of music widely diffused and well up in the air, with a strong sense of perspective, just as it comes from the concert platform.

Six types of cabinet made to order to house every good multiple or single speaker system.

**EMG HANDMADE GRAMOPHONES LTD**

6 Newman Street London W1 MUSeum 9771

**SITUATIONS VACANT**

**T**ECHNICAL Writer for preparation of operating manuals, testing procedures and technical bulletins in connection with electrical and electronic instruments, facsimile transmission equipment and servo-mechanisms.

**A**PPLICANTS should have an aptitude for this specialised form of writing, together with technical qualifications equivalent to H.N.C. Experience with light mechanisms is desirable. Salary commensurate with qualifications and experience. Ideal working conditions. Pension Social and sports facilities. Modern canteen.—Please write, giving full details, to Muirhead & Co., Ltd., Precision Electrical Instrument Makers, Beckenham, Kent. [6989]

**S**ENIOR engineer required for research and development work on magnetic amplifiers, transistors and electronics, with particular reference to aircraft and guided weapon applications.—Full particulars of qualifications, experience and salary required to Box 7922. [7008]

**T**RANSFORMER designer required for a small but expanding company, successful applicant must have experience in power transformers up to 50 K.V.A., pulse and electronic transformers, etc.; top salary to first class man.—Apply in writing to Works Manager, Ampco Ltd., Reading, Berks. [7012]

**E**LECTRONIC Engineers required for work on Transistor circuitry and other projects. The minimum qualification for senior post H.N.C. or equivalent. For junior post, O.N.C., but consideration will be given to advanced student of special ability. North London district.—Box 8122. [7043]

**P**YE, Ltd., Radio Works, Cambridge, invite applications for positions as technical dealers to compile maintenance handbooks dealing with radio equipment; applicants must possess command of English and some technical knowledge.—Applications in writing to Personnel Officer. [6843]

**G**RAMOPHONE record changers. Production Foreman required by company engaged in the manufacture of record changers, N.W. London area; initiative and drive essential, and only those who have had a thorough experience in this type of production need apply.—Box 8003. [7018]

**I**STRUMENT Technician required; knowledge of metal work, drawing and electronic circuit reading; salary in the range £380 to £545, according to age and experience, plus London Weighting.—Apply to R. H. Young, Laboratory Superintendent, Organic Chemistry Laboratories, Imperial College, London, S.W.7. [7056]

**D**EVELOPMENT engineers required for work on communications, test, and industrial control equipment; applicants should have H.N.C. or degree and previous experience in one of the above fields; permanent, pensionable positions.—Apply to Personnel Officer, Airtec Ltd., High Wycombe, Bucks. [7023]

**I**STRUMENT Fitter required for development stages and production; experience in instrument assembly and wiring, precision fitting and machining, and reading of drawings desirable; minimum age 24.—Apply Personnel Manager, Southern Instruments, Ltd., Frimley Rd., Camberley, Surrey. [7015]

**A** PROGRESSIVE radio and T.V. manufacturer wishes to engage an Engineer for the Testgear Department; the post is interesting and opportunity will be given to suitable applicants for some original development work; salary will be commensurate with qualifications and experience; persons without relevant experience need not apply.—Apply Personnel Officer, Radio Works, Parkhurst Rd., Holloway, N.7. [7050]

**S**ALES engineer required for interesting post. With excellent opportunities, should be capable of making sales contacts at high level in telecommunication field at home and overseas supervising systems, practical surveys and installations.—Apply to Personnel Officer, British Communications Corporation, Ltd., Exhibition Grounds, Wembley. [6990]

**M**ALTA.—Murphy radio distributor in Malta Applications in attractive terms to radio and T.V. Service Engineer; interviews will be held in Welwyn Garden City and applications giving full details of age, experience and qualifications should be forwarded for consideration to Personnel Department, Murphy Radio, Ltd., Welwyn Garden City, Herts. [7042]

**P**ROTOTYPE Wireman required for interesting work on modification and installation of complex electronic equipment; ability to read and work from circuit diagrams essential; knowledge of relay circuits and adjustments an advantage; able to work without supervision.—Apply Personnel Manager, Southern Instruments, Ltd., Frimley Rd., Camberley, Surrey. [7014]

**P**YE TELECOMMUNICATIONS, Ltd., Ditton Works, Cambridge, have vacancies for both junior and intermediate engineers, experienced in V.H.F. and H.F. transmitter development; these vacancies offer permanent and progressive employment to higher grade.—Applications, which should give full details of past experience, etc., should be addressed to the Personnel Manager. [6933]

**I**LFD, Ltd., require a University Graduate (27 to 37) for research on the use of electronics in photography; a knowledge of television circuit techniques and the principles of colour television and photography will all prove useful; the essential requirements are a Degree in Physics or Electrical Engineering, experience in electronics and a flair for research work from circuit practical results; successful candidates will work with a senior research engineer in the Physics Research Laboratory at Brentwood, Essex. Apply in writing to Research Director, Ilford, Ltd., Ilford, Essex. [7059]

**DEPENDABLE RADIO SUPPLIES LIMITED**

12a TOTTENHAM STREET, W.I.  
(2 minutes Goodge St. Station)  
opp. Heals in Tott. Ct. Rd.)  
Phone: LANGHAM 7391/2  
Hours of business 9-6

**SPECIAL OFFER WHILE STOCKS LAST**

**TANNOY LOUD HAILERS EX-GOV.**



Impedance 7½Ω  
Handling cap. 8 watts  
price 29/6, post 3/6.

**807 VALVES**

Individually boxed

5/- each

Special price for quantity

**SPECIAL OFFER**

Balanced twin Aerial Feeder Cable 100Ω per foot. Suitable for V.H.F., F.M., RADAR, etc. At fraction of cost.

**OUR PRICE 6d. per yard**

in coils of 200/400 yards.

Small quantities add 20%.

**BRAND NEW TAPE RECORDER MOTOR AT HALF MANUFACTURER'S COST**

Single phase motors suitable for tape recorders, radiograms, workshops, etc., etc. Has many uses. Reversible 200-230 v., 5in. oz. torque, 1,400 r.p.m. Capacitor start. Weight 4½lb. Length overall 5in., spindle both ends, 2in. x 1/4in., 3in. x 1/4in. Price, inc. P. & P. and capacitor, 55/-.



**SIEMENS HIGH SPEED RELAYS**

Twin 1,700Ω	} BRAND NEW
" 1,000Ω	
" 250Ω	

Price on application.

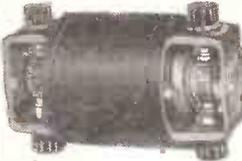
**HEADPHONES. SPECIAL OFFER**

D.L.R.2 low resistance balance armature complete with band and plugs. Price 10/6 each. P.P. 1/6.

D.L.R.5 BALANCED ARMATURES 3/6 ea. or £2 per doz. P.P. 1/- ea. or 4/- doz.

**ROTARY TRANSFORMERS**

Delivery Ex stock. Quotations on application.



H.T. 31  
Input 11.5 v.  
Output 250 v. at 125 mA.

H.T. 32  
Input 11.5 v.  
Output 490 v. at 65 mA.

**AMERICAN DYNAMOTORS**

Price 37/6 ea. P. & P. 2/- D.C. Input 27 volts at 1.75 amps. D.C. Output 285 volts, .075 amps. Can be supplied in 12 volt at extra cost.

**BLOWER MOTORS**

(6-12 or 27 volt)  
Complete with blower 22/6.

P. & P. 2/6.

See our Jan. issue for more detailed stocks



**CABINETS for EQUIPMENT, SPEAKERS and RECORDS**



The "SHANKLIN"

36in. wide, 35in. high, with choice of Motor Boards either (A) 35 x 14in. or (B) 16 x 14in. and control panel 16 x 12in. as shown. Amplifier compartment and L.P. record storage in lower section. Price £15/15/- or 47/- Deposit and 9 payments of 32/- monthly. Supplied in Oak, Walnut and Mahogany veneers finished to required shade. Delivery England and Wales 12/6 (Scotland, N. Ireland and Channel Isles 25/-).

WRITE FOR CATALOGUE.

**A. L. STAMFORD,**

(Dept. M.4), 20, College Parade, Salisbury Road, LONDON, N.W.6.

**TANNOY**  
SOUND EQUIPMENT

Tells you what's going on clearly

WEST NORWOOD · S.E.27  
Telephone: GIPsy Hill (131 7 lines)

"DIPLOMA" HEADPHONES



Lightweight High Resistance (4,000 ohms). Complete with cord.

17/6

Ideal for CRYSTAL SETS  
The 'TYANA' Standard Soldering Iron



- Adjustable Bit.
- Weight approx. 4 oz.
- Heating time 3 min.
- 40 Watt economy Consumption.
- Standard Voltage Ranges.

16/9

Replacement Elements and Bits always available

**KENROY LIMITED**  
152/297 UPPER ST., ISLINGTON,  
LONDON, N.1

Telephone: CANonbury 4905-4663

**SITUATIONS VACANT**

SENIOR design draughtsmen required for mechanical design work on radio and television receivers from initial prototype stage to issue of manufacturing drawings; technical qualifications and previous experience on radio and television desirable but not essential; good salary and prospects; 37½-hour week.—Apply to Personnel Officer, McMichael Radio, Ltd., Vixham Rd., Slough, [70198]

THE GENERAL ELECTRIC Co. have a vacancy in their valve and electronics department for a young man with basic knowledge of electronics having G.C.E. Advanced or equivalent certificate, to assist in handling technical enquiries and preparation of technical literature.—Apply in writing to Staff Manager, Magnet House, Kingsway, London, W.C.2. [7010]

ELECTRONICS Technician.—Senior Technician required to take charge of instrument room and care of instruments in the inorganic and physical chemistry laboratories; salary in the range £560-£660, plus London Weighting.—Write, stating experience and qualifications, to the Departmental Superintendent, Chemistry Department, Imperial College, London, S.W.7. [7055]

UNIVERSITY OF LEEDS.—Electronics technician required for maintenance and constructional work in chemistry department's workshop, suitable for services-trained radio/radar personnel; salary on university scale; starting point dependent on age and experience.—Write giving full details of training and experience to Mr. A. W. Walton, Chemistry Department, [7006]

ELECTRONIC section at new and expanding research laboratories near Cambridge has vacancy for which experience in circuit development is essential; a Degree or Higher National Certificate is desirable; salary according to qualifications and experience.—Application form and further details from the Secretary, Investments Research Laboratories, Hinxtion Hall, Cambridge, quoting Reference No. 134. [7057]

RADIO technicians required by International Aeradio, Ltd., for overseas service; permanent and pensionable positions; salaries from £894 per annum to £1,373 per annum, tax free, according to marital status; free accommodation; kit allowance; free air fares; generous O.K. leave.—Qualified candidates, to whom replies only will be sent, please write, quoting RT to Personnel Officer, 40, Park St., W.1. [0262]

ELECTRONIC engineers or physicists required for rapidly expanding research department; experience of pulse techniques or ultrasonics desirable but not essential; the work is varied and interesting and offers scope and opportunities for people with initiative, B.Sc. or H.N.C. standard, pension scheme.—Write giving details of age, experience, salary required, etc., to Ultrasonoscope Co. (London), Ltd., Subourne Rd., London, S.W. [6662]

THE NATIONAL CASH REGISTER Co., Ltd., have recently entered the field of electronic computation and require qualified electronic engineers and technicians of all grades. Senior men will be offered four-figured salaries. Experience of electronic computers not necessary.—training will be given. Bonus, Pension and Life Assurance Schemes.—Please apply in writing to Personnel Manager, 206, Marylebone Rd., London, N.W.1. [7004]

VACANCY exists in the Television and Radio Design Department for a practical engineer with H.N.C. or equivalent qualifications; candidates must have a sound knowledge of circuit techniques; a good background in physics would be an advantage; apply in writing giving details of experience, age and qualifications to—Personnel Department (R.7), Murphy Radio, Ltd., Welwyn Garden City, [6923]

SALES Engineer required to join Scottish Representatives of firm manufacturing High Frequency Induction Heating, Dielectric Heating and Plastic Welding equipment; basic knowledge of electronics plus general electrical knowledge required but technical experience in Induction and Dielectric application work essential.—Apply in writing giving details of previous experience and salary required, to Morris, Warden & Co., Ltd., 10, Royal Crescent, Glasgow, C.3. [6923]

RADIO maintenance technician required immediately for service and installation staff in telecommunications factory manufacturing V.H.F. business radio telephone equipment for domestic and export markets; permanent position offered to applicants with suitable experience.—Write, giving full details, qualifications, experience, references and salary required, to Telecommunications, Ltd., Finglas, Co. Dublin, Ireland, quoting reference RMT. [6991]

DEVELOPMENT Engineer required for interesting work on various aspects of telecommunications systems engineering; experience in telephone and teleprinter circuitry, particularly the switching aspects, will be an asset; the engineer chosen will be called upon to exercise his initiative and act upon his own responsibility as a leading member of a development team; the salary paid will be commensurate with experience and academic qualifications which, although not essential, are desirable; there are prospects for a permanent career in telecommunications engineering and the company operates an up-to-date Superannuation and Insurance Scheme.—Write in the first instance with full details to the Personnel and Admin. Officer, International Aeradio, Ltd., Engineering Division, Hayes Rd., Southall. [7017]

**TELEGRAPH AND TELEPHONE EQUIPMENT**

1+4 Carrier Telephone Terminals, Repeaters and Spares.  
1+1 Carrier Telephone Terminals, Repeaters and Spares.  
VF Telegraph 3-channel Group Units.  
VF Telegraph Speech + Duplex Terminals and Filter Assemblies.  
VF Telegraph Speech + Simplex No. 3.  
Racked Bays for multi-channel telegraph and telephone equipment.  
Filter Units, 600 ohms, various cut-off frequencies.  
Retardation Coils and Repeating Coils.  
Input and Output Transformers.  
Close Tolerance Condensers.  
Teleprinters Tape and Page.  
Telephone Switchboards.  
Field Telephone Sets. Types D, F and L.  
Polarized Relays 299 AN.  
Attenuator Assemblies Wiper Types.  
Vibrators 7 pin Synchronous.

**LOW POWER RADIO STATIONS**

Wireless Set 19. Freq. 2.8 Mc/s and 235 Mc/s Systems A1, A2 and A3 AM.  
Wireless Set X32D. Freq. 2.8 Mc/s Systems A1, A2 and A3 AM and FM.  
Wireless Set 31.  
Wireless Set 58. Canadian Walkie-Talkie. Complete with all ancillaries.  
Wireless Set 63T. Tropicalized Man-Pack set 3.0 to 6.2 Mc/s.  
Wireless Set 88. Walkie-Talkie.  
Handy-Talkie SCR 538. Handy Talkie 3.5 to 6.0 Mc/s.  
Collins 13Q Stations. Complete 1.5 Mc/s to 12 Mc/s.  
T.C.S. Stations with choice of Power Supply Units 12 v., 24 v. or 115 v.  
Wireless Set 62. 1½-10 Mc/s, fully tropicalized.

**AIRBORNE EQUIPMENT**

AN/ARC 1 VHF Stations. 100-150 Mc/s 10-channel, 20-channel or 50-channel.  
SCR 289G Radio Compasses. Complete with all parts including Inverter Supply Units.  
SCR 522 VHF Stations. 100-150 Mc/s. Complete with all spares.

AN/ARN-5 Instrument Landing System Equipment.

**R. GILFILLAN & CO. LTD.**

7, HIGH ST., WORTHING, SUSSEX  
Tel.: Worthing 8719 and 30181.

Cables: BENTLEY'S 2nd.  
"GIL WORTHING"



**SIFAM ELECTRICAL INSTRUMENT CO. LTD.**  
LEIGH COURT - TOROUAY - Telephone 4547/8

**SPECIAL OFFER**  
**G.E.C., B.T.H.**  
**WESTINGHOUSE**  
**GERMANIUM CRYSTAL DIODES**

1/- each. Postage 2½d.

Diagrams and three Crystal Set Circuits Free with each diode.

A large purchase of these fully GUARANTEED diodes from the manufacturers enables us to make this attractive offer.

**COPPER INSTRUMENT WIRE**  
ENAMELLED; TINNED, LITZ,  
COTTON AND SILK COVERED

All gauges available.  
B.A. SCREWS, NUTS, WASHERS,  
soldering tags, eyelets and rivets.  
EBONITE AND BAKELITE PANELS.  
TUFNOL ROD, PAXOLIN TYPE COIL  
FORMERS AND TUBES.  
ALL DIAMETERS.

SEND STAMP FOR LIST. TRADE SUPPLIED.

**POST RADIO SUPPLIES**  
33 Bourne Gardens, London, E.4

**SOUTHERN RADIO'S WIRELESS BARGAINS**

**TRANSCEIVERS.** Type "38" (Walkie-Talkie) complete in case with Five Valves (Four A.R.P.12, One A.T.P.4). Untested by us, are serviceable, but no guarantee. £1/2/6 each.

**ATTACHMENTS** for Type "38" Transceiver. ALL BRAND NEW: HEADPHONES with Plug and Lead, 15/6; THROAT MICROPHONE with Plug and Lead, 4/6; JUNCTION BOX 2/6; AERIAL No. 1, 4ft., 2/6; AERIAL No. 2, 4ft., 5/-; WEBBING for "38" 4/-; HAVERSACKS, 5/-; SPARE VALVES A.R.P.12, 4/6; A.T.P.4, 3/6.

**TRANSCEIVERS.** Type "18" Mark II. (Receiver and Sender) in Metal Case. Six Valves; Microammeter, etc. Less External Attachments, £4/10/-.

**ATTACHMENTS FOR USE WITH "18"** Transceiver. HEADPHONES with Plug and Lead, 15/6; HAND MICROPHONE (4a) with Lead and Plug 12/6; AERIALS, 5/-.

**RECEIVERS R.109.** 8-valves S.W. Receiver with Vibrator Pack 6-volts; Built-in SPEAKER. Metal Case, £5.

**RESISTANCES.** 100 ASSORTED USEFUL VALUES. New Wire-ended, 12/6 per 100.

**CONDENSERS.** 100 ASSORTED: Mica; Tubular, etc. New, 15/- per 100.

**BOMBSIGHT COMPUTERS.** Ex-R.A.F. NEW. Ideal for Experimenters. A wealth of Components; MOTORS, GEARS, etc., etc., £3.

**LUFBA HOLE CUTTERS.** Adjustable 3in. to 3 1/2in. for Metal, Plastic, etc., 7/-.

**MORSE TAPPERS.** Extra heavy, on base, 5/6; Standard 3/6; Midget, 2/9.

**MORSE PRACTICE SETS.** With Tapper and Buzzer on base, 6/9. With Battery, 9/9.

**DINGHY AERIALS.** Ex-U.S.A. Reflector Type. Brand new, 4/6.

**PLASTIC TRANSPARENT CASES,** 14in. x 10 1/2in. Ideal for Maps, Display, etc., 5/6.

**CRYSTAL MONITORS** Type 2. New in case. Less Valves, 8/-.

**STAR IDENTIFIERS.** Type I A-N Covers both Hemispheres, 5/6.

**CONTACTOR TIME SWITCHES.** 2 Impulses per sec. in case, 11/6.

Post or carr. extra. Full list Radio Books, etc., 3d.

**SOUTHERN RADIO SUPPLY LTD**  
11 LITTLE NEWPORT STREET,  
LONDON, W.C.2. GERrard 6653

**SITUATIONS VACANT**

**MEDICAL RESEARCH COUNCIL.**—Junior Development Engineer required; a sound knowledge of electronics is essential and some experience of prototype work is desirable; the salary will commence in the range of £535-£715, depending upon qualifications and experience, rising by annual increments up to possible maximum of £850 per annum. Write stating age and full details of education and experience, to Personnel Officer, National Institute for Medical Research, The Ridgeway, Mill Hill, N.W.7. [7033]

**JUNIOR** sales executive required for electronic section of a Midlands engineering works; applicants should have general knowledge and experience of sales and handling of electronic apparatus, the ability to answer sales enquiries of a technical nature and, where necessary, to follow up such enquiries by personal visits, to give technical advice and promote sales; apply, giving full particulars of experience and stating age and salary required, to—Box 8066. [7020]

**THE NATIONAL CASH REGISTER CO., LTD.** invite applications from qualified electronic engineers for positions in their modern and extremely well equipped development laboratory and model shop at Boreham Wood, Herts. for very interesting work on electronic accounting machines, including electronic pulse circuits and small electro-mechanic mechanisms; salary range £900-£1,300 per annum according to qualifications and experience.—Please apply in writing giving full details of age, academic or other training qualifications and practical experience, to Personnel Manager, 206, Marylebone Rd. London, N.W.1.

**B.E.A.** require radio maintenance engineers at Manchester Airport. Qualifications: Experience of aircraft radio servicing and maintenance for at least 4 years; knowledge of aircraft radio communication systems landing and navigation aids and routine tests on this equipment; should possess a current Aircraft Radio Maintenance Engineers license "A" category with "A" rating; a knowledge of aircraft electrical systems and ability to supervise is desirable; commencing salary £14/4 p.w. rising to £16/9 p.w. plus shift pay and 12/6 p.w. special bonus; applications to—Station Superintendent, British European Airways, Ringway Airport, Wythenshawe, Manchester.

**CABLE AND WIRELESS, LTD.** have vacancies for a limited number of young men aged about 24-30 for appointment as engineers at their London head office. Applicants should be in possession of the Higher National Certificate and, for preference, should have qualifications in the field of telecommunications. Commencing salary according to age. Examples: age 24 £650 per annum, age 27 £725 per annum, inclusive, rising by annual increments to £1,050 with openings for positions up to £1,500 per annum. Service in the company is pensionable. Candidates should apply in writing, giving full particulars of qualifications and experience, to the Personnel Officer, Cable and Wireless, Ltd., Mercury House, Theobalds Road, London, W.C.1. [6908]

**JUNIOR** electronic engineers required to assist in the development of electronic equipment associated with railway traffic control systems; together with 2 or 3 years' electronic development experience applicants should possess C. & G. Telecommunication Certificates to Intermediate or final level; this latter requirement may be waived for applicants with more than 5 years' experience, and who are capable of developing outline circuitry to its final state with a minimum of supervision; some experience of transistor circuitry is desirable, but not essential; pension scheme and 5-day week.—Write, giving full particulars of age, qualifications and experience, to the Personnel Superintendent, Westinghouse Brake & Signal Co., Ltd., Chippenham, Wilts. quoting reference No. EQUIP/N/W. [6938]

**PLESSEY NUCLEONICS LTD.** have vacancies for Electronic Engineers to work on design of reactor instruments, pulse circuits, and other applications of electronics to nuclear problems; both senior and junior posts are offered; all applicants should possess a thorough knowledge of basic electronic theory, a degree in science or electrical engineering, H.N.C., or appropriate equivalent standards of technical education for the two grades; previous experience in nucleonics advantageous but not essential; the other important qualifications are enthusiasm and initiative in progress in this new and expanding field; these posts will carry attractive salaries commensurate with qualifications and experience.—Apply in writing to Chief Engineer, Plessey Nucleonics, Ltd., Weedon Rd., Northampton. [6929]

**D.S.I.R.** require Experimental Officers and Assistant Experimental Officers at Radio Research Station, Datchet, Berks, to (i) assist in radio research and (ii) prepare abstracts of scientific and technical articles on radio research and development. Quails in Physics or Electrical Engineering, min. G.C.E. (Advanced level) in two scientific subjects or equiv. Over 22 pass degree, H.N.C. or equiv. generally expected. Experience in radio research or development, or communications an advantage. For posts (ii) ability to read technical French and German an advantage. Posts (i) offer opportunities for service abroad. Special short-term appointments are also available at home and abroad for assistance in observations and reduction of results during the International Geophysical Year (1957-58). Salary within ranges: E.O. £875-£1,075 A.E.O. £350 (age 18)-£755. Slightly less for women but subject to improvement under equal pay scheme. 5-day week. Forms from—M.L.N.S., Technical and Scientific Register, (K), 26, King St., London, S.W.1. quoting A111/7A. [6996]

**BAKERS 'selhurst' RADIO**



The 12" 15W DE-LUXE with FOAM suspension

30-17,000 c/s  
£9. 15. 0

The BRADFORD PERFECT BAFFLE (Patent Pending)



A COMPACT enclosure ensuring realism and clarity of reproduction with NO BOOM.

A comprehensive range for single- and multi-speaker systems is available.

From £8/15/0 for 17in. x 17in. x 1 1/2in.

We are demonstrating the GOODSELL "Golden Range," the ORTOFON Pick-Ups and the WOOLLETT Transcription Gramophone Turntable.

Daily: 9 a.m. to 6 p.m.  
Saturdays: 9 a.m. to Noon.



17, Charing Cross Rd., London, W.C.2

Tel.: TRAFalgar 5575 (opp. Garrick Theatre)

LIMITED

Trade & Export enquiries to:—

**JOHN LIONNET & COMPANY** (at above address)

**HANNEY**

OFFERS

All components for Osram and Mullard Amplifiers and F.M. Tuners.

Send stamp for list.

**L. F. HANNEY**  
77 LOWER BRISTOL ROAD, BATH

Tel.: 3811

# CONDENSERS

"METALPACK" CONDENSERS 0.5μF 500 v. 2/-, 0.25μF, 500 v., 1/9. 0.1μF, 500 v., 1/6. 0.1μF, 350 v., 1/-. 0.05μF 500 v. 0.02μF, 750 v. 0.1μF, 1,000 v., 0.05μF, 1,000 v., 0.02μF, 1,000 v. and 0.01μF, 750 v., all at 10d. each. (Special price for quantities).

SILVER MICAS AND MOULDED MICAS. Per 100, 22/6.

MIDGET CERAMICS. 2 x 500 pt. 75 pt., 100 pt. and 150 pt. per 100, 36/-.

MIDGET MICAS (Type 635). 0001, 0003, 0005, per 100 36/-.

TUBULAR BAKELITE CONDENSERS (Jelly filled). 0.1μF. 4 kV. wkg. 4/8 each. 0.1μF. 2.5 kV. wkg. 3/6 each. 0.01μF. 5 kV. wkg. 0.05 3.5 kV. wkg. and 0.002μF. 5 kV. wkg. 2/8 each. 0.1μF. 1,200 v. wkg. 0.01μF. 4 kV. wkg. 0.02μF. 3 kV. wkg. 0.05μF. 2 kV. wkg. 0.001μF. 5 kV. wkg. and 0.25μF. 800 v. wkg. and 0.001μF. 2 kV. wkg. All at 2/- each.

BLOCK PAPER TYPES. 0.1μF. 4 kV. working size 2 x 2 x 4in. 3/6 each. 50 mfd. 300 v. D.O. wkg. size 7 x 5 x 3 1/2in., 27/6 each. Other types in stock from 0.25 mfd. 0.5 mfd., 1 mfd., 2 mfd., 3 mfd., 4 mfd., 6 mfd., 8 mfd., 10 mfd., 200 v. to 2,000 v. wkg. (Prices as advertised in the March issue "W.W.")

PHILIPS TRIMMERS (Boehve type), 3 to 30 pt., 1/- each or 2/- per 100.

WAFER SWITCHES 4 p., 3 w. at 2/-, 4 p., 2 w., at 1/9, with 1 ins., spindle, 2 p., 4 w., with 1/2 in. spindle at 1/-.

REOSTATS W/W 30 ohms. with S.P. switch, 1/2 in. spindle, 2/- each.

DUAL POTS 2 x 1 meg. 1 1/2 in. spindle, 2/- each. 500 k. pots with S.P. switch 1 1/2 in. spindle, 2/3 each. 50 k., 100 k., 500 k., Pots with 1/2 in. spindle, 10/- per doz.

TOGGLE SWITCHES D.P. 1/9 each.

TRANSFORMERS 200/240 v. input 820-0-820 v. output No. 0s., 30/- each.

CHOKO to suit 15 H., 300 mls. 110 ohms, 12/6 each. or 37/6 the pair.

SPIRIT LEVELS, small for Instruments etc. 1in. long 1/2 in. wide 1/- each, or 9/- doz.

SLYLOK FUSE HOLDERS. 5 amp., and 15 amp., 2/- each.

VALVE HOLDERS. Int., Octal (U.S.A. type), 6/- doz. B.7.G. Ceramic with lower skirt, 8/6 doz.

Many other items in stock, all goods offered are ex-W.D., new and unused.

TERMS C.W.O. WRITE OR CALL

**W. MILLS**

3B TRULOCK RD., TOTTENHAM, N.17  
Phone: Tottenham 9213 & 9330

## YOUR METER DAMAGED?



Leading Electrical Instrument Repairers to the Industry

Contractors to the Ministry of Supply and General Post Office. Repairs by skilled craftsmen of all makes and types of Voltmeters, Ammeters, Microammeters, Multirange Test meters, Electrical Thermometers, Recording Instruments, etc. Quick deliveries—for speedy estimate send defective instruments by registered post to—

**L. GLASER & CO. LTD.**

Electrical Instrument Repairers  
97-100 ALDERSGATE STREET, E.C.1  
(Tel.: MONarch 6822)

The NEW

# EDDYSTONE '870'

RECEIVER

PRICE — £24 (plus P.T. £10.16.0)

Efficient broadcast reception on short, medium and long waves. A Semi-Portable AC/DC set equally suitable for cabin or home use, offering Eddystone design and workmanship at a Reasonable Price.

In stock at:-

**WEBB'S RADIO**

14 SOHO STREET, LONDON, W.1

Telephone GERrard 2089

## SITUATIONS VACANT

**ELECTRONIC Engineers** (age 23-30) required as assistant project engineers; applicants should possess H.N.C. or equivalent, and have experience in development, also a knowledge of production engineering would be an advantage; these posts are permanent and carry the benefit of the firm's pension scheme and offer much scope for engineers with drive and initiative; applicants should apply immediately to the Personnel Officer (Factory Division) Decca Radar, Ltd., 2, Tolworth House, Surbiton, Surrey. (7000)

**RADIO Officers** required by East Africa High Commission Directorate Civil Aviation for one tour 30 to 36 months in first instance with prospect permanency; salary scale (including inducement pay) £815, rising to £1,175 a year; commencing salary according experience; good prospect promotion to Radio Superintendent (salary scale including Inducement Pay rising to £1,341 a year); free passages; liberal leave on full salary; outfit allowance £250; candidates must be capable operating at 25 w.p.m. and should hold M.T.C.A. 1st class Flight Radio Operator's Licence or Cert. of Competency or P.M.G. 1st Class Cert. or Communicator (M.T.C.A.) or equiv.; knowledge of touch typing for teleprinter an advantage; established Civil Servants should apply through their Establishments Officer—Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M2C/41553/WF. (7016)

**BUYING** office of large company operating in West Africa have vacancy for a technical buyer specialising in the purchase of a wide range of domestic, commercial and industrial electrical equipment; the post offers considerable opportunities for the right individual but demands a candidate of mature age and of devoting more than the usual office hours to harnessing and fostering a growing section of the business; candidates, age 25-30, must be of good education—having qualified G.C.E. "O" level at least; also must have sound practical knowledge electricity essential; experience with radios, VHF or electric motors, switchgear, domestic appliances, preferable; commencing salary dependent upon qualifications and experience; applications must be handwritten and should contain details of education and National Service.—Write in confidence quoting reference T.S.D., to Box 7684. (6981)

**WAR OFFICE** requires Assistant Mechanical Engineering Officers to R.E.M.E. Base Workshops at Donnington, Salop (D62/7A) and Old Dalby, Leics (D63/7A). Qualifications: corporate membership of Institutions of Electrical or Mechanical Engineers, or exemption from parts A and B of relevant Associate Membership examination, subject to election to corporate membership within two years. Experience desirable: for both posts, wide experience in electrical measurement, repair and calibration of electronic test equipment, and ability to organize and control large civilian workshop; for Old Dalby, experience of planning and production, precision mechanical engineering, microwave and pulse techniques as applied to radar; salary within range £722 (age 25) to £1,150 (Provincial), according to age qualifications to 1500. Applications to M.L.N.S., Technical and Scientific Register (K), 26, King St., London, S.W.1. quoting appropriate reference. (6998)

**TECHNICIANS (Aeradio) Grade I**, required by East Africa High Commission Directorate of Civil Aviation on probation for pensionable employment. Salary scale (including inducement pay) £815 rising to £1,175 a year. Commencing salary according to experience. Outfit allowance £250. Free passages. Liberal leave on full salary after each tour 30/36 months. Candidates not over 38 years of age, should preferably possess C. and G. Certificate in Telecommunications Principles or Radio Part III or equivalent. Must have had at least three years experience in erection and maintenance of ground station transmitters, radio and radar navigational aids and aerial systems and should have up-to-date knowledge of workshop practice. Knowledge of teleprinter and perforator equipment servicing or diesel electric power plant maintenance an advantage.—Write to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience, and quote M2C/42260/WF. (7027)

**BRITISH OVERSEAS AIRWAYS CORPORATION** have vacancies for Radio Instructors for the instruction of all grades of staff on the maintenance and overhaul of current radio, radar and allied equipment and in preparation for the aircraft radio engineers' licences class "A" and "B" with radar ratings. Duties will include the preparation of technical manuals which will involve liaison with manufacturers' design staff at the prototype or production stage of the equipment. Applicants should have City & Guilds Final Certificate in Telecommunications or equivalent qualifications; real ability to express themselves clearly on technical subjects, with previous experience as lecturer on technical subjects; experience of the operation, maintenance and overhaul of radio, radar and electronic systems, preferably on aircraft equipment. The salary for these posts will be in the scale £920—£1,190 per annum. In the event of an applicant not having the full qualifications required but who is otherwise suitable, appointment initially in the scale £852 10s—£1,032 10s per annum may be considered. Generous staff pension and insurance, and leave schemes.—Write, giving details of experience, to the Assistant Station Manager (Appointments), Recruitment Centre, B.O.A.C., London Airport. (6987)

# HOME RADIO LTD.

for



By return service

Length	Size	Complete	Empty
150ft.	3in.	5/6	2/6
300ft.	4in.	10/6	3/-
600ft.	5in.	20/-	3/6
850ft.	5 1/2 in.	27/6	3/9
1,200ft.	7in.	35/-	4/-
1,750ft.	8 1/2 in.	55/-	12/6

Also comprehensive range of:—  
**FERROGRAPH, SIMON, SCOTCHBOY, E.M.I., B.A.S.F., PURETONE, GEVAERT, FERROVOICE**  
Tapes and Accessories.

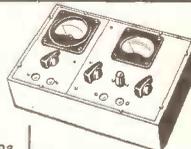
Full list sent on request.

## HOME RADIO (MITCHAM) LTD.

187 LONDON ROAD, MITCHAM, SURREY.  
MIT 3282

## PORTABLE

### TEST PANEL



for workshop or students' use.

Two separate moving coil meters for voltage, current and resistance measurement. In wooden case with metal front and test prods.

Ranges (AC & DC)  
0-30mA  
0-10v, 0-25v  
0-500v  
0-10,000 ohms  
Size 8 1/2" x 5 1/2" x 2 1/2"  
light and portable.

**Cash £6** (inc. post/pkg.) or **£2 down** and 5 monthly instalments of £1

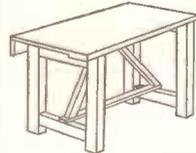
Order now from:—  
E.M.I. Institutes, Dept. T.P.127, London, W.4  
1C87

# WORK BENCHES

AS SUPPLIED TO INDUSTRY

FROM **£3 - 9 - 9**

Lists FREE. REF. W.W.



**POWNALL LTD.**

BENCH MAKERS

TEL. MAL 4464

BLAGDON RD., NEW MALDEN

# Bridge Meggers

Series 2 250 volt £25.  
500 volt £45.  
1,000 volt £55.  
Packing and carriage 12/6.

# Insulation Testers

Evershed and Vignoles Wee Megger  
500 volt £12.10.0.  
250 volt £11.10.0.  
Record 500 volt £10.  
All with leather cases.

WESTON Multirange tester model 785,  
20,000 ohms per volt, from £12.10.0.

## METERS

4" sq. 0-50 microampere, £5.10.0. p.p.  
A.C. current, any size single or up to  
8 ranges. 1 mA.-10 A. F.S.D. with current  
transformer.

## REPAIRS

All types and makes of single and multi-  
range meters repaired and converted to  
your requirements.

METERS SUPPLIED TO YOUR SPECIFICATIONS.  
Delivery 7-14 days.

Microampere meters our speciality.

## THE V.Z. Electrical Service

4 LISLE STREET, LONDON, W.C.2  
TELEPHONE: GERRARD 4861.

**SITUATIONS VACANT**  
REQUIRED for interesting research develop-  
ment work on electro-acoustic devices, an  
engineer up to B.Sc. standard.—Apply Box  
7090 [6315]

**THE UNIVERSITY OF MANCHESTER.**—  
There are vacancies for 4 controllers in  
connection with the Radio Telescope at Jodrell  
Bank. duties will include the operation and  
maintenance of the telescope control  
mechanism and recording apparatus for which  
some experience of electronics is necessary;  
applicants must be prepared to work on a  
shift basis.—Applications should be sent to  
the Secretary, Jodrell Bank Experimental  
Station, Lower Withington, Macclesfield,  
Cheshire. [7011]

**TRAINEE managers** required for branches of  
large British company distributing technical  
equipment throughout West Africa: a  
progressive career is offered to men aged 25-30;  
successful applicants will undertake duties of a  
varied nature during their period of train-  
ing, giving scope for those with organising,  
selling and administrative ability; we are seek-  
ing graduates or others with G.C.E. Advance  
level education; commercial experience, par-  
ticularly in the electrical industry desirable; com-  
mencing salary according to qualifications and  
experience; first-class passage, sea/air, free  
furnished quarters, full pay on leave after ap-  
proximately 18 months' tour, pension scheme;  
applicants must give age, domestic status, full  
details education, commercial and technical  
(degrees/diplomas), other qualifications,  
national service and business experience; all  
applications treated in strictest confidence;  
applications should be marked Tech.—Box  
7685. [6982]

### SITUATIONS WANTED

**ELECTRONIC/radio technician** (23) seeks  
E position with design and development sec-  
tion of firm in Sussex, Surrey.—Box 7687. [6980]

### TECHNICAL TRAINING

**LEARN** it as you do it—we provide practical  
equipment combined with instruction in  
radio, television, electricity, mechanics,  
chemistry, photography, etc.—Write for full  
details to E.M.I. Institutes, Dept. WW47, [0006  
London, W.4.]

**CITY and Guilds** (Electrical, etc.) on "No  
Pass—No Fee" terms, over 95% successes.  
For full details of modern courses in all  
branches of Electrical Technology send for  
our 144-page handbook, free and post free,  
B. I. E. (Dept. 388A), 29, Wright's Lane,  
London, W.8. [0117]

### TUITION

**NOTHING** succeeds like success! What we  
have done a thousand times we can do again  
for you—see the B.N.R.S. advt. page 56. [C172]

**WIRELESS** operating; attendance and postal  
courses.—Stamp for reply to Manager, The  
Wireless School, Manor Gdns., London, N.7. [0104]

**FULL-TIME** courses for P.M.G. Certs.,  
C.G.L.I. Telecommunications, Radar Main-  
tenance Cert. and B.Sc. (Eng.); prospectus free.  
—Technical College, Hull. [0111]

**WIRELESS**—See the world as a radio officer  
in the Merchant Navy; short training  
period; low fees, scholarships, etc., available;  
boarding and day students; stamp for prospec-  
tus.—Wireless College, Colwyn Bay. [0018]

**A.M. Mech.E., M.A. Brit.I.R.E., City and  
Guilds, etc.** on "No Pass—No Fee"  
terms, over 95% successes—Details of  
Exams and courses in all branches of Engineer-  
ing, Building, etc., write for 144-page Hand-  
book—Free. B.I.E.T. (Dept. 397B), 29, Wright's  
Lane, London, W.8. [0118]

**TV & Radio**—A.M. Brit.I.R.E., City &  
Guilds, R.T.E.B. Cert., etc. on "No Pass  
—No Fee" terms; over 95% successes—De-  
tails of Exams and Home Training Courses  
in all branches of Radio and TV, write for  
144-page Handbook—Free. B.I.E.T. (Dept.  
397A), 29, Wright's Lane, London, W.8. [0116]

**TRAIN** at home for a better position or a  
new hobby—We offer comprehensive  
modern home tuition courses covering over 100  
careers and hobbies, practical equipment sup-  
plied with many courses.—Write for free bro-  
chure stating subject of interest, to: E.M.I.  
Institutes, Dept. WW 39, London, W.4. (Asso-  
ciated with H.M.V.) [0180]

**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. Write  
with the College operated by Britain's largest  
electronics organization; moderate fees.—Write  
to E.M.I. Institutes, Dept. WW28, London, W.4. [0179]

**COURSES** in Electronics, covering practical  
and theoretical aspects, basic principles,  
industrial applications, electronic apparatus,  
etc. Also courses in Radio and TV Engineer-  
ing and Frequency Modulation. Guaranteed  
coaching for Brit.I.R.E., City & Guilds, etc.  
Study at home under highly qualified tutors.  
Write for free book: International Corre-  
spondence Schools, Ltd., Dept. CL.42, Kings-  
way, London, W.C.2. [0033]

**INCORPORATED** Practical Radio Engineers  
home study courses of radio and TV  
engineering are recognized by the trade as  
outstanding and authoritative. Moderate fees  
to a limited number of students only. Sylla-  
bus of Instructional Text is free. "The Practical  
Radio Engineer" journal, sample copy 2/-;  
6,000 Alignment Peaks for Superhets,  
3rd members' 2nd entry conditions book-  
let, 1/- all post free from the Secretary,  
I.P.R.E., 20, Fairfield Rd., London, N.8. [1088]



## ELECTRONIC COMPONENTS DIS- TRIBUTORS FOR OVER 25 YEARS

Some popular lines:

### FOUR-SIDED BLANK CHASSIS

Made in our own works from commercial quality  
half-hard aluminium of 16 s.w.g. thickness, these  
chassis will carry components of considerable weight  
and normally require no corner strengthening.  
Standard stock sizes (in inches) are as follows:—  
6 x 4 x 2 5/8 12 x 5 x 3 7/11 13 x 10 x 2 3/8 9/9  
7 x 5 x 2 5/8 12 x 7 x 2 8/8 14 x 10 x 2 10/10  
10 x 4 x 2 6/4 11 x 8 x 2 8/3 12 x 10 x 3 10/3  
9 x 7 x 2 6/6 10 x 8 x 3 8/6 15 x 10 x 2 10/6  
12 x 4 x 2 6/10 13 x 8 x 2 8/10 17 x 10 x 2 11/3  
9 x 8 x 2 7/6 12 x 9 x 2 8/11 17 x 9 x 3 11/6  
10 x 8 x 2 7/10 14 x 7 x 3 9/6 17 x 10 x 3 12/3  
Special sizes to order. The same material cut to any  
size up to 3ft at 4/- per square foot.

### Close Tolerance Wax-protected Silver Mica CAPACITORS.

Values stocked (pF):  
5 22 47 75 180 180 270 370 515 635 815 3000  
10 25 50 80 135 200 280 350 530 680 820 3300  
11 27 56 82 140 220 300 400 540 680 1000 3500  
13 28 60 100 145 225 316 410 556 703 1500 4000  
15 30 65 110 150 230 330 450 560 710 2000 4700  
18 33 68 120 160 245 340 470 600 750 2200 5000  
20 40 70 125 175 250 350 500 603 800 2500  
Tot.: up to 33pF, 1pF; over 33pF, 1 per cent.

PRICES: 5-300pF, 9d.; 316-820pF, 10d.; 1,000-  
2,500pF, 1/3; 3,000-5,000pF, 1/6.  
Special (limited number only), 0.1 mfd. 1%, 12d.  
\*Surplus stocks of mica, paper and ceramic capacitors  
from 6d. each.

\*DAILY guaranteed ELECTROLYTICS.  
Full range from 1/6 ea.

\*HIGH STABILITY RESISTORS. "T.S.L." 1/4-watt,  
10% tol. 5-year guarantee. Full "preferred value"  
range, 12Ω to 10MΩ, 6d. each. 1% tol., 3/- each.

\*Surplus stocks, various makes:  
1/4 watt ..... 5% 2% 1%  
1/2 watt ..... 7d. 10d. 1/3  
1 watt ..... 9d. 1/- 1/6  
1 watt ..... 10d. 1/3 1/9

\*\*"ELECTROVOICE" guaranteed TRANSFORMERS  
AND CHOKES. Individually tested. Fully shrouded.  
Used by leading laboratories. 66 types in stock.

WAFER SWITCHES made to order, N.S.F. parts.  
Quotations on request.

## The COOPER-SMITH HIGH FIDELITY AMPLIFIER

Model BPI Main Amplifier, £16. Build-it-your-  
self £14. Mk. II Pre-arranged Control Unit,  
£10. Build-it-yourself, £7/10/-

**DIRECT FROM MAKER TO USER**  
A better 10 watt amplifier at lower cost. Send for  
illustrated details of this remarkable outfit  
or hear it in our demonstration room.  
Other HI-FI equipment includes Acoustical,  
Leak, Rogers, Lowther, Goodmans, Wharfedale,  
Lorenz, Philips, Connoisseur, Collaro, Garrard,  
Goldring.

**AMERICAN RELAYS**, brand new—  
3-make, 60Ω coil, small, 2/3; 2-make, 50Ω coil,  
3,000 seal, 2/6. 2-make, 200Ω coil, 3,000 seal, 2/6;  
3-make, 50Ω coil, 3,000 seal, 3/6. 2-make, 2-break,  
50Ω coil, large, 2/6.

**VISUAL INDICATORS**, type 3 (10Q/4) containing two  
micro-amp movements. Brand new, 6/8 each. With  
neon lamps (two), 9/6.

200 V. D.C. wkg. MANSBRIDGE CAPACITORS.  
Suitable for crossover units, etc. .5 mF, 4d. each;  
1 mF, 6d. each; 2 mF, 6d. each; 4 mF, 9d. each.

100 watt VITREOUS ENAMELLED RESISTORS,  
clip-in type: 800Ω, 2,500Ω, 100KΩ, 2/6 each.  
\*Also 300 other values and wattages.

A.C. MOTORS, 230 V. (Converted Rotary Trans-  
formers.) With gearbox giving 3, 7 or 14 R.P.M.  
Reversible. 12/6 each.

**LIGHTWEIGHT HEADPHONES**: "Iviatek", 2,000Ω,  
12/6 pr. "Stein", 4,000Ω, 17/8 pr.

**AMERICAN** 21-way PLUGS AND SOCKETS, with  
cover, 7/6 pr.

**SMALL ADMIRALTY DRIVES**, 1 1/4 in. dia., 25:1  
reduction. 0-100 scale. 180 deg. 6/6 each.

**METERS** by famous maker, 2 1/4 in. dia. Square front:  
80 V., 160 V. (100Ω PV), 8/6 ea 50mA. 10/6, 5A.  
10/6, 15. 20. 30 Amp., 8/6 each

## H. L. SMITH & CO. LTD

287/289 EDGWARE ROAD LONDON W2  
Telephone Paddington 5891

## CABINETS AND HI-FI EQUIPMENT

We can supply any Cabinet to  
your own specification



"The Contemporary" £9.15.0.

This beautifully made cabinet is oak,  
veneered with mahogany interior and is  
finished. Available in any shade to  
order at slightly extra cost.

We can also supply and fit this or any  
cabinet with the latest Hi-Fi amplifiers,  
tuners, transcription units, record  
changers, speakers, etc.

Send for comprehensive illustrated cata-  
logue of cabinets, chassis, autochangers,  
speakers, etc., all available on easy H.P.  
terms.

## LEWIS RADIO COMPANY

120 (WW8) Green Lanes, Palmers Green,  
London, N.13 BOWes Park 1155/6

**Solder with**



**LITESOL**  
REGD. TRADE MARK

**"PERMATIP"**  
AND  
**"PERMABIT"**  
INSTRUMENTS  
FOR  
**GREATER  
SOLDERING  
EFFICIENCY**

The soldering bit which maintains its face indefinitely without attention, 25 models available for mains or low voltage supply. Bit sizes 3/32 to 3/8 inch. Full details in booklet S.P.5 from sole manufacturers:—

**LIGHT SOLDERING DEVELOPMENTS LTD.**  
106, GEORGE ST., CROYDON, SURREY  
Tel.: CROYdon 8589

**JAMES H. MARTIN & CO.**  
COLLARD Tape Transcriber, 3 speed, £20. MONARCH UAS Gram-autochange unit, 4 speed with crystal turn-over heads, £29/15/- FM/VHF Tuner chassis, ready wired with 6 valves, inc. tuning indicator, 10 circuits, built-in Power Supply, £17/10/- 80UND Tape Recorder complete with mikes and tape. £57/15/- Soldering Irons, instrument type with neon lamp in handle, 230/250 v. 22/8, postage extra.  
Easy Terms available. Stamp (only) for List.  
**JAMES H. MARTIN & CO., FINSTHWAITE, NEWBY BRIDGE, ULVERSTON, LANS.**

**BRASS, COPPER, DURAL, ALUMINIUM, BRONZE**  
ROD, BAR, SHEET, TUBE, STRIP, WIRE  
3,000 STANDARD STOCK SIZES  
No Quantity too Small. List on Application  
**H. ROLLET & Co. Ltd.**  
6 Chesham Place, S.W.1. SLOane 3463  
ALSO AT LIVERPOOL, BIRMINGHAM, MANCHESTER, LEEDS

**A SPENCER-WEST BAND III CONVERTOR**  
FOR **£6.5.0**



The Type 80 with printed circuits, panel controls for Band switch and fine tuning and a performance which ensures enthusiastic satisfaction. Handsomely designed and finished to stand on your receiver with its self-contained power supply it just plugs straight in.

From your dealer or post free from the manufacturers:  
**SPENCER-WEST LTD.**  
QUAY WORKS, GREAT YARMOUTH, NORFOLK  
\*Phones: Works 4794; Sales 3009  
\*Grams: Spencer-West, Gt. Yarmouth  
LEAFLETS GLADLY SENT

**BOOKS, INSTRUCTIONS, ETC.**  
OFFERS, W.W. Jan. 1957-AUG. 1940, 8 missing, part 1932.—Beale, Station App. Merstham, Sy. [7048]  
OFFERS invited for whole or part of all proceedings and journals of I.E.E., complete from 1948.—Box 8135 [7046]  
"WIRELESS WORLD," 1948-1950 (bound), 1951-1956 (unbound); May 1956 missing; what offers?—15, Heugh St., Falkirk, Stirlingshire. [7047]

**AUCTIONS**  
SALES every Thursday at 11 a.m.  
EASTERN Auction Mart, Ltd.  
TELEVISIONS, radios, fridges, wash/machines, etc., etc.  
ENTRIES accepted working or not. 15% commission on lots sold (min. 10/-). No sale no charge.  
WE collect in Greater London area.  
WHITEHORSE Lane, Mile End Rd., Stepney, E.1.  
STEPNEY Green 3993, 3296, 1033. [0125]

**THE DE HAVILLAND AIRCRAFT COMPANY LIMITED**  
**BROUGHTON - CHESTER**  
have vacancies for  
**RADIO ENGINEERS**  
with previous experience of pre-installation testing, overhaul and repair of civil and military airborne Radio Equipment.  
City and Guilds or National Certificates desirable but not essential.  
Write stating age and experience to the Personnel Manager.

Applications are invited for employment as Technical Assistants, Test Engineers and Testers on Radar and Guided Weapon equipments. The work is varied and interesting and offers opportunities for advancement. Applications should be made to the Personnel Manager, The General Electric Co. Ltd., Applied Electronics Laboratories, Brown's Lane, Allesley, Coventry quoting Ref RG/RRB

**FM and HI-FI COMPONENTS**  
in stock for the  
**WIRELESS WORLD FM TUNER UNIT**  
DENCO FM TUNER circuits 1s. 6d.  
RADIO CONSTRUCTOR FM " 2s. 0d.  
MULLARD AMPLIFIERS " 3s. 6d.  
G.E.C. 912 PLUS AMPLIFIERS " 4s. 0d.  
G.E.C. FM PLUS TUNER " 2s. 6d.  
Separate price lists on request to  
**J. T. FILMER** MAYPOLE ESTATE  
BEXLEY, KENT  
Tel.: Bexleyheath 7267

**ENGINEERS!**  
Whatever your age or experience, you must read "ENGINEERING OPPORTUNITIES." Full details of the easiest way to pass A.M.I.Mech.E., A.M.I.C.E., C. & G. (Electrical, etc.), General Cert., etc., on "NO PASS—NO FEE" terms and details of Courses in all branches of Engineering—Mechanical, Electrical, Civil, Auto, Aero, Radio, etc., Building, etc. If you're earning less than 15 a week, tell us what interests you and write for your copy of "ENGINEERING OPPORTUNITIES" today—FREE.  
**B.I.E.T.**  
387 College House, 29-31, Wright's Lane, London, W.8.  
**BRITISH INSTITUTE OF ENGINEERING** TEL. 3000

**NEW BOOKS ON RADIO & TELEVISION**

The A.R.R.L. Handbook 1957. Postage 1/6	32/6
Radio Control Mechanisms, by R. F. Stock. Postage 4d.	4/6
T.V. Synchronizing Separators, by G. N. Patchett. Postage 4d.	5/-
Radio Valve Data, 5th Edition, by Wireless World. Postage 6d.	5/-
Electronic Computers: Principles and Application, by T. Ivall. Postage 1/-	25/-
F.M. Radio, by Sturley. Postage 9d.	15/-
T.V. Receiver Servicing, Vol. 2, by Spreadbury. Receiver and Power Supply Circuits. Postage 1/3	21/-
Radio Designers Handbook, by Langford Smith. Postage 1/9	42/-
Electronic and Radio Engineering, by Terman. Postage 1/9	71/6
Radio Control of Models, by F. C. Judd. Postage 6d.	8/6
Practical Transistors and Circuits, by Kendall. Postage 4d.	3/6
Radio Servicing Instruments, by Bradley. Postage 6d.	4/6

**UNIVERSAL BOOK CO.**  
12 LITTLE NEWPORT STREET, LONDON, W.C.2 (adjoining Lisle Street).

**D.C. TELEPHONE REPEATER**  
Western Electric X-61824, each with two rectifiers, Western 115v. 50-60 cycles X.61680B-2". Brand new.  
Full list available. Send your requirements.  
**N.A.R. Agencies Ltd.**  
40 King's Road, London, S.W.3

**ARIEL SOUND LTD.**  
for  
★ Industrial Electronic Equipment  
★ Prototype Design and Development  
★ Electronic Assembly Sub-contracting  
57, Lancaster Mews, London, W.2.  
Tel.: PADdington 5092

**THE LESDIX CRYSTAL SET**



In neat bakelite case 4in. x 2in. x 3in., fitted solid dielectric var. condenser, tapped litz wound aerial coil, germanium diode detector, plugs and sockets for aerial and earth connections, 25/-, post 1/6. The above set is offered without headphones for feeding into tape recorder. Each set aerial tested before despatch.  
**THE DIXON-LESLEY HOLE CUTTER** for use in portable or bench electric or pneumatic drills 3in. cap. and upwards. Cuts metal plates with same ease and efficiency as a 5/15in. twist drill. Best quality Tuagsten-Cobalt H.S. Steel teeth removable for regrinding or replacement. Sizes 3in., 1in., x 1 1/2in., 2 1/2in., 3 1/2in., 4in., Mandrels with H.S. Pilot Drills 3in. straight shank, 15/-, No. 1 Morse 17/6, No. 2 Morse, 18/6. **400 CYCLE INVERTERS**, dual output 115 v., 3-ph. 750 v.a., and 24/26 v. S.P. 250 V.A. output from 28 v. D.C. input, 2 K.W. Model 230 V. A.C. 50 cy. Motor Cap. start 15.5 A. belt driving a 2 K.W. 400 cy single phase alternator with B.T.H. 50 v. D.C. 7 amps. exciter. Ex-Admiralty pattern with starter. Write for details.  
**Leslie Dixon & Co.**  
Dept. A, 214 Queenstown Road, London, S.W.8  
Telephone: MACaulay 2159

**Build a Quality Tape Recorder with  
'ASPDEN'  
TAPE DECK  
& AMPLIFIER KITS**

Tape deck kit model 521 ..... £7 10 0  
Tape deck kit model 721 ..... £8 10 0

Two speed, twin track  
Complete with high-class motor, high fidelity heads and all instructions.

Record-replay AMPLIFIER kit £5 18 0  
Power pack for above, kit ... £2 18 6  
(both without valves)

Carriage extra

This tape deck and amplifier is being used in the Antarctic by a member of the expedition.

"G.D. 3 U.B." Isle of Man, writes:  
"Congratulations on this excellent tape deck at such a low price."

Send stamp for full particulars to:—

**W. S. ASPDEN,**  
STANLEY WORKS,  
back CLEVEDON ROAD,  
BLACKPOOL, LANCs.

**LOUDSPEAKER CABINETS**

For

**GOODMANS W.B. G.E.C.  
KELLY and JENSEN**

**STANDARD BASS REFLEX CABINETS**  
Demonstrations without Appointment

You can see your cabinet being made in our cabinet-making workshop

Cabinets made to order.

**ARMSTRONG CHASSIS AND AMPLIFIERS  
LOUDSPEAKERS**

Open till 5.30 Saturdays.

**A. DAVIES & CO. (Cabinet Makers)**

3 Parkhill Place, off Parkhill Road, London, N.W.3.  
GULLIVER 5775

**LYONS RADIO LTD.**

**HAND GENERATORS MK. 2.** Manually operated generators originally designed to provide the operating voltages for the American/Transreceivers types 18 and 48 but of course suitable for a variety of other purposes. Nominal rating is H.P. 162 v. D.C. at 60 mA. and 3.1 v. D.C. at 0.3 A. which with suitable series resistances would provide for 2 v. or 1.4 v. filaments. A built-in filter unit provides adequate smoothing and suppression. Ideal for portable rig. Weight approx. 14 lb. and size 6 1/2 x 6 1/2 x 5 1/2 in. In good condition and unused with carrying haversack. PRICE 35/-. carriage 8/6. We can also supply the combined mounting legs and seat for these generators as a separate item. PRICE 7/6, carriage 2/6.

**0/500 MICROAMMETERS.** Moving coil type, 2 1/2 in. dia., bakelite case. PRICE 17/6, post 1/3.

**ELECTRIC MOTOR/ROTARY TRANSFORMERS.** One end of these units is fitted with a gear box and the other a blower fan. Both can be easily removed if desired. Rating of R/T. "A" 18 v. D.C. input "B" 9 v. D.C. input, 450 v. D.C. output at 50 mA. Can easily be converted for use as a motor to operate from either D.C. or A.C. mains, details provided. Speed of shaft which protrudes from gear box when 12 v. D.C. is applied to B/T. is approx. 20 r.p.m. In good working order. PRICE £17/6, post 3/6. Please state first choice "A" or "B".

**POWER UNITS TYPE 15.** Rotary converter units fitted with starter relay, carbon pile voltage regulator, input/output filter, etc. Housed in metal cases 12 x 8 x 5 in. Input 12 v. D.C. Output D.C., 300 v. at 240 mA., 150 v. at 10 mA. and 14.5 v. at 5 A. In good condition. PRICE 35/-. carriage 7/6.

**3 GOLDHAWK ROAD, (Dept. M.W.)  
SHEPHERD'S BUSH, LONDON, W.12**

Telephone: Shepherd's Bush 1729

**SPECIALIST SUPPLIERS  
TO RADIO & T/V SERVICE**

RETAILERS

**A.W.F.  
RADIO PRODUCTS LTD.**

Send for latest comprehensive lists

TRADE ONLY

10 SACKVILLE STREET,  
BRADFORD, YORKS. Phone: 24008

**TELETRON SUPER INDUCTOR COILS**



Ferrite Rod Aerials. Wound on high permeability Ferroxcube rod, Medium wave 8/9, Dual wave 12/9.



Type HAX. Selective crystal diode coil for tape and quality amplifiers, MW 3/-. LW 3/6. Dual wave TRF Coils, matched pairs (as illustrated) 7/- pair. Type S.S.O. Supersonic Tape Osc. coil, provides 6.3 v. 3 a. RF for pre-amp heater. Eliminates induced

50 c/s hum, 40/100 kc, 15/- ea. Transistor coils, etc. Available from leading stockists. Stamp for complete data and circuits.

THE TELETRON CO LTD.

266, Nightingale Rd., London, N.9. How 2527

**PROVED**  
The finest method  
for cleaning records  
Already over 20,000 enthusiastic users

THE "Dust Bug"  
AUTOMATIC GRAMOPHONE RECORD CLEANER  
PATENT APPLIED FOR

Price reduced to 17/6 (plus 7/- purchase tax)

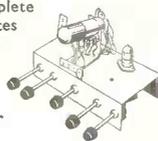
from your local dealer or  
**CECIL E. WATTS**

Consultant and Engineer (Sound Recording and Reproduction)  
Darby House, SUNBURY-ON-THAMES, MIDDXX

**OSCILLOSCOPE**

(MINIATURE TYPE—1" C.R.T.)

Supplied in kit form complete with full instructional notes for radio & T/V servicing. Operates from power supply of most AC domestic radio receiver equipment or from power unit supplied as an extra.



**Cash £10** (inc. post/pkg.) or £2 down and 9 monthly instalments of £1 (Power unit, if required, £3 extra)

Order now or send for further details to:—  
EMI INSTITUTES Dept. S.C.127, LONDON, W.4

IC82

**TELEPHONE SETS**

IN ATTRACTIVE BAKELITE CASE  
BRAND NEW EX-GOV'T. "F" TYPE



Ideal between 2 or more positions up to five miles. STORE FACTORY AND OFFICE: BUILDINGS; GARDEN SHEED



and HOUSE. 2 sets in individual carrying cases, complete with long life batteries, bells, ringer and 100ft. telephone cable.

£7.10.0 per pair  
Carr. (G.B.) 9/6

DON 3 telephone cable NEW 1 mile drum  
£5/10/- carr. extra.

**SPECIAL OFFER OF  
AERIAL MASTS**

R.A.F. TYPE 50

**36ft. HIGH**

Kite comprise—9 2in. dia. Tubular Steel (Copper Plated) sections of 4ft. length, top-section and base, Pickets, Guy's and Fittings.

YOU can purchase this normally expensive MAST for a fraction of its cost. i.e.,

**£7.10.0 ONLY**  
(Carr. 15/6)

Please add £1 for (returnable) wooden carrying case.

The MAST is particularly suitable to take aerials for Tx., Rx., F.M. and T.V. (especially COMMERCIAL), and has many other uses. Extra 4ft. sections can be supplied at 11/6 per section.

**U.S.A. 45ft. AERIAL MAST** (10 sections 4ft. 6in. x 2in. guys etc.) This entirely new and complete set in canvas carrying bag £12/10/- each, carr. 17/6 or 2 sets with additional low and high frequency antenna £25 pair. Carr. extra.

**ARMY TYPE 32FT. MASTS** similar to above but 10 in. screw-sections, suitable for permanent lightweight installation. Kit in canvas bag, £5/10/-, carriage 12/6.

**TRUVOX**

**LOUD  
HAILERS  
EX-GOV.**



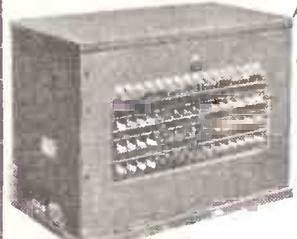
Impedance 7 1/2  
Handling cap. 8 watts  
price 27/6, post 5/-

**Brand New TELEPRINTER EQUIPMENT**

**CREED AUTOMATIC TRANSMITTER**  
No. 684/N for telegraph working, in original cases.

**RECTIFIER UNITS 26B.** Input 110/230 v. A.C. Output 80+ 80 volts. In original cases.  
**TELEGRAPH RELAYS 299 AN.**  
Also other equipment.

**TELEPHONE SWITCHBOARDS**



A.D. 1240.  
and others—  
spares  
etc.

**G.P.O. SWITCHBOARD TL.1806** 10 lines, thru' connexion, £12/10/-, carriage 15/-.

Quantity & Export enquiries are invited for above items, also other Electronic Component parts

**HATTER & DAVIS (RELAYS) LTD.**  
126, KENSAL ROAD, LONDON, W.10. LADbroke 0666

**CLASSICAL & HANDBOOK**

**L/P**

**RECORD LIBRARY**

**CATALOGUE FOR 1957**

**NOW READY**

- Includes 1957 additions to the library.
- The only comprehensive *selective* catalogue of Classical L/P Records—listing only recordings recommended by the Critics.
- Nearly 4000 discs listed (as already available to Library members).

**Also selections on:—**

- The care of Long Playing Records.
- The Reproduction of Long Playing Records.
- A Basis for Record Collection (100 Recommended L/Ps)
- FULL DETAILS OF LIBRARY MEMBERSHIP

**Post 3/- FREE FROM**

**THE LP RECORD LIBRARY**

**SQUIRES GATE STATION APPROACH, BLACKPOOL, LANCS.**

PURCHASE, HIRE OR HIRE-PURCHASE

**VORTEXION** Tape Recorders and P.A. Equipment, etc.

also Recordings—Tape to Tape/Disc Service

**GRIFFITHS HANSEN (Recordings) LTD.**

32-33, COSFIELD STREET, LONDON, W.1

Phones: MUSeum 2771/0642

FOR PROMPT DELIVERY

**WAFER SWITCH ASSEMBLIES, CUSTOM BUILT**

Banks	PAXOLIN		CERAMIC	
	s.	d.	s.	d.
1	7	0	11	3
2	10	3	22	7
3	13	6	33	4
4	16	2	45	2
5	18	10	56	2
6	21	6	67	8
7	23	8	—	—
8	26	11	—	—

When A.B. 11 and 12 way Wafers are required, please add 1/- per bank to above prices. SPECIALS AT time & material plus 50%.

● N.S.F. TYPE "G" SWITCHES.

1 Bank	£1 4 0	Control Plate etc., each	15/-
2 Banks	£1 13 0	Wafers, each	9/-
3 Banks	£2 2 0		
4 Banks	£2 11 0		
5 Banks	£3 0 0		
6 Banks	£3 9 0		

Quotations gladly given for small as well as large quantities, also for special assemblies.

**TELE-RADIO (1943) LTD.**

189, EDGWARE ROAD, LONDON, W.2.  
Paddington 4455/6.

**NEW METERS**

(by well-known manufacturers)

to your requirements

**7-14 DAYS DELIVERY**

**METER REPAIRS**

by

**SPECIALISTS**

*Frompt and Efficient Service*

Phone HOP 1408

**INSTRUMENTS ELECTRICAL CO.**

107, Newington Causeway, London, S.E.1

**RECORD PLAYERS**

GRAM MOTORS AUTOCHANGERS CABINETS

COLLARO AC.3/554. Three-speed, single player for A.C. mains 200/250 v., cream finish, complete with turnover crystal pick-up, "T" type head. Strictly limited quantity at £6/19/6, plus 5/6 carr.

CRYSTAL PICK-UPS fitted Acos HGP37 cartridge. Ultra lightweight. Our price 37/6, plus 2/6 carr.

VOLMAR 3-SPEED AUTO CHANGE RECORD PLAYERS, incorporating Garrard RC 80 changers. List price £20. Our price 12½ gns.

3-SPEED RECORD PLAYERS, fitted with Acos turnover HGP39 pick-ups with twin sapphire styl, rexine case with lid, fitted clasps and handle. Worth 10 gns. Our price £7/15/6, plus 5/6 carr.

3-SPEED GRAM MOTORS, by well-known maker. Our price 59/6, plus 5/6 carr.

FOUR-SPEED CHANGERS! The new B.S.R. 4-speed auto-changers now available at £8/15/- only, plus 5/6 carr.

Send stamp for complete bargain lists.

**RONALD WILSON & CO.**

(DEPT. W.W.), 12 BRIDGE STREET, WORCESTER

IMPERIAL CHEMICAL INDUSTRIES LIMITED

Metals Division require

**DRAUGHTSMEN (ELECTRONIC)**

for work in connection with the Guided Weapons Programme. The posts afford most varied and interesting work in pleasant surroundings at our Summerfield Research Station, Kidderminster.

Excellent conditions of employment include a Profit-Sharing Scheme, a Pension Fund, and a good commencing salary. After joining the Staff, a married man will receive a reasonable refund of removal (including travel) expenses and, in approved cases, facilities are available to assist in house purchase.

Write for an application form to General Services Manager, Imperial Chemical Industries Limited, Summerfield Research Station, Kidderminster.

A MAST PROBLEM? **Skymasts** WRITE TO

BEADON GARAGE BEADON ROAD LONDON W6 Telephone RIVerside 1124 & 7878.

## BAND III CHANNELS 8-9-10

A new CONVERTOR KIT is now available for LONDON—MIDLANDS—NORTH

Fit this new convertor not to your set but inside your set, even 9in. table models, and retain that professional look.

This convertor has been evolved since the I.T.A. transmission began, and is based upon experience gained in the conversion of very many Band I sets in the London area.

- IT will convert any set, any age, TRF or Superhet
- IT includes station switching
- IT provides pre-set contrast balancing
- IT uses only one aerial input for both bands
- IT provides manual tuning on Band III
- IT is totally screened
- IT completely rejects unwanted signals
- IT requires no additional power supply where either 6.3V or .3 amp line is available.

CONVERTOR wired and aligned with fitting instructions .....	£4 2 6
KIT complete in every detail, less knobs.....	£2 12 6
KNOBs each.....	1 0
CIRCUIT and instructions in detail (free with kit)...	3 6
BAND III AERIALS (send for list), from.....	12 6
CROSS-OVER UNITS—Outdoor (printed circuit)	15 0
AERIALXIAL feeder cable per yard.....	10

When ordering please state present B.B.C. Station and I.T.A. Orders over £2 post free.

### C. & G. KITS

285, LOWER ADDISCOMBE ROAD, ADDISCOMBE, CROYDON, SURREY

Phone: ADDiscombe 5262

## EDDY'S (Nottm.) LTD.

172 ALFRETON ROAD, NOTTINGHAM

Postage and Packing 6d. per valve extra. OVER £2 free.		NEW & GUARANTEED VALVES	Any parcel insured against damage in transit 6d. EXTRA.		
1R5	7/3	12J7GT	9/6	ECC83	8/3
1S5	7/3	12K7GT	8/11	ECC84	10/11
1T4	7/3	12Q7GT	9/3	ECC85	9/-
3S4	7/3	14S7	10/6	ECH35	9/-
3V4	8/3	25L6GT	8/6	ECH81	8/11
5U4G	7/11	25Z4G	8/11	ECL80	8/11
5Y3GT	7/6	35A5	10/6	EF80	8/3
5Z4G	8/3	35L6GT	8/11	EF86	11/6
6AT6	7/11	35W4	8/11	EF89	9/6
6BA6	7/3	35Z3	10/3	EF91	7/11
6BJ6	7/11	35Z4GT	8/3	EL32	5/11
6B8G	3/6	50L6GT	8/6	EL84	10/3
6F1	12/11	807	3/11	EY51	9/6
6F15	13/11	954	1/6	EZ86	10/3
6I5	3/11	955	3/11	EZ80	8/3
6K7G	2/11	956	2/11	PEN46	5/11
6K8GT	9/6	958	3/11	PCC84	10/11
6Q7GT	8/3	9003	5/3	PCF80	9/11
6S7GT	7/11	DAF96	9/6	PCL83	11/9
6V6GT	5/11	DF96	9/6	PL81	11/6
6X4	6/11	DK96	9/6	PL82	8/11
6X5GT	7/6	DL96	9/6	PL83	11/6
7B7	7/11	DM70	7/11	PY81	8/3
7C5	7/11	EAB80	7/6	PY82	8/3
7C6	7/11	EBF80	9/-	UBC41	8/11
7H7	7/11	ECC81	8/11	UL41	9/11
7S7	8/11	ECC82	7/6	UL84	9/6
7Y4	7/11			UY41	7/11
12AH8	10/6			VU111	1/6

OUTSTANDING OFFER OF COLLARO RC54  
3 speed autochange units crystal turnover cartridge 200-250 volts A.C. £7-19-6. Postage and Packing 5/- extra.

RECORDING TAPE — 1,200 ft. reels, 9/11 each. LIMITED QUANTITY. Postage, etc. 1/- each.

# CLASSIFIED ADVERTISEMENTS

## Use this Form for your Sales and Wants

To "Wireless World" Classified Advertisement Dept., Dorset House, Stamford Street, London, S.E.1

PLEASE INSERT THE ADVERTISEMENT INDICATED ON FORM BELOW

- RATE: 7/- for TWO LINES. 3/6 every Additional Line. Average six words per line.
- Name and address to be included in charge if used in advertisement.
- Box No. Allow two words, plus 1/-.
- Cheques, etc., payable to Iliffe & Sons Ltd., and crossed " & Co "
- Press Day, Wednesday May 29th or July 1957 issue.

NAME .....

ADDRESS.....


REMITTANCE VALUE..... ENCLOSED

Please write in block letters with ball pen or pencil.

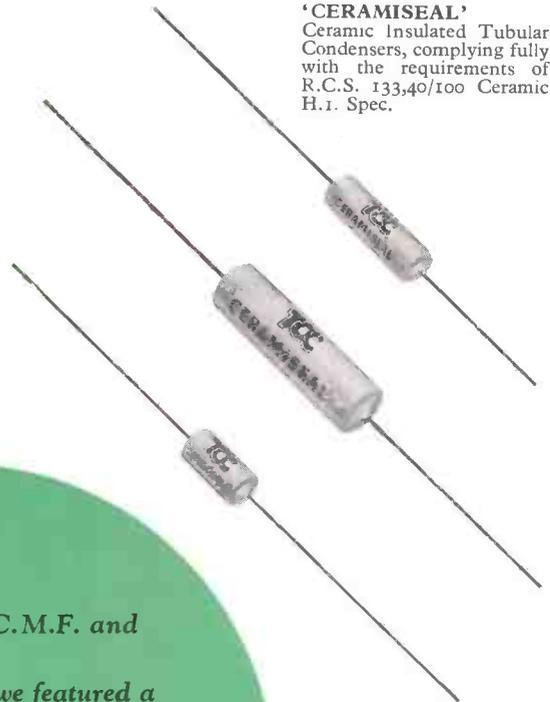
NUMBER OF INSERTIONS .....

# INDEX TO ADVERTISERS

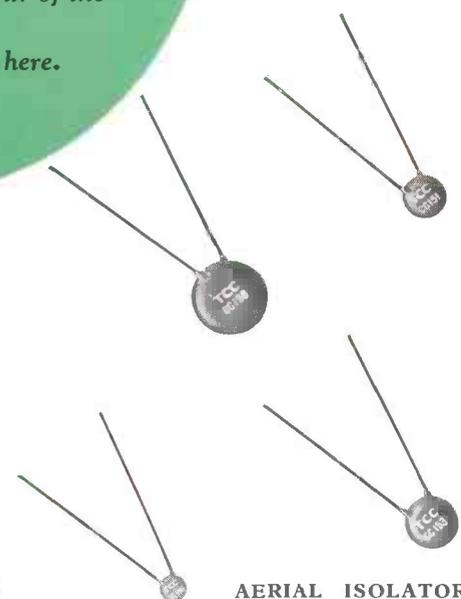
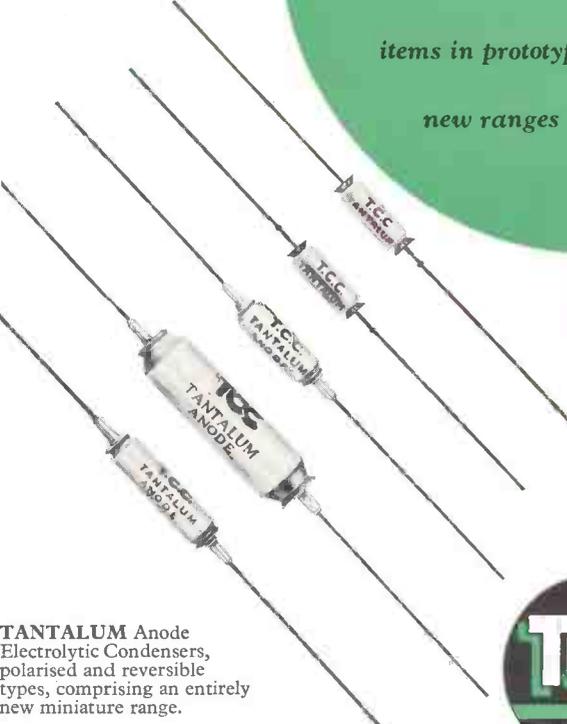
	Page		Page		Page
Abix (Metal Industries), Ltd.	36	Galpins	132	Precious Metal Depositors	56
Acoustical Mfg. Co. Ltd.	27	Garrard Engineering & Mfg. Co., Ltd.	29	Premier Radio Co.	94, 95
Aeola Products, Ltd.	114	Gee Bros., Radio, Ltd.	141	Preston, A., & Sons	136
A.D.S. Relays, Ltd.	82	General Electric Co., Ltd.	67	Proops Bros. Ltd.	124, 125
Advance Components, Ltd.	31, 65	Gillfillan, R., & Co., Ltd.	158	Pye, Ltd.	33
Aircraft-Marine Products (Great Britain), Ltd.	37	Glaser, L., & Co.	160	Pye Telecommunications, Ltd.	55
Airmec, Ltd.	6	Golding Mfg. Co., Ltd.	57		
Alpha Radio Supply Co., The	137	Goodmans Industries, Ltd.	57		
Altham Radio Co.	92	Gramplan Reproducers, Ltd.	77	Quality Mart	138
Amalgamated Wireless (Australasia), Ltd.	79	Gray, Arthur, Ltd.	64	Quartz Crystal Co., Ltd.	154
Amplex Appliances (Kent), Ltd.	90	Grayshaw Instruments	138		
Anders Electronics, Ltd.	76	Griffiths Hansen (Recordings), Ltd.	164		
Antiference, Ltd.	38	Grundig (Gt. Britain), Ltd.	110		
Appointments Vacant 140, 143, 144, 145, 146, 147, 148, 149, 162, 164				Radio & TV Components (Acton), Ltd.	138
Arcoelectric Switches, Ltd.	50	Hall Electric, Ltd.	14, 15	Radio Component Specialists	135
Ariel Sound, Ltd.	162	Hanney, L. F.	152	Radio Corporation of America	21
Armelstrong Wireless & Television Co., Ltd.	83, 153	Harris, P.	115	Radio Ham Shack, Ltd.	84
Ashdowns, Ltd.	88	Hartley, H. A. Co., Ltd.	163	Radio Resistor Co., Ltd. The	47
Ashworth, H.	64	Hatter & Davis	163	Radio Servicing Co.	44
Aspen, W. S.	163	Henley's, W. T., Telegraph Works Co., Ltd.	155	Radiospares, Ltd.	120, 121
Automatic Coil Winder & Electrical Equipment Co., Ltd., The	1	Henry's (Radio), Ltd.	116, 172	Radio Supply Co. (Leeds), Ltd.	120, 121
Automat, Ltd.	115	Hilger & Watts, Ltd.	42	Radio Traders, Ltd.	134
Automatic Telephone & Electric Co., Ltd.	7	Hivac, Ltd.	160	RCA Great Britain, Ltd.	84
Autoset (Production), Ltd.	72	Home Radio (Mitcham), Ltd.	60	Relda Radio, Ltd.	133
A.W.F. Radio Products, Ltd.	163	H.P. Radio Services, Ltd.	22	Reliance Mfg. Co. (Southwark), Ltd.	76
		Hunt, A. H. (Capacitors), Ltd.	53	Standard Telephones & Amplifiers, Ltd.	20
		Hunton, Ltd.		Rogers Developments (Electronics), Ltd.	76
				Rola Celestion, Ltd.	162
				Rollet, H., & Co., Ltd.	162
Beam-Echo, Ltd.	96				
Beamish, V. W.	154	Iliffe Books	80, 147	Salford Electrical Instruments, Ltd.	64
Beclere Transformers	85	Instruments Electrical Co.	164	Samsons Surplus Stores	134
Belling & Lee, Ltd.	101	International Correspondence Schools	70	Savage Transformers, Ltd.	155
Benson, W. A.	155			Sifam Electrical Instruments Co., Ltd.	158
Berry's (Short Wave), Ltd.	8			Simmonds, L. E., Ltd.	54
Birmingham Sound Reproducers, Ltd.	9	Jackson Bros. (London), Ltd.	150	Sky-mat	164
B. K. Partners, Ltd.	74	Jason Motor & Electronic Co.	62	Smith, G. W. (Radio), Ltd.	122, 123
Blackvac Engineering, Ltd.	58	J.P. Electrics, Ltd.	46	Smith, H. L., & Co., Ltd.	161
Bradmatic, Ltd.	136			Solartron Electronic Group, Ltd.	2, 143
Britain, Chas. (Radio), Ltd.	119			Sonomag, Ltd.	90
British Institute of Engineering Technology	152, 162	Kaye Electrical Mfg. Co., Ltd.	114	Southern Radio Supply, Ltd.	159
British Insulated Callender's Cables, Ltd.	Cover ii	Kenroy, Ltd.	158	Specialist Switches	58
British National Radio School	56	Keyswitch Co., The	78	Spectro, Ltd.	44
British Physical Laboratories	35	Kolectric, Ltd.	81	Spencer-West, Ltd.	162
British Thomson-Houston Co., Ltd.	70			Sperry Gyroscope Co., Ltd.	13
Brookes Crystals, Ltd.	78	Lasky's (Harrow Road), Ltd.	130, 131	Stamford, A. L.	158
Brown, S. G., Ltd.	81	Leak, H. J., & Co., Ltd.	111	Standard Telephones & Cables, Ltd.	36, 99
Bulgin, A. F., & Co., Ltd.	Edit. 301	Lewis Radio Co.	161	Standard Telephones Products, Ltd.	26
Bullers, Ltd.	62	Light Soldering Developments, Ltd.	162	Stearite Insulations, Ltd.	59
Burne Jones & Co., Ltd.	48	Linear Products, Ltd.	91	Stern Radio, Ltd.	126, 127
		Lion Electronic Developments, Ltd.	89	Sugden, A. R., & Co. (Engineers), Ltd.	50
		Lionnet, John, & Co.	159	Superior Radio Supplies	71
C. & G. Kits	165	Lockwood & Co. (Woodworkers), Ltd.	154	Sutton Coldfield Electrical Engineers	62
Canadian Westinghouse Co., Ltd.	34	London Central Radio Stores	152		
Candler System Co.	156	Long Playing Record Library	164	Tannoy Products, Ltd.	158
Cementation (Muffelite), Ltd.	157	Lowther Mfg. Co.	116	Taylor Electrical Co., Ltd.	45
Champion Products	157	L. R. Supply Co., Ltd.	114	Technical Trading Co.	140
Chapman, C. T. (Reproducers), Ltd.	68	Lyons Radio, Ltd.	163	Telegraph Condenser Co., Ltd.	Cover iii
Cinema Television, Ltd.	51			Telegraph Construction & Maintenance Co., Ltd.	48
City Sale & Exchange, Ltd.	78	Magnetic Devices, Ltd.	30	Tele-Radio (1943), Ltd.	52, 164
Clarke, H., & Co. (Manchester), Ltd.	42	Mail Order Supply Co.	86	Telerys, Ltd.	142
Clyne Radio, Ltd.	128, 129	Marconi Instruments, Ltd.	23	Teleton Co., The	163
Cosmograd, Ltd.	100	Marcomi's Wireless Telegraph Co., Ltd.	106, 107, 136	Thorn Electrical Industries, Ltd.	15
Cossor, A. C., Ltd.	103	Martin J. H.	162	Trix Electrical Co., Ltd.	Edit. 299
Coventry Radio	156	McMurdo Instruments Co., Ltd.	54, 87, 118	T.R.S.	140
		Merca Enterprises, Ltd.	56	Truvox, Ltd.	75
		Midland Instrument Co.	160	Tutor Tape Co., Ltd.	86
Daly (Condensers), Ltd.	75	Mills, W.	152		
Davies, A., & Co.	163	Modern Book Co.	152	Universal Book Co.	162
Denco (Clacton), Ltd.	89	Modern Electronics, Ltd.	132	Universal Electrical Instruments Corporation	139
Dependable Radio Supplies	157	M.R. Supplies, Ltd.	52	Universal Electronics	142
Dependable Relay Co.	91	M.S.S. Recording Co., Ltd.	70	University of Southampton	149
Direct TV Replacements	115	Mullard, Ltd.	3, 16, 17, 63, 73, 74		
Dixon, L., & Co.	162	Multicore Solders, Ltd.	Cover iv	Valradio, Ltd.	80
Duke & Co.	132	Multiton Electric Co., Ltd.	Cover 39	Verdik Sales, Ltd.	68
Dulci Co., Ltd., The	60	Murex, Ltd.	79	Venner Electronics, Ltd.	82
Duode Natural Reproducers	154			V.E.S. Wholesale Services, Ltd.	88
		N.A.R. Agencies, Ltd.	162	Vitavox, Ltd.	37
		Newmarket Transistor Co., Ltd.	61	Vortexion, Ltd.	109
		Newnes, George, Ltd.	32A, 32B	V.Z. Electrical Service	161
		New Zealand Migration	142		
		Northampton Polytechnic	149	Walmore Electronics, Ltd.	52
		Northern Radio Services	90	Watts, Cecil E.	163
				Wayne Kerr Laboratories, Ltd., The	69
		Oddie, Bradbury & Cull, Ltd.	154	Webber, R. A., Ltd.	86
		Osmer Radio Products, Ltd.	82	Webb's Radio	160
		Oxley Developments Co., Ltd.	156	Westwood, L.	32
				Weymouth Radio Mfg. Co., Ltd., The	58
		Painton & Co., Ltd.	18	Wharfedale Wireless Works, Ltd.	66, 93
		Palmer, G. A. Stanley, Ltd.	74	White, S. S. Co. of Gt. Britain, Ltd., The	60, 77
		P.A.M., Ltd.	49	Wilkinson, L. (Croydon), Ltd.	136
		Parker, A. B.	88	Wilson, Ronald, & Co.	164
		Partridge Transformers, Ltd.	151	Woden Transformers, Ltd.	25
		Partridge Wilson & Co., Ltd.	72	Wolsey Television, Ltd.	83
		P.C.A. Radio	46	Wright & Weaire, Ltd.	5
		Pearce, T. W.	156		
		Photo Printed Circuits	118	Young, C. H.	66
		Plasticable, Ltd.	86		
		Plessey Co., Ltd., The	12	Z. & I. Aero Services, Ltd.	150
		Post Radio Supplies	152		
		Pownall, W.	160		

**P.T.F.E. Dielectric Tubular Condensers**, having constant capacity, high I.R. and low P.F. in working conditions of  $-55^{\circ}\text{C}$  to  $+200^{\circ}\text{C}$ .

**'CERAMISEAL'**  
Ceramic Insulated Tubular Condensers, complying fully with the requirements of R.C.S. 133,40/100 Ceramic H.I. Spec.



*At the 1957 R.E.C.M.F. and I.E.A. Exhibitions we featured a number of developments in Condensers and Printed Circuits, together with other items in prototype form. Four of the new ranges are shown here.*



**TANTALUM Anode Electrolytic Condensers**, polarised and reversible types, comprising an entirely new miniature range.

**AERIAL ISOLATORS**  
Ceramic Condensers conforming to safety requirements of B.S. 415—1957.



**THE TELEGRAPH CONDENSER CO. LTD**

RADIO DIVISION • NORTH ACTON • LONDON • W.3 • Tel: ACOrn 0061

SYDNEY S. BIRD &amp; SONS LTD.

R.G.D. CO. LTD.



# Two more leading manufacturers



## change to Ersin Multicore SAVBIT TYPE 1 ALLOY

Radio and Television manufactures have been testing Ersin Multicore 5-core Savbit Type 1 Alloy for themselves and proving its advantages. Comparative tests between Savbit Type 1 Alloy and solders of tin/lead alloy, have shown that the useful life of soldering bits can be increased by 10 times by using Savbit Type 1

Alloy. Many man hours are saved daily quite apart from the replacement cost of copper bits, and in consequence, the speed of assembly operations is increased because the iron needs cleaning less frequently. Ersin Multicore Savbit Type 1 Alloy contains 5 cores of extra fast non-corrosive Type 366 flux.



### 7 LB. REELS

Savbit Type 1 Alloy is supplied on 7lb. Reels for factory use. Ersin Multicore 5-core Solder is also available on these reels in 6 alloys and 9 gauges. Prices on application.



### SAVBIT 1 LB. REELS

Approximately 170ft. of 18s.w.g. Ersin Multicore Savbit Type 1 Alloy is supplied on this 1lb. reel. It is invaluable to all who are interested in cutting down on bit replacement and maintenance costs. 15/- each (subject).



### SIZE 1 CARTON

In addition to the normal 4 specifications of Ersin Multicore 5-core Solder, Savbit Type 1 Alloy is also available for Service Engineers and radio enthusiasts, containing 53 ft. of 18 s.w.g. 5/- each (subject).

### HOME CONSTRUCTOR'S 2/6 PACK

Now available containing alternative specifications: 19 ft. of 18 s.w.g. 60/40 alloy or, for soldering printed circuits, 40 ft. of 22 s.w.g. 60/40 alloy; both wound on reels. 2/6 each (subject).



### BIB WIRE STRIPPER AND CUTTER

This 3 in 1 tool strips insulation without nicking the wire, cuts wire cleanly and splits plastic extruded twin flex. Adjustable to most wire thicknesses. 3/6 each (subject).



### BIB RECORDING TAPE SPLICER

An excellent splicer incorporating many refinements and quickly saving its cost in tape economies.

Complete with razor cutter. 18/6 (subject).



MULTICORE SOLDERS LIMITED, MULTICORE WORKS, HEMEL HEMPSTEAD, HERTS. (BOXMOOR 3636)