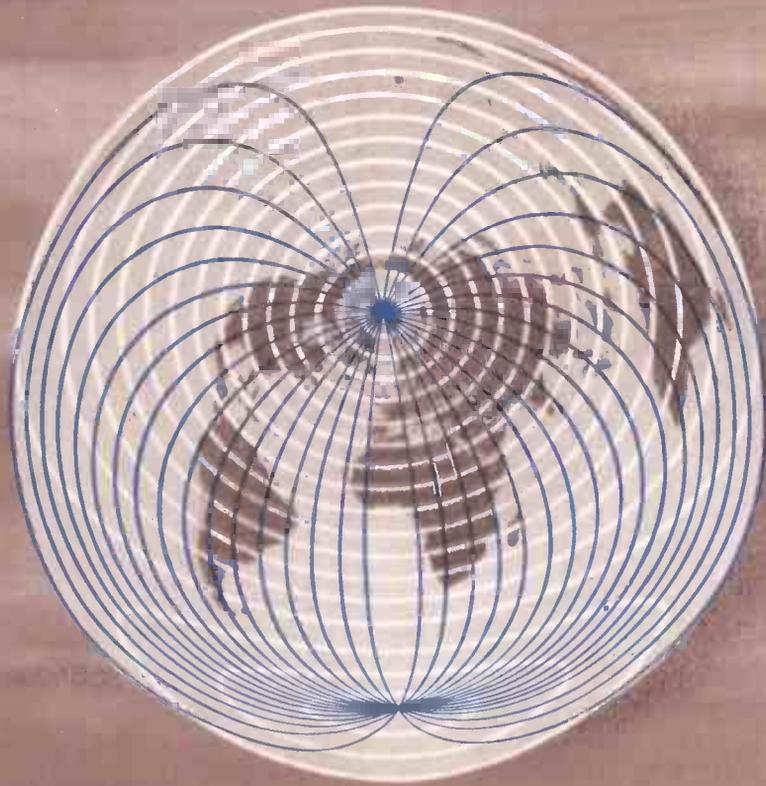


JUNE 1955

TWO SHILLINGS

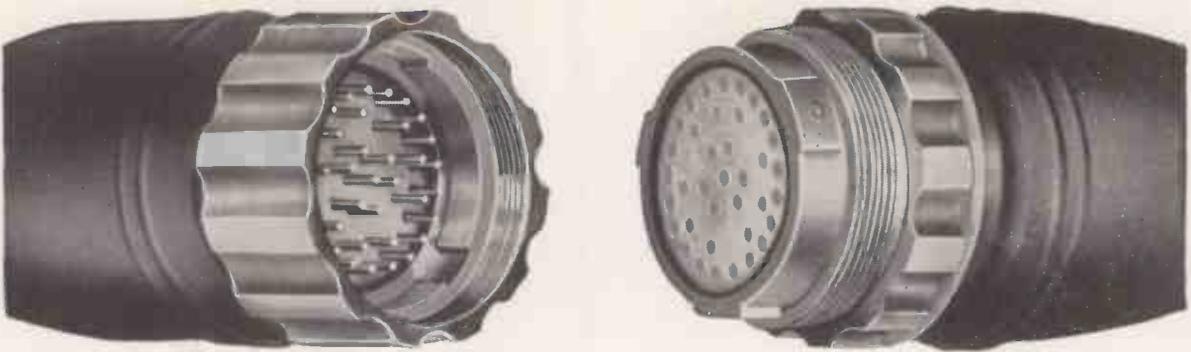
# Wireless World

Radio · Electronics · Television



**FORTY-FIFTH YEAR OF PUBLICATION**

# TELEVISION



In the impressive link-up of national television services, large numbers of BICC Multi-Unit Cables and Polypole Couplers were used throughout Europe. They were employed with both V.H.F. link equipment and T/V cameras. These cables and couplers are designed to provide a robust trailing cable system to withstand the hazards of outside television service. For further information please ask for Publication T.D.T.15.

## **BICC** multi-unit cables and polypole couplers

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



# Wireless World

RADIO, ELECTRONICS, TELEVISION

Managing Editor:  
HUGH S. POCOCK, M.I.E.E.

Editor:  
H. F. SMITH

JUNE 1955

## *In This Issue*

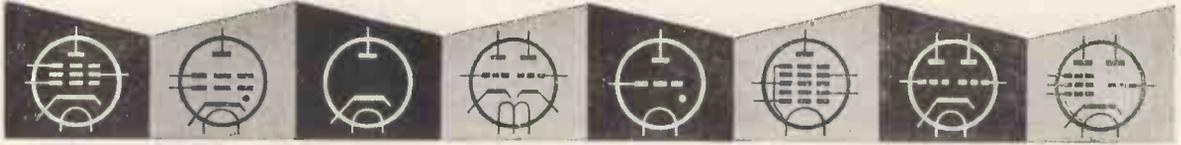
Editorial Comment .. .. .	251
V.H.F. Broadcasting Starts .. .. .	252
Tropospheric Scatter Propagation .. .. .	253
World of Wireless .. .. .	255
Components Exhibition .. .. .	258
Wide Range Electrostatic Loudspeakers—2. <i>By P. J. Walker</i>	265
Letters to the Editor .. .. .	269
Physical Society's Exhibition .. .. .	271
Test and Measuring Gear .. .. .	274
Valves and Semi-conductors .. .. .	277
Design for a 20 - Watt High - Quality Amplifier — 2. <i>By W. A. Ferguson</i> .. .. .	279
Wobbulator Adaptor for Band III. <i>By G. H. Leonard</i> ..	283
Some Problems in Television Lighting. <i>By W. C. Pafford</i>	288
B.B.C. Television Frequencies .. .. .	291
Cathode Followers — <i>By "Cathode Ray"</i> .. .. .	292
Short-wave Conditions .. .. .	296
F.M. Tuning Indicator. <i>By J. R. Davies</i> .. .. .	297
Random Radiations. <i>By "Diallist"</i> .. .. .	300
Unbiased. <i>By "Free Grid"</i> .. .. .	302

VOLUME 61 NO. 6

PRICE: TWO SHILLINGS

FORTY-FIFTH YEAR  
OF PUBLICATION

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: "Ethaworld, Sedist, London." Annual Subscription: Home and Overseas, £1 7s. 0d. U.S.A. \$4.50. Canada \$4.00. BRANCH OFFICES: Birmingham: King Edward House, New Street, 2. Coventry: 8-10 Corporation Street. Glasgow: 26B Renfield Street, C.2. Manchester: 260 Deansgate, 3.



# VALVES, TUBES & CIRCUITS

## 30. GERMANIUM DIODES FOR TELEVISION RECEIVERS

### Advantages and Disadvantages

The point-contact germanium diode can often be used with advantage in place of its thermionic counterpart. Its compactness and long life make it suitable for inclusion in a coil unit. It is robust and non-microphonic. The inter-electrode capacitance is low. There is no heater, therefore supplies are simplified and a possible source of hum is eliminated. And the forward resistance is low, giving improved detection efficiency.

The main limitations of the germanium diode, namely its reverse current at negative voltages and its relatively large temperature dependence, can be easily allowed for in circuit design and chassis layout. Earlier diode troubles, such as sensitivity to atmospheric moisture, have been eliminated by present-day manufacturing techniques.

The characteristic, as it changes from the positive to the negative region, passes through the origin, therefore at zero voltage there is no current flow. In the immediate vicinity of this point (say within  $\pm 10\text{mV}$ ) the ratio of forward to reverse resistance becomes small, and detection efficiency is much reduced.

### High and Low Current Types

The steeply rising forward characteristic of a high-current type of germanium diode implies a comparatively large reverse current and a comparatively low turnover voltage. Conversely, the less steep forward characteristic of a low-current type gives an extended reverse characteristic. These contrasted pairs of features are the basis of the possible range of diode types. They are the key to the choice of type for a particular application, and they are important influences on circuit design.

### Temperature Effects

Germanium diodes are affected by temperature, and all ratings apply at specified temperatures. It is necessary for the circuit designer to take into account not only the air temperature which is likely to occur in the receiver but also any heat which may be transmitted through the chassis. The appropriate forward current and reverse voltage ratings must be observed if the diode itself is not to generate destructive heat. It is not to be assumed, however, that a germanium diode is excessively sensitive in this respect. The dangers have been mentioned only in order to draw attention to the temperature rating—a rating which is not normally of much consequence where thermionic valves are used.

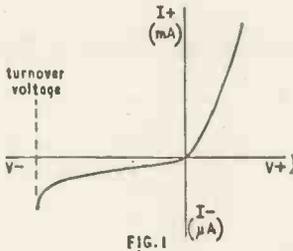


FIG. 1

### The Diode Characteristic

The general form of the germanium diode current/voltage characteristic is shown in Fig. 1. There are certain significant differences from the characteristic of a thermionic diode. The comparatively steep rise of the positive portion obeys an exponential rather than a three-halves power law, with forward currents which are normally of the order of 5 or 10mA at 1 or 2V. At high positive voltages, beyond the normal working range, the characteristic becomes nearly linear (that is resistive), without the saturation effect which is seen in a thermionic diode.

The negative characteristic shows not only a negative current for negative voltages, but also a rapid growth of this current if the voltage is made sufficiently great. In this region (which is well beyond the working range) *turnover* takes place, and the characteristic reverses. This condition produces overheating and a destructive runaway. The normal reverse currents are quite small (a few microamps) and, if the published temperature and peak reverse voltage ratings are observed, reverse currents have no harmful effect.

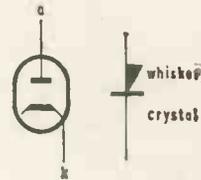


FIG. 2

Fig. 2 shows the standard symbol for a germanium diode in parallel with the familiar diode valve symbol. The figure is intended to assist in the reading of circuit diagrams. The differences between the two kinds of diodes should, of course, be borne in mind.

Further advertisements in this series will discuss the employment of the diode characteristic in a number of typical applications in television and f.m. receivers.

Reprints of this advertisement, supplemented by data for Mullard diode types, are available without charge.



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

## Television and V.H.F. Sound

**T**HOUGH prophets are usually not lacking in courage, not many of them have been bold enough to speculate on the future of sound broadcasting *vis-à-vis* television. But, without entering into competition with those few who have chanced an opinion, we may suggest that the B.B.C.'s newly launched scheme for v.h.f. broadcasting may well point the way towards a closely integrated sound/vision system of the future.

The new B.B.C. scheme, conceived several years ago, represents an idea in large-scale broadcasting that is without parallel in the world. Essentially it is based on combining Band I television stations with Band II three-channel v.h.f. sound transmitters. Propagation characteristics of these two sets of signals are not wildly different, and the scheme represents good engineering, being economical in both equipment and manpower.

Just as the addition of sound broadcasting transmitters to the television stations is a relatively inexpensive matter, the provision of v.h.f. sound facilities in television receivers is even more economical. A number of these combined sets have already made an appearance, and more are to be expected. Such combined broadcast receivers may, in the future, well satisfy the needs of the majority, and their widespread use may well lead to a closer integration between sound and vision broadcasting.

Apart from these possibilities, there is the question of quality of the new service. Interference is now almost intolerable on the medium frequencies; it goes without saying that listeners within the v.h.f. service areas will get a much quieter background. But what of improved frequency range and dynamic range? Here there are obvious limitations, including the landlines, but the B.B.C. has given assurances that the new transmissions will permit a substantial improvement in receiver performance.

### Electrostatic Loudspeakers

**D**EVELOPMENTS in electrostatic speakers, now being described in articles appearing in our pages, may conceivably have an important effect on the

combined vision/sound receiver discussed in the preceding paragraphs. High-quality sound is not usually considered necessary in a television set, but improvement in this direction may be demanded when the set includes provision for v.h.f. sound reception. An obvious advantage of using the electrostatic speaker for such a set is that the necessary high polarizing voltage is already there without extra cost. It is too early to make guesses about the shape an ideal speaker would take; perhaps some change in the now-almost-traditional proportions of the television receiver cabinet would be needed.

Whether these speculations be justified or not, the resurgence of the electrostatic speaker is certainly a matter of the greatest interest. Every conceivable method of artificially reproducing sound has been explored, but for over a quarter of a century the moving-coil principle has met no serious challenger; now, good as it can be, further development seems unlikely. The moving-coil speaker has always had to carry two onerous limitations: the mass of its moving parts and the necessity for providing a diaphragm that is at one and the same time rigid and flexible. True, the mass has been utilized in designing for level output at low and medium frequencies, but the price of linearity in this range is a steady deterioration in output at high frequencies. This disability can be lessened only by allowing the diaphragm to "break up."

The electrostatic speaker, on the other hand, would appear to be the answer to the designer's dream. As was pointed out last month, its performance is always predictable, no matter what the size and shape of the diaphragm.

Since it has been shown that the electrostatic principle is not inherently non-linear, the field is open to almost limitless development. We have already heard working a prototype speaker which covers a frequency range from 40 c/s to the upper limits of audibility. There can be no denying that the quality of reproduction has a freshness not usually associated with the heavier diaphragms of moving-coil speakers. No doubt practical problems remain to be solved, but it seems likely that the electrostatic speaker, after a long period of hibernation, is coming back to vigorous life.

# V.H.F. Broadcasting Starts

ON May 2nd, the v.h.f. station at Wrotham ceased to operate experimentally and started to work a regular service as the first station of the B.B.C.'s new f.m. broadcasting system. By the end of 1956, it is expected that eleven stations will be in operation and will cover 83% of the country with the Light, Home and Third programmes in a way which will be but little affected by interference. After Wrotham, a further ten stations are scheduled:—at Pontop Pike, Divis, Meldrum, Norwich, South Devon, Sutton Coldfield, Wenvoe, Holme Moss, Blaen Plwy, and Penmon.

At each station the three programmes will be radiated on frequencies 2.2 Mc/s apart in Band II. For Wrotham, the frequencies are 89.1 Mc/s (Light), 91.3 Mc/s (Third) and 93.5 Mc/s (Home). They will all be radiated from a common aerial array of the slot type. This has already been provided on many television stations (e.g., Sutton Coldfield and Holme Moss) and is evidence of the long-term planning of which this Band II service is the result.

The general plan is to have six 10-kW transmitters at each station. In effect, they will operate in parallel pairs to provide three transmitters of 20 kW each and, with the aerial gain, an effective radiated power of 120 kW each. The interconnection of the transmitters is not straightforward paralleling, however.

If we call one pair  $A_1$  and  $A_2$ , another  $B_1$  and  $B_2$  and the third  $C_1$  and  $C_2$ , then the outputs of  $A_1$  and  $B_1$  are combined and then mixed with the output of  $C_1$  and fed to one-half of the aerial array. The outputs of  $A_2$  and  $B_2$  are similarly combined and mixed with the output of  $C_2$  and fed to the other half of the aerial array.

The object of this somewhat curious arrangement is to minimize the effects of any fault. If any one transmitter develops a fault, the other one of the pair continues in operation and the result is merely a 3-db drop in signal strength. If a fault occurs in one-half of the aerial, the same thing happens. Indeed, there can be simultaneous faults in one-half of the aerial and in three of the transmitters on the same side of the chain with only a 6-db reduction in the signal. Arrangements are made to reverse the connections of the transmitters to the aerials so that, in the event of such a double fault, the good half of the aerial can be connected to the good transmitters.

It might be thought that the parallel operation of transmitters around 100 Mc/s would be a difficult matter. Actually, however, they have a common drive. Each basic transmitter has its own drive unit but only one is used at a time to drive both transmitters of a pair, the other acting as a spare.

The system of modulation used is F.M.Q.<sup>1</sup>, developed by Marconi's, who built the Wrotham station and from whom 46 other transmitters for the scheme

<sup>1</sup> "F.M.Q.," by W. S. Mortley, A.M.I.E.E., *Wireless World*, October 1951, p. 399.

have been ordered. The mean frequency is determined by a high-stability crystal oscillator and modulation is effected by a reactance-valve circuit which "pulls" the crystal frequency.

The general arrangement has been dictated by the requirement of extreme reliability, so that operating personnel are virtually unnecessary. Automatic monitoring devices are installed to call attention to any defect and, except for the repair of a fault, the stations should need no attention beyond routine maintenance.

The station at Wrotham differs quite a bit from this general description, for the apparatus is, in the main, that used for the experimental transmissions over the last few years. There are two 25-kW transmitters with two 4½-kW stand-by types and two 10-kW transmitters. The outputs of the two 25-kW ones are combined and then the signal is split into two. With each half is mixed the output of one of the 10-kW transmitters and each is fed, as before, to one-half of the aerial array. The final result is much the same, but the way in which it is achieved is different. It would clearly have been uneconomical to scrap two 25-kW transmitters, which is what would have been necessary if Wrotham were to keep to the general plan for the other stations.



**FATHER OF THE TRANSISTOR.** This year's I.E.E. Kelvin Lecture was delivered by Dr. W. Shockley, leader of a team at Bell Telephone Laboratories which extended the foundations of semi-conductor physics and ultimately evolved the transistor. Dr. Shockley gave an account of the basis of transistor physics and described some of the many applications of this device, such as in hearing aids and portable radio receivers. He also dealt with the prospects of using semi-conductor junctions for converting light into electrical energy and disclosed that trials are to be carried out on rural telephone lines powered by sunlight.

# Tropospheric Scatter Propagation

*200-mile Transmission on Frequencies in the U.H.F. Band*

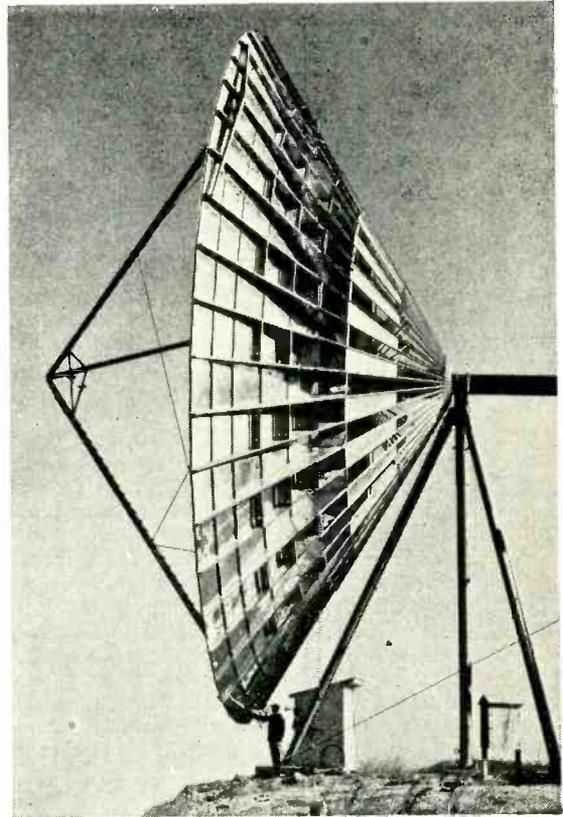
**I**N *Wireless World* for July, 1952<sup>1</sup>, a type of relatively long-distance transmission for frequencies in the lower part of the v.h.f. range was described, in which propagation is by a forward scattering process from irregularities in the lower part of the ionosphere, so that a portion of the radiated energy is returned to the ground and is receivable at distances up to about 1,250 miles.

According to the theory of Booker and Gordon<sup>2</sup> a similar, but distinct, type of scattering should take place in the troposphere, even though the air there is not ionized. In this region the air is in a state of irregular motion, this turbulence being due to local irregularities in the speed and direction of the air flow, thermal instabilities, etc. Such a turbulent medium may be visualized as one containing a large number of spherical blobs, and the dielectric constant of the individual blobs may differ widely from the mean dielectric constant of the medium as a whole. Therefore their refractive indices differ from that of the medium, in a degree depending on the scale of the turbulence, and they thus constitute a system of scattering centres for radio energy, the amount of energy scattered depending on the relation between the size of the blobs and the wavelength. The energy is scattered mainly in a forward direction, so as to be receivable at points far beyond the radio horizon of the transmitting aerial. Of course the amount of energy scattered by unit volume of the atmosphere is extremely small, but by the use of highly directive beam aerials for both transmitting and receiving, both being directed on to a given area in the troposphere, a large number of scattering centres can be brought into use, and a usable amount of energy made available at the receiver. There is increased forward beaming of the scattering with increased frequency, so that on frequencies in the u.h.f. band the scattered energy per unit volume of atmosphere is much greater than on lower frequencies.

## Practical Applications

Some experiments designed to put the above facts to a practical use have recently been carried out in America. They have been conducted jointly by Bell Telephone Laboratories and Massachusetts Institute of Technology on the lower frequencies in the u.h.f. band, and also by Syracuse University on a frequency of 915 Mc/s, the latter experiment being still in progress.

The result of the first of these experiments has been to develop a system of "over the horizon" transmission, capable of being used for television picture transmission, as well as for multi-channel telephone service. The propagation medium will thus support the wide-band transmission necessary for the above services, and signals would appear to be usable over a range of about 200 miles. It is visualized, therefore, that the present requirement for u.h.f. radio links to be with-



*The 60-ft. experimental aerial reflector used to receive u.h.f. television pictures at a distance of 200 miles by means of tropospheric scatter propagation.*

*Courtesy Bell Telephone Laboratories*

in "line of sight," i.e., about 30 miles apart, will no longer apply, and that the new system may, in time, supersede the present microwave radio relay network across the United States, in which the stations are spaced by about that distance. If that is so, and the system is economical in use, one can see immediate useful applications for it in Europe; for example, in the international exchange of television programmes.

The experiment was based on the fact that signals were consistently obtained beyond the radio horizon with the present radio link system: signals which were most probably propagated according to the Booker and Gordon theory. The next step was to use higher power and erect larger aerials than are used in the conventional system. Ten-kilowatt transmitters were employed using aerial reflectors of 60 feet in diameter, that is 20,000 times the power and 30 times the aerial reflector area as compared with that used in the ordinary links. One of these aerial systems is shown in the accompanying illustration. By this means it was found possible to "beam" enough power on to the appropriate area of the lower atmosphere that sufficient energy was scattered in a forward direction so as to reach the receiving aerial far over the horizon, and there provide a workable signal. Towards the

end of 1953 it was found possible to transmit 12 speech-frequency channels over the system, and in 1954 television was first successfully transmitted between Holmdel, N.J., and New Bedford, Mass., a distance of 188 miles.

The system may be likened to that of a powerful searchlight, which casts a beam in a straight line. Such a searchlight aimed at the sky can be seen from the ground miles away, even when the searchlight is behind a hill. This is possible only because some of the light is scattered by the atmosphere and reaches the observer on the ground.

It is emphasized that, in the United States, the new system will, at first, probably act as a supplement to, rather than as a replacement of, the present radio relay link system.

The system should not be confused with the ionospheric scatter system mentioned at the beginning of this article. The maximum distances possible are much less in the present case, but, on the other hand, the ionospheric system will not support the wide-band transmission necessary for television.

The experiment being conducted by Syracuse University appears to be on much the same lines as that just mentioned, the transmitter being at Lexington, Mass., and the receiver at Syracuse, N.Y., a distance of 254 miles, the intervening mountains ranging up to 3,000ft. The transmitter power is 12 kW and the aerial reflectors 28ft in diameter, these being identical at transmitter and receiver. A.M., f.m. and pulse signals are being used. The transmitting and receiving aerials are manually adjustable in azimuth and elevation in order to determine the most suitable angles for optimum results. These tests are designed to determine which type of modulation is best suited to this type of radio link, and to determine the variations in reception with time of day, weather and seasons of the year.

#### REFERENCES

- 1 "New Kind of V.H.F. Propagation," *Wireless World*, p. 273, July, 1952.
- 2 Booker, H. G., and Gordon, W. E., "A Theory of Radio Scattering in the Troposphere," *P.I.R.E.*, Vol. 38, No. 4, p. 401, April, 1950.

## "Adjacent-Channel" Colour Television

INVESTIGATIONS by the radio industry into the merits of various colour television systems for this country were discussed at a recent lecture by L. C. Jesty to the Television Society. One system under consideration, which has often been mentioned in *Wireless World*, is the modified version of the American N.T.S.C. system in which the colour signal is transmitted outside of the normal monochrome band, but overlapping the monochrome band of the station in the adjacent channel. For example, the colour signal of Kirk O'Shotts (Channel 3) would be transmitted within the monochrome band of Sutton Coldfield (Channel 4), and although this would undoubtedly cause some interference it would probably not be so bad for the Midland viewers as having their own colour signal continuously present and interfering in Channel 4.

Of course, the amount of interference in this system would depend on the geographical proximity of the stations in the adjacent channels, and it appears that the radio industry's investigation so far has been largely concerned with this matter. Mr. Jesty showed a map which indicated the areas most likely to suffer from the colour-

signal interference, the worst-affected ones appearing to be largely in the North and the West. This, however, was only based on calculation and it would be necessary to carry out actual field tests if the system proved worthy of further investigation. Expressed in actual figures, the calculated results suggested that only about 1.5-2% of the viewing public would suffer from the interference for 1% of the time, and this, said Mr. Jesty, did not look too impossible.

## F.M. Tuner Kit

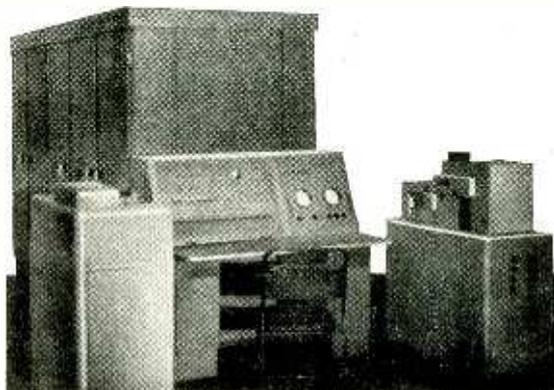
CAPACITOR and resistor kits for the F.M. Tuner described in our May 1955 issue have been put up by Erie Resistor, Ltd., and should now be obtainable from retailers. To assist constructors the 270- $\Omega$ ,  $\pm 10\%$  and the 180- $\Omega$ ,  $\pm 10\%$  resistors for  $R_2$ ,  $R_8$  and  $R_{10}$  are included so that either EF80 or EF91 valves may be employed. The alternative resistors are included free of charge. Resistors  $R_{20}$  and  $R_{22}$  are, however, not included as the former is not made by Erie and the value of the latter has to be found experimentally.

The capacitor kit costs £2 5s 6d and the resistor kit £1 7s 2d. It should be noted that type NPOL is included for  $C_6$  and type NPOM for  $C_{11}$ , as these are more suitable than type NPOK which was originally specified.

## Election Result Computer

BELOW is the electronic digital computer which the B.B.C. are using on election night to calculate the totals of seats won, lost and retained by the parties and also to forecast the final result. Built by English Electric, it is an engineered version of the N.P.L. ACE (Automatic Computing Engine) and is therefore appropriately named DEUCE (Digital Electronic Universal Calculating Engine). A feature of the machine is a magnetic drum storage system in which the two sets of recording and pick-up heads (16 heads on each) can be shifted automatically to any one of 16 positions across the 256 tracks on the drum in 25 milliseconds. This facility permits a great saving in electronic equipment and in fact about 1,300 miniature valves are used.

Numbers are represented in binary form by trains of pulses at a p.r.f. of 1 Mc/s, each train (or "word") containing 32 binary digits or the equivalent of 9 decimal places plus a sign. The magnetic storage drum will hold 8,192 of these "words." High speed of operation, however, is achieved partly by the use of acoustic delay lines of limited capacity for the main store, giving quick access to the stored information. Another saving of time is achieved by the precise timing of the coded instructions which initiate the various arithmetical operations. Most operations are, in fact, accomplished in 64 microseconds.



# WORLD OF WIRELESS

Organizational, Personal and Industrial Notes and News

## B.B.C. Band III Television

WHEN announcing the plan for the clearance of mobile radio from Band III (see our May issue) the retiring P.M.G.—Earl De La Warr—stated that four of the eight channels ultimately to be made available for television would be allocated to the I.T.A. and the remainder for an alternative service in that band. In anticipation, therefore, of the P.M.G.—whoever he may be in the next Government—granting these channels to the B.B.C. for a second television service, the Corporation has ordered sound and television transmitters for two stations.

The 10-kW vision transmitters with the associated 2.5-kW sound transmitters are scheduled to be delivered by Marconi's towards the end of next year.

## Competitive Television

LONDON'S first competitive television programme is to be broadcast on September 22nd from the I.T.A.'s transmitter being built at Beaulieu Heights, Croydon. The I.T.A. announces that for a few weeks prior to the opening, high-power test transmissions will be radiated.

The transmitter, which will have an e.r.p. of 60 kW, will radiate in Channel 9 with offset carriers (vision 194.75675 Mc/s, sound 191.27 Mc/s). The approximate service area was given on page 12, of our 5, 27th issue.

## Import-Export Ratio

THE provisional figure of £7,625,000 for British radio equipment exported during the first quarter of this year is an increase of more than £650,000 on the figure for the same period in 1954—a record-breaking year. The Radio Industry Council in announcing this figure draws attention to the continued marked rise in the overseas sales of sound recording and reproducing equipment. The value for the first three months of the year was £1.3M, an increase of more than £430,000 over the same period last year when exports for the whole year were valued at the record figure of £3.7M.

Although exports of valves and c.r. tubes increased during the period under review by some £175,000, and, moreover, imports of these accessories fell by nearly £130,000, there was still an adverse balance of trade of over £50,000 in this section of the industry.

Taking radio equipment as a whole, imports (according to figures issued by the Board of Trade) increased by £650,000—the increase recorded for exports.

## PERSONALITIES

**Sir Edward Appleton**, F.R.S., the new president of the Radio Industry Council in succession to Lord Burghley (who has held the office since 1952), has been principal and vice-chancellor of Edinburgh University since 1949. For ten years prior to going to Edinburgh Sir Edward was secretary (administrative head) of the Department of Scientific and Industrial Research. It will be recalled that in 1947 he was awarded the Nobel Physics Prize for his work on atmospherical physics and his discovery of the Appleton layer.

**R. H. Hammans**, recently appointed chief television engineer of Granada Theatres—one of the four programme contractors to I.T.A.—was with the B.B.C. from 1935 until taking up his new appointment. Originally on sound outside broadcasts he transferred to television O.B.s in 1937. Before going to the B.B.C. he was with the International Marine Radio Company for four years. Mr. Hammans, who operates an amateur station with the call G2IG, is executive vice-president of the R.S.G.B.

**Alfred H. Whiteley**, O.B.E., Comp. Brit.I.R.E., the new president of the Association of Public Address Engineers, founded in 1926 at the age of 33 the Whiteley Electrical Radio Company, manufacturers of components, accessories and electronic equipment. He was elected a Companion of the Brit.I.R.E. in 1949 and became the first Companion to serve on the Council of the Institution.

**T. D. Humphreys**, M.Brit.I.R.E., who joined Reproducers and Amplifiers, Ltd., as general manager in 1953, has been elected to the board. Before going to R. & A., he was general manager of Radar Components, Ltd., and was previously with A. C. Cossor, Ltd.

**L. Kearton Parker** has joined Winston Electronics, Ltd., of Hampton Hill, Middlesex, as chief sales engineer. He was for ten years with the Telephone Manufacturing Company, Ltd., which he joined in 1945 at the age of 29, and was for some time head of the audio and acoustics section of the Development Department. From 1952 to February this year he was telecommunications consultant to the company.

In addition to those mentioned in our last issue who had received the Insignia Award in Technology (C.G.I.A.) **Charles H. Rumble** received the award for his thesis on the manufacture of matrices for the production of long-playing records. Mr. Rumble is a director of the Transcription Manufacturing and Recording Company, Ltd., of Mitcham, Surrey.

**Sir George Nelson**, who is chairman and managing director of the English Electric group of companies, which includes Marconi's, has been appointed a governor of the Imperial College of Science and Technology.

## OUR AUTHORS



**W. C. Pafford**, contributor of the article on some problems of lighting in television studios, is both a television engineer and lighting engineer. In 1932 he joined the B.B.C. Midland Regional transmitter which was then transmitting sound for the 30-line television experiments. He became a maintenance engineer on 405-line television in 1936 and was later in charge of maintenance and wartime operations at Alexandra Palace. Mr. Pafford, who is now a lighting supervisor on television O.B.s, is also an artist and a number of his cartoons, signed "Paff," have appeared in *Wireless World*.

**G. H. Leonard**, who describes a wobulator adaptor for Band III in this issue, has for six years been with Ultra Electric, Ltd., where he is senior engineer in charge of radio and television test equipment. He was educated at University College, London, graduating with honours in physics in 1947.

## OBITUARY

**Charles J. Pannill**, who was the first chairman of the Board of editors of our American contemporary, *RCA Review*, until publication was temporarily suspended in 1942, died in New York in February. He was associated with Professor R. A. Fessenden in his early wireless experiments and in 1912 received the first American radio operator's licence. He became general manager of Radiomarine Corporation of America in 1928 and was president when he retired in 1947.

**Arthur H. Morse**, who was with the Marconi Company as an engineer specializing in direction finding before going to N. America in the early 1920s to become managing director of the Canadian Marconi Company, died in New York on April 6th, aged 74. He joined Marconi's on their acquisition of United Wireless Telegraph Co., of which he was superintendent. In his book "Radio: Beam and Broadcast," published in 1925, he reviewed the history of radio patents, on which he was an acknowledged authority.

## IN BRIEF

**Television Licences** in force in the United Kingdom increased during March by 96,373, bringing the total to over 4.5 million. The number of domestic sound-only licences totalled 9,208,936 (including 62,506 issued free to blind persons). Television licences totalled 4,503,766 and car radio 267,794, giving an overall total of 13,980,496.

**Competitive Television.**—The licence granted by the P.M.G. to the I.T.A. on April 6th for the operation of its stations will continue in force until July, 1964. It names only the Croydon station but permits the establishment of stations "at such other places in the United Kingdom, the Isle of Man or the Channel Islands, as shall be approved." The annual fee payable is £500.

**B.R.E.M.A. Council.**—The following member firms of the British Radio Equipment Manufacturers' Association have been re-elected to the executive council for the ensuing year. The names of the companies' representatives are in parentheses: Balcombe (E. K. Balcombe); Bush (G. Darnley Smith); Cole (G. W. Godfrey); Cossor (J. S. Clark); English Electric (D. C. Spink); Ferguson (L. Bentley-Jones); G.E.C. (M. M. Macqueen, chairman); Gramophone Co. (F. W. Perks); Kolster-Brandes (P. H. Spagnoletti); Philips (A. L. Sutherland); Pilot (H. L. Levy) and Ultra (E. E. Rosen).

At the annual general meeting of the **British Sound Recording Association** on May 13th Norman Leever, director of Leever Rich and Company, was re-elected president for a second year of office. R. W. Lowden continues as honorary secretary, H. J. Houlgate, membership secretary and D. W. Aldous, technical secretary.

It was announced at the annual dinner of the **British Wireless Dinner Club** that Harold Bishop (B.B.C. Director of Technical Services) and Earl Mountbatten had accepted the invitations to become president and vice-president respectively. The membership now totals 68.

**Independent Commercial TV?** A special licence was granted by the Post Office to the J. Arthur Rank Organization for relaying television programmes, including specimen "commercials," by a 6,800-Mc/s transmitter from the State Theatre, Kilburn, to the British Industries Fair at Olympia, where demonstrations of Cintel large-screen television were given.

The present extended schedule of B.B.C. **Television Trade Tests** (weekdays 11.0-1.0) which was introduced last September will continue until August 31st.

Since we published particulars of the international contest for **Radio-Controlled Models** in our May issue the dates have been changed. The boat competition will be on July 30th and the aircraft contest on the following day. Further details are obtainable from D. W. Aldridge, 1, Fowberry Crescent, Fenham, Newcastle-upon-Tyne, 4.

**I.T.A. Headquarters.**—Towards the end of June the I.T.A. plans to move from the temporary premises at Woods Mews, Park Lane, occupied since last October, to its permanent administrative headquarters at 13-14, Princes Gate, London, S.W.7.

**Transistor-Grade Germanium**—single crystal or polycrystalline—is available to specified characteristics from G. A. Stanley Palmer, Maxwell House, Arundel Street, Strand, London, W.C.2, who will supply small quantities if required.

**Band III Tests.**—There has been some confusion regarding the times of the transmissions (vision 194.75 Mc/s, sound 191.27 Mc/s) from the Belling-Lee station, G9AED, at Croydon. A test pattern is now radiated from 10.30-12.30 and 2.0-4.0 (Monday to Friday) and 10.0-1.0 (Saturday).

**What is V.H.F.?** What is f.m.? Shall I need a new set to receive v.h.f.? These questions and many more are answered for the non-technical listener in a booklet prepared by the Engineering Information Department of the B.B.C. Sketch maps giving the approximate coverage of the first ten v.h.f. stations planned are included in the 12-page booklet obtainable free from the B.B.C. Publicity Department, 12, Cavendish Place, London, W.1.

**Maximum Allowances** for second-hand sound and television receivers purchased by dealers are given in the booklet "Used Radio and Television Set Values (1955)" prepared by the Radio and Television Retailers' Association and published by the Trader Publishing Company. It costs 2s 9d, including postage. The oldest sound and television receivers listed are of 1949 vintage. A nominal allowance of £2 is quoted for older television sets.

## EXHIBITIONS

Twenty papers on the production and properties of plastics will be presented at the Convention which is being held during the **British Plastics Exhibition** at Olympia from June 1st to 11th. Admission to the exhibition, which is organized by *British Plastics* and will be open daily from 10.0-6.0, is 2s 6d.

"**Silicones for Industry**" is the title of an exhibition covering the production and application of silicones, which is being held at the Midland Hotel, Manchester, from June 13th to 18th. Invitation tickets can be obtained from the organizers, Midland Silicones, Ltd., 19, Upper Brook Street, London, W.1.

**Instruments on Show.**—The third British Instrument Industries Exhibition opens at Earls Court on June 28th. It will be open from 10.0-6.30 daily (except Sunday) until July 9th. Admission is 2s 6d.

**Amateur Radio Show.**—The R.S.G.B. has tentatively booked accommodation in the Royal Hotel, Woburn Place, London, W.C.1, for the week November 21st-26th for this year's amateur radio show.

A **Scottish Exhibition** of electronic equipment in which 26 firms are participating has been arranged at the School of Engineering, Burnbank, Lanarkshire. It will be open daily (10.0 to 9.0) from June 6th to 11th.

## BUSINESS NOTES

An order for six more v.h.f. transmitters, making 46 in all, has been placed by the B.B.C. with **Marconi's**. They will provide a three-programme service from Holme Moss; two transmitters being operated in parallel for each programme. The Corporation also has on order 38 transmitters from Standard Telephones & Cables.

**Aveley Electric, Ltd.**, representatives for Rohde and Schwarz, Munich (communication and laboratory equipment), are closing their office in Tottenham Court Road, London, W.1, on June 12th and moving into a new factory at Ayron Road, Aveley Industrial Estate, South Ockendon, Essex (Tel.: South Ockendon 3292).

Closed-circuit television equipment has been installed in a ship of the Royal Canadian Navy by **Pye Canada, Ltd.**, to permit visual communication from the operations room to various key points in the vessel. A camera in the operations room will be focused on the plotting chart upon which the movements of other vessels are recorded. Receivers will be installed at five or six key points in the ship so that officers will have an immediate picture of the tactical situation rather than mere information about it.

Radio communication equipment, radar and other electronic aids to navigation and fishing have been installed by the **Marconi International Marine Communication Company** in the new fishery research vessel *Sir William Hardy*. Other recent Marconi Marine installations include communication equipment and d.f. gear in the new 32,000-ton-capacity steam turbine tanker *British Victory*, telegraphy-telephony transmitter, receivers, echometers and direction finders in the motor trawler *Princess Anne*, and an R/T transmitter-receiver and echometers in the motor trawler *Bermuda*.

**McMurdo Instrument Company**, of Ashted, Surrey, announce that sales of their Unitags, both unassembled and assembled, are now conducted by Harwin (Engineers), Ltd., 101, Nibthwaite Road, Harrow, Middx. (Tel.: Harrow 0381), to whom all enquiries and orders for this component should be sent direct.

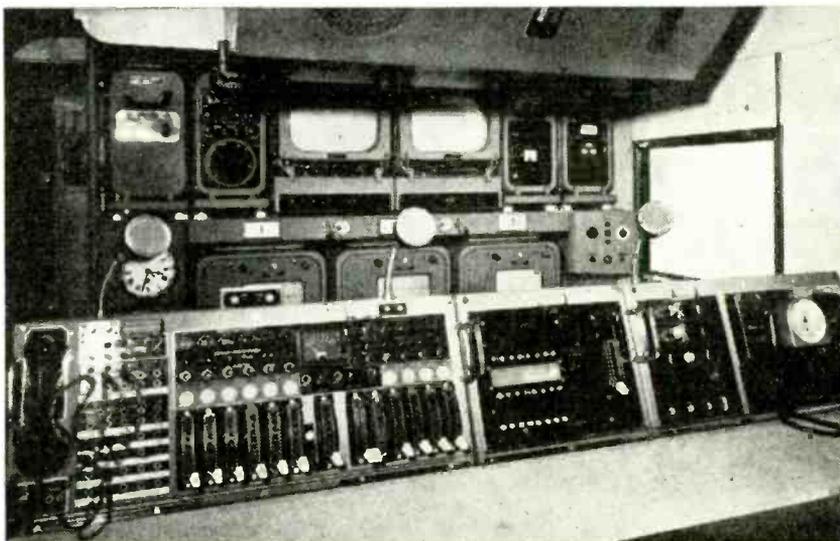
**Airtech, Ltd.**, of Aylesbury and Thame Airport, Had-denham, Bucks, have been awarded, by the Canadian Department of Defence Production, the contract for the maintenance and repair of all radio and electronic equipment used by the Canadian air force in the United Kingdom.

**Gresham Transformers, Ltd.**, have transferred the production of small transformers for the Electronics Division to their Lion Works on Hanworth Trading Estate, Feltham, Middlesex. K. G. Lockyer, B.Sc., A.M.I.E.E., A.M.Brit.I.R.E., who has been appointed manager of Lion Works, was formerly production manager with Solartron Laboratory Instruments, having previously been with Philips (Mitcham Works), Plessey and London Electrical Company.

A transposition of figures in **Goodmans'** advertisement in this issue has been noticed since the page went to press. The fundamental resonance of Type 1205 is 75 c/s and that of Type 1210 is 35 c/s.

Among the contracts recently placed with **Pye Marine** for v.h.f. radio-telephone equipment are installations for 10 tankers operating on the Manchester Ship Canal; for Aberdeen fishing vessels—providing short-range inter-communication whilst fishing in pairs; and for the new Trinity House pilot vessel *Pathfinder*. Pye Marine have also provided a fixed station at the boat yard of Saunders-Roe (Anglesey), Ltd., and a mobile set is taken on board new craft undergoing sea trials so that results of the tests can continually be communicated to the yard at Beaumaris.

THE LATEST B.B.C. mobile control room for television O.B.s which is fitted with three Marconi cameras and associated control and monitoring equipment. In the foreground are the 10-channel sound-mixing panel and the vision-mixer which will accept eight inputs. Behind are the picture monitors.



A new factory at West End, Congleton, Cheshire, has been bought by **Aerialite, Ltd.**, for the manufacture of television aerial equipment, converters and components.

The radio components (Clix) and wiring accessories departments of the **Edison Swan Electric Company, Ltd.**, have moved from 21, Bruton Street, London, W.1, to the company's head office at 155, Charing Cross Road, London, W.C.2 (Tel.: Gerrard 8660).

## EXPORT NEWS

The equipment for another radio link for the Swiss television network has been supplied by the **General Electric Company**, who equipped the trans-Alpine link in time for the European programme exchange last year. The new link connects Uetliberg (Zurich) with La Dole (Geneva)—a distance of about 150 miles—and also ties in with the earlier installation linking Chasseral and Monte Generoso.

An order worth over £20,000 to supply the Eire Department of Posts and Telegraphs with three 12-channel open-wire telephone carrier systems has been secured by the **Automatic Telephone and Electric Company** in face of keen Continental and American competition. The equipment will link Limerick and Tralee, Limerick and Ennis, and Mulingar and Cavan.

A technical assistance mission from the International Civil Aviation Organization is advising the Afghanistan government on bringing the country's two main airfields up to international standards. As part of the development scheme the Department of Civil Aviation has ordered from **Redifon, Ltd.**, twelve 5-W radio-telephones, three 50-W radio-telephones, two 500-W h.f. transmitters for ground-to-air telephony, two non-directional beacons and four communication receivers. Twelve of these communication receivers, which cover the range 13.5 kc/s to 32 Mc/s, have also been ordered by the New Zealand Posts and Telegraphs Department.

Six studio tape recorders (Type BTR/2A) have been ordered from **E.M.I. International, Ltd.**, by All India Radio, which has previously ordered 17 transportable tape recorders (Type TR/50A). Thirty-two of these transportable instruments have also been supplied to the Indian Ministry of Information and Broadcasting.

**Redifon** radio equipment has been installed in the fleet of 75-ft motor trawlers built in Hong Kong for the South Korean government under a United National Korean Reconstruction Agency procurement plan.

# Components Exhibition

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

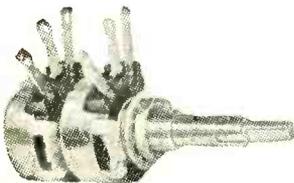
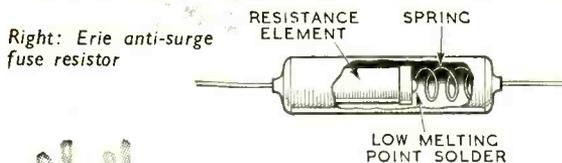
The "private" exhibition held in London by the Radio and Electronic Component Manufacturers' Federation from 19th to 21st April is reviewed in these pages. In addition to describing in detail some of the new components and accessories shown, we give in each category a list of exhibitors and their main products. Test and measuring equipment, and also valves, are dealt with on pp. 274 and 277. New sound-reproducing equipment will be discussed in a later issue.

## RESISTORS

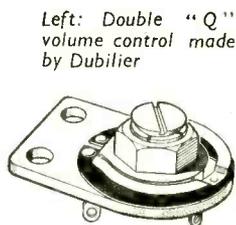
ONE of the most interesting and useful resistance devices seen for some time was shown this year by Eric. It consists of a low-value resistor with a tensioned coil spring soft-soldered to one end, the whole being enclosed in a ceramic capsule. It is intended to combine the functions of a surge limiting resistor and fuse in the anode circuit of mains rectifiers and is appropriately called a fuse resistor. In the event of a heavy current flowing for an appreciable time the heat generated in the resistor melts the solder and releases the spring and so opens the circuit. The fuse "blows" about 15 sec after the breakdown, or short circuit developing.

Metallized film resistors are being more widely adopted where high stability is required and although the technique is not new it laid dormant for many years before revival in admittedly a modernized form a few years ago. The latest addition to this type is the new "Q" model developed by Erg. It measures 2in long by  $\frac{1}{32}$ in in diameter and is rated at 2 W. The metal film is deposited on a glass rod and then spirally cut to give the required resistance values.

Two main lines of development can be seen in connection with the ubiquitous carbon volume control. One is the introduction of still smaller models with, of course, lower wattage ratings. For transistor equipments only low-wattage types are required at present. Egen have a sub-miniature pre-set open type rated at  $\frac{1}{10}$  W and



Right: Miniature  $\frac{1}{10}$  W pre-set volume control (Egen)



measuring approximately  $\frac{3}{4}$ in  $\times$   $\frac{1}{2}$ in; Plessey have one, described as the Type G, on a circular base of just over  $\frac{1}{2}$ in in diameter while Morganite have some models designed originally for hearing aids and later developed for other uses.

Reduction in size of the domestic-type volume control proceeds apace and several firms, Dubilier being one, have extended the idea by ganging their miniature "Q" type in order to save panel space. Concentric spindles are employed. Ganged type are popular in mobile equipments and especially in car radio sets where the frontal aspect has to be kept down.

The final main development is complete sealing of the element, the object being to give better stability under widely varying conditions of temperature and humidity. Many ingenious ways are employed to seal the spindle without introducing too much friction.

Manufacturers: A.B. Metal Prods.; British Elect. Res.; Bulgin; Colvern; Dubilier; Egen; Electronic Comp.; Electrothermal; Erg; Erie; Labgear; Morganite; N.S.F.; Painton; Plessey; Salford; Welwyn; W.B.; Zenith.

## CAPACITORS

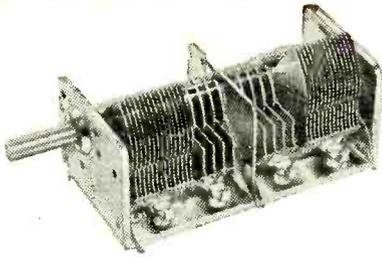
TWO fairly recent developments in electronics are largely responsible for a new trend in capacitor design. One is the transistor, which has called for some quite high-value capacitors for low-voltage operation (1.5 volts upwards). The other is the more recent jump to popularity of the printed circuit. This, and the transistor assault, has required capacitor makers to think in terms of sub-miniature parts, so we now have quite a large number of what can only be described as lilliputian capacitors, fixed and variable.

T.C.C. have introduced a range of low-voltage electrolytics designed especially for transistor circuits. Known as the CE58 series, they have capacitances ranging from 0.25  $\mu$ F to 6  $\mu$ F and in working voltages of from 25 for the small capacitance to 1.5 for the larger. Those in this series measure  $\frac{3}{16}$ in long and only  $\frac{1}{16}$ in in diameter. Some slightly larger models with higher working voltages are also available.

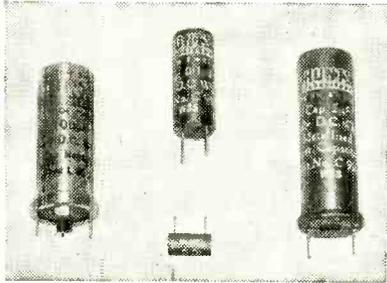
Sub-miniaturization of ceramic and other types is being applied for use in printed circuits, also the position and kind of connecting wires may be almost, if not quite, as important as the size of the component itself. Erie has introduced a range of components, including capacitors, described as "stripped." The omission of moulded cases and other "protection" has resulted in quite a big reduction in size. While the lead-out wires are arranged to suit their own particular versions of the printed circuit there are many Erie capacitors that meet without modification the requirements of other styles of printed circuitry.

Hunt's have modified several of their existing capacitors for printed circuit use. The main changes consist of fitting thin easily solderable wires to electrolytics and other capacitors which previously had unsuitable connections and bringing out the leads along the side of a tubular rather than at the extreme ends. The "Thermic" Type W97 is a new Hunt's product and is one of the smallest metal-clad metallized-paper capacitors seen so far. A 400-V, 0.001- $\mu$ F capacitor in this range measures only 0.135in in diameter and 0.61in long. The range includes 200-, 400- and 600-V type from 50 pF to 0.04  $\mu$ F.

A smaller version of the Polystyrene series of capacitor made by Suflex is now available; it measures only  $\frac{1}{16}$ in



Wingrove and Rogers a.m./f.m. two-gang capacitor.



Hunt's capacitors modified for printed circuits.

long and  $\frac{3}{8}$  in in diameter and is made in capacitance ranging from 5 to 250 pF. Some Suffix models now have the connecting wires brought at one end instead of at both ends; these are intended primarily for printed circuit use, but have other applications as well.

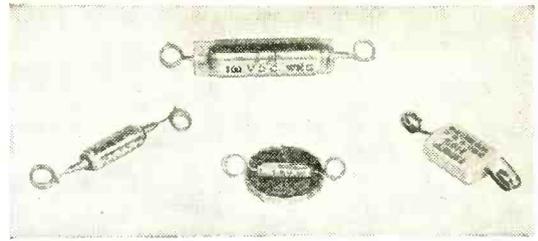
Although Dubilier did not show capacitors made especially for printed circuits it was pointed out that so many of their capacitors are in the lilliputian class that they fit the requirements without modification. They have introduced a new range of lead-through capacitors for use with screened rooms and screened equipment of various kinds. They are metal clad and some models are actually two capacitors back-to-back with a common "earthing" plate between them. Some of the larger (physically speaking) models will carry as much as 5A; a 0.1- $\mu$ F type in this category measures only  $\frac{3}{4}$  in in diameter and extends  $1\frac{1}{2}$  in either side of the earthing flange. This model is for 250 V a.c. or d.c. working.

An interesting development is a vitreous capacitor using glaze for both the coating and the dielectric. Known as the Vitricon range they are made by Welwyn Laboratories, and are said to be quite satisfactory for use up to 150° C. At this temperature the insulation resistance is better than  $10^{10} \Omega$ . They are quite small and available in a wide range of values.

The demand for a tuning capacitor suitable for an a.m./f.m. receiver has been met by Wingrove and Rogers with a model having a normal capacitor section associated with a special wide-spaced anti-microphonic v.h.f. section. The v.h.f. sections are set in the middle of a 2-gang assembly each side of the dividing screen with the a.m. sections before and behind them respectively. A capacitance swing of 17.4 pF is provided for f.m. tuning. These are available to manufacturers only.

Jackson Bros. have a range of gang capacitors embodying what is described as a band-spread section in each unit. These sections can be of various values and the smallest, giving about a 12-pF swing, would serve a.m./f.m. requirements. The main capacitor unit is of the usual size for medium- and long-wave use.

Special two-gang variable capacitors for f.m. units and converters giving under 20 pF coverage were shown by Plessey, Jackson and Wingrove and Rogers, while a long range of lilliputian variables in single, butterfly and split-stator patterns were seen on the Stratton stand. These have small-diameter spindles and provision is made for



Selection of latest T.C.C. capacitors including transistor sub-miniature types.

ganging any number by means of appropriately small flexible couplers.

**Manufacturers:** B.I. Callenders Cyldon; Daly; Dubilier; Erie; Hunt; Jackson Bros.; London Elect. Manf.; Mullard; Plessey; Stability Radio; Stratton; Suffix; T.C.C.; T.M.C.; Walter Inst.; Wego; Wingrove and Rogers.

## COILS AND TRANSFORMERS

BY combining a 10.7-Mc/s i.f. transformer with one of 465 kc/s or so in a single screening can a considerable saving can be effected in the space taken up by i.f. transformers in an a.m./f.m. receiver. Dual i.f. transformers of this kind were shown by the Wireless Telephone Company (one of the Plessey group) and by Weymouth.

The W.T.C. model is housed in an aluminium can measuring  $1\frac{1}{2}$  in  $\times$  1 in  $\times$   $2\frac{1}{2}$  in high and the two transformers are mounted side-by-side lengthwise in the can with the dust cores accessible from top and bottom. Each is independently trimmed. The "Q" of the a.m. transformer is given as 110 and that of the f.m. one somewhat less. The f.m. bandwidth is said to be about 330 kc/s. In addition to the dual i.f.s. there is a dual a.m./f.m. ratio detector unit and a separate 10.7-Mc/s i.f. transformer.

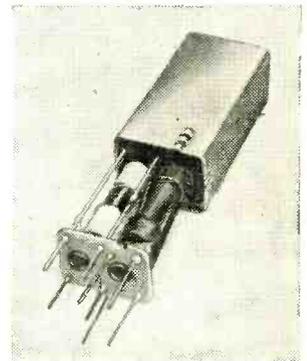
In the Weymouth models the two transformers are assembled crosswise in the can with the dust cores accessible from two opposite sides. The f.m. transformer is designed for 10.7-Mc/s working, has a bandwidth of 330 kc/s measured between 6-db points and a nominal "Q" of 80. The companion a.m. transformer is designed for an 11-kc/s bandwidth (6-db points), has a "Q" of 55 and is centred on 470 kc/s. The ratio detector model has a peak-to-peak bandwidth of 400 kc/s and the a.m.-rejection is said to be -45 db.

Stratton also were showing some 10.7-Mc/s and some 5.2-Mc/s transformers, and these included both ratio detector and Foster-Seeley types.

Except for improvements to detail nothing outstanding was seen in the design of iron-cored components. Further developments and expansion in the application of the resin potting technique was evident, and in the principal makes there are now some four different styles available; resin cast, metal potted with some kind of filling, hermetically sealed and open windings, now almost always vacuum impregnated.

**Manufacturers:** Advance; Associated Electronic; Elac; English Electric; Ferranti; Goodmans; Gresham; Igranite; Parmeko; Partridge; Plessey; R. & A.; Rola; Stratton; T.M.C.; Weymouth; Wireless Telephone; W.B.; Woden; Wearite; Zenith.

Wireless Telephone (Plessey) a.m./f.m. dual i.f. transformer.



## TELEVISION COMPONENTS

THE double-triode cascode r.f. amplifier and the triode-pentode frequency-changer form the basis of nearly all television receiver "front-ends." Tuners embodying them fall into two groups of similar external appearance and controls. Most have switch station selectors with 12 positions giving a choice among five Band I and seven Band III stations. The other control is an oscillator trimmer.

In one group, the turret tuners, there are individual coils for each station, fixed to strips carrying the connecting contacts which are mounted on a rotating framework. The individual coils are thus brought round to the circuit for connection. The other group is of the incremental inductance type. Wafer switches are used and between each pair of contacts is connected the small inductance needed to change the tuning from one channel to the next. With this type, alignment must be done first on the highest frequency channel, then on the next channel lower and so on. With the turret tuner, however, the coils for each channel can be aligned independently.

The Cyldon Teletuner Mark 1 is of the turret type and is claimed to have noise factors of 5 db and 9 db on channels 1 and 8 with gains of 43 db and 36 db. The oscillator drift is stated to be under 100 kc/s for a temperature rise to 60°C.

The N.S.F. tuners are examples of the incremental-inductance type. One model covers not only the 13 Bands I and III stations but has an extra switch position to enable reception to be obtained in the u.h.f. band if it becomes necessary in the future.

The Weymouth television i.f. strips are virtually com-

plete receivers except for the scanning circuits and power supplies. They comprise sound and vision i.f. amplifiers with the detectors, noise limiters, video stage and sync separator. The r.f. side is made as a separate unit which can be dropped into a cut-out in the main chassis.

This firm also showed a two-valve convertor for Band III which is designed to provide an output in Band I at the frequency of the local station. Aerialite also showed Band III convertors intended for use with any Band I receiver.

Little change was evident this year in scanning components save in details of design. The use of Ferro-cube, dust-iron and similar materials has obviously come to stay, as has the castellated yoke. Mullard now have such a yoke with 16 slots, enabling a better field distribution to be secured. Deflection assemblies for 90° tubes were shown by several firms, including Igranic and Plessey, and can be picked out at once from the 70° types by the enormous turned-up front ends of the line coils. It is interesting to see that in these assemblies the frame coils are not the conventional saddle type but are the so-called toroidal type. That is, there are four frame coils wound around the core material.

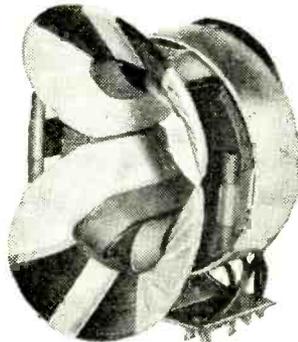
Line-scan transformers are of the type that has now become conventional, but it is obvious that increasing attention is being paid to insulation. In some Igranic models, for instance, the e.h.t. rectifier is mounted inside what can only be termed a plastic "bath-tub"!

The permanent magnet for focusing and for ion traps was well in evidence. Goodmans showed a new focusing unit in which the magnets are held by a die-casting, while Elac showed several types. Among these is the Duomagnette with two opposing ring magnets. The Marrison & Catherall unit is designed to minimize astigmatism and both the focus and the shift controls can be adjusted from outside the receiver.

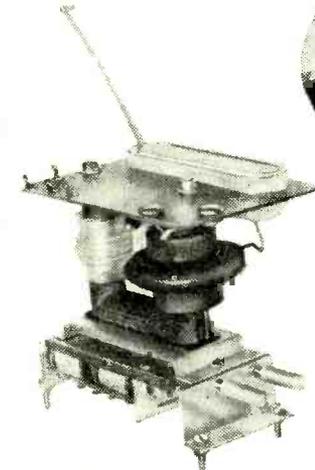
**\*Makers:** Aerialite (C); Cyldon (T); Elac (F); Goodmans (F); Igranic (D, Tr.); Long & Hambly (M); Marrison & Catherall (F); James Neill (F); N.S.F. (T); Plessey (D, F, T, Tr); Weymouth (C); W.B. (D, F, Tr).

**\*Abbreviations:** C, convertors; D, deflector coils; F, focus units and ion-trap magnets; M, masks; T, tuners; Tr, transformers.

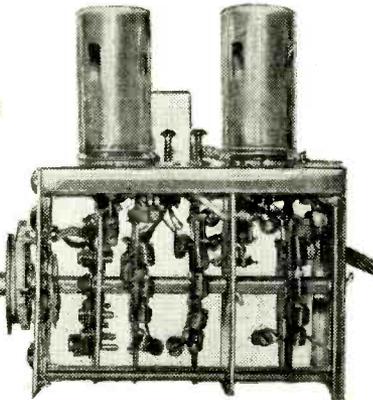
Right: Plessey deflector coil for 90 degree tube.



Left: Igranic line-scan transformer; note the "bath-tub" for the rectifier.



N.S.F. television tuner of the incremental-inductance type.



Weymouth a.m./f.m. tuner.

## SUB-ASSEMBLIES

AMONG the larger items in this category was a new a.m./f.m. tuner shown by Weymouth. It covers the medium- and long-wave bands and the full f.m. allocation from 84 to 96 Mc/s, and the wavechange switch also has a position for "Gram." The r.f. amplifier is a 6AM6 and is operative only on the f.m. band, while the frequency changer is a 6BE6. Maximum power consumption is 0.6 A at 6.3 V for l.t. and 12-22 mA at 200 V for h.t. Another new tuning unit, for the medium-wave band, was shown by Cyldon, but this contained no valves and was simply a

system of pre-set permeability-tuned coils operated by push-buttons, with facilities also for manual tuning.

Printed circuits were very much in evidence and a wide range of circuit configurations, including Band I/Band III television tuners and aerial cross-over networks, 35-Mc/s i.f. transformers, computer panels, transistor circuits and r.f. filters, were displayed by T.C.C. These were made by the conventional etching process, but examples of a new method of manufacture were to be seen on the Erie stand. In this the insulating base material is embossed with the required circuit and the copper foil is pressed into the declivities, the excess copper on the raised parts being milled off afterwards. The method is claimed to avoid any troubles which may be caused by acid remaining from the etching process and also to give thicker conductors capable of carrying more current.

The valve-circuit support shown by McMurdo last year, with the valvholder mounted on top of a plug-in pedestal, is now supplied by the makers with the customer's circuit components already assembled and potted in a solid cylinder of resin around the pedestal.

**Makers\*:** Advance (D); B.I.C. (D); Cyldon (T); Erie (P); Ferranti (D); Hunt (P); McMurdo (VC); Plessey (P, LA); T.C.C. (P); Wego (D); Weymouth (T, LA); Wright and Weaire (LA).

**\*Abbreviations:** D, delay networks; LA, coil assemblies; P, printed circuits; T, tuning units; VC, valve circuit assemblies.

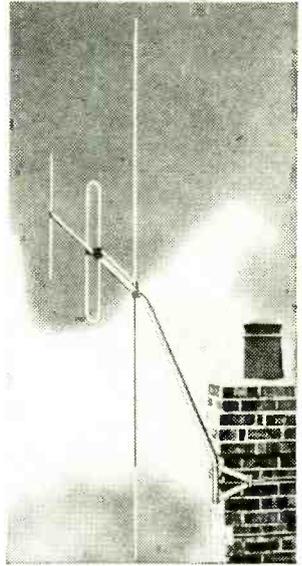
## AERIAL EQUIPMENT

ALTHOUGH the new f.m. broadcast service is due to commence long before Band III television will materialize the whole emphasis in the aerial display at the show this year was Band III aeriels and adaptors.

It is now apparent that anywhere outside the immediate vicinity, or swamp area, of a Band III station something more elaborate than a simple dipole, or dipole adaptor, will have to be used. This may not always be necessary in order to get a strong enough signal, but very often to differentiate between the direct signal and a signal arriving by an alternative path or paths and produced by reflections from buildings of one kind or another. These invariably give rise to ghost images.

Simple adaptors for existing types of Band I aeriels will find many applications and some quite ingenious and inexpensive arrangements were seen this year. For example, Belling-Lee have a kit comprising a number of rods and two plastic insulators for holding them in position on a single dipole. The rods extend each side of the centre insulator and lie parallel with the dipole and partially enclose it. They behave on Band III as two transmission lines end-feeding the exposed end parts of the Band I

*Belling-Lee combined Band-I dipole and director and folded dipole for Band III.*



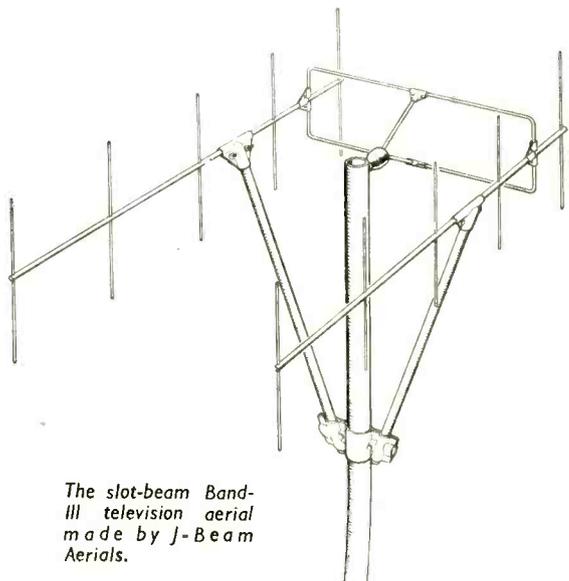
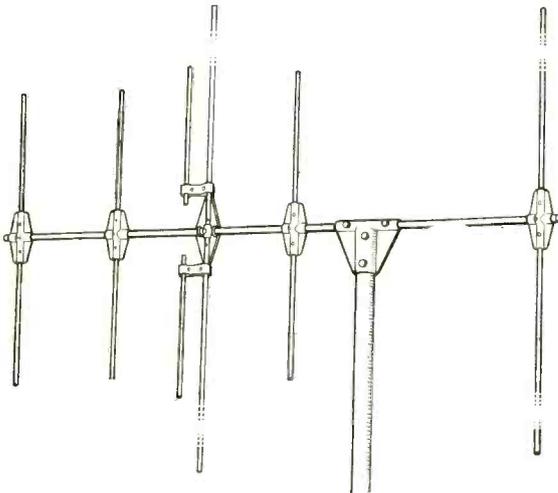
aerial. These end parts behave as three-quarter wavelength aeriels fed in phase. The result is that on Band III there is a gain of about 3 db over a plain dipole.

Other firms have applied various schemes which enable the Band I aerial to be made to operate as an harmonic-type aerial giving a gain over the existing aerial. Adaptors of one kind or another for "H" and "X" aeriels were shown by Aerialite and Antiference.

The more elaborate kind of adaptor takes the form of two or more elements of Band III length fitted to an existing "H" or multi-element aerial and utilizing in some cases one of the existing larger elements to reinforce the pick-up on Band III. Sometimes the mast is employed as an untuned reflector element. These adaptors are arranged to be fixed either in line with the existing Band I elements or at any desired angle, the latter to cope with conditions arising from the Band I and Band III stations being differently sited. Aerialite, Antiference and Belling-Lee showed these additional aerial parts mounted on outriggers for attachment to the cross arm of an existing "H" type and capable of swinging to any direction required irrespective of the alignment of the "H." In all cases the aim is to provide more gain from the Band III system than given by the accompanying Band I aerial, as this will generally be found necessary.

Whereas a four-element aerial is about the largest it is practical to use for Band I, it will be quite practical to go to a 10- or 12-element Yagi on Band III, given a suitable kind of mast. The smallest independent Band III aerial was a 3-element one, the largest had 10 to 12

*Antiference combined Band-I "H" and Band-III 4-element Yagi television aerial.*



*The slot-beam Band-III television aerial made by J-Beam Aerials.*

elements, giving a gain over a plain dipole of 14 db or more. Like the Band I 4-element Yagi these multi-element types can be mounted either as a stack, i.e., one above the other with appropriate spacing, or as a broadside array; the two systems being a half wavelength apart and side-by-side. Being generally smaller stacking or broadside mounting is more practical on Band III than on Band I. All the firms making aerials had several designs of this kind.

When separate Band I and III aerials feed into a single input on the receiver, or a combined aerial such as a Band I with adaptor elements feeds into separate inputs on the set, a filter is required between the aerial system and the receiver to prevent inter-action between the aerials. These filters take various forms, but basically they separate out the signals on the two bands and direct them along their correct courses. Belling-Lee call their unit a "Diplexer Tuned Filter." Antiference call theirs a "Y Box" and it provides rejection of the unwanted band of something over 20 db; its insertion loss is said to be no greater than 0.75 db on any channel and it is intended for 70- to 80-Ω cables.

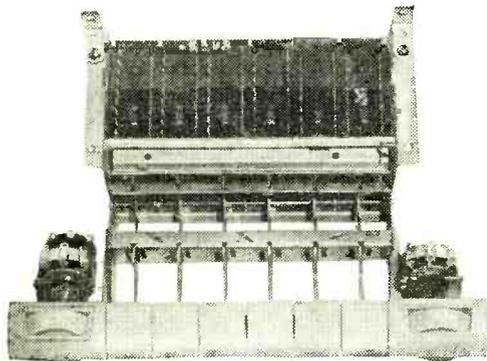
A Band III aerial of very unusual design is made by J-Beam Aerials. It consists of a horizontal skeleton slot flanked on each side by a 4-element vertical Yagi. The combination is matched to an 80-Ω cable and it is said to give a gain over a plain dipole of 14 db. The ends of the slot form bent-over aerial elements for the Yagis and the long sides the matching section for end-feeding the two Yagis. Although J-Beam Aerials specialize in end-fed television aerials this must surely be a unique application of the principle.

Manufacturers: A.B. Metal Products; Aerialite; Antiference; Belling-Lee; B.I. Callenders Cables; Henley's; J. Beam; Permanoid; Suffix; Telcon; Transradio.

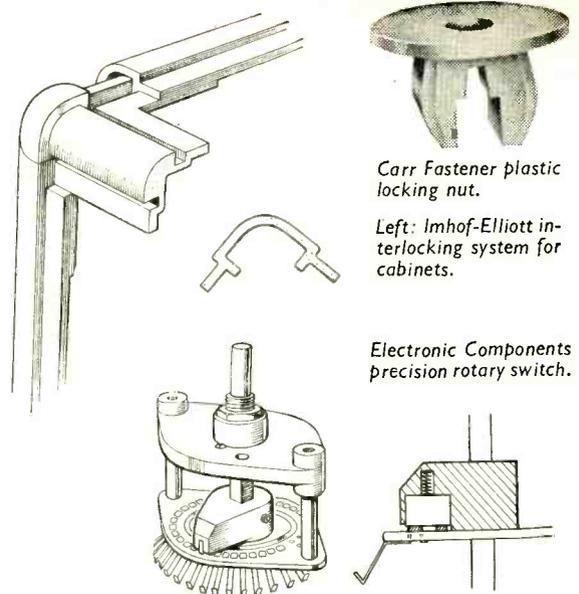
## SWITCHES

THE advent of a.m./f.m. reception has obviously brought with it some complications in receiver switching. The new switches designed for this type of circuit by A.B. Metal Products bring to mind the days of press-button tuning, for they use a piano-key type of action. A maximum of eight keys can be provided in one unit and there are six sets of changeover contacts on each key. Mountings for coils are also incorporated. Slider switches intended for a.m./f.m. receivers were shown by Plessey, and these had a two-way action with as many as 10 poles available.

Amongst the rotary switches a new precision type on the Electronic Components stand was notable for the even pressure of the wiper contacts on the fixed contacts, obtained by a helical spring inside the wiper (see sketch). The switch has 32 positions and can be supplied with one, two or three poles and up to six banks. Another rotary switch using helical springs in a similar way was shown by N.S.F. and was capable of carrying up to 10 amps. A version of the well-known German Winkler rotary switch is now being made by Painton, and a notable improve-



A.B. Metal Products piano-action switch.



Carr Fastener plastic locking nut.

Left: Imhof-Elliott interlocking system for cabinets.

Electronic Components precision rotary switch.

ment is the use of a moulded panel to carry the fixed contact studs. The contacts can be silver-, gold- or rhodium-plated.

A new range of micro-switches was shown this year by Pye, with operating pressures ranging from 3 oz to 18 oz. Some of these are worked directly by the plunger while others have a lever acting on it. The contact ratings are all 5 A, 250 V for a.c. and 5 A, 12-29 V for d.c. Bulgin have extended their range of micro-switches and were again showing the more recent sub-miniature types which are not in the usual Bakelite cases.

Makers\*: A.B. Metal Products (L, P, R, S); B.E.R.C.O. (R); Bulgin (L, M, P, R); Diamond, H. (L, R); Electronic Components (P, R); Erie (R); N.S.F. (L, P, R, S); Painton (L, P, R); Plessey (L, P, R, S); Pullin (R); Pye (M); T.M.C. (L, P); Walter (L, P, R, S); Whiteley (P, R, S); Wright and Weaire (R).

\*Abbreviations: L, lever or toggle; M, micro-switch; P, push-button; R, rotary; S, slide.

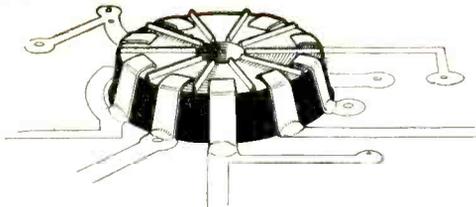
## CHASSIS FITTINGS

THE rapid development of printed circuits is having a noticeable effect on the type of chassis fittings now coming on to the market. Flat, strip-type connectors were shown by Bulgin, McMurdo and Belling-Lee (see picture) and specially designed valveholders by Carr Fastener, McMurdo and British Mechanical Productions. Some of the valveholders have tags which project downwards through holes in the printed circuit plate, but the one shown by British Mechanical Productions has long spring fingers bent upwards which press on the edges of the circuit when the holder is let into a hole in the plate.

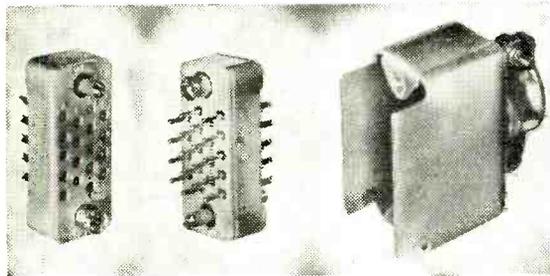
A wide range of spring clips for various applications was displayed by Simmonds Aerocessories, the two latest additions being clips for holding screening cans and a small coil-former support (see sketch). Another new fixing device was a self-locking plastic nut shown by Carr Fastener. It snaps into a hole in the metal and when a self-tapping screw is driven into it the plastic expands and grips tightly.

Tag-strip in a very simple and cheap form was a popular exhibit on the Creators stand. Known as "Plantag" it consists of a rigid P.V.C. moulding of L-shape cross-section with tags in one plane and fixing holes in the other, and it can be supplied in any length. By warming the P.V.C. the strip can be bent round in a circle if required.

Prefabricated cabinets were again the main feature of



Printed-circuit valveholder by British Mechanical Productions



McMurdo miniature connectors

the Widney Dorlec stand, and this year die-cast corner units were on view. Imhof have now entered this field in conjunction with Elliott Brothers, the instrument manufacturers, and they were showing an interlocking system for fixing the struts of the cabinet frame into the corner pieces (see sketch).

Makers: Aerialite; Antiference; Associated Electronic Engineers; Belling-Lee; British Mechanical Productions; Bulgin; Carr Fastener; Creators; Colvern; Egen; Electrothermal; Electronic Components; Hassett & Harper; Hellerman; Igranic; Imhof; Long & Hamblly; McMurdo; Micanite; Painton; Plessey; Ross Courtney; Simmonds; Spear; Standard Insulator; Stocko; Stratton; Telcon; Thermoplastics; T.M.C.; Transradio; Tucker-Eyelet; Tufnol; Weymouth; Whiteley; Widney-Dorlec; Wimbledon; Wingrove & Rogers.

## RELAYS

THE switching of r.f. circuits on coaxial cable presents a difficult problem in relay design because of the impedance mismatching which can occur. Besson & Robinson have tackled it successfully, however, and were showing three coaxial changeover relays with very low standing-wave ratios. The latest one, type A07, is characterized by having permanently fixed cable tails instead of sockets. The v.s.w.r. is 1:1.1 while the impedance is 45/60 ohms or 70/80 ohms and the operating voltage 17/28 volts d.c.

A new relay notable for its sensitivity was shown by Magnetic Devices. It operates on a current of 1 mA at under 0.5 V and will switch two circuits of either 5 A at

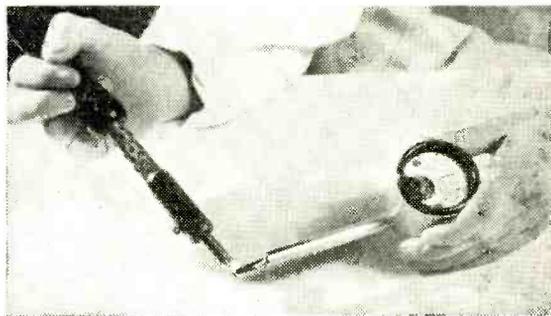
250 V a.c. or 5 A at 30 V d.c. The mechanism is hermetically sealed and mounted on an octal plug-in base. Like many other of the relays on show it has a balanced-type armature to prevent false operation by external shock or vibration. The Besson & Robinson K01, for example, an alternative to the Post Office type 3,000 relay, will withstand accelerations of up to 25g.

Makers: Besson & Robinson; Magnetic Devices; N.S.F.; Oliver Pell Control; Plessey; Pullin; T.M.C.; Walter Instruments; Woden; Zenith.

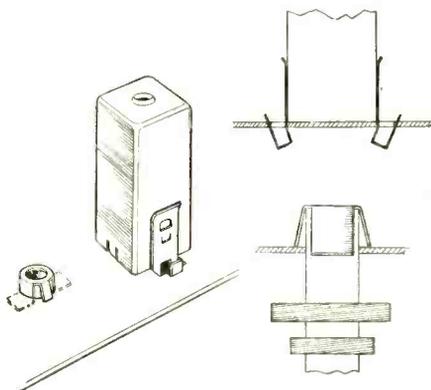
## MATERIALS

IN the production of high-permeability nickel-iron alloys by conventional melting processes, the properties of the material are often adversely affected by the inclusion of impurities originating in the crucible lining or de-oxidizing fluxes. It is also difficult to control the composition due to the different rates of loss of the constituent elements. A powder-metallurgy process developed by Henry Wiggin and Company uses carbonyl nickel, iron and other metallic powders as raw materials, and retains the original measured proportions and produces an alloy which is less susceptible to the presence of water vapour in the hydrogen atmosphere used for final heat treatment. There is also less susceptibility to surface effects which reduce permeability when the strip is rolled, and an initial permeability of 25,000 is maintained down to a thickness of 0.0005in in Ni77, Fe14, Mo4, Cu5 alloy.

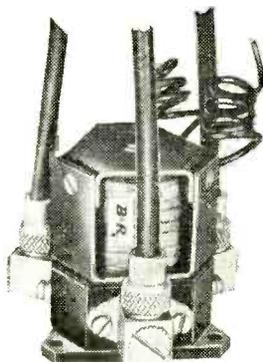
Most manufacturers of core laminations are concentrating on the production of oriented-grain silicon steels, primarily for "C" and "E" cores fabricated from bent strip. Strip thickness down to 0.002in are available from



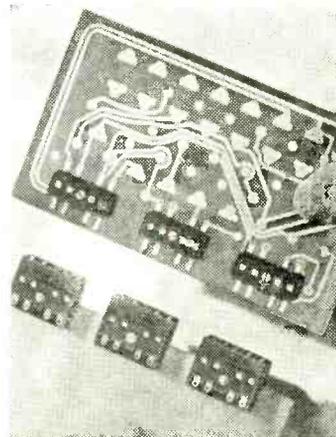
Multicore solder thermometer.



Clips for screening cans and coil former support by Simmonds Aerocessories.



Besson & Robinson coaxial relay with fixed cable tails.



Belling-Lee connectors for printed circuits.



G.K.N. loudspeaker fixing screw

Telcon-Magnetic Cores. Geo. L. Scott also supply flat laminations of this material 0.012in thick for cores assembled in the conventional manner. Joseph Sankey and Sons have introduced a new interlaminar coating which will withstand re-annealing temperatures of 800°C and is also waterproof.

Ferrite moulded cores for television line timebase transformers and deflection yokes, and extruded rod for r.f. inductors and aerials have been added to the range of moulded magnetic materials made by Salford Electrical Instruments.

Among "hard" magnetic materials the new Mullard "Ticonal L" anisotropic alloy, designed for loudspeaker magnets, is of special interest to manufacturers of loudspeakers using a centre-slug type of magnet assembly. It has a remanence of 14,000 gauss, and increases of up to 10 per cent on the previous upper limit of flux density of gauss/cm<sup>2</sup> are possible.

Most manufacturers of winding wires are now in production with polyurethane coatings which need not be previously removed before soldering. A new coating with exceptional resistance to the action of solvents has been developed by Connollys. It is known as "Conyclad" and consists of a basic layer of vinyl acetal enamel, coated with nylon. The outer layer protects the base enamel from "crazing" under the action of varnish solvents, and eliminates the annealing process which is normally adopted to reduce crazing.

The successful production of wave-wound coils depends upon the mechanical as well as the electrical properties of the wire, and Fine Wires, Ltd., have produced a range of single and multiple conductors with a variety of textile coverings specially for use on wave-winding machines.

Manufacturers of r.f. cables have anticipated the demand for Band III television aerial downleads with coaxial cables in which the dielectric is cellular polythene. Compared with a solid polythene dielectric cable the attenuation may be reduced by as much as 40 per cent, and typical figures for a 0.290in outside diameter cable are 3.3 db/100 ft at 200 Mc/s with a capacitance of 17 pF/ft. Another advantage of the cellular type of filling is that no elaborate precautions are necessary to seal the ends, as there are no connecting passages between the air cells, and moisture cannot penetrate the dielectric.

Polythene-insulated cables can give rise to microphonic noise which may be troublesome at very low signal levels. This has been overcome in Telcon "G" coaxial cables by coating the outer surface of the polythene with graphitic conducting film to disperse charges which might otherwise fluctuate with intermittent movement of the outer braiding. This year a further improvement has been effected in a "GG" cable in which similar treatment is applied to the inner surface of the insulant.

Silicone elastomer materials are finding increasing applications in the preparation of insulating cloths, tapes and sleeving. In the "Symel" grade of sleeving made by H. D. Symons the mechanical strength is improved by glass braiding applied on the inside and/or the outside of the silicone. A similar combination of special interest for high-temperature applications was shown by Suffix, Ltd.

Electrical insulating tapes coated with a thermosetting adhesive have been added to the already wide range of "Scotch Boy" tapes made by the Minnesota Mining and Manufacturing Company. Curing is effected during the normal drying-out process in coil manufacture, to give a permanent bond which will withstand subsequent varnishing or impregnation. The composition of the adhesive is controlled to obviate any possibility of initiating corrosion in the wires.

Impregnating resins of the ethoxyline type with low viscosities at room temperature are among the new plas-

tics introduced by Aero Research, Ltd. No solvent is necessary and polymerization on heating is effected without the evolution of any vapours which might cause voids. Another recent "Araldite" product is a cold-setting adhesive for fixing electrical strain gauges.

Formers for the resistance elements of wire-wound potentiometers are usually of phenolic plastic strip, and difficulty is often experienced in finding material of suitable thickness which will not crack when bent. A suitable grade has been developed by H. Clarke & Co. (Manchester) which can be bent into circles of less than 1in diameter without cracking.

Printed circuits and dip soldering techniques have made new demands on the services of solder manufacturers, who have responded with a full range of special alloys, fluxes, and chemicals for preparing and preserving metal surfaces. Other new products in this field include a neat and robust junction pyrometer by Multicore for measuring rapidly the temperature of soldering baths or soldering iron bits. The scale is calibrated in Centigrade and Fahrenheit with a maximum of 400°C (752°F). Enthoven have demonstrated a new cored aluminium solder which functions at ordinary soldering iron temperatures without any auxiliary aids such as ultrasonic vibration. Copper wires can be soldered to aluminium of light-gauge and commercial purity and also to a number of aluminium alloys.

Finally, since screws can be regarded as a raw material as far as radio engineers are concerned, we mention two interesting developments by Guest, Keen and Nettlefold. One is the introduction of B.A. and wood screws in solid nylon, which, apart from their obvious non-conducting and good dielectric properties, are free from corrosion. The tensile strength is 5 tons/in<sup>2</sup> at room temperature and 7 ton/in<sup>2</sup> at -40°C. The other Nettlefold screw is a combination of a left-hand wood screw and a B.A. screw on the same shank for fixing loudspeakers to baffle boards. The left-hand wood thread ensures that any movement when finally tightening the fixing nuts will tend to draw the screw further into the woodwork.

**Makers\*:** Aerialite (C, IS, W); Aero Research (IM); Associated Technical Manufacturers (B, C, IM, IS, W); Bakelite (IM); Geo. Bray (CF, CE); B. I. Callenders (C, CO, IS, W); British Moulded Plastics (IM); Bullers (CF, CE); Clarke (CF, IM, IS); Connollys (C, IM, W); Cosmocord (CF); Creators (IS); De La Rue (IM, IS); Duratube and Wire (B, C, CO, IS, W); Ediswan (W); English Electric (L); Enthoven (S); Fine Wires (W); Guest, Keen and Nettlefolds (BO); Hellerman (CF, IM, IS); Henley's (C, CO, IM, W); Insulating Components and Materials, Ltd. (IM); Langley, London (IM); Long and Hambley (IM, IS, RP); Magnetic and Electrical Alloys (L, M); Marrison and Catherall (M, L); Micamite and Insulators (CF, IM, IS); Minnesota Mining (IM); Mullard (DC, M); Multicore (S); Murex (RM, M); Mycalex (CF, IM); James Neill (M); Permaoid (C, IM, IS, W); Plessey (CE, DC, M); Reliance Wire (C, CO, IS, W); Rola Celestion (D, L, M); Salford (DC, M); Sankey (L); Geo. L. Scott (L); F. D. Sims (C, CO, W); S.T.C. (M); Steatite (CF, CE); Stratton (CF); Suffix (B, CO, IM, IS, W); Swift Levick (M); H. D. Symons (IM, IS); Taylor Tunncliffe (CE); Telcon (C, DC, IM, L, M, RN, W); Telcon Magnetic (L); Telephone Manufacturing Co. (DC); Thermo Plastics (CF, IM); Transradio (B, C, IS, W); Tufnol (IM); United Insulator (CF, CE, IM); Vactite Wire (RM, W); Whiteley Electrical (CF, M).

**\*Abbreviations:** B, braiding; BO, bolts; C, cables; CE, ceramics; CF, coil formers, bobbins; CO, cords; DC, dust cores, ferrites; IM, insulating materials; IS, insulating sleeving; L, core laminations and strip; M, magnets and magnetic alloys; RM, refractory metals; RP, rubber products; S, solder; W, bare or covered wires.

## Directory of Metals

A COMPREHENSIVE guide to the physical properties of the non-ferrous metal elements and their alloys is contained in the "Metal Industry Handbook and Directory 1955." Not the least useful section of this work is the list of proprietary alloys, their makers, properties and uses.

A separate set of tables gives the specific resistances of alloys which are not normally found in electrical reference books, and there is a large section on the technique of electroplating, anodizing and other electrolytic processes which should be of value to workers in the radio industry.

Published by the Louis Cassier Company, Ltd., Dorset House, Stamford Street, London, S.E.1, this directory costs 15s.

# Wide Range Electrostatic Loudspeakers

By P. J. WALKER\*

## 2—Problems of Air Loading : Different Requirements of Moving-coil and Electrostatic Drive Units

**I**N the first part of this article we showed that it was possible to design and construct electrostatic driving units which were capable of applying a force which virtually acted directly on to the air, and we showed that this force was linear. This state of affairs applied over a bandwidth of several octaves for any single unit, depending upon the efficiency required from that unit, and it was further shown that that bandwidth could be placed anywhere in the audio range.

The only mechanical impedance likely to affect performance is the suspension compliance of the diaphragm, necessary to offset the negative compliance due to electrical attraction. We can therefore begin to draw an electrical analogue circuit of the mechanical elements of the loudspeaker as in Fig. 1, showing the force fed in series with a capacitance. In practice the compliance will considerably exceed the electrical negative compliance, so that this capacitance  $C_d$  is almost solely due to the diaphragm compliance.

For simplicity we will restrict consideration to units driven from constant-voltage sources, so that no elements need be included to indicate amplifier source impedance.

Since the loudspeaker will be coupled to the air, we can now add the front air load radiation resistance  $R_f$  and the front air load mass,  $M_f$ , and we can include the impedance  $Z$  which represents the impedance presented to the back of the diaphragm.

The impedance  $Z$  may include dissipative terms in the form of absorption and/or acoustic radiation resistance. With most acoustic devices the analogy elements change with frequency and the problem, as with all loudspeaker design, is to arrange matters so that the power developed in the radiation resistance(s) is independent of frequency.

The electrostatic unit differs from the moving coil in that there is no large mass component (cone and

speech coil) which normally appears as a large inductance in series with  $C_d$ . The absence of this inductance profoundly alters the requirements for  $Z$ , and since  $Z$  is the cabinet or back enclosure it is to be expected that the form of cabinet for electrostatic units will follow trends entirely different from those that have been evolved for moving-coil units. A further difference is that the shape of the diaphragm area is more versatile, so that  $R_f$  and  $M_f$  may be independently varied over reasonable limits.

Due to the absence of large mass we can, if we wish, arrange the constants so that  $R_f$  is large compared with the other elements, and therefore becomes the controlling factor for the equivalent current in the circuit, i.e., the velocity of motion of the diaphragm. This means that the impedance looking back into the loudspeaker can be very low. When this is so, any increase in the acoustic resistance on the front of the diaphragm will result in *reduced* power output. If, on the other hand, the impedance of the loudspeaker is made to appear high by arranging that the total impedance is

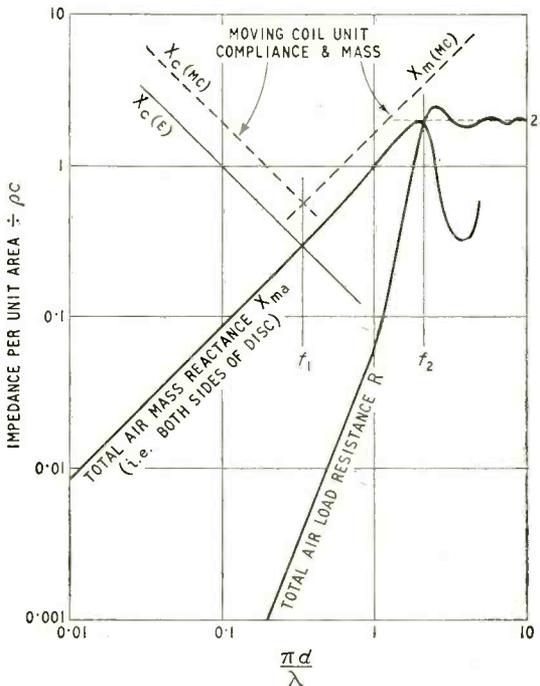


Fig. 2. Mass and radiation resistance loads on circular diaphragm in free air. The normalized frequency scale is in terms of the relationship of diaphragm size to wavelength.

\* Acoustical Manufacturing Co. Ltd.

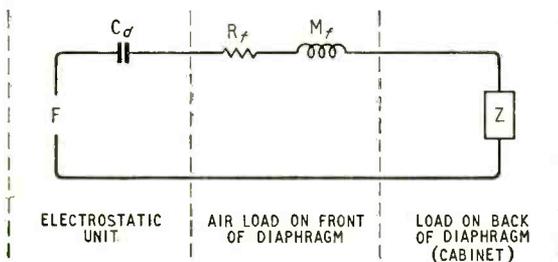


Fig. 1. Elementary equivalent circuit of mechanical and acoustical parameters of an electrostatic loudspeaker.

large compared with  $R$ , then an increase in acoustic resistance on the front of the diaphragm will result in *increased* power output. This ability to control the impedance looking back into the diaphragm is a useful feature in designs where  $R$ , is subject to fluctuations due to surroundings, horn reflections, etc., and, in particular, where one loudspeaker unit is influenced by another unit at cross-over frequencies.

In order to show the action of an electrostatic unit which is small compared to the wavelength of the radiated sound it is convenient to commence with a circular shape, because impedance information is readily available for such a shape. Load impedance for other shapes is best obtained by considering the diaphragm as a number of unit areas of equal size and calculating the impedance of each unit area, taking into account the mutual radiation due to the presence of all other unit areas.

Fig. 2 shows the load on a piston operated in an unlimited atmosphere without a baffle. The diaphragm compliance reactance  $X_c(E)$  is also drawn. Between  $f_1$  and  $f_2$  the controlling factor is the air mass, and the velocity of motion will vary directly with frequency until resonance between  $X_c(E)$  and  $X_{ma}$  is approached.  $R$ , however, falls rapidly with frequency, and the power output will fall at approximately 6db per octave with declining frequency. (Exactly the same would occur with a moving coil unit, control this time being the mass of cone and speech coil designated  $X_m(MC)$ .  $X_c(MC)$  is the moving-coil suspension compliance.)

Multiple diaphragms without baffles, having the above characteristics, form the basis of design for loudspeakers to provide the directivity of a doublet. Such a system has useful attributes in relation to the listening rooms, a subject to be dealt with in a later article.

Above  $f_2$  the velocity of the moving-coil unit would still be controlled by  $X_m(MC)$  (except for cone "break-up") and, since the resistance becomes constant, the response will fall with increasing frequency. In the electrostatic case above  $f_2$  the velocity will be controlled by the air load resistance, and the response will be independent of frequency.

Extending this comparison to units in very large baffles we have the curves of Fig. 3. Here the radiation resistance varies with the square of the frequency below  $f_2$ . With a moving coil the response will be level below  $f_2$  and will fall with frequency above  $f_2$ . With the electrostatic the response will be level below  $f_2$  and also level above  $f_2$ , but there will be a step in response so that the output level above  $f_2$  will be 3db higher than that below  $f_2$ .

A simple arithmetical example will make clear the reason for this step. With constant force  $F$  applied to the diaphragm, the velocity of movement will be

$$\frac{F}{\sqrt{R^2 + X^2}} \text{ and the power expended usefully in the}$$

$$\text{radiation resistance will be } P = \left( \frac{F}{\sqrt{R^2 + X^2}} \right)^2 \times R$$

At  $f_B$  in Fig. 3, neglecting  $Z$  due to the declining air mass reactance, we have for a constant force  $F = 1$ ,

$$P = \frac{R}{R^2} = \frac{2}{4} = \frac{1}{2}. \text{ At } f_A, \text{ on the other hand, the air}$$

$$\text{mass predominates and, if } R \text{ can be neglected in calculating the velocity of motion, } P = \frac{R}{X^2} = \frac{0.01}{(0.2)^2}$$

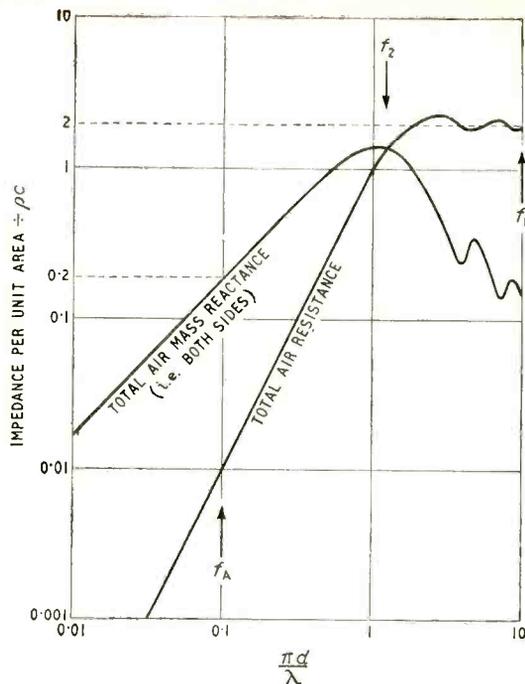


Fig. 3. Mass and radiation resistance curves for a circular diaphragm in a large baffle. The power radiated at any frequency  $f_A$  well below  $f_2$  is half that radiated at frequencies  $f_B$  well above  $f_2$  (see text).

$$= \frac{0.01}{0.04} = \frac{1}{4}, \text{ or half the power at } f_B. \text{ A similar relation-}$$

ship will be found for any other pair of values of  $R$  and  $X$  at points below  $f_2$ .

This change in level can be overcome by deviating from the circular piston shape. For wavelengths large compared to the diaphragm size the resistance per unit area is dependent upon the new area and not upon the shape, whereas the mass is mainly dependent upon the smaller dimension. By elongating the diaphragm shape the output level below  $f_2$  can be made equal to that above  $f_2$ .

We have so far been considering a comparatively small diaphragm in a flat baffle, the latter being very much larger than the piston, and the size of the complete system is obviously that of the baffle. The reason that the piston has been kept small is purely for the convenience of the moving-coil unit, because its diaphragm is driven at only one point. In the electrostatic case we no longer have this restriction, and it will always be preferable to increase the size of the piston (without increasing the total size of the complete system). This will usually be necessary because there is a limit to the available amplitude of movement, and thus, for a given power output per unit area, we have a minimum limit to the radiation resistance in order that the diaphragm excursions may be attainable. Increasing the size of the piston for a given power output has the double advantage of reducing power requirements per unit area, and, where the loading is below  $2\rho c$ , of increasing the radiation resistance per unit area, and therefore reducing the amplitude required to provide that power output. For reasons of efficiency we shall in any case limit the high-frequency response of the unit so that

optimum design is obtained by increasing the area of the diaphragm to the point where the piston just begins to become directional at the frequency which we have chosen for cross-over (set by the efficiency laid down in the design requirements).

Continuing the consideration of the air load on diaphragms, reference should be made to horn loading. Here we have large resistive and mass components due to the horn. Fig. 4 shows the load of an idealized horn to which has been added  $X_m(MC)$ , the cone mass of a typical moving-coil loudspeaker which might be used with such a horn. It will be seen that at low frequencies the cone mass is largely swamped by the horn impedance, so that the design of horns for electrostatic units differs very little from the design for moving-coil units. Although we can now have the advantages of a virtually distortionless driving unit, we are still left with the disadvantages of practical horns, which are present independently of the drive units. Horns are normally used to match the high impedance of moving-coil diaphragms to the low impedance of the air. Since we have no such fundamental mismatch with the electrostatic loudspeaker, and since diaphragm shape and size are not fundamentally restricted, we shall not normally have to resort to the use of horns to the same degree. It should be remembered, however, that any back enclosed volume is a direct function of throat area, so that in some applications it is possible to use space for providing a length of horn in exchange for saving in size of capacitive enclosure. Again, we may wish to restrict the front-wave expansion in order to maintain a reasonable resistance per unit area at low frequencies (utilizing the corner of a room, for example).

One of the most desirable diaphragm shapes for electrostatic designs is that of a strip having a length (together with floor or wall image) large compared to  $\lambda/3$  at the lowest frequency of interest, and a width small compared to wavelength at the highest frequency of interest. The strip may be curved along its length if desired, provided the radius of curvature is not less than  $\lambda/3$  at the lowest frequency.

To consider the load on such a strip it is convenient to assume the strip as being infinite in length (legitimate provided it is at least  $\lambda/3$  in length). With such a diaphragm there will be no expansion of sound in the direction of the length since all pressures along the length of the strip will be equal. Expansion from any given element of the diaphragm takes place in one plane only and will therefore take the form  $S = S_0x$ . This is the expansion of a parabolic horn. At low

frequencies the front air load resistance is falling directly with frequency (instead of  $f_2$  as with the circular piston shape). The advantages of the strip shape may now be enumerated:—

- (a) The air resistance even at low frequencies (since  $R \propto f$ ) is sufficient to develop adequate power with reasonable diaphragm amplitude.
- (b) The narrow diaphragm gives good dispersion for several octaves (up to the frequency at which width  $\approx \lambda/3$ ).
- (c) The narrow diaphragm enables other units to be placed close to it, thus being less than  $\frac{1}{4}$  wavelength apart at cross-over frequency.
- (d) The frequency limitations, amplitude at the low end, and directional problems at the high end, fit in nicely with the 4-5 octave range which we established in Part I of this article for satisfactory efficiency. Thus a strip shape can form one basis of design for our ideal—the perfect loudspeaker.

It will be obvious that a curved front source similar to that illustrated in the photograph of Fig. 5 in Part I of this article will give similar distribution to a strip, and, due to the larger surface, smaller spacing may be used and higher efficiency may thus be achieved. In such a case however, the diaphragm must be large compared to wavelength in both dimensions, because it is the nature of curved surfaces to become directional when the radius of curvature is comparable with the wavelength. When the diaphragm is large compared to  $\lambda$  it is impossible to design an intimate acoustic cross-over. This small inherent imperfection would appear to preclude its use in a "perfect" loudspeaker design, although its "efficiency" advantages will have obvious applications in some practical compromise designs.

Although designs free to the air on both sides have useful attributes, it is obviously desirable also to produce loudspeakers in cabinet form, enclosing the rear. This rear enclosure, if it is to be of reasonable size, will be the controlling factor for the diaphragm velocity, at least at low frequencies.

With any unit, the high-frequency limit will be set by efficiency requirements, and the low-frequency limit by amplitude limitation or by the compliance of the enclosure in series with the diaphragm compliance. This compliance will resonate with the air mass on the front and back of the diaphragm (unless the diaphragm is so large that the loading is  $\rho c$ —for example, as in the curved diaphragms previously mentioned). Since the total mass is small, this resonance will usually occur above the lowest frequency of interest. It may be dealt with in two ways, (1) by adding acoustic mass within the cabinet to reduce the resonant frequency to the lowest required frequency, or (2) critically damping the resonant frequency and maintaining response below this frequency either by re-matching or by a secondary acoustic resonant circuit, or both.

There are innumerable ways in which either of these alternatives may be achieved. Consider the first alternative. Suppose that the enclosure is made deep and narrow (or fitted with partitions so that it appears deep and narrow to the loudspeaker): then, at wavelengths just under four times the depth, the reaction on the diaphragm will be positive. This will effectively force the resonance to the  $\frac{1}{4}$  wavelength resonance of the depth of the enclosure. Absorbent wedges may now be fitted to control the resonance and to present

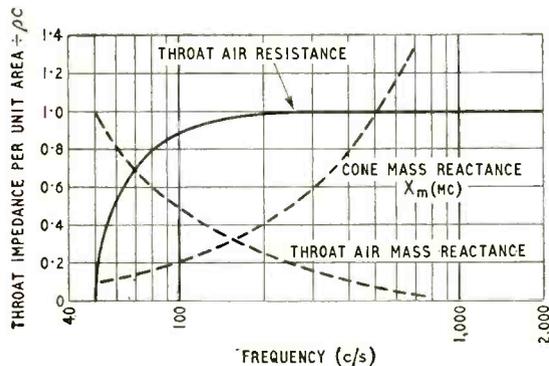


Fig. 4. Throat air resistance and reactance curves of idealized horn with moving-coil mass reactance superimposed.

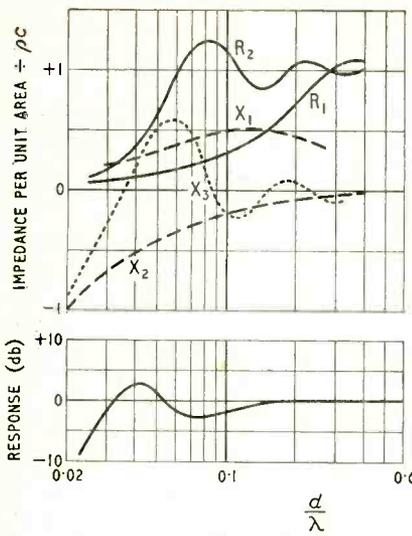
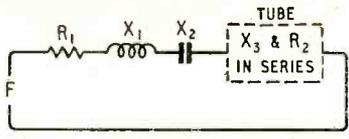


Fig. 5. Strip loudspeaker, long compared with wavelength, and of width  $d$ , mounted in a wall, with the back of the diaphragm loaded by a tube with cross-sectional area equal to that of the diaphragm and of a length  $5d$ , blocked at the far end. Resistance (fibre-glass wedge) included in tube to control impedance.



- FRONT {  $R_1$  = RADIATION RESISTANCE
- $X_1$  = AIR MASS (FRONT OF DIAPHRAGM)
- BACK {  $X_2$  = DIAPHRAGM SUSPENSION REACTANCE
- $X_3$  = TUBE REACTANCE
- $R_2$  = RESISTANCE DUE TO FIBREGLASS

volumes have dimensions many times less than the wavelength in the ranges where they are operative.

If the constants are adjusted to give a step in response as the frequency is lowered, then the total volume of the enclosure is reduced accordingly and the response restored to level by re-matching at the step frequency.

Fig. 7 shows a strip diaphragm loaded by a capacitance with series resistance, all elements continuing along the whole length of the structure. With this assumption there will be no waves in the enclosure along its length so that the constants can be calculated on a sectional element of thickness  $z$ . If the cross section of  $C_2$  has dimensions which are many times smaller than the wavelength, then  $C_2$  will behave as a capacitance (independent of length). If this proviso is not met then  $R_2$  must be distributed to avoid  $C_2$  appearing as a multi-resonant circuit.

Where the unit crosses over to another unit for low frequencies then  $R_2$  may be adjusted to give a  $Q$  of 0.7 so that the cross-over components are already present in the acoustic circuit.

When the lower-frequency unit is arranged so that the two diaphragms are close and intimately coupled, then  $R_1$  will be increased in value by the mutual radiation of the low-frequency unit.  $R_2$  is then reduced to restore  $Q$  and we find that if  $R_1$  is larger

a purely resistive load at all higher frequencies. Sound compression within the wedges becomes isothermal, decreasing the speed of sound, so that the depth of the enclosure can be reduced accordingly.

Fig. 5 shows the impedances of a strip unit loaded on this principle together with a curve showing the power output radiated as sound for constant applied voltage. The output is extended by more than an octave over that which would be obtained if the same volume of enclosure were allowed to act as a lumped capacitance.

Turning now to the second method of extending the low frequency range, Fig. 6 shows a diaphragm loaded by a capacitance leading through resistance and inductance into a larger capacitance. Both

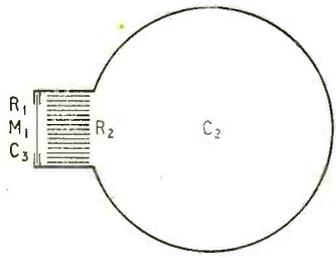


Fig. 6. Diaphragm loaded by an equivalent capacitance  $C_1$  leading through an acoustic mass and resistance  $M_2$  and  $R_2$  into a larger capacitance  $C_2$ .

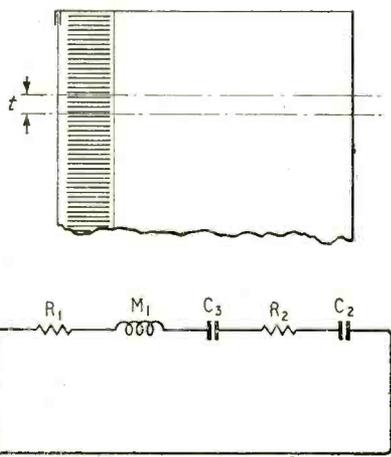
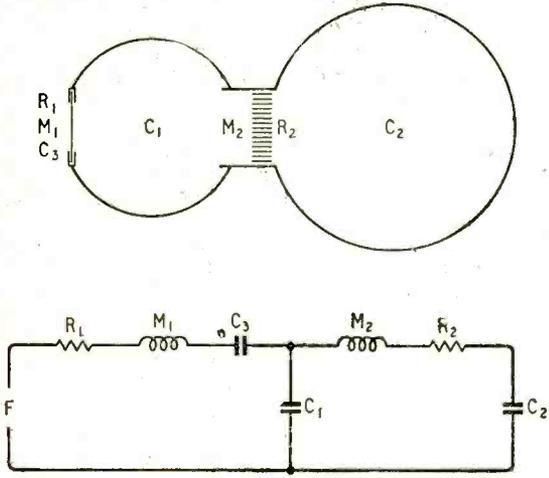


Fig. 7. In a long cylindrical structure the air column will be driven equally at all points along its length and no appreciable longitudinal standing waves can be established, at frequencies other than that corresponding to  $\lambda/4$ .

than  $R_2$ , a useful self-compensating effect takes place.

If the voltage applied to the low-frequency unit is reduced at cross-over due to tolerance in its cross-over components then  $R_1$  is automatically reduced and the output of the higher-frequency unit increases at

cross-over. At cross-over  $P_{out} \propto \frac{R_1}{(R_1 + R_2)^2}$

Where the enclosure of Fig. 7 is used for the unit covering the lowest part of the audio range, bass response may be extended by rematching or by introducing a secondary resonant circuit and utilizing back radiation from the diaphragm. If an aperture is provided at one end of the enclosure, opening to the air, then, when the enclosure length is  $\frac{1}{4}$  wavelength, resonance will occur along its length, and there will be radiation from the aperture.  $\frac{3}{4}$ ,  $\frac{5}{4}$  resonances, etc., will not arise, because the enclosure is excited by a force distributed along its length. At frequen-

cies above the  $\frac{1}{4}$  wavelength, the enclosure will behave approximately as a capacitance, as if the aperture were not present.

The next part of this article will deal with electrostatic units as part of delay lines, and the application of various complete designs, "built in," "boxed in" and "doublet" in relation to the listening-room. Complete electrostatic loudspeakers can take several different forms, each of which in terms of frequency response, distortion and sound dispersion can meet a specification virtually to perfection. When the listening-room and subjective factors are considered it becomes impossible to lay down a rigid specification. To adopt a quotation "Each design is perfect, but some designs are more perfect than others"!

**Acknowledgement.** Fig. 2 is based on Fig. 5. 9, p. 127 of "Acoustics" by Leo. L. Beranek (McGraw Hill).

(To be continued)

## LETTERS TO THE EDITOR

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

### Situations Vacant

WITH the present state of full employment in the electronic profession, the competition amongst employers to find suitable men is fierce. This is shown by the numerous posts advertised in technical journals. The time has come, however, for employers to pay a little more attention to the "Sits. Vac." replies.

Three members of my laboratory have, over a period of the last six months, written to a dozen advertisers. The results have been very disheartening; only 40 per cent of the applications were acknowledged. The applicants were qualified men: A.M.I.E.E., A.M.Brit.I.R.E., Higher National, National and City and Guilds certificates. In good faith they have taken some trouble to apply for positions, expecting that they would be treated with good manners by the advertiser, and have been embittered by the callous manner in which their applications were treated.

I would ask "Sits. Vac." advertisers to read page 498 of *Electronics* for March, 1955, and then to make moves at least to treat engineers with the courtesy their professional status deserves.

J. GILBERT.

Biophysics Dept.,  
Postgraduate Medical School of London.

### Transistor Symbols

IT would seem that an over-riding factor when assessing the desirability of a logical system of transistor symbols is whether the advantages of the system are more important than international standardization. It is impossible to ignore the fact that there is a well-established convention at present widely used in both Europe and the U.S.A., and it is, to say the least of it, unlikely that any alternative suggestions at this late stage will replace the accepted practice. I would suggest that it is better to follow the generally accepted convention and concentrate on clearing up minor differences about points such as the thickness of base line and the presence of a circle to isolate the transistor from the rest of the circuit.

Leaving on one side the question of standardization, there is still a doubt whether your suggested symbols (April and May, Editorial Comment) do in fact add to an understanding of the devices. The symbol you suggest is particularly undesirable since it is very misleading to regard a transistor as a back-to-back arrangement of two diodes.

Finally, the point raised about the abbreviation to use in circuit diagrams can be met without causing confusion

by using the same "V" for the crystal valve as for the thermionic version.

B. R. BETTRIDGE.

General Electric Company,  
London, W.C.2.

BOTH D. Nappin and W. E. Thompson (your May issue) regard the transistor as a new device needing a new symbol, but surely this problem arose as the normal valve developed.

It was no doubt thought that gas triodes and neon stabilizers were separate devices, that each needed a new letter symbol, but in fact they are both given the letter V, and no confusion is caused by this. The type of device is made clear by the circuit symbol.

I suggest, therefore, that the letter V be kept to include the transistor.

London, N.1.

M. LEVY.

WHILST in full agreement with the general scheme of transistor symbols proposed in your April and May Editorials, I should like to plead for the symbol originally shown for the  $n-p-n$  junction transistor in *Wireless World*, July, 1954, p. 325, Fig. 2(c), rather than the new version in Fig. (f) of the May Editorial. This later version is likely to cause error, particularly when pencil sketches are copied in the drawing office or print room. Furthermore, the original version appears more logical and distinct, being characterized by a black and white triangle like the symbol for the  $p-n-p$  transistors.

London, N.W.3.

FRANCIS OAKES.

### Electronics on the Farm

R. S. DRAKE'S letter (your May issue) is very interesting and certainly very pertinent. Within limits one must admit that a manufacturer should know! However, I beg leave to suggest that there is justification for some comment, if not criticism.

Popularity obviously justifies manufacture and sale, but it does not follow that it confirms excellence of design and practical value. Established habits die hard.

It may be true that there is no serviceable electronic "switch" or "trigger," but I feel that there is no valid objection to a glass-enveloped tube in a fencer unit. These units must in practice be effectively boxed and weather-proofed, and in any case we have electric lights all over the place on farms these days.

I still hope to find an electronic dry battery unit on sale in the not-too-distant future; a unit which is neatly boxed

and requires no servicing beyond the occasional plugging in of a relatively inexpensive replacement. Furthermore, I consider that this unit should carry its own test equipment. I see no reason why this should be very expensive, even if it does have to involve more than a neon tube or a blade of grass, and I think loose test equipment is an anachronism. In theory it enables one to test the fence at any point, but in practice this is an advantage of negligible value. Nine times out of ten one naturally puts the unit at the gate or most convenient point of approach, and again nine times out of ten if the fence is "down" the only effective way of locating the fault is to walk the fence. Finally, more often than not it is easier and more convenient to switch off before one walks so that one can repair in comfort. Of course, one *can* wear gloves, one *can* withstand the shock, one *can* use a handkerchief, kick down a weed or pull off a branch. But how often does one in practice? In practice it is far more desirable to be able to check when there, without having to remember to take the tester, than to be able to test at all sorts of odd points.

No doubt my desired unit would not be cheap, but I fail to see why it should be any more expensive than the average unit now on the market.

Hempstead, Essex.

H. G. TAYLOR.

### "As She Is Spoke"

I HAVE just been reading M. G. Scroggie's letter in your May issue, and I notice that the linoleum in my immediate vicinity is very clean. This must be due to the fact that Mr. Scroggie has been wiping the floor with me.

I apologise to him for having wrongly deduced from

his previous letter that he objected to the use of the word "recording" as a noun; I now realize that he only objected to its use in reference to a recording.

As Mr. Scroggie now concedes that we can have a recording on a record, I readily agree that there should be no logical objection to using the words "tape record" to refer to a recording on tape. In fact, I notice that this nomenclature has already been adopted by your journal, so that just about clinches the argument.

Wharfedale Wireless Works, Ltd., G. A. BRIGGS.  
Bradford.

### Earthing Metal Braiding

IN the illustration of the component layout for P. J. Baxandall's pre-amplifier in your February issue, the method shown of making a connection to a metal braid screening is by wrapping a connecting wire round it. This, I know, is a common method, but it involves soldering which may injure the sleeve or insulated wire directly beneath. It also does nothing to remove the jagged ends of the braiding, and I have known them penetrate the insulation beneath and cause a short when the conductor is sharply bent.

Another method, suggested to me long ago, is better on both counts, but does not appear to be widely known. About one inch from the end of the braiding the wires of the "warp" are separated and so are the wires of the "weft." This leaves a diamond shaped hole and the sleeve or insulated conductor within the inch of braiding is pulled out through the hole. The braid thus left empty forms a convenient pigtail for connection to the remainder.

London, N.W.7.

W. J. CLUFF.

## Commercial Literature

**Audio Amplifier**, the Cape 25, by Cape Electrophonics, mentioned in the March issue. An error of 0.08% was made in the distortion figure, which should be 0.12% at 64 c/s with 26 watts output. At 1,000 c/s, 25 watts output, the distortion is claimed to be 0.03%.

**Band-III Aerials**, including composite Band-I/Band-III types, add-on units for existing aerials; indoor types and also converters, pre-amplifiers and downleads. Described in a leaflet from Aerialite, Castle Works, Stalybridge, Cheshire. Also a non-technical leaflet explaining aerials and converters for Band III.

**Marine Communications Receiver** covering long, medium and trawler wavebands with Consol navigational aid. Power supply from 12-V or 24-V ships' battery. General specification in a leaflet (also containing a list of available Consol charts) from Pye Marine, Oulton Works, Lowestoft.

**Small Electrolytic Capacitors** with paper dielectric construction and very low leakage currents. Capacitances of 0.5-50 $\mu$ F, working voltages of 250-25V d.c. and sizes up to 2in $\times$ 0.6in (diam) approx. Technical bulletin from the Telegraph Condenser Co., North Acton, London, W.3.

**Magnetic Permeability Tester** for measuring metallurgical uniformity of production samples from foundries, rolling-mills, etc. Brief outline in a leaflet from Excel Sound Services, Celsonic Works, Garfield Avenue, Bradford, 8, Yorks.

**Impregnation Plants** for impregnation of coils, transformers, etc., with varnish, resin or other materials under alternate vacuum and pressure. Also available for "potting" work. Features described in a leaflet from Blickvac Engineering, 96-100, Aldersgate Street, London, E.C.1.

**Geared-down Motors**, fractional horsepower, either series-wound, variable speed, for a.c./d.c. or capacitor-induction, constant speed, for a.c. only. Output speeds ranging from 0.2 r.p.m. to 840 r.p.m. with torques from 3 lb-in to 75 lb-in. Technical specification from M.R. Supplies, 68, New Oxford Street, London, W.C.1.

**High Quality Sound Reproduction** equipment including combined amplifier and record-playing units; separate record

players and amplifiers; and loudspeaker units. Leaflets from Pye, P.O. Box 49, Cambridge.

**Inexpensive Oscilloscope** with circuit for measuring voltage of waveform, or a selected portion of it, on a voltmeter within the range 0.2-500V. Deflection sensitivity, 1cm/V; bandwidth, 3Mc/s; and time base frequencies, 3c/s to 120kc/s. Leaflet from E.M.I. Electronics, Hayes, Middlesex.

**Power Oscillator**, giving 120 watts into 10 $\Omega$  with frequency range of 10c/s-10kc/s, for driving vibration generator. Leaflets on this, and also on moving-coil electro-dynamic exciters with peak thrusts from 2 to 300lb, from Goodmans Industries, Axiom Works, Wembley.

**Timer**, for hand-setting, driven by synchronous motor. Can be provided with dial for any time range between 0-30 seconds and 0-7 days. Normal switching capacity 5A at 230V. Descriptive leaflet from the Electrical Remote Control Co., East Industrial Estate, Harlow New Town, Essex.

**Aluminium Soldering Tool**. A steel wire brush in the soldering bit vibrates and cleans the work surface while a pool of molten solder around the bit protects the cleaned area from the air. Illustrated leaflet from Belark Tool & Stamping Co., 33, Sussex Place, London, W.2.

**Nickel Alloys in Valves**; applications of the metal in cathodes, grids, anodes, supports, springs, non-magnetic components and glass-to-metal seals described in an illustrated booklet from Henry Wiggin & Co., Thames House, Millbank, London, S.W.1.

"**The Cosmocord Story**" is the title of an illustrated booklet describing the development of the firm's work in piezo-electric crystal devices and also some of the present manufacturing techniques. From Cosmocord, 700, Great Cambridge Road, Enfield, Middlesex.

**V.H.F. Equipment from Germany**. F.M. transmitters; receivers for radio relay systems; dual-receiver equipments; f.m. transmitter aerials; broadband receiving aerials; and test equipment; made by Rohde & Schwarz. Leaflets from the British agents, Avey Electric, 44, Tottenham Court Road, London, W.1.

# Physical Society's Exhibition

## NEW ELECTRONIC DEVICES AND TECHNIQUES

This report is followed by surveys of recently introduced valves and allied devices; also of test and measuring gear. These surveys cover exhibits at both the Physical Society's and R.E.C.M.F. shows. Some products appeared at both, so no distinction is made here between the two exhibitions.

### RESEARCH

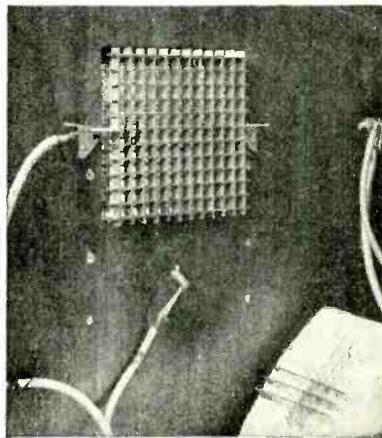
MANY physical effects have been exploited in the search for the ideal electro-acoustic transducer (loudspeaker) and a new one, demonstrated by D. M. Tombs, of Imperial College, makes use of the fact that a corona discharge between points is accompanied by a wind, generated by the migration of ionized air particles. Under normal conditions the wind is unidirectional, because of the difference in mobility between the negative and positive ions, but by interposing a grid, suitably biased, between the point electrodes the opposing streams can be balanced. If, now, an alternating signal voltage is superimposed on the grid, acoustic radiation is possible and was in fact demonstrated. From the initial asymmetry of air movement one deduces that, in its present state of development, the transfer characteristic would be non-linear—a sort of "ionic Stentorphone"; but at least it opens a new line for investigation in improving what most people agree is the weakest link in the sound reproducing chain. A similar electrical principle is involved in the "corona triode" also shown by Mr. Tombs. Like the transistor it requires no heater current, and it gives a gain of 5 with an a.c. resistance of 500 M $\Omega$  and a mutual conductance of 25  $\mu$ A/kV.

A photocell amplifier with a simple wide-range a.g.c. system was shown by the Armament Research Establishment. It makes use of the fact that the input resistance of a valve is inversely proportional to the grid current; thus an input potential divider is established with the photocell impedance which automatically reduces the grid voltage due to steady illumination. The a.c. gain is not affected and light modulation does not vary more than  $\pm 3$  db over a frequency range of 10 c/s to 10 kc/s even when the steady background illumination is varied over a range of 1,000:1 from, say, 0.0002 lumen to 0.2 lumen.

The basic causes of the residual interference from the gas discharge in fluorescent lamps, and similar phenomena in vacuum filament lamps, are being investigated by Siemens and a demonstration was given showing how the radiation is related to the electrode emission and the filament current. Normal gas-filled filament lamps do not radiate.

Research into the properties of new and existing materials was prominently represented at this exhibition. Wayne Kerr were showing examples of potting resins specially compounded to minimize mechanical and thermal shocks, and the reduction of valve microphony obtained by the use of semi-flexible resins was demonstrated. Butyl rubber as a moulded insulator for high-voltage transformers was shown by B.T.H.

Much interest is being shown in silicon as a semiconductor for diodes on account of its low reverse voltage, which is held to much higher temperatures than in germanium. B.T.H. demonstrated the method of growing crystals and also a method of radioactive analysis to show



Corona wind loudspeaker (D. M. Tombs).

the distribution of residual impurity in the growing crystal.

Development continues in the production and utilization of new ferrites. Plessey were demonstrating a ferrite switch depending on the large change of incremental permeability when the operating point is changed from remanence to saturation, and have also produced a range of nickel ferrites with magnetostrictive properties.

The Faraday magneto-optic effect in which the plane of polarization of electromagnetic waves in a medium is rotated under the influence of a magnetic field is exploited in special ferrites to attenuate or modulate microwaves (Radar Research Establishment), (Plessey). It is also used for current measurement in high-tension power distribution systems, where the use of a current transformer would present difficulties (British Electrical and Allied Industries Research Association).

Ferroelectric behaviour in ceramics formed the subject of a comprehensive exhibit by G. E. C. Research Laboratories, and it was shown that the large change in permittivity at the Curie point could be exploited to generate a fire alarm signal. Dielectric amplifiers based on the hysteresis characteristics of these materials were also demonstrated.

### NON-INDUSTRIAL ELECTRONICS

IMAGE converter tubes are well known for their use as "electronic shutters" in high-speed photography, but hitherto the shortness of exposure has been limited to about  $30 \times 10^{-9}$  second by the inability of the electrical circuit to convey pulses of such short duration. Mullard were showing how this exposure can be reduced some ten times to  $3 \times 10^{-9}$  second by using r.f. techniques—the pulse being conveyed by a coaxial line to a modified image converter tube with coaxial connections and a ring of resistors providing correct termination of the line. The switching pulse was actually generated by a spark, and it was the light from this spark that was being shuttered, a visual image appearing on the screen of the image converter. By using mirrors to vary the length of the light path from the spark point to the tube photo-cathode (and so altering the arrival time of the spark image relative to the shuttering pulse), it is possible to examine individual stages of

the spark formation—reducing the effective exposure time to as small as  $3 \times 10^{-10}$  second.

The scanning and display principle used in the flying-spot microscope (represented at the show by the well-known Cintel model) is now extending into other fields. One particularly interesting example was a scanning X-ray system shown by the Royal Cancer Hospital. Here, the place of the flying-spot c.r. tube is taken by a special X-ray tube in which an electron beam scans a platinum-foil target about the size of a post-card. The raster of X-rays so produced passes through the thin target and the tube face and after being modulated by the object under examination is picked up by a scintillation detector. The signal pulses from this are then integrated and amplified and used to intensity modulate a display c.r. tube which is being scanned in synchronism with the X-ray tube. Because of the great sensitivity of the scintillation detector the system is claimed to be about 20 times more sensitive than conventional X-ray apparatus.

Another exhibit using the flying-spot principle was an equipment for counting and sizing small particles, demonstrated by Mullard. This works on the same general principle as the Mullard apparatus shown last year, but for sizing purposes the scanning spot is given a secondary deflection, downwards across the particle and back again, at the end of the first line scan. The length of the excursion is then used as a measure of the particle size.

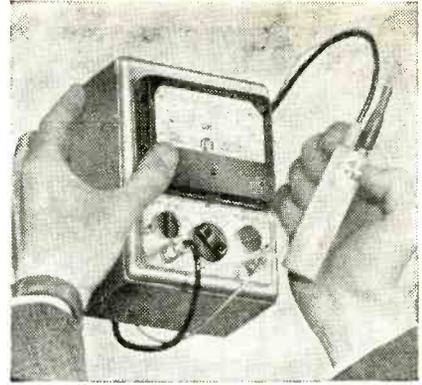
For the actual process of counting and registering pulses the well-known Dekatron was very much in evidence in a large number of instruments. There is now, however, a new type of decade counting tube which is a good deal faster in operation than the glow-discharge transfer method. This is the Mullard E1T, a miniature c.r. tube using electrostatic deflection of the beam into ten different positions, and in a demonstration it was shown counting at a p.r.f. of 100 kc/s. Counting is also the basic operation in digital computers, and in this field the same firm were demonstrating how transistors can be used in place of valves for various functions—with considerable advantage in reliability and heat dissipation.

There were actually no complete digital computers to be seen at the exhibition, but several of the analogue kind. A particularly interesting one, shown by Elliott and using d.c. amplifiers as functional units, is designed so that problems can be set up on a series of detachable panels, each of which plugs into a d.c. amplifier. It is thus possible to remove a problem *en bloc* and keep it set up whilst leaving the main instrument free for other work. A miniature analogue computer was demonstrated by Saunders-Roe, while Southern Instruments had a correlator computer with photo-electric line followers to work from continuous line records on film or paper.

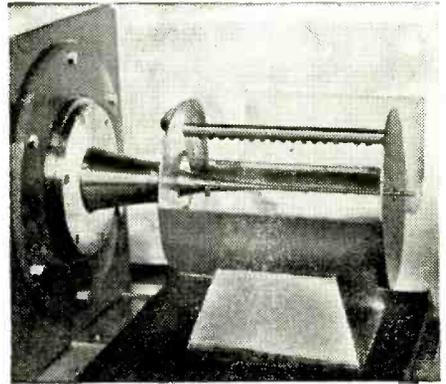
## INDUSTRIAL ELECTRONICS

THE measurement and recording of fundamental physical quantities such as displacement, velocity, acceleration, temperature and pressure forms the basis of the application of electronics to industrial processes. Initially, a transducer is required to convert the physical quantity into a voltage or current which can be amplified by valves or magnetic amplifiers. The output from this transducer is generally applied to a self-balancing potentiometer, operated by a servo motor, and the setting of the potentiometer is recorded on a moving chart or may be used to control industrial processes through relays or larger servo motors. Typical of this widely represented branch of the electronic art are the Foster continuous-balance electronic potentiometers, the Cambridge Instrument multi-point electronic recorder and the Boulton and Paul automatic manometer for use in wind tunnels or in any fluid pressure system.

Variation of capacitance forms a sensitive method of measuring distance or displacement and is applied in the prototype of a probe for the exploration of the internal diameter of small bores. It is used in conjunction with the three-terminal bridge shown last year by Wayne Kerr and can be calibrated to give direct readings of distance at balance.



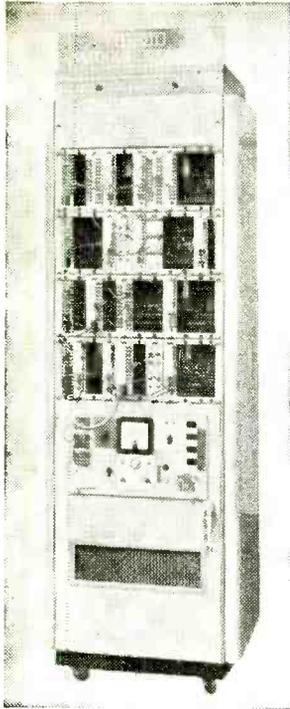
Pye miniature pH meter.



Fatigue testing of rod specimens by ultrasonic vibration (Mullard).

The thickness of electroplated films can be measured magnetically as in the B.S.A.-Tinsley gauge in which the adhesion of a small magnet is balanced against the tension of a light spring balance; or thermo-electrically as in a method developed by the British Non-ferrous Metals Research Association and shown by Elliott Brothers. A hot probe and a cold probe are applied to the surface of the plating and the thermal e.m.f. generated between the plating and the base material appears between the two probes. A magnetic amplifier is used between the probe output and any suitable indicator, recorder or relay.

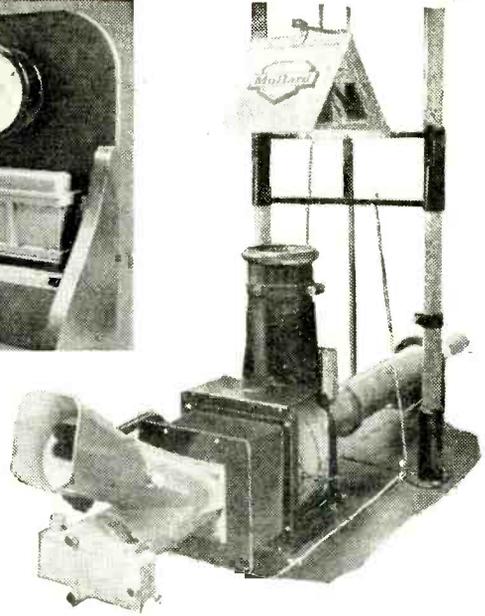
Measurement of thickness by ultrasonic methods where only one side of the material is accessible, as in the case of pressure vessels, may be effected in several ways. In the Dawe Instruments "Visigauge" standing-wave resonance in the thickness of the plate increases the power absorbed from the driving oscillator and this change is displayed as a "pip" on the vertical scale of a cathode-ray tube. The horizontal scale is a function of frequency, which is swept cyclically through an appropriate range, and can be calibrated to read thickness directly. In the Kelvin-Hughes depth and thickness accessory for their standard ultrasonic flaw detector, a short pulse is applied simultaneously to the plating under test and to a liquid delay line of adjustable length. Both return pulses are displayed on a c.r. tube, and, when adjusted to coincidence, the depth can be read off directly. The instrument is calibrated for mild steel and has a range of  $\frac{1}{16}$  in to 4 in. By a technique, in which an electrical step function is applied to a thick barium titanate disc with heavy mechanical damping to give a stress with a sharply defined leading edge, the Ultrasonoscope Company (London) have succeeded in resolving echoes in steel and aluminium for thicknesses down to 0.02 in.



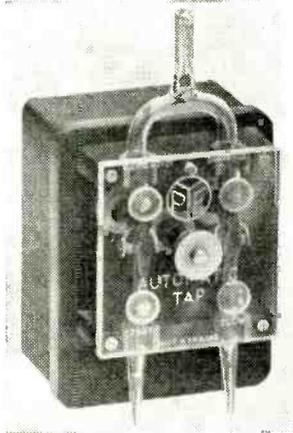
*Elliott analogue computer.*



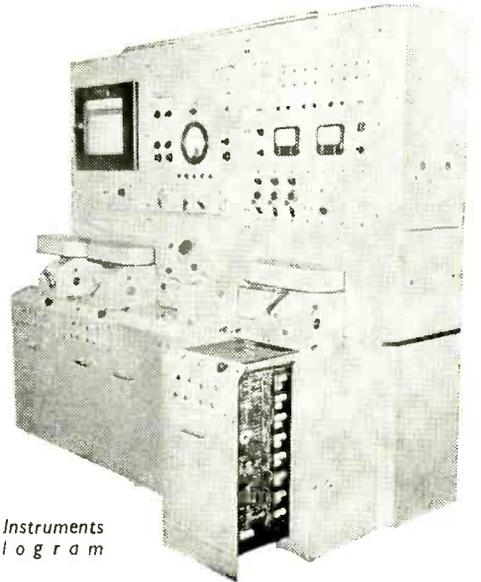
*Isotope Developments Type 150 beta ray thickness gauge.*



*Mullard high-speed photography apparatus.*



*Magnetically-controlled tap for automatic titration (Pye).*



*Southern Instruments correlogram computer.*

Applications of ultrasonics for the non-destructive testing of materials were shown by the National Coal Board (elastic properties of coal) and by A. E. Cawkell (for checking the compressive strength of concrete in fabricated building units). A spectacular demonstration of the time that can be saved in fatigue testing of metals was given by Mullard. Short rod specimens, welded to a tapered mechanical transformer element were excited with ultrasonic power of the order of kilowatts at a frequency equivalent to the half-wave longitudinal resonance of the bar. Under these conditions velocities are a maximum at each end, and compressional and tensile stresses at the middle. Strain is measured by capacitance probe near the free end. To show the magnitude of the forces which could be applied, specimen bars were raised to incandescence in the centre in a matter of seconds. Normally, of course, the specimen would be water-cooled.

Continuous monitoring of thickness of sheet materials during manufacture by the absorption of beta rays (electrons) from a radioactive source has long passed the development stage, and ruggedly housed units suitable for use under factory and mill conditions are made by a number of firms. Typical of this trend is the Type 150 beta gauge made by Isotope Developments. In the Ekco thickness gauge, provision is made for automatic overall standardization every 30 minutes with servo correction for amplifier sensitivity and source decay or contamination. The thickness at predetermined points across the width can be sampled at intervals, the duration of which can be pre-set by the operator. To meet the needs of the paper industry Baldwin Instruments have produced an accessory to their "Automat" beta ray thickness gauge designed to measure the weight per unit area, and thus the "height" or "profile" of the paper surface, across its whole width.

A continuous record is obtained on a pen recorder.

As an alternative to electron penetration, the back-scatter due to gamma radiation is now coming into use for the measurement of thickness. In a prototype instrument shown by Ekco Electronics, cobalt 60 is used as the radiation source and a differential circuit is used to separate the reflected photons from the primary radiation. The detecting photomultiplier tube is associated with a circuit time constant long enough to remove random fluctuations from the indicator. Baldwin Instruments also showed a prototype back-scatter thickness gauge designed to measure metal sheet thickness where only one side is presented, and a transmission gamma-ray thickness gauge for revealing non-uniformity due to variations of ingot temperature in hot steel rolling mills.

In chemical analysis increasing use is being made of electronic methods. The measurement of hydrogen ion concentration (pH) is already well established and the

trend is towards miniaturization, as exemplified in the Pye Type 11084 instrument.

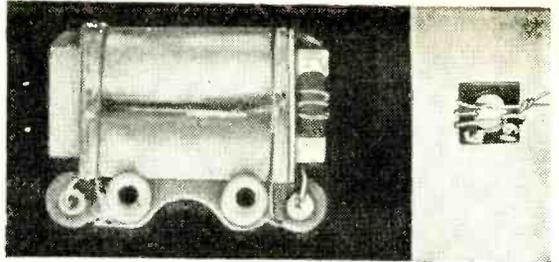
In the estimation of acids and alkalies by titration, the end point is usually indicated by a pH meter and in the Pye Type 11600 instrument the out-of-balance signal from the pH meter is used to control a magnetic stop valve with fast and slow rates of dispensation of the neutralizing reagent. The end point may be pre-set to any value within  $\pm 0.1$  pH and the changeover from fast to slow dispensation can be set to come into operation up to 5 pH units before the end point.

A different method of titration with many interesting features is employed in the automatic titrimer shown by Electronic Instruments. Instead of using calibrated acid or alkaline solutions of known concentration, the starting point is a neutral salt of indeterminate strength. A current is passed through the salt solution in a cell with semi-permeable ends and acid or alkali is liberated at the electrodes, depending on the direction of the current. The current is integrated by a low inertia motor and counter unit of the type designed by Electro Methods and gives a direct measure of the amount of reagent generated and used for the titration (1 gram equivalent ion is equivalent to 96,494 coulombs). The process is stopped automatically when the predetermined end point is reached on the pH meter.

Rapid analysis of the constituent elements of solutions is possible by a method known as polarography, in which a progressively rising e.m.f. is applied to a mercury dropping electrode. Current flows in well defined steps in which the starting e.m.f. is related to the identity of the conducting ion and the height of the step to its concentration. In the Tinsley recording polarograph the first derivative  $di/dv$  of the current-voltage relationship is displayed, which gives better resolution, and a square-wave method developed by Barker and Jenkins, of A.E.R.E., and utilized in the Mervyn Instruments polarograph gives greater latitude in dealing with constituents of widely different concentration.

## MISCELLANEOUS EXHIBITS

A MAGNETIC reactor, having various applications involving frequency shift of an oscillator by means of an externally applied audio or d.c. voltage has been developed



*Plessey magnetic ferrite reactor.*

by Plessey. A fruitful field of usefulness is for frequency modulating v.h.f. oscillators and transmitters and for automatic frequency control of a v.h.f. oscillator.

The reactor consists of a small ferrite former with a few turns of wire wound toroidally on it and forming part of the tuned circuit of the oscillator it is required to control, or frequency-modulate as the case may be. The toroidal coil is mounted in an electromagnet system in such a way that by applying either a d.c. or an a.c. voltage to the electromagnet winding the incremental permeability of the ferrite core, and hence the inductance of the toroidal winding, can be varied. An inductance change of the order of 10 per cent is attainable. The unit shown by Plessey is designed for use at frequencies of from 50 to 100 Mc/s.

Some really lilliputian input and output audio transformers were exhibited by Fortiphone. The company has, of course, had a wide experience in the manufacture of very small parts for hearing aids. The transformers shown were mainly for transistor circuits and were in ratios of between 2 and 10 to 1 and either encapsulated in potting resin or open. The smallest measures  $\frac{1}{8}$  in  $\times$   $\frac{1}{8}$  in  $\times$   $\frac{1}{8}$  in, while the largest of the miniatures is only  $\frac{3}{8}$  in  $\times$   $\frac{1}{2}$  in  $\times$   $\frac{3}{8}$  in. Primary inductances (with no d.c. flowing) of 30H or so are achievable with some of these tiny transformers.

Recent improvements in the precision-type silvered-mica capacitors made by Johnson, Matthey consist of using thinner mica and a larger silvered area than hitherto and thus providing more pFs per unit area.

## TEST AND MEASURING GEAR

### *Apparatus Shown at the R.E.C.M.F. and Physical Society's Exhibitions*

MANY of the instruments to be mentioned were shown in prototype or pre-production form, and are therefore subject to modification before they become available, if they do. Likewise many of those which were available for the first time had been previously reported in *Wireless World* so are not mentioned again unless the modifications were substantial.

After a period during which the design of unamplified meters had seemed almost to have reached finality, signs of renewed activity were to be seen in a considerable number of new models. The demand by the Services for hermetical sealing has been met by several makers. The well-known Avometers 7 and 8 now have counterparts in Araldite "D" tropical dress as 7X and 8X. The trend towards wide-angle deflection continues. British Physical Laboratories showed sub-panel-mounted meters to accord with contemporary styling, and Everett Edgcombe a new system of scale lighting distributed by a Perspex surround. Pullin now have two multi-range d.c./a.c. test meters of the Amp-Volt-Ohm type, one with a 1mA movement and the other 50  $\mu$ A, for which a special 20-way multi-bank switch was developed; there is also a miniature d.c./a.c. 19-range set. The same firm showed a moving-coil voltmeter mounted in a probe for

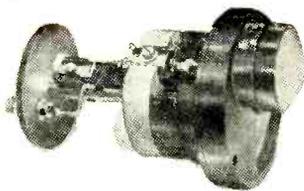
measuring television e.h.t. up to 25 kV; full-scale current, 40  $\mu$ A. An ingenious device enables the whole of the scale to be used for either positive or negative voltages without reversing connections. To the Pye series of "Scalamp" high-sensitivity instruments has been added a voltmeter taking a full-scale current of 1  $\mu$ A (i.e., 1M $\Omega$  per volt, for those who prefer to put it in that roundabout way). The lowest range is 10 mV f.s.

Another conception of rugged sensitivity is the Doran portable combined pointer and reflecting galvanometer, obtainable with various full-scale readings; examples are  $\pm 0.12$  mV (10- $\Omega$  coil) and  $\pm 1.5$   $\mu$ A. Among new frequency meters are those by Pullin and Electrical Instrument Co.; the latter also showed differential a.c. meters in which two opposing rectifiers are connected to a centre-zero movement, obtainable with f.s.r. from  $\pm 50$   $\mu$ A upwards.

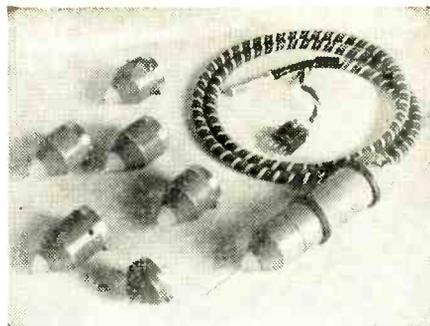
The valves in valve voltmeters have hitherto been of the vacuum type, but this year a sign of the times is the British Physical Laboratories' "Transranger" multi-range voltmeter and megohmmeter in which an instrument outwardly uniform with their test meters having a movement requiring 25  $\mu$ A for f.s.d. nevertheless is fully deflected by 1  $\mu$ A, the gain being provided by an internal



Pullin e.h.t. probe voltmeter.



Combined pointer and reflecting galvo made by Doran Instruments.



E.M.I. cathode follower probe with some of the interchangeable heads available.

transistor amplifier. Changes due to temperature coefficient are neutralized by initial setting-up procedure. Voltage is measurable from 0.001 to 500, and resistance from 0.001 to 100 MΩ. A new Avo multi-range d.c. voltmeter also takes 1 μA f.s., but uses conventional valves. So does the Marconi Instruments TF1041 on its d.c. ranges, which extend up to 1,000 V; but for a.c. measurements use is made of a probe containing a rectifier valve of the coaxial type, by means of which the frequency range is maintained level within 1 db up to 700 Mc/s. Resistance is measurable from 0.2 Ω to 500 MΩ. This instrument is in production. So is the latest version of the Pye d.c. microvoltmeter, in which a galvanometer moving coil is made to set up an a.c. signal which is amplified and rectified. A somewhat similar means of stepping-up sensitivity is used in a new Pye instrument, called a "Nanoammeter" because on its most sensitive range the f.s. reading is  $10 \times 10^{-9}$  A.

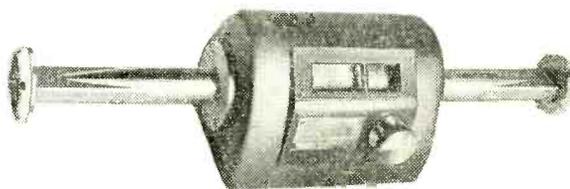
A considerable number of new or improved oscilloscopes were shown, including several each by Cossor, Nagard and Solartron. Most if not all of these use post-deflection accelerator tubes to give adequate traces at the very high speeds which now are expected of even general-purpose instruments. Along with this goes wide bandwidth in the deflection amplifier; for example, 5 c/s to 10 Mc/s in the "Soloscope" CD514, notwithstanding that this is a relatively inexpensive model. A new Cossor model (1056) covers from 5 kc/s up to no less than 80 Mc/s. The E.M.I. Type WM5 includes the valuable feature of meter-read voltage and time along the X and Y axes of the trace, together with the ability to put a television picture on the screen and select any part of any line of it by means of a marker and then switch over to normal waveform examination of the selected part. A cathode-follower probe unit with interchangeable attenuator heads enables the wide frequency band to be maintained up to the point of application. E.M.I. distributed amplifiers, suitable for oscilloscopes, handle a bandwidth of over 100 Mc/s; to the earlier high-level Type 2C has now been added a low-level type that can be cascaded with it to give an overall gain of  $\times 300$ .

It is interesting to compare methods of providing more than one trace. Cossor continue to use their single-gun split beam, with improved non-interaction, in their new Model 1059. Nagard and Southern Instruments use the 20th Century Electronics multi-gun tubes, of which advantage is taken in Southern's M972 of the ability to make one of the traces a horizontally expanded version of the other. In the Mullard L101 the two traces result from electronic to-and-fro switching of a single beam during each flyback. Lastly, Cintel provide any number of traces by means of separate c.r. tube units, which can be assembled like bricks. Incidentally, the Nagard "Unitel" system imparts similar flexibility to the oscilloscope as a whole.

A number of new attenuators were to be seen. The Advance A63 turret model for frequencies from zero to 1,000 Mc/s provides 10 db steps from 0-50 db using resistance arms. It is of 75-ohm coaxial construction, and the operations of withdrawing both end connections axially, bringing a new attenuator pad into line, and closing up the contacts, are all performed by a continuous rotational movement of the control knob. Separate 75-ohm encapsulated attenuator pads for use up to

300 Mc/s were shown by British Physical Laboratories. Coming to microwaves, an assembly was shown by Wayne Kerr for calibrating S-band attenuators from a piston attenuator at 80 Mc/s to within 0.015-0.02 db. Elliott demonstrated absolute calibration of X-band attenuators by a process of adding together two signal outputs previously adjusted to equality, thereby giving a 6.02 db step, from which further steps can be determined. The B443 continuously-variable X-band attenuator shown by the same firm is a beautiful piece of instrument making. It is calibrated direct in db, standing-wave ratio and voltage reflection coefficient, and of the total range up to 100 db that up to 40 db is of high precision.

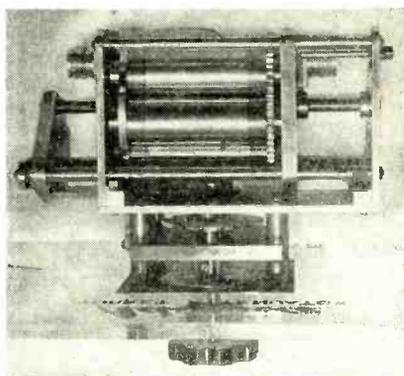
In the field of bridge work a most imposing exhibit



Elliott precision "X" band attenuator.



Encapsulated attenuator unit, FA200, made by British Physical Laboratories.



Top view of turret attenuator made by Advance Components.

was the Smith bridge on the Tinsley stand, for the measurement of thermometer resistors to within 4 in  $10^6$ . Notable features are the massive switchgear and the elaborate precautions to ensure constancy of the manganin resistance standards, such as the method of spirally winding a helix of the annealed wire between Perspex discs, and the devices for maintaining constant and uniform temperature. A modern version of the Kelvin double bridge for low resistances was shown by the Cambridge Instrument Co. For use with the r.f. capacitance bridge by Electronic Tubes for the measurement of interelectrode capacitances can now be obtained a series of jigs to Anglo-American Service standards, each for a particular type of valve holder. Doran showed a new universal a.c./d.c. bridge and a bridge amplifier-indicator; Griffin and George a "Nivoc" unit system from which bridges can be assembled; and Salford Instruments an incremental-inductance bridge of the Owen type, with c.r.t. balance indicator. In the Muirhead D728 equipment the impedance and phase angle of two-terminal networks between 0.3 and 100 k $\Omega$  are measured at 50 and  $10^4/2\pi$  c/s by comparison with resistance in a balanced amplifier circuit. The same firm showed an instrument for comparing the voltage and phase of two sinusoidal signals. Comparison is also the basis of an instrument by the Electrical Instrument Co. for measuring and grading components. Its standard is normally their push-button decade capacitor (also shown), and a useful feature of the comparator is a sensitivity switch by which the meter can be made direct-reading in percentage deviation of the component under test. The display mechanism in the Wayne Kerr CR and LR bridges, by which mistakes in reading are rendered almost impossible, appears in improved form in the production versions of those instruments.

The same admirable attention to operational convenience is found in the new decade oscillator of the same make, in which the frequency from 10 c/s to 110 kc/s is directly shown. The decade principle for oscillators has been used by Muirhead for some years, and the latest example is their D695, considerably smaller than previous models but with a high performance. Where spot frequencies (5 c/s to 50 kc/s) and output voltages (5 mV to 20 V) will do, the Cawtell OSP31 oscillator gives 0.1 per cent frequency calibration at a low price—and there is a 1-per cent model at a lower price. The beat-frequency principle is used in the Furzehill 50 c/s to 20 kc/s oscillator, a feature of which is a  $\pm 50$  c/s incremental control. For the exceptionally low frequency range 0.03-30 c/s Airmec use a rotating capacitor to modulate a h.f. signal which is rectified and amplified to yield the output.

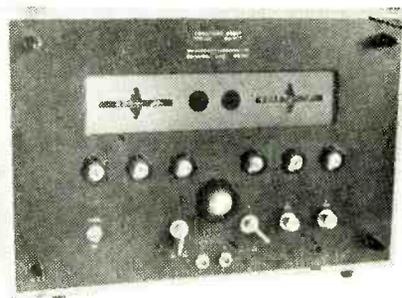
Most of the new oscillators and signal generators for the higher frequencies have been inspired by developments in television and f.m. broadcasting. The Advance range has been supplemented by Type R1, covering the whole v.f. 30 c/s to 3 Mc/s in one range, and 3-10 Mc/s in

another, using a RC type of oscillator. Bands I, II and III and the relevant i.f.s are included in a low-priced sweep oscillator by Taylor, in which 5-250 Mc/s is covered in one beat-frequency range; wobulation is by reactance valve. The Cossor "Telecheck" Model 1323 also covers all three bands and their i.f.s in a more elaborate specification that includes a crystal oscillator to provide accurate frequency marker pips on the trace. Owners of the earlier Model 1322, which is similar except for the absence of Band II, may be interested in Model 1324, which is an alignment generator specifically for testing f.m. receivers, and includes a display of the discriminator characteristic. The Avo Type TFM a.m. and f.m. signal generator, shown in prototype last year, has not yet reached finality, but is expected to cover 5-255 Mc/s with an a.m. signal and 80-100 Mc/s with f.m. The frequency scale is direct reading and fitted with a device for correcting it by known frequencies. At the laboratory level, Marconi Instruments have recently introduced the TF1077 f.m. signal generator covering 19.7-102.5 Mc/s. A piston attenuator is used, and frequency modulation is by varying the permeability of a ferrite core on which the r.f. inductor is wound. A new M.I. a.m. signal generator is the TF801B, covering the unusually wide frequency range of 10-500 Mc/s. Range changing is by contactless switch, and the r.f. valves are of the disc-seal type. For still higher frequencies (L band, 960-1,250 Mc/s) there is now the TF1078, with a piston attenuator having a range up to 110 dbm. Yet another new generator of the same make is the OA1000, for the increasingly important Q band (33,300-37,500 Mc/s). The oscillator is, of course, a klystron, its frequency being stabilized by a variety of the Pound system. A feature of the latest version of the Airmec general-purpose 30 kc/s to 30 Mc/s signal generator is a horizontal direct-reading illuminated frequency scale 4ft long on every range.

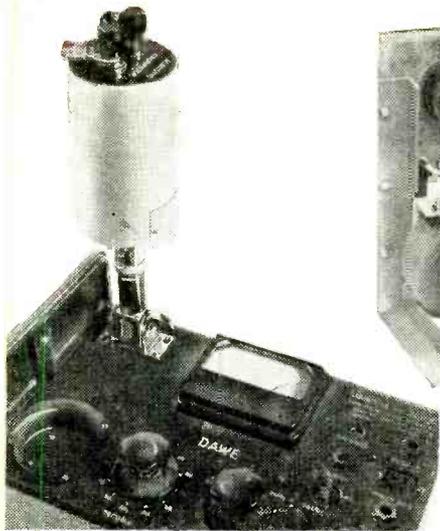
With applications in such fields as television, radar, communications and nucleonics, the need for pulse generators is growing, and new types were shown by Solartron, British Physical Laboratories and E.M.I., with pulse width adjustable down to a few millimicro-seconds. The Mullard L141 generator produces pulses in pairs separated by an interval variable from 1  $\mu$ sec to 0.1 sec, B.P.L. also exhibited a pulse-height voltmeter, independent of pulse width and repetition rate above 700 p.p.s. For amplified testing Solartron have a square-wave generator (GO511) with rise and fall times as low as 40 and 25  $\mu$ sec respectively on the highest frequency range. An entirely different kind of special waveform is produced by the Dawe "white noise" generator Type 419, in which a thyratron in a magnetic field generates a noise output uniform from 20 c/s to 5 Mc/s, reducible to 500 kc/s or 20 kc/s for testing apparatus over narrower frequency bands. For taking frequency characteristics, etc., such a generator simulates transient signals such as speech more closely than does c.w., and acoustic standing waves are avoided.



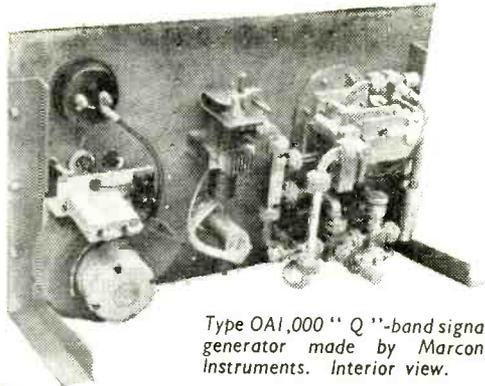
Left: Cossor Model 1324 F.M. alignment signal generator with probe and capacitance coupling.



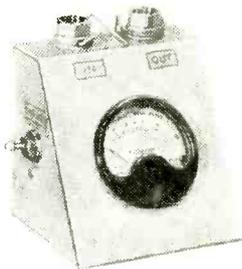
Capacitance Bridge Type B221 made by Wayne Kerr.



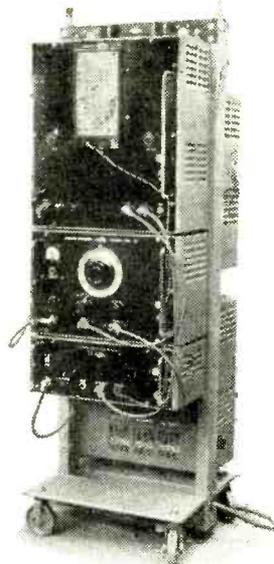
Acoustic calibrator shown in position on microphone of Dawe sound meter.



Type OAI,000 "Q" band signal generator made by Marconi Instruments. Interior view.



Right: Labgear standing-wave-ratio direct-reading meter.



Airmec rack-mounted frequency measuring equipment with electronic counter.

Useful in conjunction with it, or with other apparatus such as a sound level meter, is the Dawe Type 1410 octave-band analyser, consisting of switched filters selecting six octaves in the range 75-4,800 c/s (also 20-75 c/s and 4.8-10 kc/s), a calibrated attenuator, amplifier and output meter. Another new Dawe instrument is an acoustic calibrator, consisting of a stable  $2\frac{1}{2}$  in loudspeaker mounted at one end of a cylinder designed to fit over the microphone of a sound level meter. By feeding the loudspeaker with a known signal voltage, the calibration of the meter can be checked.

Both the Avo and Taylor valve testers have been improved into new models, especially as regards ability to cater for new valve types. The Taylor (45C) has additional switch positions and an adaptor for c.r. tubes. Two new laboratory equipments for c.r. presentation of families of valve characteristic curves were shown: one by Cossor, which is capable of displaying two sets of curves simultaneously, and is particularly suitable for revealing the characteristics in the positive-grid region, inaccessible by static tests; and the other an extremely elaborate three-rack set-up by Electronic Tubes, in which not only the valve curves but the graticule is produced via the same amplifier and beam, making the calibration independent of amplifier linearity and stability. Bridge measurements of the valve parameters can also be made at any desired point.

A neat standing-wave-ratio meter by Labgear enables v.h.f. loads to be matched to 75-ohm coaxial lines. The instrument is direct-reading in s.w.r. The Solartron s.w.r. and reflection coefficient indicator is an amplifying detector with an input impedance of 20 k $\Omega$ , for use with a slotted-line in microwave circuits. The Advance range of instruments now includes a moderate-priced and versatile Q-meter, Type T1. The basic principle is the conventional one, and a wide frequency range (100 kc/s to 100 Mc/s) is practicable owing to the use of an inductive coupling of very low impedance. The oscillator is modulated at 50 c/s, enabling a sensitive valve voltmeter to be used without the need for zero setting. A still more versatile instrument is the Airmec "TeleVet," which, as its name implies, is for television servicing. It contains in one portable case all that is normally required, including wobulator, pattern generator, a.m. signal generator, a.f. oscillator, oscilloscope, e.h.t. voltmeter, a.c. and d.c. valve

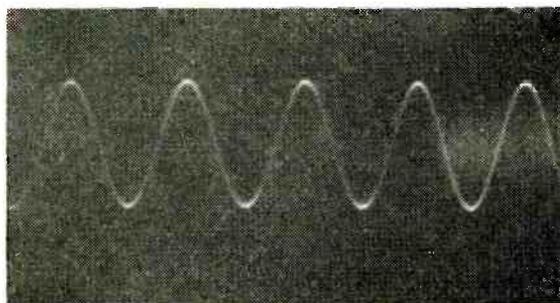
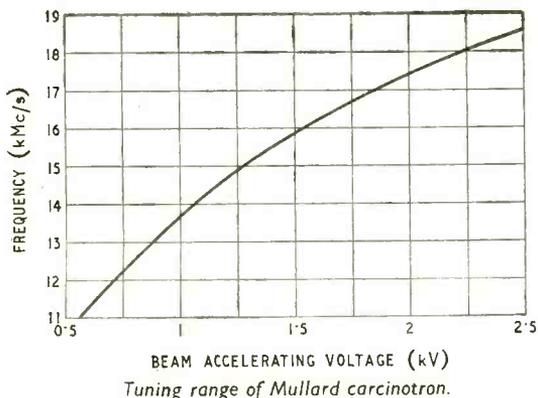
voltmeter, and crystal calibrator. The instrument covers 8-70 and 168-230 Mc/s, is safe when used with a.c./d.c. sets, and for such a comprehensive equipment is inexpensive. The same maker exhibited an electronic counter rack with very clear direct-reading illuminated display of the number of cycles, suitable for quick and accurate frequency measurement.

## VALVES AND SEMI-CONDUCTORS

THE most unusual valve be seen this year was undoubtedly the backward-wave oscillator or "carcinotron" shown by Mullard. It is similar in form to the ordinary travelling-wave tube but the r.f. field energy travels in the opposite direction to the electron beam flow. A characteristic feature is the very wide tuning range, which is obtained simply by varying the electron beam accelerating potential (see graph). The collector potential is 200 V and the beam current 25 mA, while the power output is 50 mW at 11,000 Mc/s or 120 mW at 18,000 Mc/s.

In conventional travelling-wave tubes there were two new types shown by English Electric, the N1001 and N1002. Operating as amplifiers, they both have a gain of 25 db over the frequency range 1750-2300 Mc/s, the N1001 giving an output of 20 W and the N1002 an output of 1 mW. Another microwave valve using velocity modulation of the electron beam is the klystron, and on view was a new Ferranti type with the high output power of 500 watts at 9,400-9,700 Mc/s. The cathode of this valve is designed to give a very heavy beam current and the power dissipation of the collector, which has to be water-cooled, is 4 kW.

Of particular interest amongst the receiving-type valves on show was the Osram KT55 beam tetrode. This is intended for use as an audio amplifier in a.c./d.c. circuits (the heater rating is 0.3 A, 52 V) and two of the valves connected as pentodes in push-pull will give an output of 25 watts from a mains supply of 220 volts. In this pentode condition the KT55 has the high mutual conductance of 16 mA/V. Another new audio valve for large output powers was the Mullard EL34. It is notable for its



500-Mc/s sine wave recorded on 20th Century oscilloscope tube S6A20-3.

high maximum anode voltage of 800 V, which permits operation in push-pull circuits with output powers up to 100 watts (at 5 per cent distortion). Both the KT55 and the EL34 are on the octal base.

High power and high mutual conductance were also the outstanding features of the new Ediswan beam tetrode 13E1, a d.c. control valve intended for use in stabilized power supplies or servo control systems. The slope is actually 40 mA/V, while the maximum anode dissipation is 90 watts.

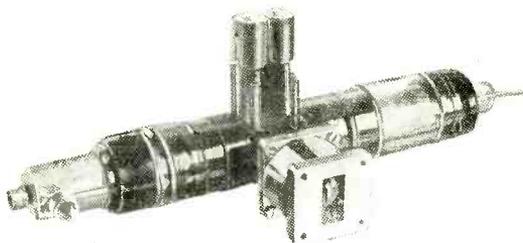
Cold cathode triodes, or trigger tubes, for use in electronic switching circuits are still very popular because they are reliable, long-lived and need no heater supplies. Osram were showing one, the CCT6, which can be used in circuits having wide component tolerances, while the Mullard Z803U is notable for the stability of its trigger characteristics.

New entrants into the transistor field are Pye Industrial Electronics, who have come out with a complete range of germanium junction *p-n-p* types, hermetically sealed, for audio and i.f. applications. Under the series type number of V10, they have collector voltages of 10 V and various input and output resistances. A similar range of junction *p-n-p* types have been produced by G.E.C. It comprises the EW53 and EW59, which are intended for power applications and will operate at frequencies up to a few hundred kilocycles, and the EW58, designed for low-power, low-frequency amplifiers such as in hearing-aids. Yet another series of junction transistors which may be already well known are the TJ1, TJ2 and TJ3, shown by Brimar and S.T.C.

A junction transistor using silicon is the next thing to be expected, but in the meantime we have a range of silicon junction diodes, types ZS10A, B and C, produced by Ferranti. These are characterized by their extremely low reverse current of less than 10  $\mu$ A for a reverse voltage of -50 V and by their ability to operate at temperatures as high as 100° C. Forward currents are 0.1 A continuous and 1 A peak. A developmental silicon junction diode was also shown by S.T.C.



English Electric travelling-wave tubes N1001 and N1002

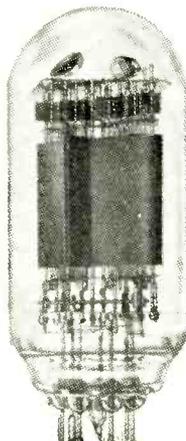


Ferranti 500-watt klystron.

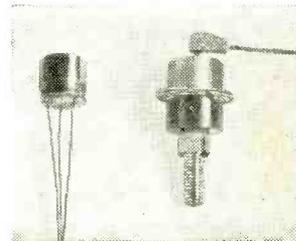
Germanium junction diodes are still being developed, however, and one interesting example was the G.E.C. type EW54, intended for power rectification. Fitted with cooling fins it will give a rectified output of 50 V, 24 A, and good regulation is obtained because of its low forward resistance of 0.05 ohm. For h.t. power supplies based on relaxation-oscillator generators, Mullard were demonstrating a power transistor used with germanium junction rectifiers to produce a d.c. output of 150 V at 5 watts from a 12-volt supply. The photo-electric properties of the germanium junction were also represented, by the S.T.C. miniature germanium photocell type P40A, which is so small that six of them can be arranged in a row across standard teleprinter tape for "reading" the punched holes.

Amongst conventional plate rectifiers the most interesting development was a range of new Westinghouse types with aluminium cases which are bolted flat to the chassis to conduct the heat away. This enables the size of the rectifier to be reduced for a given power rating. A similar reduction in size is given by elements each capable of handling 27 volts in the tubular selenium rectifiers shown by Salford.

Oscilloscope c.r. tubes were well represented, and an outstanding one for high "writing" speeds was the 20th Century S6A20-3, which has three post-deflection accelerator electrodes and is capable of recording a 500-Mc/s sine wave with a time-base speed of 650 cm per microsecond. Mullard were showing two new 3-inch tubes, DG7-32 and -36, the first-mentioned being notable for its low final anode voltage of 500 V.



Left: Ediswan beam tetrode 13E1.



G.E.C. germanium junction diode EW54 (right) and EW51 point contact transistor (left).

## DESIGN FOR A

# 20-Watt High-Quality Amplifier

### 2.—Constructional Details and Performance

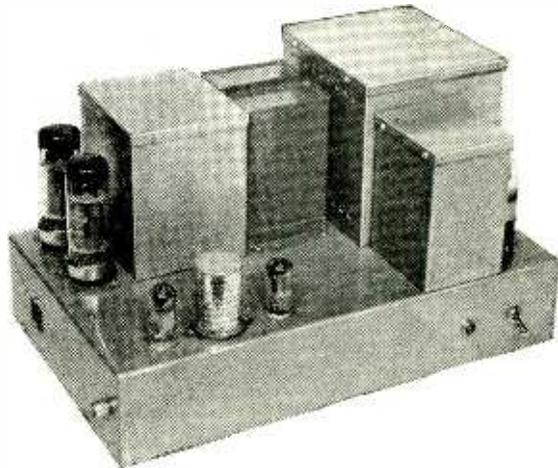
By W. A. FERGUSON,\*

B.Sc.(Eng.), A.C.G.I., Grad. I.E.E.

**I**N the first part of this article some considerations were discussed which affect the choice of valves and circuit arrangements in the output stages of amplifiers designed for use in high-quality sound reproduction.

In amplifiers designed to handle power outputs greater than 12 to 15 watts and in which low-distortion operation towards peak power output is still required, the use of distributed load operation with valves of the 25-watt anode dissipation class is of particular interest. By using this method of valve loading the effective power output of a low-distortion triode push-pull stage (approximately 12 watts) can be raised to 30 to 35 watts whilst the benefits of low inherent distortion and relatively low output impedance are well maintained. Performance typical of the Mullard EL34 output pentode with partial screen-grid loading was illustrated in Fig. 3 of the previous article.

The present article describes a design for a high-quality amplifier of 20 watts rated output in which similar load conditions are used for the EL34 valves in the output stage. The amplifier is intended to allow of the highest standard of sound reproduction when used in association with suitable pre-amplifier circuits, high-grade pickups and loudspeaker systems.



General view of top of prototype 20-watt amplifier, which uses EL34 output valves.

A summary of the overall performance of the amplifier is given in Table 1.

A circuit diagram and list of component values is given in Fig. 1. The circuit arrangement is basically similar, except for the output stage, to that used in the Mullard 5-valve 10-watt high-quality amplifier design in that the output stage is driven from a cathode-coupled twin-triode phase-splitting amplifier which is in turn preceded by a high-gain voltage amplifier stage. The first stage in the amplifier is d.c. coupled to the phase splitter in order to minimize low-frequency phase shifts. The main feedback loop includes the whole circuit, the feedback voltage being derived from the secondary of the output transformer and injected in the cathode circuit of the first stage.

**Output Stage.**—The main feature of interest in the output stage is the use of the Mullard EL34 high-slope output pentode with partial screen-grid loading, the screen grids being fed from taps on the primary of the output transformer. Measurements during the course of design showed that optimum conditions are obtained in this form of output stage when about 40% of the primary winding of the output transformer is common to anode and screen grid circuits. In the present design a C-core transformer is used which has tapings at 43% of primary turns.†

The anode-to-anode loading of the output stage is 6.6 k $\Omega$  and, with a feed voltage of 440 at the centre-tap of the output transformer primary the combined anode and screen-grid dissipation of the output valves is 28 watts per valve. With the particular screen-grid to anode load ratio used, it has been found that improved linearity is obtained at power levels above 15 watts when resistors of the order of 1,000 $\Omega$  are inserted in the screen-grid feeds. The slight reduction

TABLE I

#### Summary of Performance of Prototype Amplifier

<b>Power output:</b>	20 watts minimum from 30 c/s-20 kc/s.
<b>Power response:</b>	within 0.5 db of 1 kc/s level at 20 watts over range 30 c/s-20 kc/s.
<b>Frequency response (1 watt level):</b>	within 1 db of 1 kc/s level 2 c/s-100 kc/s.
<b>Harmonic distortion (400 c/s):</b>	<0.05% at 20 watts.
<b>Intermodulation distortion (40 c/s, 10 kc/s; ratio 4:1):</b>	0.7%, with peak corresponding to 20 W sine-wave power. 1.0%, with peak corresponding to 29 W sine-wave power.
<b>Hum and noise:</b>	-89 db relative to 20 W with 10-k $\Omega$ source resistance.
<b>Sensitivity:</b>	220 mv for 20 W output.
<b>Phase shift:</b>	10° maximum at 10 c/s. 20° maximum at 20 kc/s.
<b>Output impedance:</b>	approximately 0.3 $\Omega$ at 40 c/s, 1 kc/s and 20 kc/s at 20 watts output.

\* Mullard Valve Measurement and Application Laboratory.  
† Partridge Transformers, Ltd.—Type P3878.

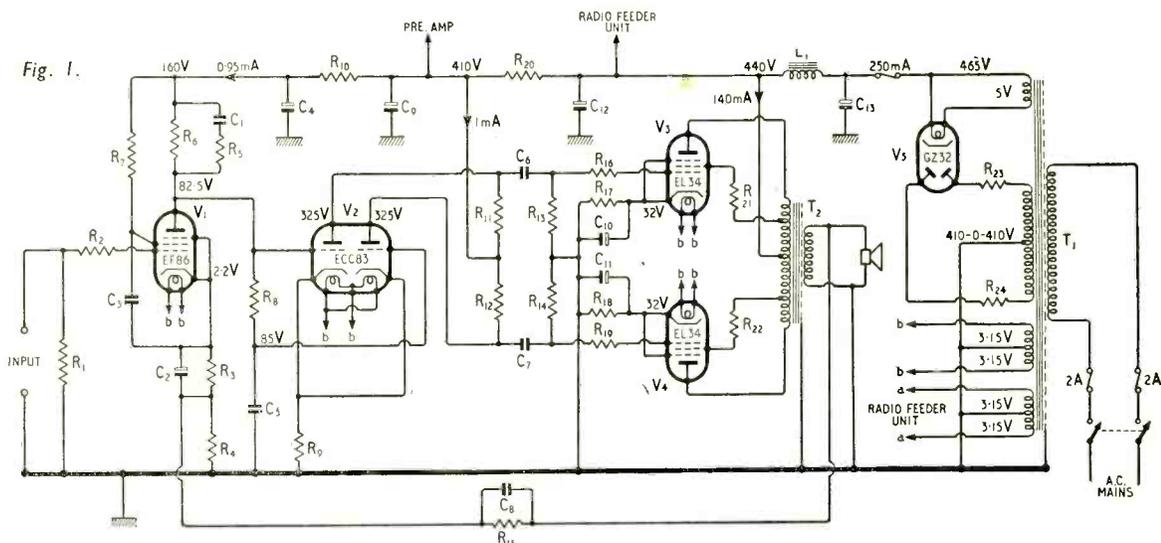
in peak power-handling capacity which results is not significant in practice. Separate cathode-bias resistors are used to limit the out-of-balance d.c. current in the output transformer primary; the use of further d.c. balancing arrangements in the output stage has not been considered necessary. It is likely, however, that some improvement in performance, particularly at low frequencies, would result from the use of d.c. balancing. It is necessary in this type of output stage that the cathodes are bypassed to earth even when a common cathode resistor is used. Thus a low-frequency time-constant in the cathode circuit cannot be eliminated when automatic bias is used.

**Power Supply.**—The power supply is conventional and uses a Mullard GZ32 indirectly heated full-wave rectifier in conjunction with a capacitor input filter. Paper smoothing capacitors have been used in the prototype amplifier, though the alternative use of electrolytic capacitors is possible. The value of the limiting resistors  $R_{23}$  and  $R_{24}$  will depend on the winding resistances of the mains transformers used. Their purpose, when required, is normally one of voltage control only. Where a transformer having very low winding resistance is used, a secondary

voltage rated at 400-0-400 may be found adequate.

The rating of the mains transformer is such that an additional 30 mA may be drawn from the h.t. supply to feed pre-amplifier circuits and radio feeder. Additional decoupling will be required for these supplies.

**Driver Stage.**—This stage uses a Mullard ECC83 twin-triode and fulfils the combined function of phase splitter and driver amplifier. It is of the cathode-coupled form and enables a high degree of push-pull balance to be obtained. With the high line voltage available the required drive voltage for the output stage is obtained at a low distortion level, which is approximately 0.4% for 20 watts power output. The anode load resistors  $R_{11}$  and  $R_{12}$  must be matched within 5%,  $R_{12}$  having the higher value for optimum operation. Optimum balance is obtained when the effective anode loads differ by 3%. It is necessary also that the grid resistors  $R_{13}$  and  $R_{14}$  in the output stage are of small tolerance since they form part of the anode loads of the driver stage. High-frequency balance will be largely determined by wiring layout since equality of shunt capacitances is required. Low-frequency balance is controlled by the value of the time constant  $R_8 C_5$  in the grid circuits



**LIST OF COMPONENT VALUES**

- $R_1$  1 M $\Omega$   $\frac{1}{4}$  watt  $\pm 20\%$
- $R_2$  4.7 k $\Omega$   $\frac{1}{4}$  watt  $\pm 20\%$
- $R_3$  2.2 k $\Omega^*$   $\pm 10\%$
- $R_4$  100 $\Omega^*$   $\pm 5\%$
- $R_5$  4.7 k $\Omega$   $\frac{1}{4}$  watt  $\pm 10\%$
- $R_6$  100 k $\Omega^*$   $\pm 10\%$
- $R_7$  390 k $\Omega^*$   $\pm 10\%$
- $R_8$  1.0 M $\Omega$   $\frac{1}{4}$  watt  $\pm 20\%$
- $R_9$  82 k $\Omega$   $\frac{1}{4}$  watt  $\pm 10\%$
- $R_{10}$  270 k $\Omega$   $\frac{1}{2}$  watt  $\pm 10\%$
- $R_{11}$  180 k $\Omega$   $\frac{1}{2}$  watt  $\pm 10\%$
- $R_{12}$  180 k $\Omega$   $\frac{1}{2}$  watt  $\pm 10\%$
- $R_{13}$  470 k $\Omega$   $\frac{1}{2}$  watt  $\pm 10\%$
- $R_{14}$  470 k $\Omega$   $\frac{1}{2}$  watt  $\pm 10\%$
- $R_{15}$  8.2 k $\Omega^*$  (15- $\Omega$  load)  $\pm 5\%$
- $R_{16}$  2.2 k $\Omega$   $\frac{1}{4}$  watt  $\pm 20\%$
- $R_{17}$  470 $\Omega$  3 W min  $\pm 5\%$

- $R_{18}$  470 $\Omega$  3 W min  $\pm 5\%$
- $R_{19}$  2.2 k $\Omega$   $\frac{1}{4}$  watt  $\pm 20\%$
- $R_{20}$  15 k $\Omega$   $\frac{1}{2}$  watt  $\pm 20\%$
- $R_{21}$  1 k $\Omega$   $\frac{1}{2}$  watt  $\pm 10\%$
- $R_{22}$  1 k $\Omega$   $\frac{1}{2}$  watt  $\pm 10\%$
- $R_{23}$  } May be required for voltage control depending on mains transformer.
- $R_{24}$  } transformer.
- $C_1$  47 pF  $\pm 10\%$
- $C_2$  50  $\mu$ F 12 V wkg.
- $C_3$  0.05  $\mu$ F 350 V wkg.
- $C_4$  8  $\mu$ F 450 V wkg.
- $C_5$  0.25  $\mu$ F 350 V wkg.
- $C_6$  0.5  $\mu$ F 350 V wkg.
- $C_7$  0.5  $\mu$ F 350 V wkg.
- $C_8$  220 pF (15- $\Omega$  load) ( $C_8 R_{15} = 1.8 \mu$  sec)

- $C_9$  8  $\mu$ F 450 V wkg.
- $C_{10}$  50  $\mu$ F 50 V wkg.
- $C_{11}$  50  $\mu$ F 50 V wkg.
- $C_{12}$  8  $\mu$ F 500 V wkg.
- $C_{13}$  8  $\mu$ F 500 V wkg.
- $L_1$  10 H, 180 mA, 200  $\Omega$
- $T_1$  Power transformer Secondary 410-0-410V, 180 mA; 5 V, 3A; 6.3 V, 4 A centre-tapped; 6.3 V 2.5 A centre-tapped.
- $T_2$  Partridge Type P3878
- $V_1$  Mullard EF86
- $V_2$  Mullard ECC83
- $V_3, V_4$  Mullard EL34
- $V_5$  Mullard GZ32

\* High-stability carbon. † Matched within 5%.  $R_{12} > R_{11}$ . ‡ Preferably matched within 5%.

and this value has been chosen to ensure adequate balance down to very low frequencies. A disadvantage of the cathode-coupled form of phase splitter is that the effective voltage gain is about one-half of that obtained from one section used as a normal voltage amplifier. Due to the high  $\mu$  of the ECC83 (100) the effective stage gain in the circuit is still about 25 times.

**First Stage.**—This stage is a high-gain pentode voltage amplifier using the Mullard EF86 low-hum pentode. The stage gain is approximately 120. High-stability cracked-carbon resistors are used in anode, screen-grid and cathode circuits and give appreciable improvement in measured background noise level as compared with ordinary carbon resistors. This stage is d.c. coupled to the input grid of the phase splitter in order to minimize low-frequency phase shift in the amplifier and improve low-frequency stability when feedback is applied.

**Negative Feedback.**—The sensitivity of the amplifier without feedback is 6.5 mV for 20 watts output. With feedback approximately 220 mV is required for the same output level, the designed overall loop gain being 30 db.

The loop gain, overall frequency response and phase shift characteristics of the complete amplifier are shown in Fig. 2.

In spite of the high degree of negative feedback used in the present design an adequate margin of stability has been achieved. Complete stability is maintained under open-circuit conditions in the prototype amplifier. An increase in feedback of at least 10 db, obtained by reducing the value of  $R_{15}$  should be possible before signs of high-frequency instability occur. In the form of design used oscillation with capacitive loads is the form of instability most likely to occur, but even with very long loudspeaker leads, instability is unlikely to arise.

**Distortion.**—The harmonic distortion of the prototype amplifier at 400 c/s, measured without feedback under resistive load conditions, is shown in Fig. 3. The distortion curve towards the overload point is also shown for feedback conditions. At the 20 watt level the distortion level without feedback is well below 1% and with feedback applied falls to below 0.05%. Harmonic distortion at 400 c/s reaches 0.1% at approximately 27 watts output. The loop gain characteristics are such that at least 20 db feedback is maintained from 15 c/s to 25 kc/s and 26 db down to 30 c/s.

Measurement of intermodulation products has been made, using a carrier frequency of 10 kc/s, and a

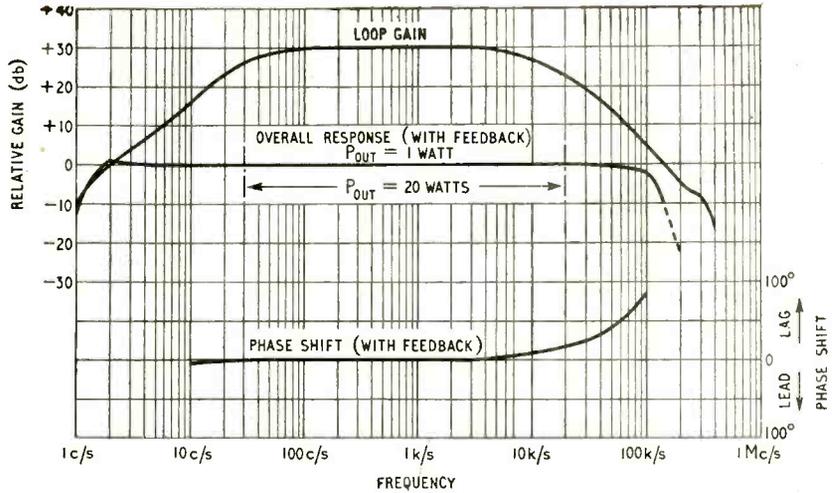


Fig. 2. Loop gain and frequency response and phase shift characteristics with feedback.

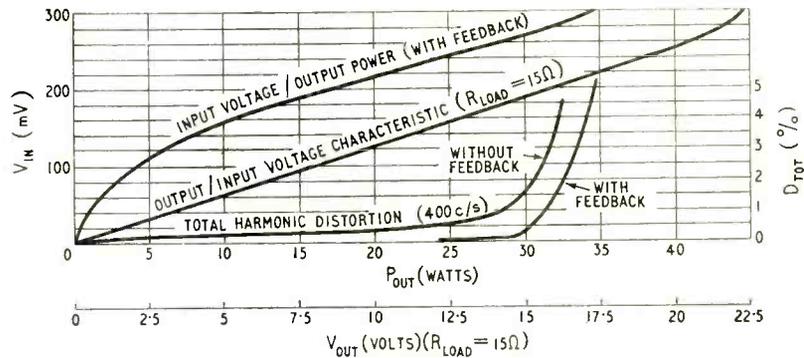


Fig. 3. Harmonic distortion and input/output characteristics of prototype amplifier.

modulating frequency of 40 c/s, with a ratio of 40-c/s to 10-kc/s amplitudes of 4:1. With the combined peak amplitude of the mixed output at a level corresponding to the peak sine wave amplitude at 20 watts r.m.s. power, intermodulation products expressed in r.m.s. terms totalled 0.7% of the 10 kc/s carrier amplitude, and at 29 watts approximately 1%.

The output/input characteristic shown in Fig 3 shows that excellent linearity is obtained up to 20 volts across 15  $\Omega$ , corresponding to 27 watts output.

**Sensitivity.**—The sensitivity of the amplifier is approximately 220 mV for 20 watts output and 300 mV at the overload point at mid frequencies. The background level in the prototype amplifier was 89 db below 20 watts, measured with a source resistance of 10 k $\Omega$ . This is equivalent to about 5.5  $\mu$ V at the input terminals. It is possible to increase the overall sensitivity of the amplifier by 6 db whilst still maintaining a low background level, high loop gain and a high margin of stability. However, considerations involved in the design of suitable pre-amplifier circuits, in particular the need for adequate signal-to-noise ratio, render a higher sensitivity of doubtful advantage.

**Power Response.**—It is important that adequate power-handling capacity is available at the low-frequency end of the audible range. This is determined chiefly by the characteristics of the output

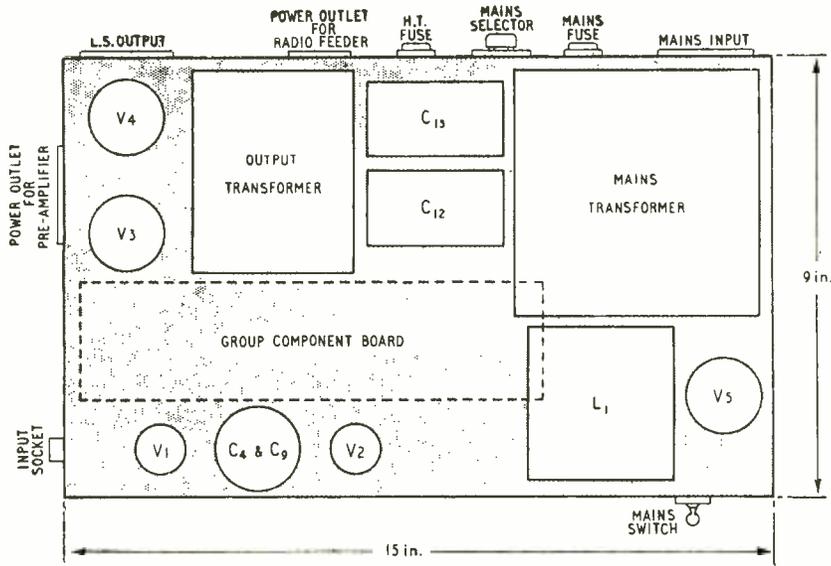


Fig. 4. Layout of principal components in prototype amplifier.

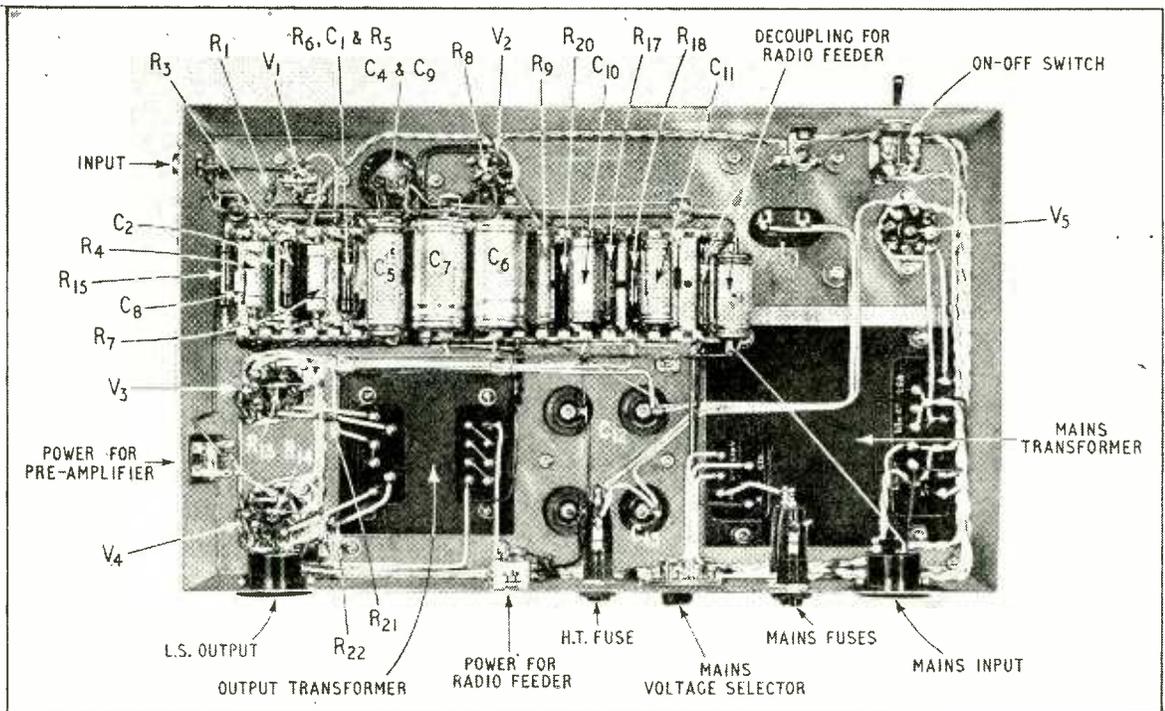
transformer employed, and it is desirable that associated pre-amplifier circuits should attenuate the very low frequencies which the amplifier is incapable of handling at rated power output without excessive distortion. With the output transformer at present employed at least 20-watts capacity is available down to 30 c/s, and the frequency response at the 20-watt level is linear from 30 c/s to 20 kc/s.

**Output Impedance.**—Due to the low inherent output impedance of the output stage, combined with a high degree of negative feedback, the output imped-

ance is very low, measuring approx.  $0.3 \Omega$  on a  $15-\Omega$  termination for 20 watts output at 40 c/s, 1 kc/s and 20 kc/s. This corresponds to a damping factor of approximately 50.

**Phase Shift and Transient Response.**—In practice a compromise must be effected between the phase shift of the amplifier, particularly at high frequencies, and the margin of stability required with a given loop gain. In the present design emphasis has been laid on ensuring as high a margin of stability as possible. The phase shift is held to a comparatively low level in the audible frequency range and, as seen from Fig. 2, reaches about  $20^\circ$  at 20 kc/s. Excellent response to signals of a transient nature is obtained, and the rise time of the amplifier is of the order of  $5 \mu\text{sec}$ .

**Mechanical Construction.**—A diagram of the layout of the chief components as used in the prototype amplifier is shown in Fig. 4. Although this differs extensively from the layout used in the original experimental circuit no difficulty due to instability has been encountered in either arrangement. A bus-bar earth return has been used with chassis connection at the input socket. With minor exceptions all resistors and capacitors are mounted on group terminal boards, shown dotted on the diagram.



Underside of chassis showing one possible grouping of the smaller components.

# Wobbulator Adaptor for Band III

Attachment to Existing Band-I Swept Frequency Oscillators

By G. H. LEONARD, B.Sc. (Hons.) Lond.\*

**T**HE introduction of new television channels in Band III has posed many problems for development and manufacturing organizations, not the least of which has been the problem of production test equipment. At the time that the production of Band I/Band III receivers was first contemplated by the author's firm, the few types of test gear for Band III which were then available were not considered suitable for mass production work. The most pressing need was for a swept frequency generator or wobbulator for the alignment of tuner units, and the equipment about to be described was built to fulfil this requirement.

The design of equipment for internal use by a manufacturing organization is inevitably governed to some extent by "domestic" considerations. In this case, the fact that substantial numbers of commercial Band-I

errors in alignment which would not necessarily be predictable, a drawback sufficiently serious to rule out further consideration of heterodyne methods. Examination of the harmonic problem, however, drew attention to a further method which was eventually adopted.

One of the sweep ranges on the Band-I wobbulators was 60-70 Mc/s and it was noticed that the third harmonic of this sweep, 180-210 Mc/s, covered Channels 8 to 11 with a sufficiently large margin to allow for the skirt bandwidth of Band-III tuners. Tripling this output of the wobbulator would therefore cover four channels in one sweep, and the desired channel could be selected by adjustment of the sweep and shift controls of the wobbulator display. A simple prototype showed that the system was workable. Consideration was then given, in consultation with the makers of the wobbulators, to the final design of an instrument capable of covering the whole of Band III.

The frequency sweep obtained from the instrument must ideally cover the whole of Band III plus a considerable margin to allow for the examination of the skirts of a response curve. This calls for a very wide sweep and a compromise has been necessary so that the sweep covered is sufficient to allow some examination of the skirts of Channels 6 and 13 while at the same time excluding unwanted harmonics. The frequency relationships are shown in Fig. 1, the wobbulator coverage being suitably modified.

Using a sweep of 171 to 219 Mc/s, there is a margin

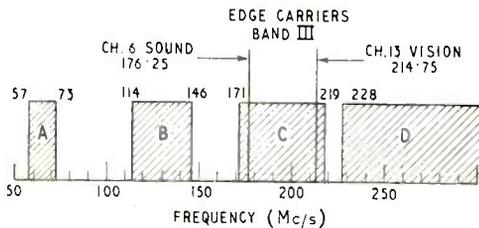


Fig. 1. Frequency sweep of the Band-I wobbulator is shown at A, while its 2nd, 3rd and 4th harmonics are at B, C, and D respectively.

wobbulators (Samwell & Hutton Type 41) were already in use for Band I alignment led to consideration being given to the provision of an adaptor to provide r.f. in Band III, the rate of frequency sweep being so arranged that the existing display facilities could be utilized. A further consideration was the company's policy of manufacturing tuners initially for Channels 8 and 9 only, provision being made for interchangeable coils to adapt the tuner for any channel when required. This gave some latitude in the initial specification of the equipment, in that, although the basic system needed to be suitable for any channel, equipment could initially be made with some limitation in performance other than on the two specified channels.

With these requirements in mind, consideration was given to the possibility of a heterodyne adaptor being designed to provide a Band-III output, using the Band-I output of the existing wobbulators in conjunction with a local oscillator. Examination of this proposal showed that each 10-Mc/s sweep available on Band I had at least one, and in many cases, two, harmonic sweeps covering such a large proportion of Band III that the output from such a heterodyne device would be likely to contain unwanted frequencies over at least a portion of the sweep. In practice this could lead to

of 5.25 Mc/s below Channel 6 sound and 3.25 Mc/s above Channel 13 vision; adjacent harmonics do not fall within the band but are, however, still too close for comfort and special measures are needed to eliminate them.

Within the desired band the output of the instrument is held flat within close limits. At first sight this does not appear necessary; from the alignment point of view a slope of up to 1db over any one channel might well be tolerable but this would mean that a consider-

\* Ultra Electric.

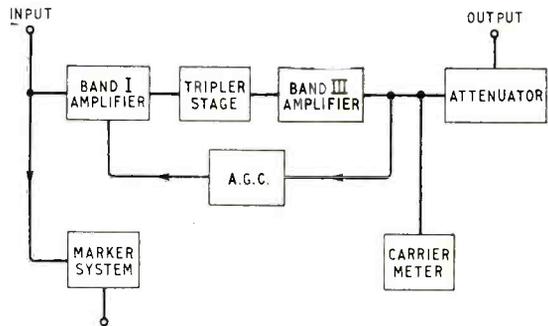


Fig. 2. Block diagram of the adaptor.



CG12E will cause a large increase in bias at the grid of V1, with a consequent reduction in gain to cancel the rise in output. The system is very effective and allows considerable latitude in the tuning of the Band-III amplifier; it is therefore possible to arrange the response so that unwanted harmonics are minimized.

The time constants of the a.g.c. system are chosen as a result of practical experience. When the attenuator is switched from one position to another a momentary change in impedance occurs when the wiper is between contacts, giving rise to a large momentary change in output. If the time constants in the circuits of V8 and V1 are too long this causes a damped, very low frequency oscillation of output level which may be observed as a variation in response curve amplitude or as a fluctuation of the carrier meter reading. It has been found possible to make the system "dead beat" by a suitable choice of time constants.

The marker system, which was developed in close co-operation with the wobblator manufacturers, operates in the following manner. V9 and V11 are crystal-controlled oscillators, the screen grid circuit in both cases being tuned to the fundamental and the anode circuit to the 4th harmonic of the crystal frequency. The two frequencies so developed are  $\frac{1}{2}$  of the sound and vision carrier frequencies of Channel

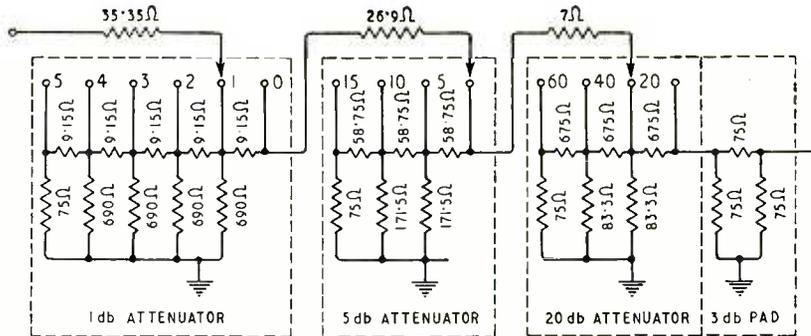


Fig. 4. Circuit of the attenuator used in the output of the adaptor.

9. V12 is a crystal-controlled oscillator operating on 1.666 Mc/s (which is  $\frac{1}{2}$  of the spacing between two sound or vision carriers) and produces a substantial harmonic content. The outputs of the three oscillators are mixed at the grid of V10, producing frequencies at  $\frac{1}{2}$  of each of the following:—

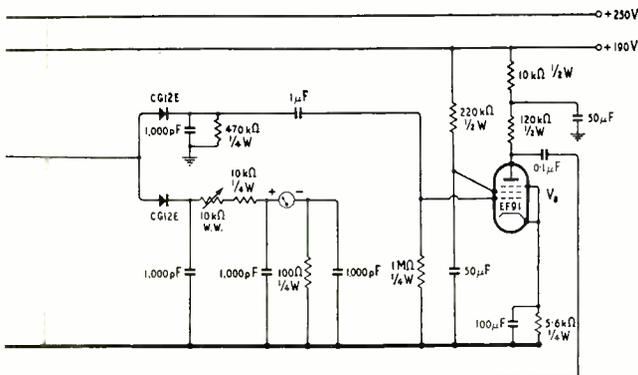
- (1) Channel 9 vision frequency.
- (2) Channel 9 sound frequency.
- (3) Other vision carrier frequencies (by mixing  $\frac{1}{2}$  Channel 9 vision frequency with 1.666 Mc/s and its harmonics).
- (4) Other sound carrier frequencies (by a similar process).

The 57-73 Mc/s sweep is injected at the suppressor of V10 and a heterodyne beat is produced as the wobblator sweep passes through each of the above frequencies, the higher frequency components of these beats being by-passed and the lower frequency components being amplified by V13 and fed to one Y plate of the wobblator display tube. The beats appear on the trace as quite narrow markers, the amplitude of which may be controlled by the potentiometer in the grid circuit of V13.

The four-position switch is arranged to break the h.t. supply to any one oscillator, permitting four marker arrangements to be made available. These are:—

- (1) Channel 9 sound and vision only (V12 not oscillating).
- (2) All sound markers (V11 not oscillating).
- (3) All vision markers (V9 not oscillating).
- (4) All sound and vision markers (all oscillators functioning).

This marker system does not lend itself to the im-



### COIL DATA

L1: } 5 turns 28 s.w.g. enamel covered wire on  
L2: }  $\frac{9}{32}$ -in former, permeability tuned.  
L3: }

L4: 2  $\frac{1}{2}$  turns }  
L5: 1  $\frac{1}{2}$  turns } 22 s.w.g. tinned copper wire on  
L6: 2  $\frac{1}{2}$  turns }  $\frac{9}{32}$ -in former, brass-slug tuned.  
L7: 6  $\frac{1}{2}$  turns }

L8: 2 turns }  
L9: 6 turns } 28 s.w.g. enamel covered wire on  
 $\frac{9}{32}$ -in former, permeability tuned.

L10: { 7 turns 16 s.w.g. enamel covered wire on  
L11: {  $\frac{1}{2}$ -in "air" former, tapped 2 turns from h.t. end.

L12: } 33 turns 28 s.w.g. enamel covered wire on  
L13: }  $\frac{9}{32}$ -in former, permeability tuned.  
L14: }

L16: { 3  $\frac{1}{2}$  turns 22 s.w.g. tinned copper wire on  
"air" former  $\frac{1}{4}$ -in long and  $\frac{9}{32}$ -in internal diameter.

L17: { 5  $\frac{1}{2}$  turns 18 s.w.g. tinned copper wire on  
"air" former  $\frac{3}{4}$ -in long and  $\frac{9}{32}$ -in internal diameter.

L18: { 4  $\frac{1}{2}$  turns 18 s.w.g. tinned copper wire on  
"air" former  $\frac{9}{32}$ -in long and  $\frac{1}{2}$ -in internal diameter.

mediate identification of channels other than Channel 9, but this has been simplified by bringing the wobbulator X shift and sweep control circuits out to a number of preset potentiometers. These are selected by a channel selector switch so that any desired portion of the sweep is presented at the centre of the display, over-riding vernier controls being provided for fine adjustment. The circuit of this section is not shown since it is associated with the wobbulator rather than with the adaptor.

An alternative marker system has been investigated with which no such ambiguity arises. This employs two oscillators, one operating on the desired channel sound frequency and the other on 1.166 Mc/s, i.e.,  $\frac{1}{3}$  of the sound-to-vision separation. This system gives the sound marker, vision marker, a spurious marker corresponding to sound frequency minus 3.5 Mc/s or, by switching off the 1.166-Mc/s oscillator, the sound marker only. This system possesses the disadvantages that separate crystals are required for each channel and that each must be switched on channel selection. As the preset shift and sweep settings are desirable for mass-production use, the advantages of the second system were not considered to be worth while in view of the extra complication involved.

During development certain facts relating to the attenuator system came to light. It became evident that a constant-input-impedance network was desirable in order to avoid changes in the tuning of L, which might affect performance, while other design

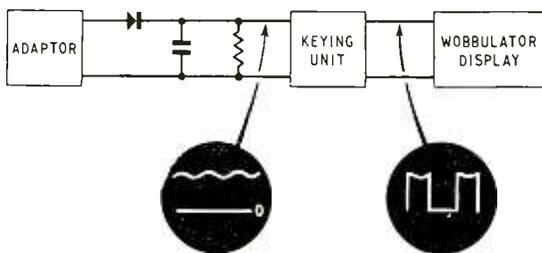


Fig. 5. Keying system used in examining response of the adaptor.

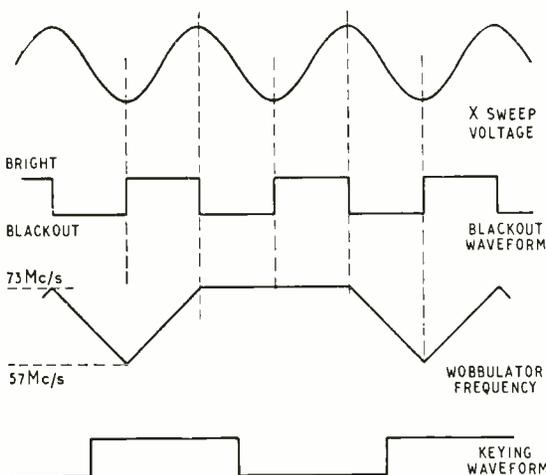


Fig. 6. System for blacking out alternate half-cycles of wobbulator display time-base, showing relationships of waveforms to frequency sweep.

considerations demanded a minimum possible insertion loss and ease of mechanical construction. The final attenuator design chosen was built in three Advance Components A37 attenuator cases, the circuit shown in Fig. 4 being employed.

Considering the 20-db section, it will be observed that, provided the output is terminated in 75 ohms, the input impedance is constant at 68 ohms for any switch position and the resistor values are such as to produce the desired attenuation. A resistor is in series with the input so that the impedance into which the 5-db step attenuator works is also 75 ohms. This, and the 1-db section, have circuits of a similar type. The output impedance of the attenuator is not 75 ohms but this is not important theoretically, since if the output cable is properly terminated no reflections should occur. In practice no undesirable effects have been noticed but a 3-db pad has, however, been incorporated in order to reduce the effects of variations of termination on the attenuation. When measurements are made working into a 75-ohm input circuit, and damping of the circuit by 75 ohms is desired, the use of an external 6-db pad is recommended.

Because of the small values used in the 1-db section and the physical limitations imposed by the Advance Components casting, high-stability resistors cannot be used and, in any case, theoretical considerations suggest that a simple resistive rod should possess better r.f. characteristics than the spiral of high-stability types. The resistors employed were made from ordinary  $\frac{1}{4}$ -watt resistors by removing the ceramic cases, scraping the rods to the required value and enclosing them in protective plastic sleeves. The lower values of  $\frac{1}{4}$ -watt resistor frequently have a metal band sprayed on to the rod to obtain the desired value. The presence of this band increases the capacitance between the end caps of the resistor, so for the range where these bands were known to exist a lower value was chosen and the band scraped off. The use of this type of resistor is, of course, theoretically questionable in the matter of stability, but in practice no important errors have yet been observed.

The initial alignment of the Band-I and Band-III amplifiers is carried out using a signal generator. For final adjustments, and in order to establish that the a.g.c. circuit is operating satisfactorily, it is necessary to check the instrument under normal operating conditions with the swept frequency input from the wobbulator. This can, of course, be effected by connecting a detector to the output socket and displaying any variations in the detector voltage on the wobbulator cathode-ray tube. However, this method has the disadvantage that since the wobbulator Y amplifier is a.c. coupled no indication of amplitude is obtained. Although the latter parameter is indicated by the carrier meter, it has been found inconvenient to observe both meter and tube while adjustments are taking place; furthermore, it is desirable that variations in amplitude through the band should be easily observed in relation to the r.f. output level. Since a detector connected to the output produces a d.c. voltage proportional to the mean output level, with superimposed a.c. corresponding to any variations, the desired display is achieved by the use of a piece of ancillary equipment to "chop up" or "key" the detector output as shown in Fig. 5, so that an alternating voltage whose amplitude varies with the total output is produced. The

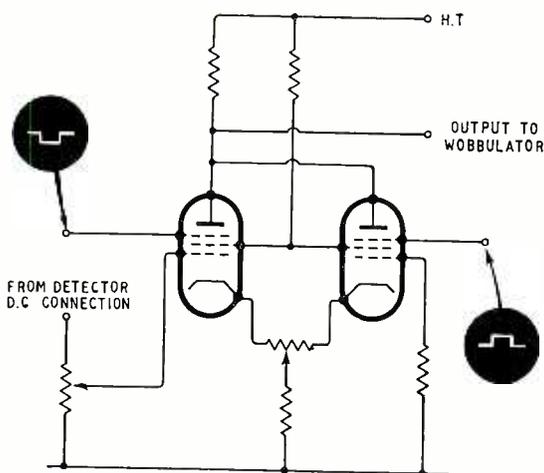


Fig. 7. Circuit diagram of keying unit used in Fig. 5.

wobbulator display employs a 50-c/s sinusoidal time base, with alternate half-cycles blacked out, which is related to the frequency sweep as shown in Fig. 6. The keying device is operated at 25 c/s so that the display shows a zero-volts base line in addition to the response of the adaptor.

The keying unit employs a beam-switch type of circuit (Fig. 7) using two pentode valves with a common anode load. The keying waveform shown in Fig. 6 (derived from a mains-synchronized 25-c/s multivibrator) is applied to the two suppressors in antiphase so that when one valve conducts the other is cut off. One valve has its grid returned to earth and the other is d.c. connected to the detector, a variable biasing arrangement allowing the currents through the valves to be made identical under

no-signal conditions. When r.f. is applied to the detector the resulting d.c. alters the bias of one valve so that the currents are no longer equal and a 25-c/s waveform appears at the anodes. This is fed to the wobbulator Y amplifier and, since the time base operates at 50 c/s, produces two traces on the screen, a zero-volts base line and the response of the adaptor. The separation of the adaptor's two traces indicates the amplitude of the adaptor's output.

The keying unit is used not only to examine the response of the adaptor but also to check the output level against a standard signal generator. For this test the adaptor output is set to give a definite separation between the traces; it is then disconnected and replaced by the signal generator, whose output is adjusted to give the same separation. This method is used to calibrate the carrier meter on the adaptor.

The adaptor is built so that it may be conveniently linked with the wobbulator to provide a compact Band I/Band III unit, the adaptor forming a pedestal on which the wobbulator stands with its display tube at eye level. The unit has a light alloy angle frame, the circuits being built up on flat plates which are screwed in. This arrangement facilitates assembly and provides a rigid pedestal for the wobbulator. The Band-III amplifier is completely screened and this screening is bonded to the rear of the attenuator in order to avoid earth currents. Lead-through capacitors, used for decoupling h.t. and heater lines, form convenient anchoring points and all "hot" leads are kept as short as possible. The channel selector switch and preset controls are mounted along one side, the edge of the switch knob being engraved so that the switch position is easily seen.

Finally, the author would like to acknowledge the parts played by M. Phillips, who was responsible for the original conception and basic design of the instrument, and A. H. Jacob, who carried out the practical work.

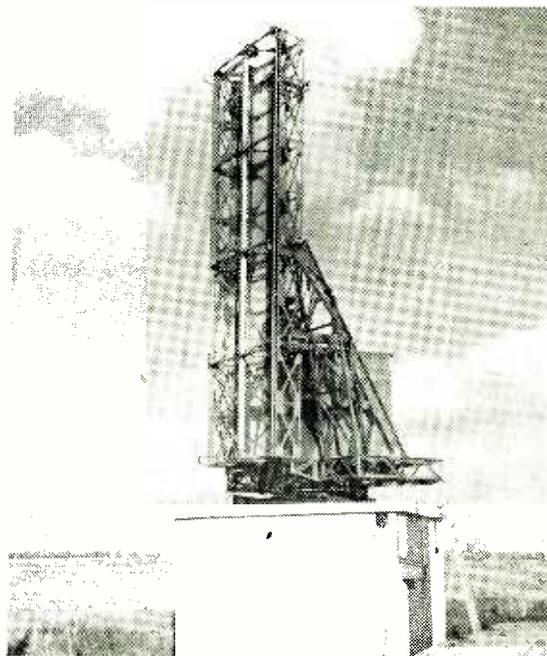
## Radar Height Finder

SHOWN in the illustration is the latest Marconi Type S13 long-range radar height finder which, it is understood, will be installed at London Airport by the Ministry of Transport and Civil Aviation. It operates in the 10-cm waveband and provides a peak pulse power output of about 500 kW and has a working range of about 150 nautical miles. An accuracy of  $\pm 500$ ft at 50 nautical miles is claimed.

The aerial system, which is designed to transmit a very narrow beam of radar pulses only 1 degree in the vertical and 4.5 degrees in the horizontal planes respectively, consists of a slotted waveguide positioned along the focal line of a vertical paraboloid reflector. It is made to oscillate in the vertical plane at about 10 times a minute and scans an angle of between  $-1^\circ$  and  $+25^\circ$  to the horizontal. Horizontal rotation of the aerial is effected as required by remote control when an aircraft has been located on the plan position display of any available search radar. It can also be rotated continuously at about 10 r.p.m. if required.

In the form shown the transmitter and receiver are housed in the concrete building with the aerial mounted on its roof, but a separate gantry can be used for the aerial where existing buildings for the equipment are available.

*The photograph shows the Marconi radar height finder, Type S13, with the aerial system mounted on the building housing the transmitter and receiver.*



# Some Problems in Television

## Lighting

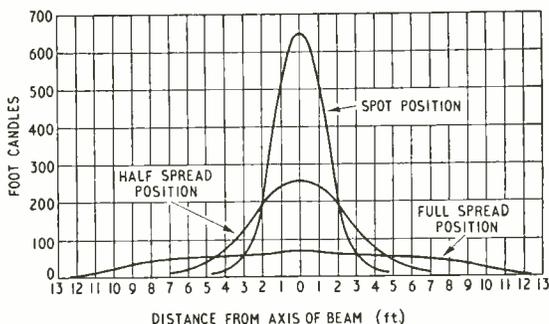
By W. C. PAFFORD, A.C.G.I., D.I.C.

**V**IEWERS sometimes complain that the lighting in television appears to vary from one camera to another. This apparently elementary matter is difficult to explain without first briefly outlining the principles involved in lighting for this new medium.

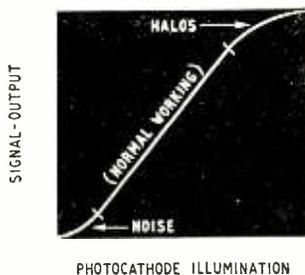
The subject itself is complex, involving not only physical optics and illumination, but also photographic principles and artistic appreciation. Not least among these is the study of the human eye and reaction to tonal quality and balance. Broadly, there are two distinct basic functions of lighting for television.

First, it must create the right artistic effect for any given production so that the mood of drama or comedy is effectively conveyed to the viewer; for example, "drama" is usually portrayed in "low-key" lighting with heavy shadows and contrast, whereas "comedy" is assisted by "high-key" lighting which creates a lighter mood with less contrast and brighter atmosphere. But this aspect of lighting obviously requires special study and may be regarded as beyond the scope of this particular article.

Secondly, television cameras need a certain basic light level and a suitable disposition of lamps in order to obtain pictures which are technically acceptable. In theory it is possible to estimate the total lighting required by any given scene by referring to the illumination-efficiency curves (Fig. 1) of the lamps to be used. In practice, however, the assessment of the kilowatts of lighting required to give a predetermined level of incident light is largely a matter of experience. The pre-war Standard Emitron camera for instance



Above: Fig. 1. Typical curves showing the spread of light for a 2-kW lens spot.



Left: Fig. 2. Signal-light curve of image-orthicon camera tube.

was comparatively insensitive and required a scene brightness of 200-300 foot-candles. The more recent C.P.S. Emitron tube now used in the studios needs less than half this amount of incident light. The latest image-orthicon cameras, used on outside broadcasts, are so sensitive that intelligible pictures can be obtained with as little as 1 foot-candle of incident light.

Although acceptable pictures are obtained with a basic light of about 10 foot-candles, in practice it is found that an incident light value of 25-30 foot-candles allows an image-orthicon camera to use a lens stop of  $f/8$ , which gives maximum optical efficiency and also a good depth of focus. It also helps in the

Type of Camera	Incident foot-candles	Permissible Contrast	Average Lens Stop $f/\text{number}$
Standard Emitron	200-300	50/1	3.0
C.P.S. Emitron	100-130	30/1	6.3
Image-Orthicon	25-30	20/1	8

operation of the tube, which for best results should be made to work on the linear part of the signal-light curve (see Fig. 2).

If the illumination on the photocathode is too low we not only run into low signal-noise ratios, but also the detail in the darker parts of the picture is crushed into the blacks. On the other hand, if the level is too high there is a tendency to flatten out the highlights and run into instability. Having established the correct basic illumination, it is now necessary to consider the disposition of the various sources of light.

"Hard light," derived from a lens spotlight or other focus source is suitable for use as a key light, and "soft light" which consists of floods is used for filler and general softening of hard shadows. Additional "sparkle" can be added to the picture by using the film-studio technique of introducing "back light." The diagram in Fig. 3 shows an elementary lighting plot using a single camera at A. In this case the lighting engineer has a fairly straightforward job to do, and by adjusting these three lamps a well-balanced portrait can be obtained.

But if we now introduce a second camera at B, then clearly it will not be looking at a very well-balanced portrait, as the key light is now acting as a three-quarter back light. To put this right it is necessary to re-balance the light sources while with three cameras a further compromise is necessary until the light balance has been restored as seen from each camera position.

It will be appreciated, therefore, that when in addition to this, the subject is, say, a crowded stage in a

Fig. 3. Three-point lighting intended for a camera at A is not right for a second camera at B.

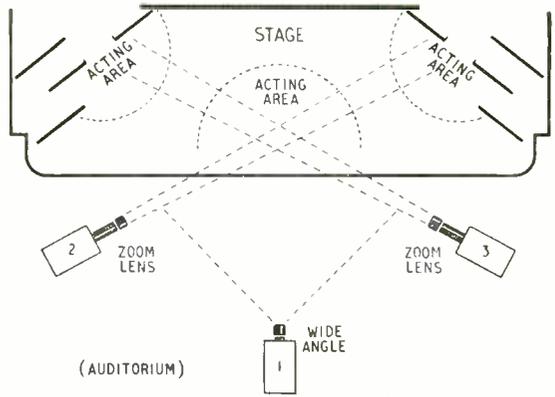
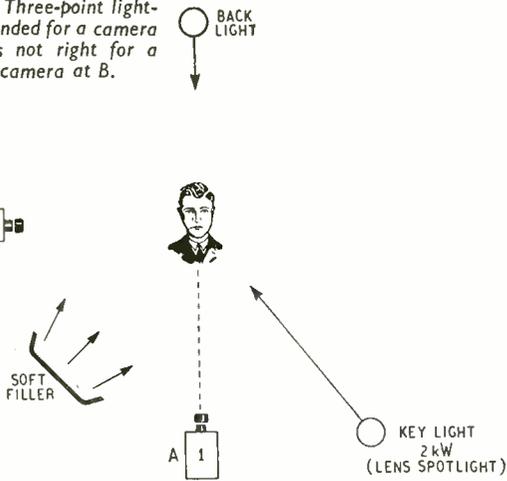


Fig. 4. General arrangement of cameras for, say, a theatre.

theatre, and possibly the available lighting positions in the auditorium or circle are restricted, then it becomes difficult to get a good balance on all three cameras. A good deal of ingenuity is called for and the lighting engineer may have to decide which camera is likely to take most of the important close-ups on principal actors, for instance. The more general shots may have to take second place. Another problem, of course, is that the best camera positions, particularly in a theatre, are not always the easiest from a lighting angle.

Fig. 4 shows a typical camera set up for an outside broadcast from a West End theatre, where two cameras (non-tracking) use zoom lenses for close-up work and usually cut across the stage into the opposite corner of the stage set. A third camera is sometimes used in the auditorium or circle to give wide-angle shots. The main problem is to get sufficient light for the close-up work and at the same time to keep a balance so that rapid switching from one camera to another is not accompanied by an apparent change in light level. In this respect the colour and design of the background become very important.

For example, the background in a stage setting may well depend for its harmony on a delicate choice of

colour or, say, a well-balanced composition made up of areas of blue-green and orange-red, which to the eye would be completely satisfying. But when translated into a monochrome picture by a panchromatic camera, the tonal composition will probably be something very different. Generally, the background needs a good a.c. light component or, in other words, a well broken-up design. Supposing, for the sake of argument, we use a chess-board type of background then, in long shot, we shall get good results. But, unfortunately, as soon as we move into a close-up, there is the danger of one camera seeing a portrait against a dark background, and the other camera getting the same portrait lit against a light background, which is usually disastrous.

A good practical example of this sometimes occurs in ice shows where the lens catches a large proportion of reflected light off the ice, leaving the figures sadly silhouetted against an unbroken white background.

A further contributory cause of unbalance, especially on faces, could be due to a mismatch in a colour response of the tubes in question, particularly if fluorescent lighting is present.

Another reason why pictures from different cameras do not always appear to match up can be demonstrated by the case of televising a boxing match with

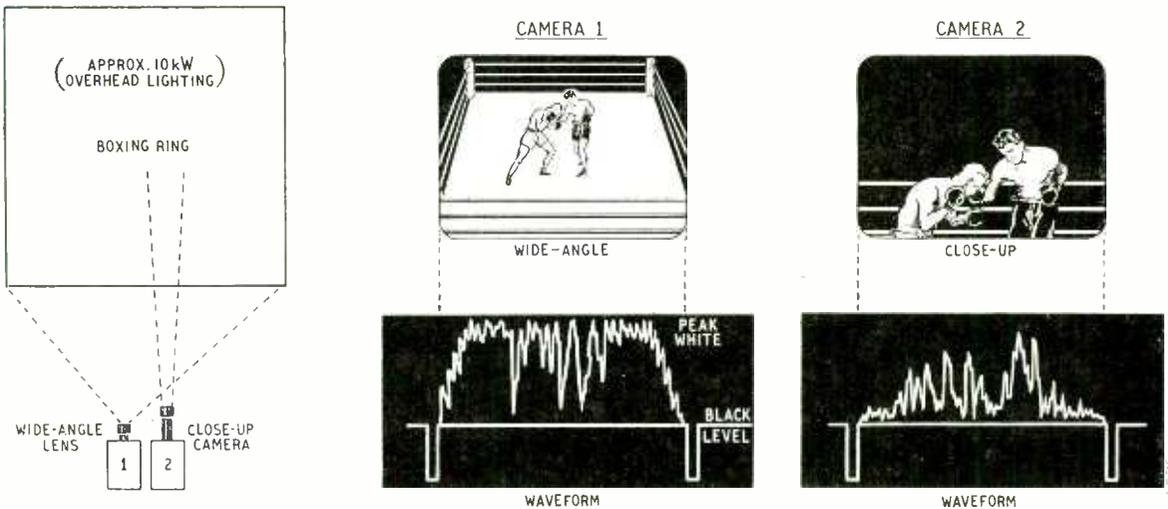


Fig. 5. In a boxing match the lighting is constant, but a wide-angle view gives a higher average brightness than a narrow angle, with the result that the waveforms differ as shown.

two cameras in the same position. In these circumstances there can be no question of different camera angles or of unbalanced lighting because boxing matches are always lit with a perfectly symmetrical overhead rig which remains static. The problem of lighting has now become one of "picture content." This is shown in Fig. 5 where camera 1 may be using a wide-angle lens giving a picture which is largely composed of white. If the adjacent camera is using a close-up lens then the picture content is predominantly black and contrasty. Clearly, a rapid series of cuts from camera 1 to camera 2 will subject the eye of the viewer to sudden changes of brightness as seen on the cathode-ray tube in the receiver. Hence the unfortunate illusion that the lighting is varying. It is, however, possible to introduce an artificial correction in the camera channel circuit by altering the electrical signal.

Probably the most difficult feature of the image-orthicon camera tube is that it has a very limited contrast range, consequently the lighting contrast has also to be kept down to the order of 20 to 1. If this is exceeded we get the familiar "throw-off" (black halo around bright objects), and also "ghosting effect" due to excessive secondary electrons emitted from the target where image highlights occur. It is usual, therefore, to employ much softer lighting for television than that used in film studio work.

Most of the above problems have been taken as typical examples occurring on outside broadcasts where physical limitations are the main obstacles. But lighting difficulties are just as prevalent inside the studios although, in this case, it is more a question of complexity of production, involving camera angles, microphone-boom positions and the use of multiple stage-sets. A fast-moving production, for instance, may use nine or ten different set designs, each requiring its own lighting plot, and each balanced so that there are no irritating changes in light level. In a studio play, for example, it is essential to maintain continuity of mood from camera to camera, whether in close-up or long-shot. This applies even more so with a ballet presentation which relies largely on its pictorial appeal. It is desirable, therefore, that not only should the studio-lighting installation be capable of a high degree of artistic control, but equally im-

portant that the receiver should be able to reproduce subtle lighting effects.

A reference has already been made in this article to the importance of having a good a.c. background so that the picture at all times contains well-proportioned areas of black, white and mid-tones. In addition, it is also very important that the overall light level (i.e., the d.c. component\*) should be faithfully reproduced on the screen of the receiver. Otherwise, the viewer will probably be looking at pictures which are either suffering from excessive d.c. level with consequent loss of detail in the high lights or, alternatively, a lack of overall brightness resulting in degradation in the dark areas. In either case, the receiver is not conveying the correct photographic qualities intended by the lighting engineer.

\* "The Importance of the D.C. Component," by D. C. Birkinshaw, *J. Tel. Soc.*, June 1953.

### Terminology of Acoustics

A REVISED edition (1955) of British Standard 661—**Glossary of Acoustical Terms**—has been issued to take into account the change of emphasis and advances in technique since the original issue in 1936. New sections on ultrasonics and underwater sound have been added, and the section on recording and reproduction has been enlarged and now includes terms used in magnetic recording. Copies, price 6s, are obtainable from the British Standards Institution, 2, Park Street, London, W.1.

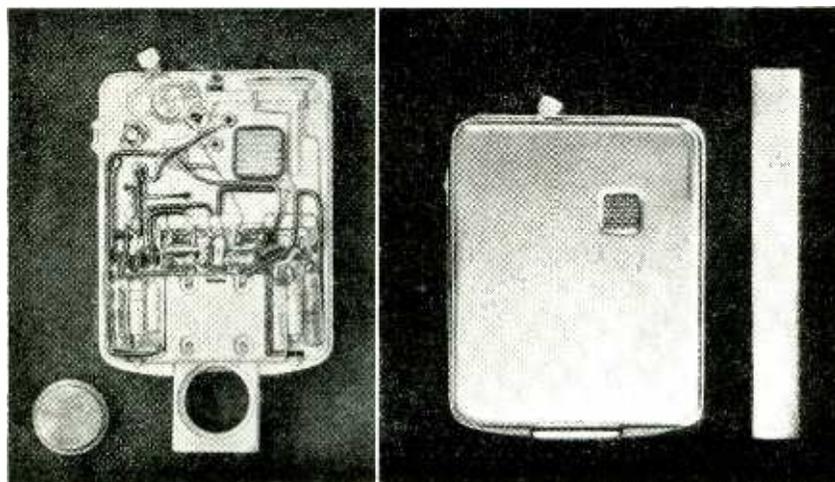
### MINIATURE TRANSISTOR HEARING AID

ALTHOUGH weighing only 1½oz and measuring less than 2¼in × 1¼in × ½in, the "Minuet" hearing aid employs a 4-stage resistance-coupled transistor circuit designed to give high-quality reproduction with sufficient gain and output for the majority of cases of deafness. At 30°C the gain is 20db and the maximum acoustic output 125db referred to 0.0002 dyne/cm<sup>2</sup>.

A single 1.3-V Mallory cell (type RM625) gives approximately 175 hours' working on the total current demand of 2mA. This cell, which is of the disc type, fits in a miniature drawer in the base of the instrument and can be replaced without opening the case. An intricate plastic moulding forms the chassis and provides a rigid housing for the various components. The microphone is resiliently mounted to eliminate case noises.

In addition to the usual volume control there is a combined on-off switch and two-position tone control with normal and top-cut responses. Alternative ear-pieces are available with normal rising response or a flat response curve and there is a choice of mounting clips.

The price is £56 13s and the makers are the Multitone Electric Co., Ltd., 223/7, St. John Street, London, E.C.1.



Multitone "Minuet" transistor hearing aid.

# B.B.C. Television Frequencies

## Medium- and Low-power Stations on Offset Carriers

ONE of the provisions of the Stockholm Plan for v.h.f. broadcasting in Europe is that sound and vision carriers of some television stations should be offset by a maximum of 20 kc/s to avoid mutual interference between transmitters sharing a channel. The B.B.C. is, therefore, operating some of its recently introduced medium- and low-power stations on offset carriers and the deviation adopted is plus or minus 6.75 kc/s for the vision frequency and 20 kc/s for sound. In the appropriate columns in the following table the nominal channel frequencies are accordingly marked + or - where they are offset. With the exception of the frequencies given for Londonderry (which have yet to be approved by the P.M.G.) all the information has been confirmed with the Engineering Information Department of the B.B.C.

In conformity with the general practice on the Continent the B.B.C. has adopted the principle of indicating that the carrier frequencies are offset by suffixing the channel number with + or - (i.e.,

Channel 2 - for North Hessary Tor).

In the fifth column is given the e.r.p. of the permanent vision transmitter, but where there is at present a temporary transmitter in use this figure is followed by the e.r.p. of the low-power installation in brackets. Stations not yet in operation are marked with an asterisk in this column.

Another provision of the Stockholm Plan to minimize interference, and adopted by the B.B.C., is the use of directional aerials. For stations with directional aerials we give in the appropriate column the minimum and maximum e.r.p. for both the permanent and temporary transmitters. No figure is available for the e.r.p. of the temporary North East Scotland transmitter at Redmoss which will be replaced by the permanent station at Meldrum (marked †) at the end of the year. Incidentally, the temporary Belfast station at present operating at Glencairn will be replaced next month by the permanent station at Divis.

The e.r.p. of the new B.B.C. London transmitter which is being

built at Crystal Palace and is scheduled to be brought into service next year will be 200 kW.

We are unable to include details of the proposed I.T.A. stations as they have not yet been agreed. It was, of course, stated by the P.M.G. some months ago that the London and Lancashire transmitters would share Channel 9 (194.75 Mc/s vision and 191.25 Mc/s sound) and that the carriers of the London transmitter would be offset by +6.75 kc/s and +20 kc/s, respectively.

## TV PROGRESS REPORT

WORK began in April on the Channel Islands station at Les Platons, Jersey, which the B.B.C. hopes to bring into service in September. Transmissions from the South Devon station at North Hessary Tor will be received on the S.W. coast of Guernsey and relayed by radio to the Les Platons station—some 20 miles away—for retransmission. Until the permanent transmitter is in use in South Devon—probably early next year—the Channel Islands television service may not be consistent.

The contract has been placed for the erection of the permanent 560-ft stayed mast for the East Anglian station at Tacolneston, near Norwich. This mast will carry the aerials for both television and the v.h.f. sound transmissions. It is hoped that the permanent television transmitters will be installed and the aerials ready for the station to replace the temporary equipment about the middle of next year.

Some difficulty has been experienced in securing a suitable site on the Isle of Man for the permanent station. The ideal position is said to be at the summit of Snaefell, but objections have been raised by the Ministry of Civil Aviation as it is feared the television station might cause interference with the Ministry's transmitting and receiving station already operating on Snaefell. Further tests are, however, to be carried out next year. In the meantime the opening of the permanent station at Divis, Northern Ireland, in July should give a service to the population in the north of the island. The temporary transmitter at Carnane, near Douglas, serves about 60% of the population.

Channel	Station	Carrier Frequencies (Mc/s)		Vision E.R.P. (kW)	Polarization
		Vision	Sound		
1	Alexandra Palace (London)	45.0	41.5	34	V
	Divis (Belfast) ... ..	45.0 -	41.5 -	20 (0.4)	H
2	Holme Moss, Yorks. ...	51.75	48.25	100	V
	N. Hessary Tor, Devon ...	51.75 -	48.25 -	1-16 (0.5)	V
	Rosemarkie, Inverness ...	51.75 -	48.25 -	1*	H
	Dover area, Kent ... ..	51.75 +	48.25 +	0.1-1*	H
	Londonderry, N. Ireland ...	51.75 -	48.25 +	0.5*	H
Truleigh Hill (Brighton) ...	51.75 +	48.25 +	(0.3)	V	
3	Kirk o'Shotts, Lanarks. ...	56.75	53.25	100	V
	Tacolneston (Norwich) ...	56.75	53.25	1-10 (0.14-1.3)	H
	Rowridge, I.O.W. ... ..	56.75 -	53.25 -	1-32 (0.3-9)	V
	Blaen Plwy, Cardigan. ...	56.75 +	53.25 +	1*	H
4	Sutton Coldfield, Warwicks.	61.75	58.25	100	V
	Meldrum, Aberdeenshire ...	61.75 -	58.25 -	20(†)	H
	Carlisle area, Northumb'd... ..	61.75 +	58.25 +	1*	H
	Jersey, C.I. ... ..	61.75 +	58.25 +	1*	H
5	Wenvoe, Glam. ... ..	66.75	63.25	100	V
	Pontop Pike (Newcastle) ...	66.75 -	63.25 -	10 (1)	H
	Douglas, I.O.M. ... ..	66.75 +	63.25 +	1 (0.25)	V

# Cathode Followers—

*With Particular Reference to Grid Bias Arrangements*

By "CATHODE RAY"

LOOKING at the basic circuit diagram (Fig. 1) we might think there wasn't much that could be said about the cathode follower. As for its grid bias, with beautiful simplicity the one and only resistor in the circuit sees to that as well as doing its main job. So it appears.

But when one thinks one knows all about cathode followers, some unsuspected complication comes to light. I hope, however, that you will not take that remark as the prelude to an astonishing new revelation. I doubt whether I am about to disclose anything new, but it may be new to some who have not made a special study of cathode followers or who have not yet had to adapt the theoretical circuits to practical work. There are one or two things about arranging their grid bias, for instance, that are not always made clear in the books.

First we had better have a quick review of cathode followers in general. Their chief use is to enable a waveform derived from a high-impedance source to be reproduced accurately across a comparatively low or variable impedance. They can do this because (1) their input impedance is exceptionally high; (2) their output impedance is exceptionally low; and (3) they cause exceptionally little distortion. These features are due largely to the 100% voltage negative feedback resulting from the position of R, on the cathode side of the valve. From the point of view of the output terminals, the impedance appears to be R in parallel with approximately  $1/\mu$  times the valve's actual anode resistance,  $r_a$ . This  $r_a/\mu$  is the same thing as  $1/g_m$ . For instance, if  $g_m$  (the mutual conductance of the valve) is 5 mA/V, that is 0.005 amps per volt, and  $1/0.005$  is 200, which is the apparent number of ohms resistance in parallel with R\*. This is far lower than a valve having its output taken from the anode side, and load impedances down to a few thousand ohms can be connected across it without making much difference to the output voltage.

I need hardly repeat the various ways (explained in all the books) by which negative feedback reduces distortion. In the cathode follower *all* the output is fed back, so (as regards a single valve at least) reduction of distortion is a maximum.

The high input impedance comes in two ways. The fact that the anode is held at a constant potential cuts out the "Miller effect," which in an anode-loaded valve greatly magnifies the effective grid-to-anode capacitance. On the other side, the effective grid-to-cathode capacitance is only a small fraction of its book value, because the potential of the cathode follows that of the grid†, the grid-to-cathode signal voltage being only the difference between the input and output voltages. Thus the cathode follower has

all the benefit of high-resistance input possessed by any valve operated with its grid negative, but without most of the spoiling effect of capacitance to anode and cathode.

Unless we are careful with our grid bias arrangements, however, we may throw away something of these advantages.

As I said at the beginning, R in Fig. 1 provides grid bias at the same time as coupling impedance. But doing two things at once often means that neither is done properly—or at best only one of them. I wouldn't say that the simple Fig. 1 circuit *never* gives satisfaction. Like some of the films reviewed in the cinema trade press ("Might get by with unsophisticated audiences") it is all right if you are easily satisfied. If the resistance of R is too small for grid bias purposes, then grid current flows at the positive peaks of input, and bang go the high input impedance and freedom from distortion. If too large, negative peaks reach the "bottom bend" and the valve ceases to cathode-follow. But if R is chosen midway between these two calamities it will be much smaller than optimum as a coupling resistance.

## Adapting the Diagram

To see this in all its naked clarity we should draw a characteristic-curve diagram. Fig. 2 is a sample‡. It starts with an ordinary set of anode-current/anode-voltage curves, as found in valve catalogues. Those in Fig. 2 refer to a rather mediocre triode, having  $r_a = 10k\Omega$ ,  $\mu = 17$ , so  $g_m = 1.7$  mA/V. Let me emphasize that these figures, like all such published for valves, refer to only one set of working conditions (represented by one point on the diagram) and vary a good deal over the area of the diagram. If it were not so, the curves would be evenly-spaced straight lines. Because they never are, there is always distortion. Each curve, of course, represents the way the anode current ( $I_a$ ) varies with anode voltage ( $V_a$ ) at the fixed value of grid voltage ( $V_g$ ) marked beside the curve. Take special note of the fact that  $V_g$  is the voltage *relative to the cathode* (as, indeed, is also  $V_a$ ). In the ordinary use of a valve that is the same thing as the voltage relative to earth or —h.t. or the lower input terminal, for all these things are tied to cathode either directly or through a by-pass capacitor.

It is because one gets so used to assuming this that the cathode follower is apt to muddle one. When the input voltage varies the grid potential, it varies the cathode potential too; so one can't use the cathode as a fixed-potential point from which to reckon all voltages. The obvious zero-potential reference point is E. And the valve electrode held at constant potential by it is not the cathode but the anode (separated only by the

\* To be precise, one should multiply  $1/g_m$  by  $\mu/(\mu+1)$ , but that makes little difference unless  $\mu$  is exceptionally small.

† That is why the term "anode follower" for the see-saw circuit is so silly; in it the anode does just the opposite of following the grid.

‡ If the principles of this kind of diagram are not understood, see next month's article.



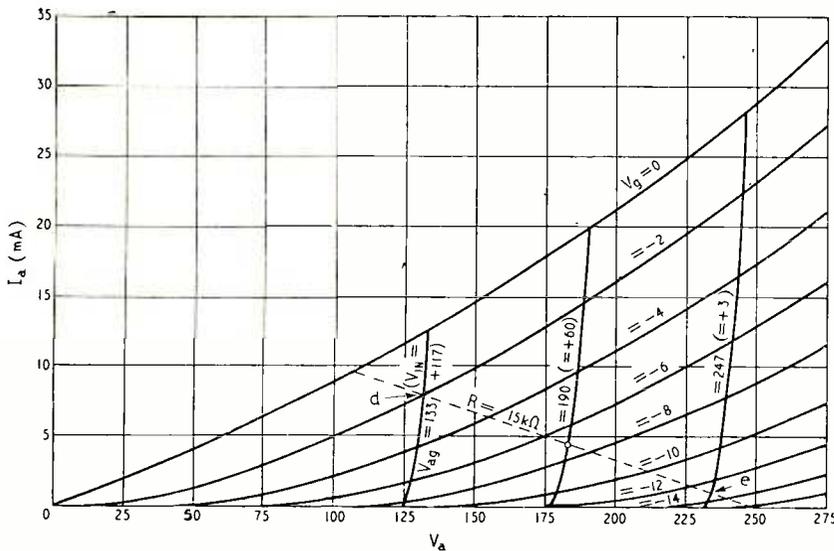


Fig. 3. By using a much higher value for R in Fig. 1 than the 700Ω in Fig. 2, maximum output is greatly increased and distortion reduced.

“amplification,”  $V_{OUT}/V_{IN}$ , is 13.9/25 (peak to peak), which is 0.56, or a loss of nearly half. We also note that the grid voltage  $V_g$  swings between  $-2$  and about  $-14$ , or 12V peak to peak, so the voltage amplification of the valve itself is  $13.9/12 = 1.16$ . If the valve were used in the ordinary way, with R on the anode side,  $V_g$  would be the same as  $V_{IN}$  (as regards signals at least), and its negative peak would be the same as the positive (5V), so the negative  $V_{OUT}$  would be only 5.1V and the distortion would be greater (10.2%). As compared with this, the cathode-follower arrangement gives about half the amplification, but about half the distortion and a shade more output.

But it is a pretty miserable output—less than 7V peak using 250V h.t. As anyone who is accustomed to valve load diagrams will see at once, the reason is that the slope of the dotted load line is too steep, signifying that the resistance is too low. The less the slope, the greater the range of voltage represented by it between the grid-current and cut-off boundaries. To get the utmost voltage output, the resistance should be so large as to be represented by a nearly horizontal line right down near the  $V_a$  scale. But then the current range would be almost nil, and the valve would be incapable of supplying appreciable signal power. For maximum power, a designer would choose a medium slope, such as that of the dotted line in Fig. 3, which represents a resistance of 15kΩ.  $V_g = -7$  again puts the starting point (o) about half way along the useful part of the line, and if we draw a  $V_{ag}$  line through it we find  $V_{ag}$  here is 190V. So  $V_{IN}$ , being  $V_{HT} - V_{ag}$ , is +60V. If again we are cautious about grid current and allow a full  $-2V$  as the minimum grid bias, the positive limit is at point d, where  $V_{ag}$  turns out to be 133V. This makes  $V_{IN}$  57V more positive than at the start, so the negative limit is found by making  $V_{IN}$  57V less than at the start, namely +3V, and drawing the  $V_{ag} = 250 - 3 = 247V$  curve.

The output is now probably easier to read direct as change in  $V_a$  than indirectly as  $I_a$ ; it is +52V and  $-51V$ . Not only is that more than seven times what it was with  $R = 700$ , but the distortion is far less—below a half of one per cent. Actually we could probably go up to at least  $\pm 60V$  peak output without much increase in distortion or risk of grid current. The

it is a d.c. path, then its effect is of course exactly the same as reducing R. If it is an a.c. path (such as a resistance load fed through a blocking capacitor) the real load line pivots on o instead of on the 250-volt point on the  $V_a$  scale, and if o has been placed low by making R very high it is so near cut-off that distortion sets in sharply at quite a small output.

The fact to which everything so far has been leading up, however, is that when the resistance of R has been chosen to give reasonable operating conditions it is far too much for grid bias. In Fig. 3 the preferred starting point is “ $V_{IN} = +60$ ,” and if that positive bias were not supplied it would mean that the grid was 60V too negative. So now we come at last to our main object—to discover how best to provide this +60V or whatever it may be. There are a lot of different ways. Also there are some snags.

The simplest and best, if circumstances make it possible, is to connect the grid straight to a source of signal that also provides the necessary positive bias. If the source is the anode of another valve, that is probably the answer: Fig. 4(a). If 60V is altogether too low for the anode of that stage, it may be practicable to design the cathode follower to work well with a more positive grid.

But perhaps there is some good reason against this—the cathode-follower load is low or widely variable, the previous anode voltage is unavoidably high, or maybe the signal source is not an anode at all, or the cathode-follower may be needed to work from different sources so must be self-contained as regards bias. In such cases it is usually necessary to admit the signal through a blocking capacitor to make sure that the bias it not short-circuited by the signal source. The grid must then be connected to a source of bias through a high resistance “grid leak,” so as not to short-circuit the signal source. An obvious method of getting the bias is from a potential divider across  $V_{HT}$  (Fig. 4(b)). Perhaps there already is such a potential divider, whether called by that name or the more unpleasant one of “bleeder,” needed for some other purpose, and it is only a matter of tapping it at a suitable point. But if not, it is easy enough to find suitable values for  $R_2$  and  $R_3$ , because the grid takes no current, so  $V_{bias}$  is to  $V_{HT}$  as  $R_3$  is to  $R_2 + R_3$ . For the same reason,  $R_2$  and  $R_3$  can be quite high

resistances, of the megohm order, provided they are reliable. If there is any question of an undesirable amount of hum getting at the grid from + h.t., a largish capacitance  $C_2$  can be added.

But if  $R_2$  and  $R_3$  are high, as suggested, why have  $R_1$  at all? True enough; if the resistance of  $R_2$  and  $R_3$  in parallel is made equal to whatever would be considered a suitable grid-leak resistance, then  $R_1$  is unnecessary and the circuit simplifies to Fig. 4(c). A suitable grid-leak resistance is the same as in a conventional amplifier; that is to say, the resistance should not be higher than the valve maker recommends as a top limit, nor low enough to load the signal source seriously. Something of the order of one megohm is usual.

### One Resistor ; Two Valves

Since one of the main objects of a cathode follower is to load the signal source as little as possible, it may happen that even the valve maker's top limit for grid resistance is lower than one wants to have across the signal source. My impression is that the valve makers cover themselves pretty well by fixing a low limit, and one can usually get away with a considerably higher value. But however that may be, one of the special features of a cathode follower is that the grid leak resistance seen by the signal source can be far higher than it is from the valve maker's point of view. This remarkable ability to have the best of things both ways is not achieved in the circuits seen so far, but it is in Fig. 4(d). This, I think, is the commonest bias arrangement for cathode followers, but I doubt whether everybody who uses it does so with the conscious intention of obtaining

the advantage just mentioned. Nor, perhaps, is everybody who uses it aware of a possible snag that we shall come to in a moment.

The principle of Fig. 4(d), of course, is that  $R$  in Fig. 1 provides slightly more than the positive bias needed to neutralize the negative excess provided by it, so a point can be found on it which gives the right amount and to which  $R_1$  can be connected. In our Fig. 3 example the total drop in  $R$  was 67V, of which 7 was needed for negative bias and therefore 60 had to be neutralized. A simpler way of looking at it, perhaps, is to regard the upper portion of  $R$ ,  $R_4$  in Fig. 4(d), as the conventional bias resistor to provide the required voltage, 7 in this example. Either way, if  $R_4 + R_5$  were 15k $\Omega$  as before,  $R_4$  would have to be 7/67 of this, or 1,565 $\Omega$ , and  $R_5$  15k $\Omega$  less this.

Suppose the valve maker's rating for maximum grid-to-cathode resistance is 1 M $\Omega$ . Then we would probably make that the value of  $R_1$  ( $R_4$  being by comparison negligible). It looks at first sight as if the impedance across the input terminals is practically the same ( $C_1$  having been made large enough for its impedance to be negligible at the signal frequency). But imagine for the moment that the lower end of  $R_1$  were taken away from  $R_4$  and  $R_5$  and connected to the grid, so that both ends of  $R_1$  were at the same potential. Then obviously no current would flow through  $R_1$ . The same would be true if it were connected to a second signal source the same as the first, for both ends would still be at the same signal potential at every instant. If it were connected to the cathode, that end would receive (in our calculated example) nine tenths of the input signal, in phase. So only one tenth of the input signal voltage would

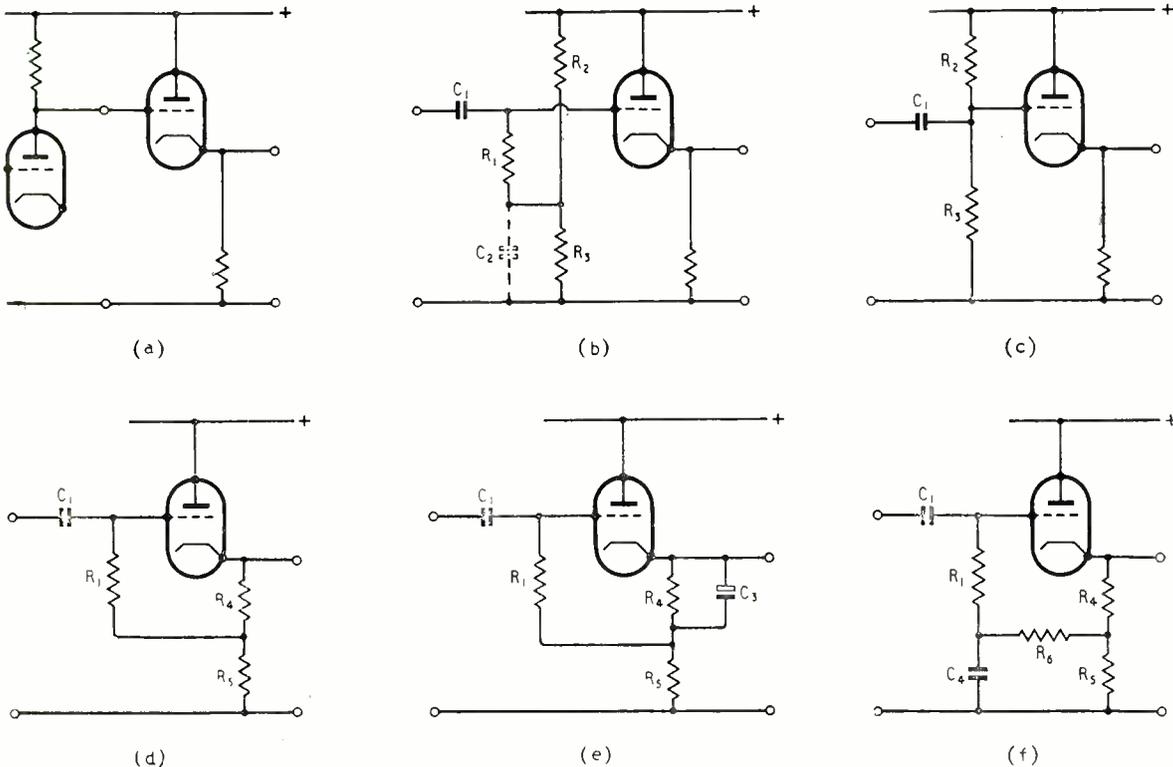


Fig. 4. Various methods for enabling the higher resistance indicated in Fig. 3 to be used in practice, by providing appropriate grid bias.

actually come across  $R_1$ , and therefore it would take no more current than  $10M\Omega$  connected across the whole input voltage. Connected as in Fig. 4(d) it receives about eight tenths of the input voltage, and so acts as a load of  $5M\Omega$ .

There is more juice still left in the orange, for  $C_1$  does not have to be large enough to be negligible in comparison with  $1M\Omega$  but with  $5M\Omega$ . Now the voltage loss in  $C_1$  is only 1% if the reactance of  $C_1$  is one seventh of the effective load resistance. If that resistance were literally  $R_1$ , the reactance would have to be one seventh of a megohm; and if the lowest frequency to be handled were 20 c/s that would mean  $C_1 =$  a little over  $0.05\mu F$ . But with  $R_1$  as in Fig. 4(d) it need be only  $0.01\mu F$  for the same results.

Now for the snag. The negative feedback in a cathode follower consists of the whole output voltage (signal voltage across  $R_4 + R_5$ ) fed back to the grid, and in this version of the circuit it can only reach the grid via the signal source. To simplify things let us for the moment imagine that the lower end of  $R_1$  is moved up to the cathode. Then the impedance of the signal source and  $R_1$  act as a potential divider across  $R_4 + R_5$ , and only that part of the fed-back voltage which is developed across  $R_1$  actually reaches the grid. If the signal source impedance at any signal frequency were  $1M\Omega$ , then, with our  $1M\Omega$   $R_1$ , only half the voltage would be fed back, and we would have only half a real cathode follower. Things are not quite so bad with  $R_1$  where it actually is, but in our example it would be nine tenths as bad. Remembering again that the main point of using a cathode follower is usually to work from a high-impedance source, this rather subtle propensity must not be overlooked. The impedance of the signal source at any signal frequency should not be more than, say, one tenth of the actual value of  $R_1$ . Even this precaution may not be strict enough if the source impedance is largely reactance and we want to keep phase shift in the cathode follower very small.

The signal source impedance normally consists of the anode resistance of the valve (after allowing for the effect of negative feedback, if any) in parallel with the load impedance.

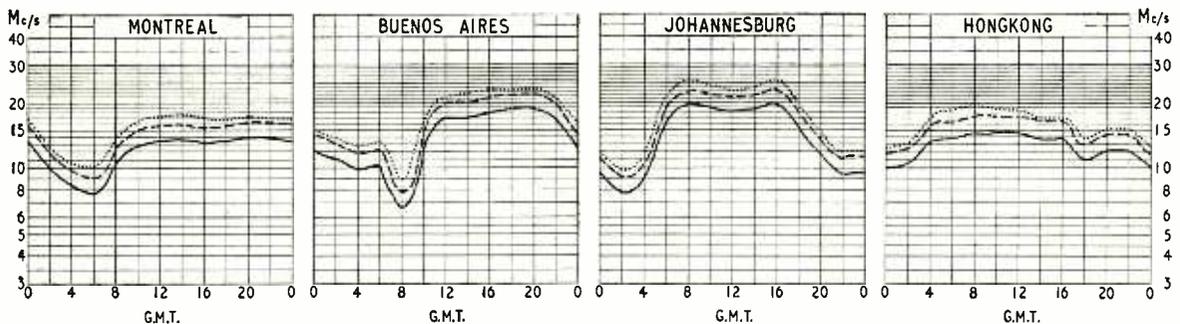
A variation of Fig. 4(d) that one sometimes sees is Fig. 4(e). The only difference is the by-pass capacitor  $C_3$ , sufficiently large to have negligible impedance (compared with  $R_4$ ) at any signal frequency. So far as signals are concerned,  $R_1$  is connected straight to the cathode (which is, if anything, a slight disadvantage), and the cathode-to-earth resistance is  $R_5$ . But so far as d.c. is concerned it is  $R_5 + R_4$ . So if we were doing a Fig. 3 diagram for this circuit we would have to draw the dotted line at a slope to represent  $R_5 + R_4$ , and then draw through  $o$  a steeper line representing  $R_5$  alone, this being the line along which signal voltages would operate. Personally I consider  $C_3$  a waste of money.

Lastly, to overcome the loss of feedback in circuits (d) and (e), type (f) has been suggested, in which  $R_1$  is "decoupled to earth" for signal voltages, but receives its bias voltage from the junction of  $R_4$  and  $R_5$  as before. The impedance of  $C_4$  at the lowest signal frequency should be very much less than  $R_6$ . For this to be so,  $R_1 + R_6$  is almost sure to be appreciably higher than  $R_1$ , which means that the input signal load, which is  $R_1$ , is appreciably lower than the valve maker's limit which (if we follow his advice) is  $R_1 + R_6$ . This arrangement seems to me to have no great advantage over (c), and is less simple. On the other hand, (c) — and (b) — have the advantage that the cathode potential is stabilized (given constant  $V_{HT}$ ) at a few volts above a level fixed by the ratio of  $R_2$  to  $R_3$ .

Summing up: (a) is much the best if it can be arranged; if not, (c) is most likely to perform as expected, whereas (d) enables one to achieve a much higher signal input resistance but has to be carefully considered for possible loss of feedback. The others also ran.

## SHORT-WAVE CONDITIONS

Predictions for June



THE full-line 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

# F.M. TUNING INDICATOR

Obtaining Zero Voltage Readings with Conventional  
"Magic Eye" Indicators

By J. R. DAVIES

THE writer, when engaged in the design and development of an f.m. tuner, was confronted with the necessity of providing a tuning indicator which could be made to give readings that were true and reliable. Also, the indicator had to be reasonably inexpensive and capable of use by non-technical persons.

At present, it seems to be fairly general practice to employ conventional tuning indicators in the f.m. receivers which are manufactured in this country, these indicators being operated from the rectified voltage appearing across the stabilizing capacitor (assuming a ratio discriminator), or from the grid resistor of an i.f. limiter valve. This system is not without its disadvantages; partly because it is necessary to ensure that the i.f. stages are accurately "peaked" (and remain so "peaked" for considerable periods of time) at the centre frequency, and partly because the initial deflection of the indicator on tuning in a strong signal is liable to be much greater than the small additional increment given at what is assumed to be the point of correct tuning.

An alternative method of obtaining tuning indications is available when a balanced ratio discriminator is employed. With such a circuit the audio take-off point provides a d.c. potential with respect to chassis which varies as the receiver is tuned through the signal being received. The d.c. potential decreases as the signal frequency deviation decreases, and it reverses polarity as the signal passes through the centre frequency. Assuming that the diode load resistors are accurately balanced about chassis, this d.c. potential may be employed to operate a tuning indicator; the position of correct tuning being represented by zero voltage.

The circuit described in this article takes advantage of this fact, and employs a conventional 6U5 "Magic Eye" tuning indicator in conjunction with a 12AU7 double triode. Interpretation of the pattern display given by the indicator is obvious since zero voltage is represented as maximum shadow angle, and excursions into either positive or negative voltage cause the shadow to "close." The sensitivity is high, zero shadow angle being given by a voltage around 2 volts on either side of zero. Due to the inherent nature of the circuit, maximum indication may not necessarily be given at zero volts, but at a potential which is very close to zero volts. Empiric tests with sample valves gave errors of less than 0.1 volt on

either side of zero for the point of maximum indication. This error is quite small when it is considered that the d.c.-potential swing of the audio take-off point in most conventional f.m. receivers is usually well above 2 volts positive and negative.

**The Circuit.**—The circuit employed is shown in Fig. 1. In this diagram the audio take-off point from the balanced ratio discriminator is connected, *via*  $R_1$  and  $R_2$ , to the grids of a double triode, V1. The cathode of V1(a) is taken direct to chassis, whilst the cathode of V1(b) is taken to a potential which is positive with respect to chassis.

Let us assume that the potential at the audio take-off point is sufficiently negative to allow V1(a) to pass only a small anode current. V1(b), due to the positive potential on its cathode, is cut off. In consequence of this, the potential at the grid of V2 is that given by the potentiometer  $R_4$ ,  $R_5$  and  $R_6$ . Due to the low anode current passed by V1(a), the cathode of V2 has a potential which is considerably higher than that at its grid. In consequence, the triode section of V2 is cut off, and the display indicator presents zero shadow angle.

If the negative potential with respect to the chassis at the audio take-off point is advanced towards zero (ultimately to reach a positive value), V1(a) passes a continually increasing current. This causes the cathode potential of V2 to drop until a stage is reached when the indicator shadow commences to "open." As the audio take-off potential continues to approach zero, the shadow opens further. At a potential close to zero, positive grid current commences to flow through  $R_1$  and the increase of anode current in V1(a) ceases.

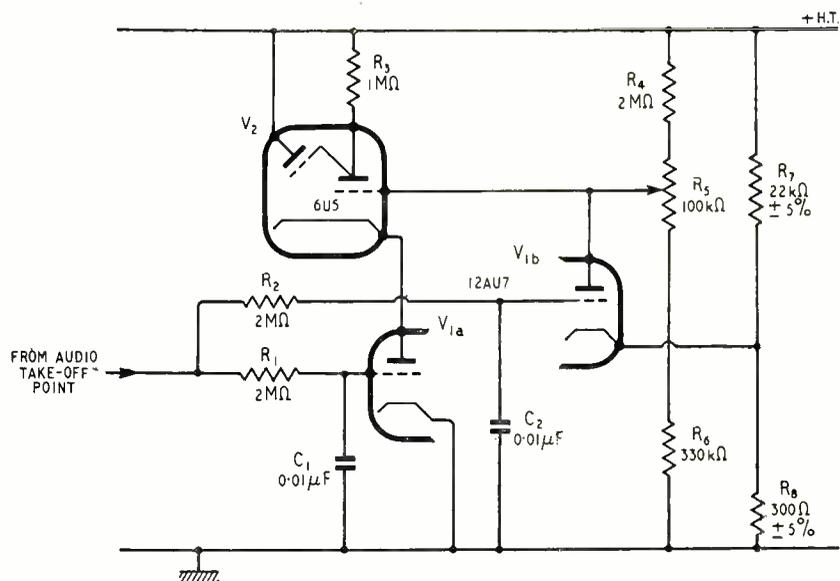


Fig. 1. The circuit of the indicator device described in this article.

The potential at the cathode of V2, in consequence, becomes comparatively steady.

Very shortly before the commencement of grid current in V1(a), V1(b) commences to conduct. However, its rate of change of anode voltage is lower than that of V1(a), and so the latter valve gives the greater control over shadow angle. After the condition of positive grid current has been reached the potential at the anode of V1(a) remains comparatively steady. As the audio take-off potential continues to rise, that at the anode of V1(b) now commences to drop further. In consequence, the grid of V2 goes further negative with respect to its cathode, and the indicator shadow commences to close again. Zero shadow angle is achieved when the audio take-off potential has gone sufficiently positive.

(It may be worth mentioning that, during the positive excursion of the audio take-off voltage, the grid potential of V2 does not affect its cathode current to any large extent, since the latter flows mainly between cathode and target.)

**Operation.**—It will be remarked that the circuit of Fig. 1 cannot give an accurate indication of zero voltage as the only "reference point" is that at which positive grid current commences to flow in V1(a); and this will vary from valve to valve. Also, the positive potential at the cathode of V1(b) may affect the operation near zero voltage.

However, empiric tests with a working circuit show that the device provides a maximum indication at points which are very close to zero voltage. Four different 12AU7s of varying ages give maximum indications which are all within 0.1 volt on either side of zero. Also, four-hour tests for drift do not show any measurable shift of the potential required for maximum shadow angle. Again, changes in h.t. line voltage between 200 and 250, and in heater voltage between 6 and 6.6, produce no noticeable shift. This is not sufficient evidence, of course, to assume that the circuit will function as well for all 12AU7s; and it is possible that the worst instances of drift, or of inaccurate voltage indication, will occur in the early life of a brand new valve.

The values of  $R_7$  and  $R_8$  are fairly critical. The writer was tempted to make  $R_8$  a variable component, but the values shown in Fig. 1 coped satisfactorily for the valves tested in his particular case. Decreasing the value of  $R_8$  decreases the sensitivity of the circuit, and the indicator ceases to function altogether before the potential which gives maximum indication is shifted at all seriously. Increasing the value of  $R_8$  results in an indication of maximum shadow over a period between the potential which initiates positive grid current and a further positive potential. The consequent lack of sensitivity is immediately apparent.

Due to the fact that the potential at the cathode of V2 rises as the audio take-off potential goes negative, a dimming of the indicator pattern takes place for high negative control voltages. This dimming becomes just noticeable at approximately 4 volts negative, and the indicator is almost completely extinguished around 10 volts negative.

The potentiometer  $R_5$  is employed to set the grid of the 6U5 to the potential which gives optimum sensitivity. Before adjustment, the slider should be set to the high-potential end of the track and the audio take-off point short-circuited to chassis. The slider is then brought down until the 90-degree shadow angle given by the short-circuit is reduced to approximately 85 degrees. The setting of  $R_5$  is not

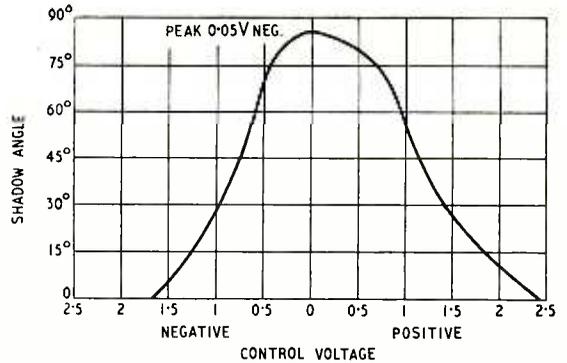


Fig. 2. Relationship between shadow angle and control voltage for typical 6U5 and 12AU7 valves.

very critical, and it might be possible to use fixed components in this part of the circuit.

The capacitors  $C_1$  and  $C_2$  are included to prevent modulation voltages from blurring the indicator pattern. A graph showing shadow angle against audio take-off potential for a typical 12AU7 and a 6U5 is given in Fig. 2.

**Performance.**—After the circuit had been put into working order (with the aid of a potentiometer and centre-tapped dry battery to stimulate the voltages appearing at the audio take-off point) it was tested with a working f.m. receiver. To ensure that the different source impedance did not affect accuracy of indication, a valve-voltmeter was also connected between the receiver's audio take-off point and chassis. However, the different source impedance did not introduce any measurable shift in the potential needed to give maximum indication.

In use, it was found that the readings given by the indicator were very satisfactory indeed. Normally, the shadow remained open until a station was tuned in; whereupon the shadow closed abruptly. At the centre frequency of the station, however, the shadow opened once more, and it was consequently possible to obtain a beautifully precise indication of correct tuning. Subjective tests carried out by having non-technical persons tune in the receiver resulted in an accurate position of optimum tuning being achieved in every case.

**Acknowledgments.**—Acknowledgments are due to Allen Components, Ltd., for facilities made available to the writer for the development of this circuit.

## RECEIVER SALES

A SURVEY of the retail sales of domestic receivers during the first quarter of this year, prepared by B.R.E.M.A., shows that by comparison with the same period last year the demand for television receivers increased by 70% and sound receivers and radio-gramophones by 51%. The table gives the 1955 monthly retail sales. The totals for the first quarter of 1954 are in parentheses.

	Sound	Radiograms	Television
January ... ..	98,000	35,000	103,000
February ... ..	99,000	33,000	98,000
March ... ..	95,000	24,000	85,000
Quarter's total ...	292,000	92,000	286,000
	(254,500)		(168,500)

## NEW DECCA RADAR

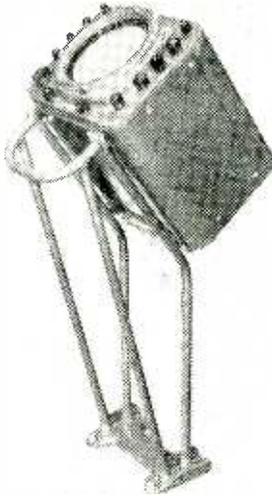
JUST over five years ago Decca produced their first radar set (Type 159) which was marketed at about half the price of existing equipment. Two other models (Types 12 and 45) were subsequently produced and together these three models have been fitted in over 3,700 ships—about two-fifths of the world's radar-equipped vessels.

The majority of the world's medium- and large-tonnage vessels are now equipped with radar and it was to meet the demand for a set for small ships—coasters, trawlers, etc.—that Decca recently produced the Type 212. Although considerably smaller, lighter and cheaper than its predecessors it is claimed to meet the stringent M.o.T. specification for marine radar and has been submitted for type approval.

A feature of the earlier Decca sets was the fitting of the r.f. head as part of the scanner unit, thereby eliminating a long waveguide run. As it is essential in smaller vessels to reduce top weight, and, also, it is possible to have a short waveguide run, the r.f. unit in the new model is separate.

The set, which has a 9-in p.p.i., has six ranges—0.5, 1, 3, 8, 15 and 30 miles—with calibration rings varying from 0.2 to 5 miles according to the range scale in use. It has a minimum range of 30 yards and a discrimination of 25 yards on the shorter ranges.

The r.f. unit, giving a peak output power of 10 kW, has a pulse duration of either 0.1  $\mu$ sec or 0.2  $\mu$ sec accord-



The 212 display unit may be mounted on the bulkhead, deckhead or, as shown, on a pedestal.

ing to the range in use. The unit can be mounted either below deck or (in a special waterproof case) at the base of the mast. The familiar Decca separate half-cheeses for transmission and reception, have given place to a single parabolic cylinder scanner of approximately 4 ft across.

Decca have equipped two vehicles with this radar unit which are now touring the ports in the U.K. and on the Continent.

## CLUB NEWS

**Barnsley.**—The subject for the meeting of the Barnsley and District Amateur Radio Club on June 24th is "Fifty Years of Ham Radio" and the speaker is P. Denison (G8OK). Meetings are held at 7.0 at the King George Hotel, Peel Street, Barnsley. Sec.: P. Carbutt (G2AFV), 33, Woodstock Road, Barnsley, Yorks.

**Birmingham.**—"The Application of Valves for Communication Purposes" is the subject of the talk to be given by G. Nicholson (G3HKC) to members of the Slade Radio Society on June 10th. On 24th L. Glew, of Marconi Instruments, will speak about instruments at v.h.f. The club room at Church House, High Street, Erdington, is open every evening and lecture meetings are held on alternate Fridays at 7.45. Sec.: C. N. Smart, 110, Woolmore Road, Erdington, Birmingham, 23.

**Chelmsford.**—At the next meeting of the Chelmsford Group of the British Amateur Television Club—on June 9th—members are to hear

a description of a portable monoscope unit. The group meets at the home of the secretary, M. Barlow (G3CVO), 10, Baddow Place Avenue, Gt. Baddow, Essex. Test transmissions are radiated each Saturday evening on 436 Mc/s by R. L. Royle (G2WJ/T), one of the members.

**Cleckheaton.**—T. C. Isaac (G4RQ), of Ambassador Radio, will speak on "High Quality Sound" at the meeting of the Spen Valley and District Radio and Television Society on June 1st. The club meets on alternate Wednesdays at 7.30 at the Temperance Hall, Cleckheaton. The final meeting of the session will be on July 13th. Sec.: N. Pride, 100, Raikes Lane, Birstall, Nr. Leeds, Yorks.

**Coventry.**—At the meeting of the Coventry Amateur Radio Society on June 20th, at 7.30 at 9, Queens Road, Coventry, D. Clift (G3BAK) will speak about v.h.f. transmission and reception. Sec.: J. H. Whitby (G3HDB), 24, Thornby Avenue, Kenilworth, Warwicks.

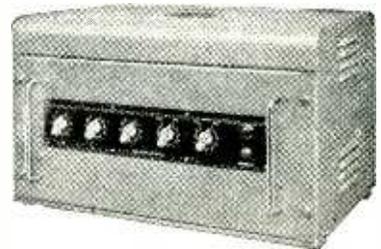


The TRIX tradition of quality has been established by an unswerving allegiance to the highest standards of electrical engineering. TRIX Sound Equipment has been developed and produced to give faithful and lasting service anywhere in the world.

**Model G7822.** Ribbon microphone with superlative performance and attractive streamlined appearance. Of exceptionally small size and weight, measuring only 1 1/2 in. in diameter.



With high sensitivity and minimum of feedback effects, it can be supplied in satin chrome or bronze finish, and with additional switch-box attachment if desired.



**Model T.635.** 30-watt Amplifier designed for A.C. mains and can also be operated by batteries. This high quality amplifier has inputs for 2 microphones and gramophone. Two tone controls are fitted for bass and treble boost.

The TRIX ELECTRICAL Co. Ltd.  
MAPLE PLACE,  
TOTTENHAM COURT ROAD,  
LONDON, W.1

Tel: MUSeum 5817  
Grams: TRIXADIO, WESDO, LONDON

# RANDOM RADIATIONS

By "DIALLIST"

## F.M. and Hi-Fi

THE B.B.C.'s decision not to strive after really high fidelity in its Band II service is due mainly to the fact that the cables provided for its use by the G.P.O. have a bandwidth limit of somewhere about 8 kc/s. Nor will the G.P.O. allow radio links. A pity, of course; still, I don't think that those in the Home Counties who buy or build first-rate v.h.f. sets will be very disappointed by the quality of those Wrotham transmissions which emanate from studios or concert halls in London—Broadcasting House and Wrotham are linked by good lines. I have listened to Wrotham for a couple of years and found the programmes a revelation in the quality that can be obtained from a good receiver. There was a high-grade m.w. set in the same room as the v.h.f. receiver. As both were fitted with a muting arrangement it was possible to change instantly from the one to the other. Even to one who can lay no better claim than I to being musical, the difference was amazing. On the v.h.f. transmission, for example, you could pick out particular instruments in a big orchestra and follow them easily. I can't do that on any m.w. orchestral programme.

## Blessed Relief

MY new abode is well over 100 yards from the nearest main road. Thanks to the distance and to the fact that the aerial is some 50-60 ft above the level of the road surface, I get no interference with television reception worth talking about; in fact, the limiter isn't in use at all and I can allow my whites to be really white. Much as I rejoice in this happy state of affairs my heart bleeds for those unfortunate enough to live on or near the road in question. It is one of the links between London and the south coast and, at this time of year anyhow, there is a constant stream of motor traffic along it all day and most of the night as well. Perhaps people grow so used to ignition interference that they cease to notice it particularly. I can't think how they can, for I'm sure I couldn't watch pictures that were continually marred by those awful lines of white spots.

Nevertheless, one finds that a good many of the houses standing right alongside the road are surmounted by "Hs," "Xs" or "Ks" and that many of these "look" right over it towards Alexandra Palace.

## Sets of Yesteryear

AMONG the long-forgotten papers that came to light when I was sorting things out on the eve of moving house was a 24-page receiver supplement of the then weekly *W.W.* of December 9th, 1932. One of the first things that caught my eye was the advertisement of the Decee-Acee receiver: "Will work off a.c. or d.c. mains without alteration. The only set of its kind." With built-in loudspeaker (which many sets of those days had not) this s.g.-det-pentode 3-valve receiver cost 18 guineas. There was also a 4-valve model with two h.f. stages, at 23 guineas. The fashionable set then was clearly the 3-valve "straight" costing £10-£12 for battery models and £16 upwards for mains models. More engaging is a page containing front and back view drawings of a typical 3-valve chassis "which will

enable the features of modern sets to be readily identified." The said features include: vari-mu h.f. valve, power-grid detector and pentode output (coupled by l.f. transformer, parallel-fed), screened bandpass coils, single-dial tuning, metal chassis (with decoupling circuits mounted below), full-wave valve rectifier and electrolytic smoothing condenser. There were some bargains in wireless sets in those days. For £3 you could buy a 2-valve "Brownie," complete with moving-iron loudspeaker, but without batteries. Batteries and all, the K-B "Pup" cost £4 10s and there were a.c. and d.c. models of the same set for £7 10s. There were quite a few superhets. The all-wave "Faraday," containing 4 s.g. valves and a power pentode and offered in a.c. or d.c. models went for 27 guineas and the G.E.C. had an a.c. mains model (with heterodyne whistle filter and automatic station index) for 26gns. The same firm offered a 6-valve all-wave, battery-operated superhet, constructed to tropical specification, for 24 guineas.

## Wireless: Unlawful Use of

IN these queer days when we are so hedged about by a multiplicity of little-known laws, orders and regulations, many of us must do what we "didn't order" at one time or another without being aware of the fact. The charge of making unlawful use of wireless telegraphic apparatus, in that he received a



## "WIRELESS WORLD" PUBLICATIONS

	Net Price	By Post
RADIO LABORATORY HANDBOOK. M. G. Scroggie, B.Sc., M.I.E.E. 6th Edition	25/-	26/3
STUDIO ENGINEERING FOR SOUND BROADCASTING. B.B.C. Engineering Training Manual by members of the B.B.C. Engineering Division. General Editor J. W. Godfrey.	25 -	25/6
SHORT-WAVE RADIO AND THE IONOSPHERE. T. W. Bennington, Engineering Division, B.B.C. Second Edition	10/6	10/10
INTRODUCTION TO VALVES. R. W. Hallows, M. A. (Cantab.), M.I.E.E., and H. K. Milward, B.Sc. (Lond.), A.M.I.E.E.	8/6	8/10
WIRELESS WORLD TELEVISION RECEIVER MODEL II: Complete constructional details with notes on modernizing the original design	3/6	3/9
RADIO INTERFERENCE SUPPRESSION as Applied to Radio and Television Reception. G. L. Stephens, A.M.I.E.E.	10/6	10/11
SOUND RECORDING AND REPRODUCTION. A B.B.C. Engineering Training Manual. J. W. Godfrey and S. W. Amos, B.Sc. (Hons.), A.M.I.E.E.	30/-	30/8
ADVANCED THEORY OF WAVEGUIDES. L. Lewin	30/-	30/7
FOUNDATIONS OF WIRELESS. M. G. Scroggie, B.Sc., M.I.E.E. 5th Edition	12/6	13/-
TELEVISION RECEIVING EQUIPMENT. W. T. Cocking. M.I.E.E. 3rd Edition	18/-	18/8

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.

police message when not authorized by the Postmaster General to do so, brought recently against an army officer is a case in point. The Andover magistrates very sensibly granted the accused an unconditional discharge, the chairman remarking that not one member of the bench had previously realized that it was an offence. If you own a receiver covering Band II, you can hardly fail to pick up such messages at times. I've often done so when tuning in Wrotham; in fact, I recall puzzling our local police superintendent one day by saying: "I hope you got that report off all right." "What report do you mean?" "Why, the one that headquarters was gingering you up about by wireless this morning." I wasn't run in.

### Offenders in Spite of Ourselves

If the authorities are going to make a practice of bringing such charges, one foresees that they'll have their hands pretty full when the B.B.C.'s Band II system gets into its stride and v.h.f. sets are in use in homes everywhere. And what of those who have telephony from nearby police stations forced upon their unwilling ears by way of the loud-speakers of their television sets? Having filled up the appropriate forms, they beg the P.M.G.'s engineers to rid them of the nuisance, only to learn that occasional (or it may be frequent) breakthrough is inevitable at such short range. Will some legal reader of *W.W.* tell us whether such folk could charge the police with aiding and abetting them to break the law?



Back projection?

## THE MATCHING RANGE of SILVER-DIAL CONTROL-KNOBS

A MATCHING group of highly polished glossy Instrument-Knobs and -Dials for the highest grade apparatus. Each knob can be used with a frosted aluminium dial. The three larger types can also take a skirt-moulding supplement, as shown; all the knobs can be used alone, if desired. Skirts and dials fix with self-tapping screws. Each knob has strong radial 4 B.A. grip-screw(s).

FITTED WITH BRASS INSERT-BUSHES. FOR 1/2" Ø SHAFTS



List No.	Item	Dimensions, etc.
K.400	Knob	1 1/8" (23.8 mm.) Ø × 3/8" (15.9 mm.) high
K.410	Dial*	1 1/2" (38.1 mm.) Ø × 21 S.W.G., engraved 0-10 over 270°
K.410/P	Dial*	ditto, not engraved

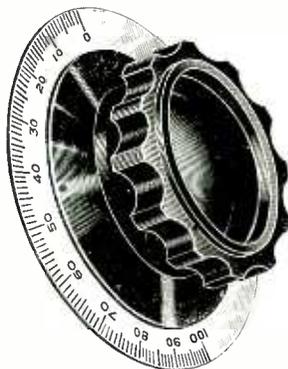
\* Rivets to Knob; we will fit and rivet, if requested



List No.	Item	Dimensions, etc.
K.401	Knob	1 1/2" (29.4 mm.) Ø × 1 1/4" (17.5 mm.) high
K.405	Skirt	1 1/2" (38.1 mm.) Ø × 3/8" (6.8 mm.) thick
K.411	Dial	2" (50.8 mm.) Ø × 21 S.W.G., engraved 0-10 over 270°
K.411/P	Dial	ditto, not engraved



List No.	Item	Dimensions, etc.
K.402	Knob	1 3/8" (41.3 mm.) Ø × 3/8" (19.9 mm.) high
K.406	Skirt	2 1/8" (52.4 mm.) Ø × 3/8" (6.8 mm.) thick
K.412	Dial	2 1/2" (69.9 mm.) Ø × 21 S.W.G., engraved 0-100 over 180°
K.412/P	Dial	ditto, not engraved



List No.	Item	Dimensions, etc.
K.403	Knob	2 3/8" (60.3 mm.) Ø × 3/8" (24.6 mm.) high
K.407	Skirt	3" (76.2 mm.) Ø × 3/8" (6.8 mm.) thick
K.413	Dial	4" (101.6 mm.) Ø × 21 S.W.G., engraved 0-100 over 180°
K.413/P	Dial	ditto, not engraved

Manufacturers of Radio and Electronic Components

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

Telephone: RIPPleway 5588 (Private branch exchange)

# UNBIASED

## By FREE GRID



1897 needle-using disc gramophone

### Talking Machines

I RATHER pride myself on historical accuracy and feel compelled to draw attention to a chronological inexactitude in an otherwise excellent article by S. Kelly on "Needles for Talking Machines" in the May issue.

Speaking of the needle or stylus the author says "Sapphire or diamond in 1900, steel needles from about 1910 to 1935 . . ." which surely implies that steel-needle machines were rare, or at any rate in the minority, before 1910. I have no statistics before me but relying on my memory of those years (which has often made the B.B.C. scrapbooks bite the dust) I venture to say that the author's statement is at least misleading.

Now let us get this matter straight. At the time of Queen Victoria's death (Jan. 22nd, 1901) there was certainly a large number of sapphire-using cylinder machines in use and I have one on the table before me as I write. But even then the needle-using disc machines were—if I may coin a word—"populescent" and by the time of King Edward's Coronation (Aug. 9th, 1902) had virtually stolen the market. Side by side with my Victorian cylinder machine I have the H.M.V. disc-and-needle-using "dog" model.

Sapphires were available with some disc machines, but, in the early years of the present century, which is the period in question, by far the greater number used needles only; in fact, it is not too much to say that discs necessarily meant needles. If I can be proved wrong I am willing to spend a night of penance on a bed of upturned steel gramophone needles like an Indian fakir.

The author is also rather misleading when, a little later in his article, he says "about 1910 the disc finally ousted the cylinder for domestic reproducers. . . ." Surely this implies that the cylinder died with King Edward (May, 1910). Actually the cylinder, like Charles II was "an unconscionably long time a

dying" and although the process started long before 1910, it lingered on until after the beginning of the Kaiser's war.

Several cylinder machines are listed in Gamage's catalogue of 1913 and I recollect buying one for 3s 6d—yes three shillings and sixpence—and it certainly wasn't a toy one. It's only disadvantage over the more costly ones was that it would not take the famous Edison "Amberol" cylinders which were the L.P. "microgroove" records of the period. For these cylinders the screwed rod which moved the stylus across the record had a much finer pitch than the one normally used.

### Electronics in the Garden

IN THE SUMMER of 1940 I attended a lecture given by Dr. P. Dalton before the Brit. I.R.E. on the interesting subject of radio therapy. I remember how this new therapy affected the processes of the body and how it had been discovered. Apparently it had been found that wireless operators sitting near the works of powerful s.w. transmitters had suffered ill effects.

I have often wondered whether this therapy with its strong effect on normal biological processes could not be applied to our gardens to speed up the growth of plants and an item I spotted recently in an American newspaper has convinced me that it can. It has been observed that in the vicinity of certain high-powered television transmitters weeds grow wilder and tulips taller and I am getting to work immediately on the problem.

If the editor keeps his promise to let us have *W.W.* on the fourth Tuesday of each month, this issue will appear on May 24th which is not only Queen Victoria's birthday but the day on which the present Queen will open the famous Chelsea Flower Show of the Royal Horticultural Society. I intend to be right there in the electrical section where they always demonstrate how our seedlings can

be warmed from the mains via a step-down transformer and a buried cable.

I am going to suggest that a compact oscillator unit working on TV frequencies is marketed enabling us to feed oscillations into a special transmission line and radiator buried among our plant roots or maybe suspended just above them. Frankly I don't know what will be the results as I'm no biologist but I remind myself that the scientists who detonated the first atom bomb in New Mexico in July, 1945, weren't any too sure about results.

### "Pidgin" Radio

IT IS an old saying that the lazy man works the hardest and I have been rather forcibly reminded of it by a few remarks that appeared in the correspondence columns of *W.W.* a month or two ago about wireless and mathematics. To my way of thinking the man who tries to take the "easy" way of trying to understand the intricacies of radio without a preliminary grounding in mathematics will find the going very heavy.

He generally proceeds by way of mechanical analogies which, seemingly apt and excellent at first, break down and leave the non-mathematical student stuck firmly in a mental morass. The mathematical man, on the other hand, sails along without the necessity of conjuring up mental pictures of the phenomena which his equations represent.

An analogous state of affairs was often to be observed over a quarter of a century ago, when the home-construction phase of wireless was at its height. I frequently came across men who were very ardent and, indeed, very skilful home constructors who were unable to understand a "theoretical" circuit diagram, a form of shorthand which enabled the essentials of the receiver of that period to be seen literally at a glance. These earnest constructors, however, could and did follow the intricacies of the practical wiring plan with a skill and celerity which left me breathless and which must have needed a lot of hard work to acquire.

If I may be permitted to use an analogy after condemning them earlier in these remarks, the non-mathematical radio aspirant may be likened unto the speakers of "pidgin" English in New Guinea and elsewhere. To learn standard, or at any rate basic, English would take only half the time, pain, power and sheer hard work which they put into acquiring a knowledge of this truly astonishing lingo.




**VALVE** Characteristic  
**METER** *Mk III*

**T**he AVO Valve Characteristic Meter Mark III offers the Radio Engineer far more than is generally implied by the words "a valve tester".

This compact and most comprehensive Meter sets a new high standard for instruments of its type. It will quickly test any standard receiving or small transmitting valve on any of its normal characteristics under conditions corresponding to a wide range of D.C. electrode voltages.

A new method of measuring mutual conductance ensures that the instrument can deal adequately with modern valves of high slope and short grid-base such as are commonly used in T.V. receivers.

**PROVIDES** all necessary data to enable Ia/Va, Ia/Vg, Ia/Vs, etc., curves to be drawn.

**MEASURES** mutual conductance up to 30mA/V.

**DETERMINES** inter-electrode insulation with heater both hot and cold.

**GIVES** direct measurement of "gas" current.

**TESTS** rectifying and signal diodes under reservoir load conditions.

**COVERS** all normal heater voltages up to 117V.

**CIRCUIT** improvements provide accurate setting and discrimination of grid voltage over the full range to 100V negative.

A relay protects the instrument against damage through overloading the H.T. circuits and also affords a high measure of protection to the valve under test.

The instrument is fitted with a hinged fold-over lid which protects the valve holders when not in use.



Regd. Trade Mark

A comprehensive Instruction Book and detailed Valve Data Manual are provided.

List Price  
**£60**

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

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

Telephone: VICTORIA 3404 (9 lines)



V.C.4



# HIGH GRADE INSTRUMENTS *for radio and electronic engineers*

2½ in. scale moving coil A.C. rectifier meter. Square flush mounting. Type S25.



3½ in. moving iron AC/DC meter. Round flush. Type S35.

"Fulscale" meter 4 in. dia scale moving coil having 270° arc with a 9 in. scale length.



Moving coil Microammeter 5 in. scale. Flush mounting rectangular case. Type S50.



High torque moving coil portable meter. Precision grade to BS.89.

## METERS



Multi purpose test set for simultaneous measurement of current and voltage.



Ohmmeter for the rapid and direct measurement of very low values of resistance. Model RM.155.



Universal multi range test set for electrical and radio engineers.

## TEST SETS



*These represent just a few of our wide range of high quality instruments which are used by the electrical and electronic industries. May we supply you with our comprehensive catalogue?*



Breakdown Tester for measuring the breakdown voltage of electrical components and insulating materials. Model RM.215.



Universal Impedance Bridge covering a wide range of values for the measurement of resistance inductance and capacity. Model UB.202.

# BRITISH PHYSICAL LABORATORIES

Radlett, HERTS

Tel: RADLETT 5674-5-6



# FLAT TUBES

**SAVE SPACE**



**DG 16-21**  
**FOR 'A' SCAN RADAR**  
**AND INSTRUMENT**  
**APPLICATIONS**

The screen of the DG16-21 cathode ray tube is a rectangle measuring  $5\frac{1}{2} \times 1\frac{1}{2}$  inches — the logical shape for radar 'A' scan and many instrument applications. A number of these tubes can be stacked vertically to provide multiple displays within a confined space . . . they are the answer to those problems in design where circular tubes make equipments excessively bulky.



**easily stacked**



**for multiple trace**



**comparison**

Deflection : Electrostatic, symmetric or asymmetric. $V_h$ : 6.3 volts. $I_h$ : 0.3 amp. Base : B14A.	TYPICAL OPERATING CONDITIONS					
	$V_{a3}$	$V_{a2}$	$V_{a1}$	$V_g$	Deflection Sensitivity	
	5,000V	600 to 700V	1,800V	-25 to -70V	$S_x$	$S_y$
					0.19mm/V	0.21mm/V

The DG16-21 has a green luminescent medium persistence screen. Versions with other screens are contemplated and your comments are invited.

See Mullard Cathode Ray Tubes and Valves on  
**STAND No. 23 — BLOCK F**  
**BRITISH INSTRUMENT INDUSTRIES EXHIBITION**  
**Earis Court, 28th June to 9th July**

# Mullard



# NEW!! For TV Band III

## Taylor Signal Generator

For Television frequencies up to 240 Mc/s.

### Model 67A

Frequency range: 100 kc/s.-240 Mc/s. in six ranges.

Accuracy:  $\pm 1\%$ .

Attenuation: 100 dB. Continuously variable.

Modulation: 400 cycles, 30% depth.

Output impedance: 75 ohms.

Direct A.F. output provided.

**Cash Price £22/-/- Prompt Delivery**

*Available on advantageous H.P. terms*



## Taylor TV Sweep Oscillator

### Model 92A

Covering Band III

Frequency-modulated oscillator designed for the rapid and accurate alignment of TV receivers. Also suitable for checking any band pass amplifier.

Frequency range: 5-250 Mc/s.

Frequency deviation: Continuously variable to approx. 15 Mc/s.

Output: 40 microvolts to 2 millivolts continuously variable.

Freq. Mod. Substantially linear to 6 Mc/s. sweep width—less than 10% max. sweep.

Sweep: Sweep voltage continuously variable to a max. of 300 v. R.M.S.

**Cash Price £30/-/- Prompt Delivery**

*Available on advantageous H.P. terms*



**STAND NO. 27. Block 'A.' British Instrument Industries Exhibition  
(June 28 to July 9)**



● All other Taylor Instruments available on H.P. Write for catalogue and details of H.P. terms.

**ELECTRICAL INSTRUMENTS LTD.**

MONTROSE AVENUE, SLOUGH, BUCKS.

Telephone: Slough 21381. Cables: Taylins, Slough

# Response is not all the story

THE FERROGRAPH was the first portable Tape Recorder to be designed and wholly manufactured in Britain. To-day the bewildered buyer may well hesitate when confronted with a choice of so many makes offered. But if he is serious — and not lightly choosing something for his casual enjoyment — he would do well to ponder the following fact.

Frequency response is often popularly quoted in advertisements as 50-12,000 c.p.s. This, of itself, means nothing in evaluating the excellence or otherwise of a recorder. Two other interdependent factors must be regarded, viz.—signal/noise ratio and distortion, if the true worth of the instrument is to be gauged.

Furthermore, the limits in which the response is held must be given or the statement is again valueless. The Ferrograph frequency response is guaranteed to be within  $\pm 3$  db up to 10,000 c.p.s. at  $7\frac{1}{2}$  i.p.s., although the response does, of course, extend much beyond this.

No exaggerated claims are made for the Ferrograph since its established reputation makes such claims unnecessary. Simple conservatism has always been a feature of Ferrograph publications and advertisements, and experience has shown the discerning user prefers it that way.

#### MODEL 2A/N

$3\frac{3}{4}$  and  $7\frac{1}{2}$  i.p.s.

76 gns.

#### MODEL 2A/NH

$7\frac{1}{2}$  and 15 i.p.s.

86 gns.



*Dealerships in several of the principal towns are still open and applications are invited.*

## Ferrograph

#### BRIEF SPECIFICATION

**Twin Track (to International standards)**  
Playing British and American pre-recorded tapes

**Playing Time with 1,750 ft. Reel**  
45 minutes per track at  $7\frac{1}{2}$  i.p.s. (other speeds prorata)

**Quick Rewind**  
in less than 60 seconds

**Signal Level Meter**  
giving positive reading

**Frequency Response**  
 $\pm 3$  db 50/10,000 c.p.s. at  $7\frac{1}{2}$  i.p.s.

**"Wow" and Flutter**  
Less than 0.2% at  $7\frac{1}{2}$  i.p.s.

**Signal to Noise Ratio**  
Better than 50 db, 200/12,000 c.p.s. Unweighted, including hum, 45 db.

**Longterm Speed Stability**  
Less than .5% variation

**Output Power**  
 $2\frac{1}{2}$  watts into 15 ohms

### WRIGHT & WEAIRE LTD

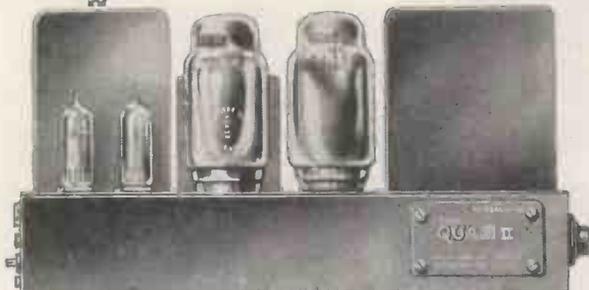
131 SLOANE STREET · LONDON · SW1 Tel: SLOane 2214/5 & 1510



There are those who consider that there is little to choose in the range of power amplifiers now available—perhaps because the power amplifier is usually considered the “easy” part in the search for audio perfection. Why is it then that leading engineers are so enthusiastic about the QUAD II design?

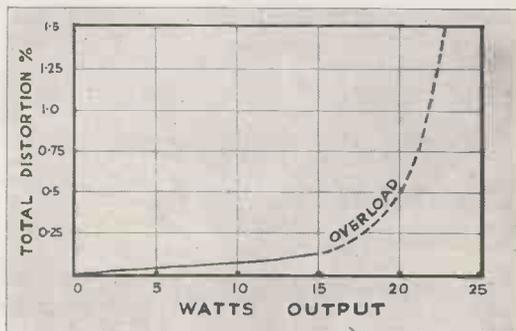
## ... on feedback and linearity

They like the unique integrated feedback to provide complete stability independent of phase changes in the load current . . . the method used for eliminating the loop gain outside the audio range without prejudice to the input signal . . . the way that feedback is again used to provide optimum design stage by stage and to control the effective time constants. They like its use yet again to provide a unique self-balancing phase changer without the usual asymmetry to the H.T. line. They like, too, the fact that the specification is fully met with commercially tested valves without matching or alignment of any kind. They extol the conservative ratings and restoration from overload (several nation-wide broadcasting corporations officially uprate the output to 20 watts, since with this degree of overload, distortion is still well within their acceptance figures).



Good engineering for the best performance\* also results in greater efficiency. Compare the size of the QUAD with any other amplifier of approaching specification. Note the size of the output transformer which results from optimum choice of flux and core material to suit design requirements.

\* The unique output stage design principles are discussed in *Wireless World*, September, 1952.



Linearity and overload of the QUAD II amplifier

The QUAD II power amplifier is primarily designed as part of the complete QUAD II amplifier. The power amplifier is also supplied separately as a quality standard when with a suitable input transformer it can be fed direct from a 600 ohm line.

The QUAD II is available throughout the world. Fully stocked servicing organisations are now operating in Canada, throughout U.S.A., Panama, Canal Zone, Trinidad, Jamaica, Venezuela, Australia, Malaya, Singapore, Japan, Hong Kong, Burma, India, Ceylon, Pakistan, South Africa, Portugal, Italy, France, Switzerland, Belgium, Norway and Sweden.



**ACOUSTICAL MANUFACTURING CO. LTD., HUNTINGDON, ENGLAND**

# RELAYS

## *announcing the* **2400 RELAY**



A Relay of noteworthy dimensions, designed in size and performance to suit present day electronic equipment. The new 2400 Relay is available with twin light duty or single heavy duty contacts.

When fitted with a 10,000 ohm coil, the pull-in is approximately 4 milli-amperes; contact pressure and clearance have not been sacrificed to achieve this sensitivity.

**DIMENSIONS:** Above chassis  $2\frac{1}{2}$ " high x 1" wide x  $1\frac{5}{8}$ " deep.

**WEIGHT:**  $4\frac{1}{2}$  ounces.



**MAGNETIC DEVICES LTD**  
NEWMARKET



**TRANSFORMER PROBLEMS  
WE HAVE SOLVED...**

**AMERICAN SPECIFICATION MIL/T27  
met with BRITISH MATERIALS**



Implementing the policies of N.A.T.O. has brought its own problems not the least of which are the varying electrical properties of the actual raw materials selected for electronic and radio equipment and components. The news that Gresham Transformers have completely and successfully met the requirements of American Specification MIL/T27 is yet another achievement which goes to prove that—

—To Every Transformer Problem  
There is a GRESHAM Answer

HANWORTH **GRESHAM** MIDDLESEX  
TRANSFORMERS LTD

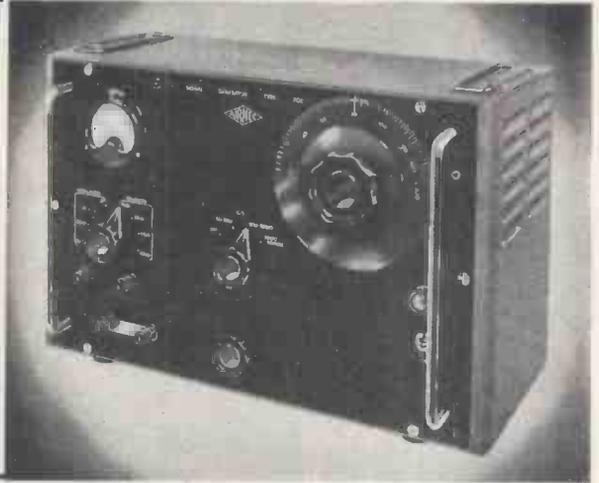


# SIGNAL GENERATORS

for the frequency range 30 c/s - 30 Mc/s

## L. F. SIGNAL GENERATOR TYPE 702

- **Frequency Range:** 30 c/s-30 kc/s.
- **Stability:**  $\pm 0.05\% \pm 0.5$  c/s.
- **Output:** A screened and balanced transformer enables balanced, unbalanced and fully floating outputs to be obtained.
- **Attenuator:** A 600 ohm constant impedance attenuator provides steps of 20, 40 and 60 db of attenuation under all output conditions.
- **Output Level:** 100 mW into 600 ohms or 15 volts open circuit.



## H. F. SIGNAL GENERATOR TYPE 701

- **Frequency Range:** 30 kc/s-30 Mc/s.
- **Output Level:** Constant to within 1 db over entire frequency range.
- **Output Impedance:** 75 ohms  $\pm$  10 ohms on the 0 db step of the attenuator and 75 ohms  $\pm$  3 ohms on all other settings.
- **Attenuators:** A slide wire and step attenuator calibrated both in db and volts open circuit enable the output to be reduced to 1 microvolt.
- **High Output:** A signal voltage of from 5-20 volts is available from a high impedance output socket.

The L.F. Signal Generator Type 702 may be connected to the H.F. Signal Generator Type 701, to enable signals over the complete frequency range 30c/s to 30 Mc/s to be obtained from the output plug of the latter instrument.

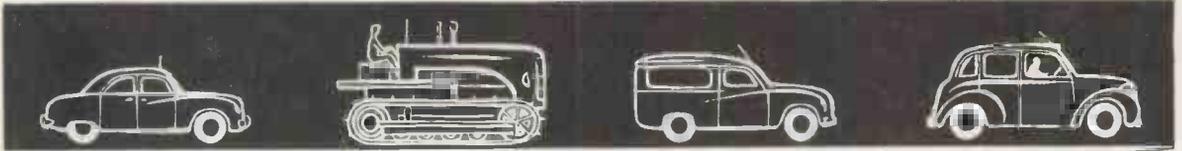
*Full details of these or any other Airmec instruments will be forwarded gladly upon request.*

**AIRMEC**  
LIMITED

HIGH WYCOMBE — BUCKINGHAMSHIRE — ENGLAND

Telephone: High Wycombe 2060

Cables: Airmec High Wycombe



An important new achievement

a lightweight mobile transmitter/receiver 68U



has been added to B.C.C. range of communications equipment

68U designed and built with the same precision and care



as a scientific instrument,

has several new features



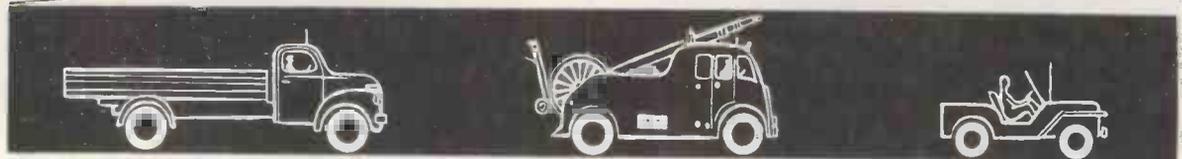
TYPE 68U.

**VHF TRANSMITTER RECEIVER**

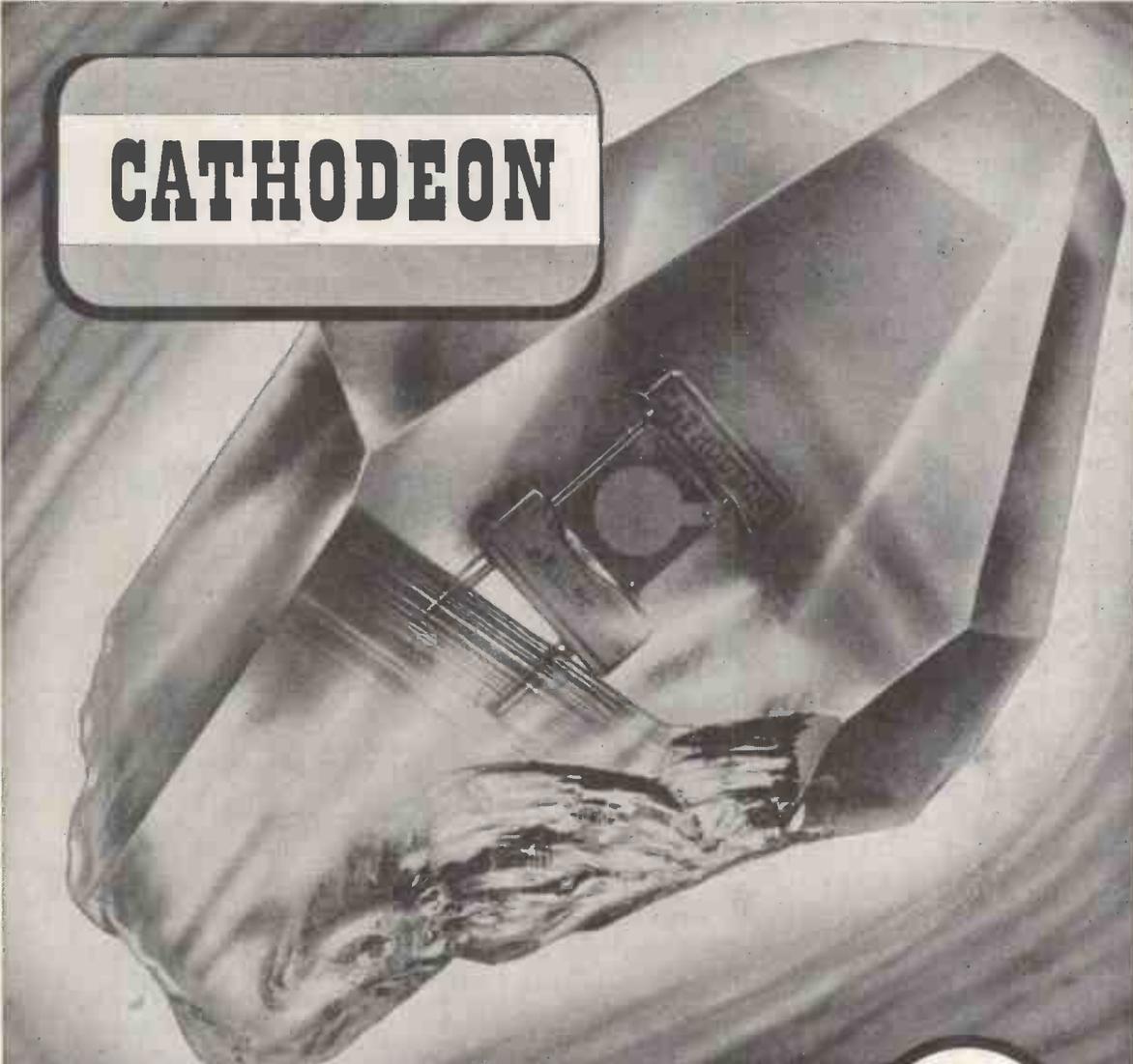


which make 68U really outstanding in its class

B.C.C. sets the standard



**BRITISH COMMUNICATIONS CORPORATION LIMITED**  
 Second Way, Exhibition Grounds, Wembley, Middlesex  
 Telephone: Wembley 1212



**CATHODEON**

**Quartz Crystals**

FOR  
RELIABLE  
FREQUENCY  
CONTROL

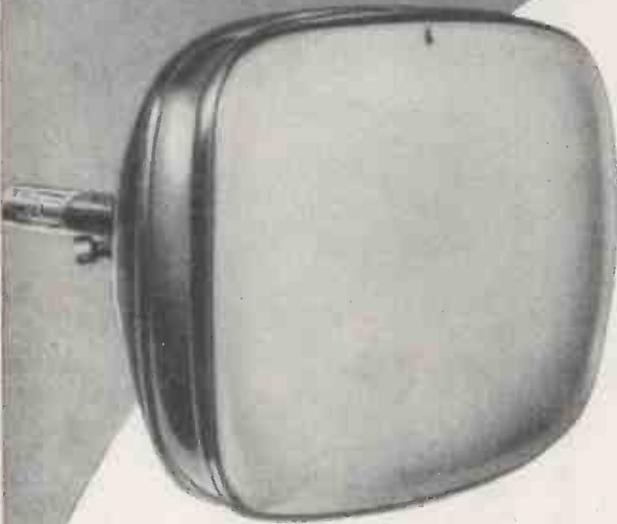
*Prompt Delivery, all types, 2,000—20,000 kc/s*

*When ordering 10X replacements, why not use our hermetically sealed Type 2XL?*

**CATHODEON CRYSTALS LIMITED**

LINTON • CAMBRIDGESHIRE • Telephone LINTON 223

*This*  
**ALUMINIZED**  
*Picture tube gives*



**60% brighter pictures  
 more contrast  
 extra tube life**

**A**N Ediswan Mazda aluminized picture tube gives a picture 60% brighter and more contrasty than is possible with an ordinary tube.

In addition, Ediswan aluminizing protects the screen from ion burn and, with the new Ediswan ion trap tetrode gun to protect the cathode, tube life is increased.

Ediswan production methods, which include the special in-line vacuumizing system, ensure a higher, more uniform standard of lasting efficiency. For complete satisfaction demonstrate and recommend Ediswan Mazda aluminized picture tubes.

**EDISWAN**  
 M A Z D A

**ALUMINIZED CATHODE RAY TUBES**

THE EDISON SWAN ELECTRIC COMPANY LIMITED,  
 155 Charing Cross Road, London, W.C.2 and Branches.  
*Member of the A.E.I. Group of Companies.*



**NATION WIDE SERVICE**

6 fully equipped cathode ray tube service depots provide better, quicker tube testing should the need arise. Stocks of tubes are available in 26 Ediswan Offices. Only Ediswan give such complete backing to the Trade.

RV9

# Advance

audio signal generator



COVERS  
15 c/s TO 50,000 c/s

ACCURACY  
PLUS/MINUS 2%  
PLUS/MINUS 1 c/s

LOW DISTORTION

1 WATT OUTPUT  
INTO 600 OHMS  
OVER ENTIRE  
RANGE

## THE TYPE "J.1."

This model completely covers the wide range of 15 c/s to 50,000 c/s in three ranges, with an accuracy of  $\pm (2\% + 1 \text{ c/s})$ . Output (continuously variable) into 600 ohms, 0.1 mW. - 1W (0.25 - 25 v)  $\pm 2 \text{ db}$ , the output impedance approximating to 600 ohms over the whole range. Max. output into 5 ohms is greater than  $\frac{1}{2}$  watt. A 20 db attenuator may be switched into use when a very accurate output impedance is required. The total harmonic and hum content as compared with fundamental above 100 c/s is better than 34 db down (2%) at full output, and better than 40 db down (1%) at 0.1 watt.

Weight 20 lb.                      Size  $13\frac{1}{2}'' \times 10\frac{1}{2}'' \times 8\frac{1}{4}''$

Full technical data on leaflet W/29

LIST PRICE (IN U.K.)

£35 : 12s.

The Type 'J2' similar to the Type 'J1,' but with output voltage meter.

LIST PRICE (IN U.K.) £45

ADVANCE COMPONENTS LIMITED · MARLOWE ROAD · WALTHAMSTOW · LONDON · E.17

'Phone: LARKSwood 4366/7/8.

'Grams: Attenuate, Walt, London.

# V.H.F. AND COMMERCIAL TV

mean  
new  
interest  
for  
you

There will be two new reasons, at Britain's 1955 National Radio Show, why your visit will have special importance. New V.H.F. Radio Sets using Frequency Modulation will be on display . . . also there will be a range of Multi-Channel Sets designed to receive commercial TV.

Throughout the Show—in Radio, Television, Telecommunications and Electronics—you will find features which will arouse tremendous interest. *It will be a truly valuable visit—make your arrangements for it NOW.*

AT THE BRITISH NATIONAL

## radio show

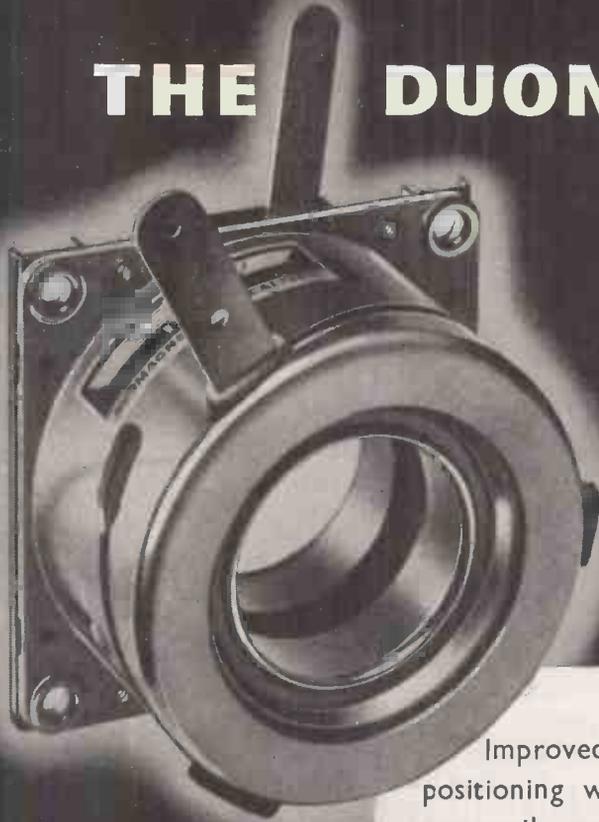
LONDON

AUGUST 23 — SEPTEMBER 3

Overseas visitors may obtain full information from  
THE RADIO INDUSTRY COUNCIL, 59 RUSSELL SQ., LONDON, W.C.1, ENGLAND  
Telegrams: Oidarlon, Westcent. London.  
Apply to your local B.O.A.C. or B.E.A. Agent for travel information.



# THE DUOMAGNETTE



## THE LATEST ELAC FOCALISER

*Leading the  
field in TV  
components*



Improved beam focus and picture positioning with minimum effect on scan coils and ion trap assemblies.

- Fitted with latest type dual "Magnadur" sintered Oxide Magnets.
- Magnets DO NOT ROTATE during adjustment.
- Friction damping ensures smooth positive movement without backlash.
- Rapid and easy adjustment of focus and picture position.

### RETAIL PRICES IN U.K.

Type FD12/90 (Low flux)	.....	22/6
Type FD13/90 (Medium flux)	.....	23/-
Type FD14/90 (High flux)	.....	25/-

## ELECTRO ACOUSTIC INDUSTRIES LIMITED

Stamford Works, Broad Lane, Tottenham, N.15

Telephone: Stamford Hill 5606 (3 lines)



## FLEXIBLE REMOTE CONTROL OUTFITS

Our experience in the industrial field has indicated that there is a definite need for this type of outfit offering facilities for making prototype flexible remote controls as required.

The two gauges of Remote Control flexible shafts in these outfits cover the range of torque loadings required for • volume controls • all types of wave change switches • condensers • all controls likely to be met in electronic, radio and television equipment.

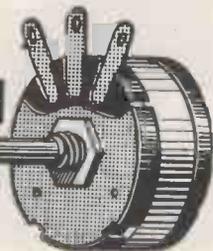
These outfits are reasonably priced and comprise:

- No. 130 (.130 in. dia.) for remote controls up to 4 in. in length.....£7. 0.0
- No. 150 (.150 in. dia.) for remote controls up to 6 in. in length .....£7.10.0

(For use without flexible casing)



BRITANNIA WORKS, 25-31 ST. PANCRAS WAY,  
LONDON, N.W.1. Telephone: EUSton 5393



The S. S. White Company will be pleased to advise which Outfit is most suitable for specific applications.

A detailed Parts List is available upon request.



# Garrard

## TRANSCRIPTION MOTOR

# 301

Features that the enthusiast will appreciate are the suppression of switch clicks, the extra heavy balanced turntable, and the very fine degrees of speed control available. Each of the nominal speeds, 78, 45 and  $33\frac{1}{2}$  r.p.m. can be adjusted by approximately  $2\frac{1}{2}\%$ . Wow and Flutter have been reduced to less than 0.2% and less than 0.05% respectively. The model is equipped for dual voltage ranges of 100 to 130 and 200 to 250 volts, 50 or 60 cycles according to the motor pulley fitted. The 301 is finished in quality grey tone enamel, is fully tropicalised and is supplied complete with plastic stroboscope, special grease, all fixing screws, washers, template and instruction manual.

*Supplies are limited, see your dealer now.*

**GARRARD ENGINEERING AND MANUFACTURING CO. LTD.**

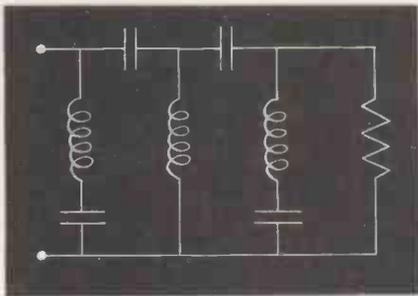




## Filtration

There may be an art in making good coffee, but even with the most fragrant brew the filtration problem is quite a simple one: to separate the infusion from the grounds which have a size ratio of 1:10,000. By comparison, many *electrical* filters are called upon to discriminate between wavelengths whose ratio is only 1:2. What is more, they must maintain their performance, with scientific accuracy, in spite of varying temperature; they must be economical; they must be small. If this kind of conflicting requirement is giving you a headache you will find strong,

black coffee merely a palliative; the cure is to specify Suflex Polystyrene Capacitors.



### Suflex Polystyrene Capacitors

- High Q
- Excellent stability
- Compensating negative temperature coefficient

*A quality component which may be economically used in commercial equipment*

**SUFLEX**  
*Limited*  
LONDON

35 BAKER STREET, LONDON W1  
Telephone: WELbeck 0791 Cables: Suflex London

**An**  
**OUTSTANDING**  
*Bass*  
**UNIT**



**GOODMANS**  
**15 WATT** 12 inch  
**AUDIOM 60**

The 12-inch Audiom 60 is a versatile single-cone medium heavy duty re-producer with an outstanding smoothness in response and performance. It is available with 35, 55 or 75 c.p.s. bass resonances, the first two types being ideally suited for use as bass units in crossover systems.

**BRIEF SPECIFICATION :**

Fundamental Resonance—	
Cone Type 1205 (for P.A.) .....	35 c.p.s.
Cone Type 1208 (for Bass repro.) .....	55 c.p.s.
Cone Type 1210 (for Bass repro.) .....	75 c.p.s.
Power Rating .....	15 watts peak A.C.
Flux Density .....	14,000 gauss
Nett Weight .....	12lb. 13oz. (5.8 kg.)
<b>PRICE</b> .....	<b>£8.12.6</b> (tax free)



**LOUDSPEAKERS WITH A MESSAGE OF PERFECTION**

**POST THE COUPON** for details of the Audiom 60, and the Axiom range of High Fidelity Loudspeakers, details of crossover systems, bass reflex chambers, etc.

**GOODMANS INDUSTRIES LTD.**

AXIOM WORKS · WEMBLEY · MIDDX. WEMBLEY 1200

U.S.A. AGENTS: ROCKBAR CORPORATION INC.  
 215 East 37th Street, New York 16

**TO: GOODMANS INDUSTRIES LTD.**  
**AXIOM WORKS, WEMBLEY, MIDDX.**

*I am interested in:*

Name.....

Address .....

.....

.....

WW/6/55 *Please write in block capitals.*

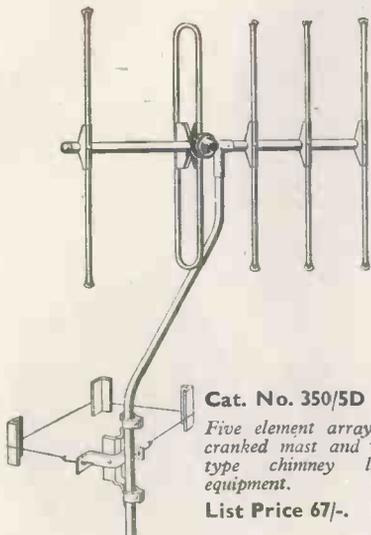
# ANTIFERRENCE

## BAND 3 AERIALS

... A comprehensive new range  
for every requirement.

Aerials as illustrated are now available for the reception of Band 3 transmissions in Channels 8 or 9 and at prices that reflect the careful planning and thought that has gone into their construction! Our wide experience gained from Antiferrence factories on the American continent has played a large part in the development of this completely new range of aerials designed for efficiency—with economy. All the fine features of the Antiferrence Band 1 range are incorporated in these models; they are easy to instal, being fully pre-assembled and aligned for peak performance on the Band 3 frequencies.

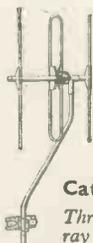
When ordering, please quote Channel for which aerials are required. E.g., CAT. No. 350/2D/ . . . (quote Channel reference here).



**Cat. No. 350/5D**

Five element array with cranked mast and NEW type chimney lashing equipment.

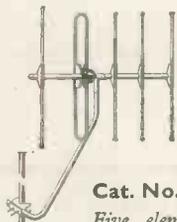
List Price 67/-.



**Cat. No. 330/2D**

Three element array with cranked mast and universal surface mounting bracket.

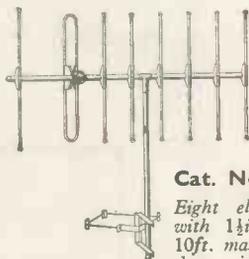
List Price 42/6



**Cat. No. 350/1C**

Five element array with swan-neck mast and "U" bolt grip for fitting to existing masts from 1/2 in. up to 2 in.

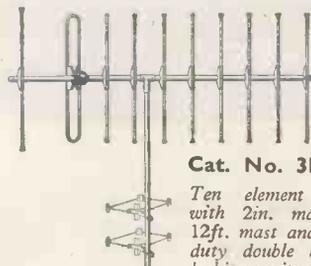
List Price 52/6



**Cat. No. 381/6G**

Eight element array with 1 1/2 in. mast cap 10 ft. mast and heavy duty single chimney lashing equipment type 6.

List Price 134/-



**Cat. No. 3102/7H**

Ten element array with 2 in. mast cap 12 ft. mast and heavy duty double chimney lashing equipment type 7.

List Price 178/6

### ANTIFERRENCE LIMITED

Bicester Road, Aylesbury, Bucks.

Telephone: Aylesbury 1467/8/9

## A NEW-PRINCIPLE A-C AUTOMATIC VOLTAGE STABILISER



We have now had released to us by a Government Department the design of our "A.C. Mains Regulator, Automatic, Step, Mark II", and are therefore manufacturing this unit for general sale. It ideally fills the need for a cheap, small and light Stabiliser. Although it measures only 8½ in. x 4½ in. x 5 in., weighs as little as 11 lbs., and costs only £24 net, it has a performance fully equal to any similarly rated Automatic Stabiliser of the resonated, saturated core type, without any of the disadvantages.

ASR-1150 has a pure output waveform, is unaffected by changes in mains frequency, and works equally well from no-load to full load, which is 1150 VA. It has a stabilised output at 230V unless otherwise ordered.

Many other Automatic Voltage Stabilisers are now manufactured by us, and all are available for immediate delivery. In some cases the constancy of output is as high as 0.15%. Models are available from 200 VA to 30 kVA, single phase. 3-Phase Stabilisers are also available. Prices are *extremely* competitive.

We can supply from stock all types of American tubes, condensers, valves, potentiometers, etc.

MEMO: If you are interested in infinitely-variable Transformers, do not forget the almost indispensable "VARIAC" (Reg'd. Trademark). Models are available from 170VA to 21kVA. Our Catalogue V-549 (3rd Edition) tells the whole story and will gladly be mailed free and post free, on request.

### The NEW "ASR-1150" costs only £24 net

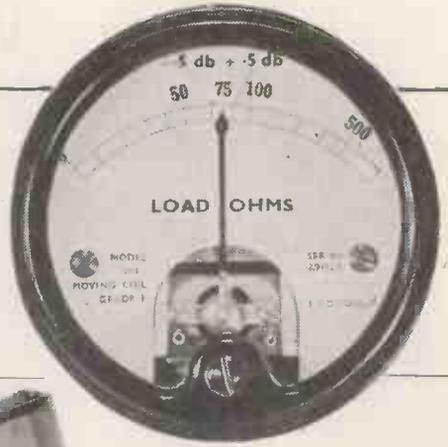
Complete information is obtainable from:

**CLAUDE LYONS LTD., STABILISER DIVISION,**  
HEAD OFFICES & WORKS: 76 OLDHALL STREET, LIVERPOOL 3, LANC.  
SOUTHERN FACTORY: VALLEY WORKS, WARE ROAD, HODDESDON, HERTS.  
(A10 main London/Cambridge Road, at Junction of A602)

# Output Level Stabilised to $\pm \frac{1}{2}$ db

OVER THE FULL FREQUENCY RANGE OF 10 kc/s — 10 Mc/s

To the established features of the Wayne Kerr Video Oscillator has been added, at the suggestion of the B.B.C., a 50 cycle Square Wave for the examination of the low frequency characteristics of Video networks. This output is achieved by interrupting a stable D.C. Source with a polarised relay energised from the mains. The rise time of the square wave is better than 0.02 $\mu$  sec.



*In transportable case £155, or for standard 19" Rack mounting £148.*

## Specification

**FREQUENCY RANGE:** 10 kc/s — 10 Mc/s, in 6 ranges, and 50 cycle Square Wave.  
*Stability:* Better than 1 in 10<sup>3</sup> in one hour.  
*Accuracy:* 1%.

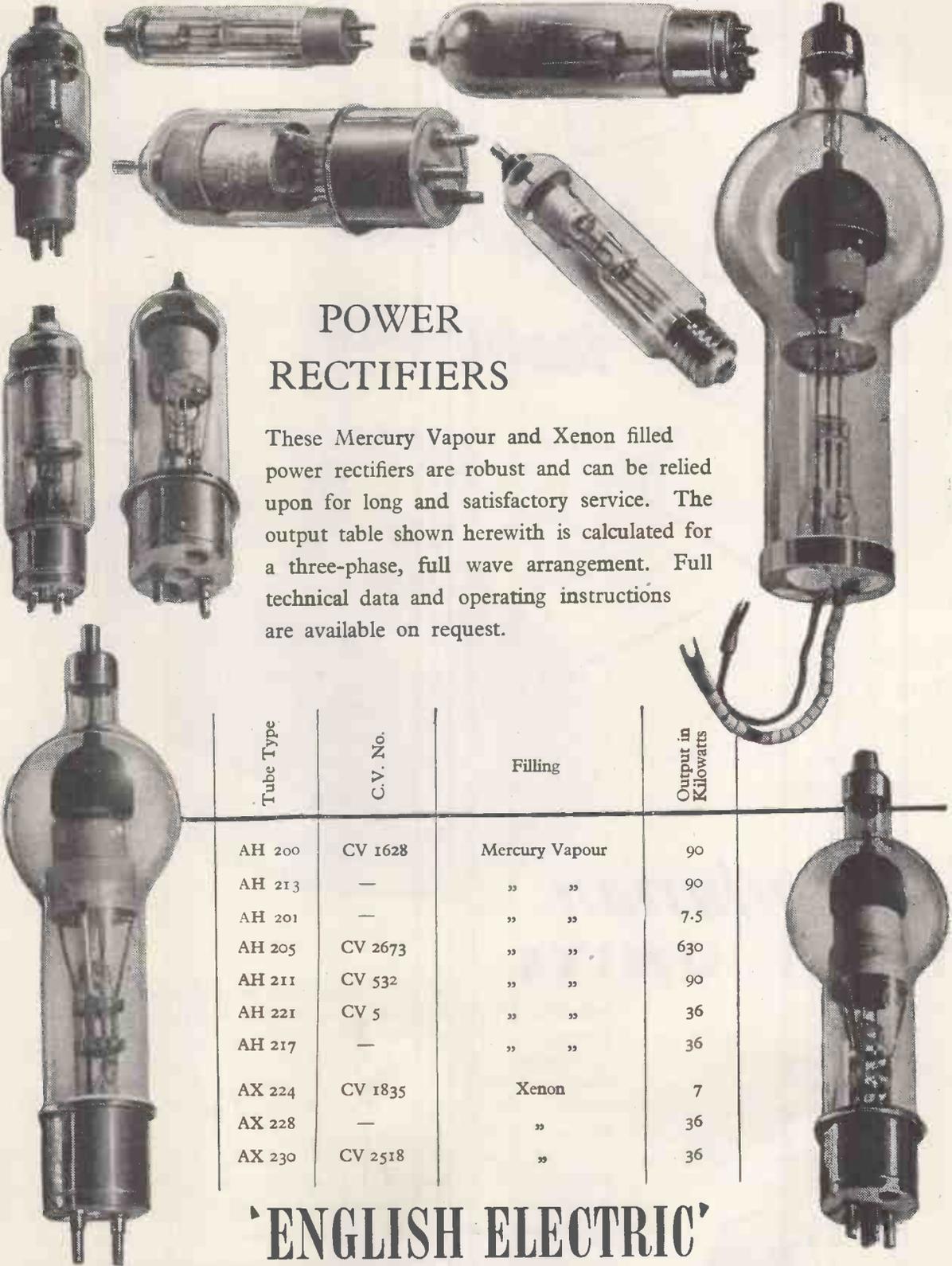
**OUTPUT RANGE:** + 10 db to -50 db on 1V p-p.  
*Level:* Constant to  $\pm 0.5$  db at any Frequency [setting].  
*Impedance:* 75  $\Omega$ .

**TOTAL HARMONIC CONTENT:** Less than 1%.



## POWER RECTIFIERS

These Mercury Vapour and Xenon filled power rectifiers are robust and can be relied upon for long and satisfactory service. The output table shown herewith is calculated for a three-phase, full wave arrangement. Full technical data and operating instructions are available on request.



Tube Type	C.V. No.	Filling	Output in Kilowatts
AH 200	CV 1628	Mercury Vapour	90
AH 213	—	” ”	90
AH 201	—	” ”	7.5
AH 205	CV 2673	” ”	630
AH 211	CV 532	” ”	90
AH 221	CV 5	” ”	36
AH 217	—	” ”	36
AX 224	CV 1835	Xenon	7
AX 228	—	”	36
AX 230	CV 2518	”	36

# 'ENGLISH ELECTRIC'

**ENGLISH ELECTRIC VALVE CO. LTD.**

*Waterhouse Lane, Chelmsford  
Telephone: Chelmsford 3491*

# World-wide testimony

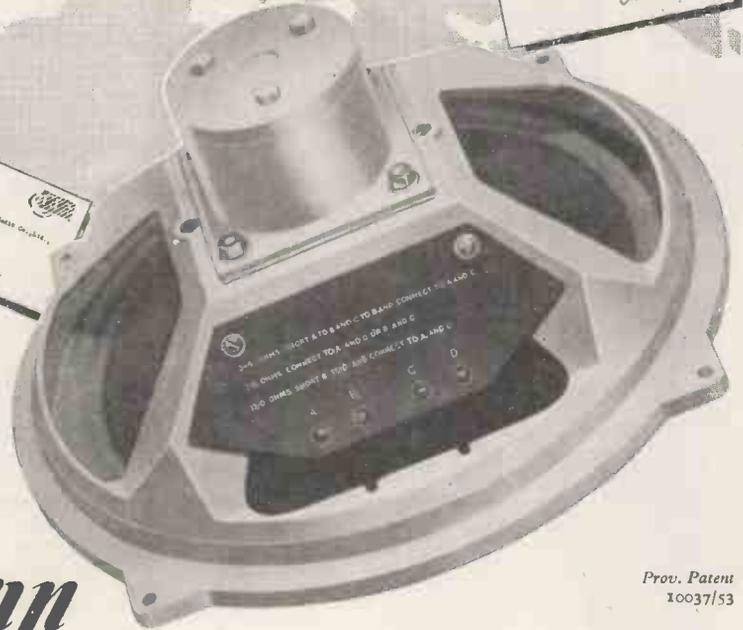
INCORPORATING  
THE PATENTED  
CAMBRIC CONE &  
UNIVERSAL IMPEDANCE  
SPEECH COIL

## Stentorian HI-FI UNITS

Write for descriptive leaflets, or ask your usual dealer to demonstrate. Alternatively, these and other Stentorian speakers may be heard at our London Office (109 Kingsway, W.C.2) any Saturday from 9 a.m. to noon.



WHITELEY ELECTRICAL RADIO CO. LTD · MANSFIELD · NOTTS



Prov. Patent  
10037/53

Every claim we have made for these remarkable units has been substantiated by experts and users—they have produced the largest volume of unsolicited testimony ever known in the history of loudspeaker manufacture.

From every part of the world we are told that the quality of reproduction is unrivalled except at many times the price—that these units have enabled everyone to enjoy High Fidelity at realistic cost. We are truly grateful for this amazing response.

Points to note: patented Cambric Cone, high flux density Alcomax magnet, die-cast chassis, Universal impedance speech coil (at 3, 7.5 and 15 ohms) on 8, 9 and 10 inch models. Prices from 37/6 to £9.15.6 (tax paid).

Ready-to-assemble Bass Reflex Console Cabinet for 10" or 12" unit £10.10.0.  
Corner Console Cabinet for 8" unit £5.10.0.

# High Fidelity Playback

THROUGH YOUR OWN FAVOURITE AMPLIFIER

with the *Playtime*

## TAPE RECORDER

For High Fidelity playback through that favourite radio or amplifier, the "Playtime" is superb. The frequency response is limited only by that of the playback medium. Completely self-contained for recording; simple joystick control for all functions; ONE HOUR'S PLAYING TIME.

### BRIEF SPECIFICATION

★ High Fidelity twin track recording heads ★ Infinite impedance output ensuring perfect matching ★ Powered by specially designed motor ★ Minimum wow and flutter ★ Built-in 3-stage specially matched pre-amplifier with miniature Mullard valves ★ Weight 16lb. ★ Overall size 12½in. x 10in. x 4½in. ★ For use on A.C. mains 220/250 v.

**26 gns.** Or complete with high fidelity desk microphone and one hour spool of tape for £31/4/6.

The "Playtime" is also available as a complete recorder—the "Playtime Plus," a full hour's recording and playback for only **35 gns.** Complete with microphone and tape.



Complete with tape and microphone.

**55 gns.**

## EDITOR SUPER TWO-SPEED

De luxe version of the "Editor" incorporating mixing and monitoring facilities and single knob control super tape deck. IDEAL FOR USE WITH PRE-RECORDED TAPES. In padded simulated crocodile case. For 200-250 v. A.C. mains.

**Buy a British-made Tape Recorder!**

### BUY ON THE M.O.S. PERSONAL CREDIT PLAN

Send 15 per cent deposit with your order, with remainder spread over any period up to 18 months. All proprietary brands of equipment advertised in this Journal are available from us under the M.O.S. Personal Credit Plan.

# MAIL ORDER SUPPLY CO.

E. & G.

The Radio Centre

33, Tottenham Court Road · London · W.1 · Tel. MUS 6667

**Editor TWO-SPEED**  
The smallest mains-operated fully automatic two-speed recorder with 7in. spools. IDEAL FOR USE WITH PRE-RECORDED TAPES. Two hours' full playing time. Independently variable Bass and Treble controls. For 200-250 v. A.C. mains.

**45 gns.**  
Complete with tape and microphone.



# NEW ARCOLECTRIC SIGNAL LAMPS

## For Low Voltage or Mains

Illustrated are a few signal lamps taken from our wide range. The insulation of every Arcolectric signal lamp will resist a flash test of 1,500 volts A.C.

The S.L.90 illustrated here is a typical Arcoelectric low voltage signal lampholder. It is designed to accept popular M.E.S. bulbs. The bulb is accessible from front or rear of panel. The domed plastic lens surrounded by a polished chrome bezel gives a most attractive panel appearance. This holder can be fixed in a single  $\frac{3}{4}$ " hole.

The mains voltage signal lamp S.L.88/N is supplied complete with an M.E.S. neon tube and a suitable series resistance.

Write for Catalogue No. 128

**ARCOLECTRIC**  
SWITCHES · LTD



S.L.88/N



S.L.90



S.L.86



S.L.82



S.L.92

CENTRAL AVENUE, WEST MOLESEY, SURREY. TELEPHONE: MOLESEY 4336 (3 LINES)



Actual size of magnet

Photograph by courtesy  
of The Acoustical  
Manufacturing Co. Ltd.

**MUREX SINTERED  
PERMANENT MAGNETS**  
*are used in this new*  
**FERRANTI RIBBON PICK-UP**  
*(designed by D. T. N. Williamson)*

Yet another example of the use of Murex Sintered Magnets where the need is for high flux density and magnetic stability. In this application, as in many others, Murex Sintered Magnets continue to give accurate and reliable service.

**MUREX LIMITED** (Powder Metallurgy Division)

**RAINHAM · ESSEX**

Rainham, Essex 3322

London Sales Office: CENTRAL HOUSE, UPPER WOBURN PLACE, W.C.1. EUSon 8265

**STAND 5 (Block B) BRITISH INSTRUMENT INDUSTRIES EXHIBITION, Earls Court, JUNE 28-JULY 9**

**AN  
OUTSTANDING**  **PAIR**



**60-WATT H.F.  
FIXED STATION**

1.6 — 14 Mc/s

Newly designed to use the most modern valves and components available, this station incorporates local or remote push-button selection of up to four channels, remote control being possible to a distance of 15 miles.

**50-WATT V.H.F.  
FIXED STATION**

60 — 184 Mc/s

Employing the latest techniques, this most efficient station is of particular value for fixed and mobile V.H.F. schemes, ground-to-air control of aircraft and point-to-point links. Six-channel operation is available if required.



**Telecommunications**

CAMBRIDGE ENGLAND



Pye (New Zealand) Ltd.  
Auckland C.I., New Zealand

Pye Canada Ltd.  
Ajax, Canada

Pye-Electronic Pty., Ltd.  
Melbourne, Australia

Pye (Ireland), Ltd.  
Dublin, Eire

Pye Radio & Television (Pty.) Ltd.  
Johannesburg  
South Africa

Pye Limited  
Mexico City

Pye Limited  
Tucuman 829  
Buenos Aires

Pye Corporation of America  
5th Avenue Building  
200, 5th Avenue, New York

**PYE LIMITED**

**CAMBRIDGE**

**ENGLAND**

ANNOUNCING THE  
**'SECUNDUS'**  
FOR  
SUB MINIATURE WORK  
by

**ADCOLA**  
PRODUCTS LIMITED  
(Regd. Trade Mark)

$\frac{1}{8}$ "  
BIT

Illustrated  
List No. 70  
(Actual Size)

**SPECIAL FEATURES**

1. Traditional British quality.
2. Designed temperatures.
3. Weight 2 oz. (excluding flex).
4. Length 8 in.
5. 18 watts.
6. Practical temperature for high class solder jointing.

Supplied in all  
voltage ranges

Models  
to  
cover all fields  
of the  
Radio, TV, and  
Electronic Industry.

For all Soldering  
Instruments  
and  
Allied equipment,

WRITE TO:—

**ADCOLA**  
PRODUCTS LIMITED  
(Regd. Trade Mark)

Head Office and Sales

**GAUDEN RD.  
CLAPHAM HIGH ST.  
LONDON S.W.4** Telephone  
**MACAULAY 4272**

**TRUVOX**

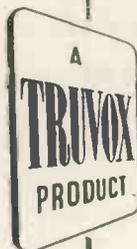
TAPE RECORDER COMPONENTS  
AND ACCESSORIES



**TAPE DECKS  
MARK IIIU SERIES**

Technically identical with  
the world-famous Deck  
supplied, in bulk, to Recorder  
Manufacturers. With B.S.S.  
sense of tracking, it is fully  
approved for playback of  
pre-recorded tapes. List  
Price remains at 22 gns.

Details of complete recorders incor-  
porating the TRUVOX Tape Deck are  
available on request.



The full range of Truvox Tape  
Recorder Components and  
Accessories is listed below—send  
for fully descriptive leaflets.

**TAPE DECKS · AMPLIFIER · RADIO  
JACKS · FOOT CONTROL · TELEPHONE  
ADAPTOR · MONOSET & STETHOSET  
HEADPHONES · CORNER DIFFUSION  
SPEAKER**

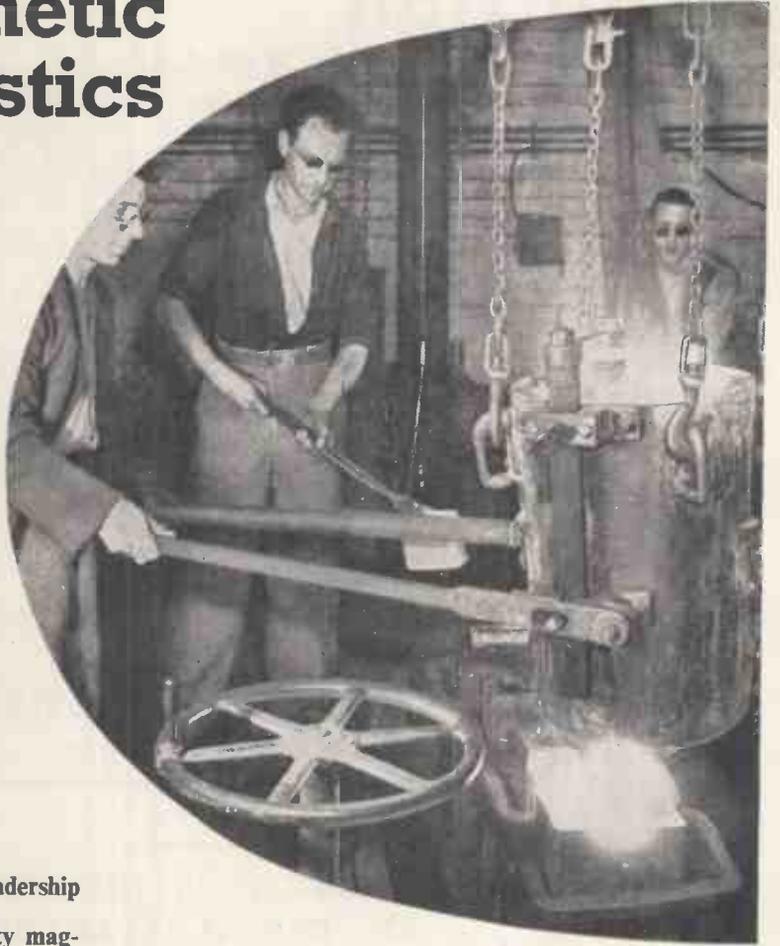
**TRUVOX LIMITED**

Sales Office: 15, LYON ROAD, HARROW, MIDDX.  
Tel.: Harrow 9282  
Tech. & Service Depts.: 328, THE BROADWAY, STATION ROAD,  
HARROW, MIDDX. Tel.: Harrow 4455

# good magnetic characteristics

*demand*

# CAREFUL CASTING CONTROL



*Standard* maintains its established leadership in the manufacture of high permeability magnetic alloys by constant vigilance in the control of each and every production process, one of which is illustrated here. Produced by a Company which has the unique advantage of being a large-scale user of its own magnetic materials, a long experience of the applications of these materials gives full appreciation of the properties essential for uniform electrical characteristics and stable performance.

It will pay you to investigate the capabilities of *Standard* magnetic alloys with relation to your specific requirements.

● PERMALLOY 'C' for highest initial permeability, useful for wide-band frequency transformers, current transformers, chokes, relays and magnetic shielding.

● PERMALLOY 'B' has lower initial permeability than Permalloy 'C' but higher values of flux density. Suitable where high permeability to alternating field is required superimposed upon a steady polarising field.

● PERMALLOY 'D' for very high resistivity without undue lowering of the maximum flux density. Variation of permeability with frequency is small. Ideal for H.F. applications.

● PERMALLOY 'F' for high flux density, very rectangular hysteresis loop, with a retentivity of at least 95% of its saturation value and low coercive force. Ideal for saturable reactors, magnetic amplifiers, digital computers, memory devices, etc.

● V-PERMEUDUR for high permeability with a very high value of maximum flux density. Finds special application for use as high quality receiver diaphragms, also motor generators and servo-mechanisms in aircraft where weight and volume are important factors.



## *Standard Telephones and Cables Limited*

Registered Office: Connaught House, Aldwych, W.C.2

TELEPHONE LINE DIVISION: North Woolwich, London, E.16

# Evolution

## WHARFEDALE W10/CSB 10" LOUDSPEAKER

First introduced in 1938, this 10in. speaker has been improved in stages and now embodies the following details of good design:

Flux density 14,000 lines. Total flux 74,000 lines.

Rigid, open, die-cast chassis.

Cone with bakelised apex and special radial corrugations.

Centring device in bakelised fabric.

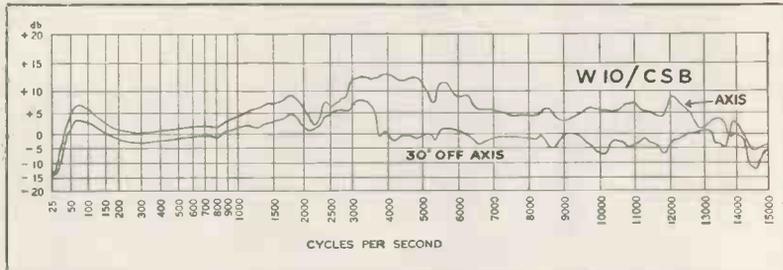
Aluminium dome.

Cloth suspension, which involves hand-assembly by experts who have attained a world-wide reputation.

Bass resonance now 45 c/s.

Any speaker maker could produce a loudspeaker including some or all of these specifications. Only WHARFEDALE can produce one which sounds like the W10/CSB.

After the Super 12/CS/AL—which costs £17 10s. 0d.—the W10/CSB is the best single speaker in the Wharfedale range. At £9 5s. 0d. plus £3 1s. 6d. P.T. the performance is outstandingly good; some idea of the frequency range is given by the response curve.



32-page catalogue free on request.

# Wharfedale Wireless Works Ltd.,

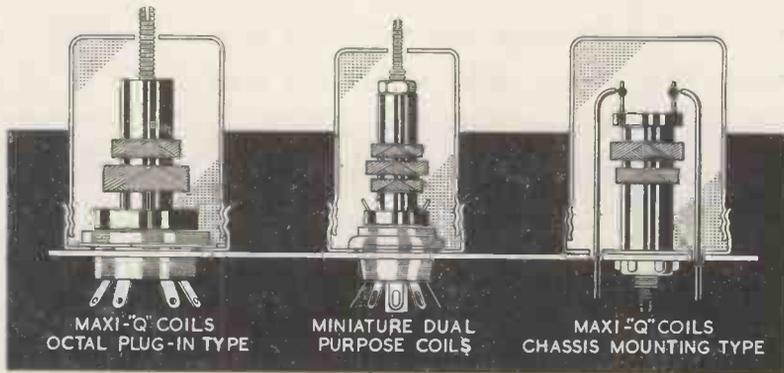
BRADFORD ROAD · IDLE · BRADFORD · YORKS

Telephone : Idle 123516 Grams : Wharfedel, Idle, Bradford

**MAXI-Q**  
REGD.

"MAXI-Q" IS THE REGISTERED TRADE MARK OF DENCO (CLACTON) LTD. IT IS ALSO A MARK OF TECHNICAL SUPERIORITY AND GUARANTEED QUALITY

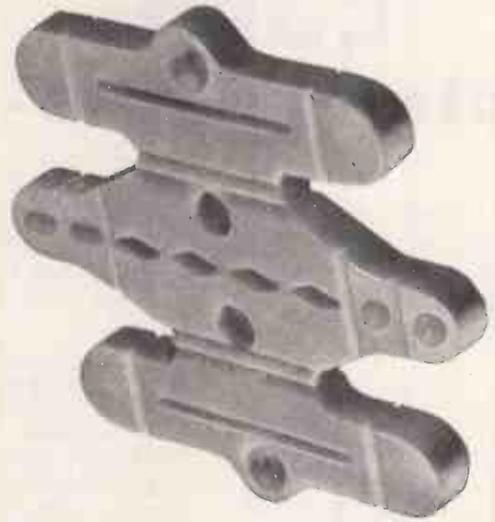
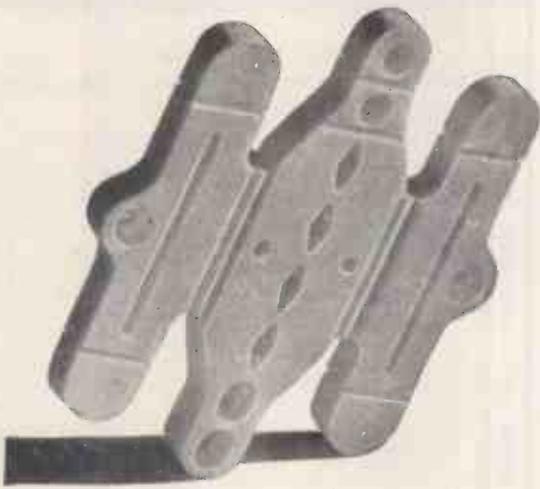
Coverage from 3.8 to 2,000 metres in 7 ranges—Each coil is packed in an aluminium container which may be used as a screening can for the coil itself—Brass threaded adjustable iron cores—Colour coded moulded polystyrene formers—Chassis/Plug-in Technical Bulletin DTB.1 1/6—Dual Purpose Technical Bulletin, DTB.4 1/6—Colour Code Identified Coils: BLUE Signal Grid Coil with Aerial Coupling winding—YELLOW Signal Grid Coil with intervalve coupling winding—GREEN Grid Coil with reaction and coupling windings—RED Superhet Oscillator for I.F. of 465 Kc/s.—WHITE Superhet Oscillator for 1.6 Mc/s. Prices range from 3/11 to 4/9 each.



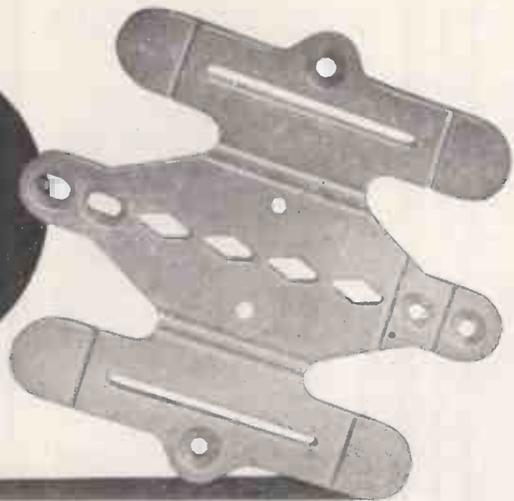
Obtainable from all reputable stockists or in cases of difficulty direct from works. General Catalogue covering technical information on full range of components 1/- post paid.

**DENCO (CLACTON) LTD.** 357/9 OLD ROAD, CLACTON-ON-SEA, ESSEX

STOP PRESS: The "Practical Wireless" "Fury Four" uses the Maxi-Q Yellow (3/11) and Green Chassis Mounting Coils (4/9). (Please state frequency range when ordering.) Also available are the "Fury Four" Chassis and Paxolin Front Panel, 19/6. Maxi-Q "Home Constructor's Car Radio" bulletin, 2/6, used the Miniature Dual Purpose Coils, Range 2 (Medium Wave), Red, Blue and Yellow, 3/11 each. The "Wireless World" "No Compromise" R.F. Tuner used Range 1 and 2 Blue and Yellow Chassis Coils, 3/11 each. The "Wireless World" "Midget Three Valve A.C. Mains Receiver" used C2 and C3 TRF Coils, 9/- per pair.



**from every  
point of view**



'Frequentite' is the most suitable insulating material for all high frequency applications. Seventeen years ago we introduced the first British-made low-loss ceramic, and consultation with us before finalising the design of new components is a wise precaution.

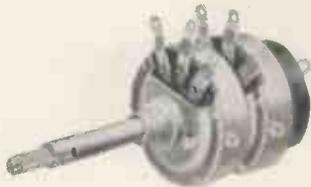
**STEATITE & PORCELAIN PRODUCTS LTD.**

Head Office: Stourport-on-Severn, Worcestershire. Telephone: Stourport 111. Telegrams: Steatins, Stourport



# WHY ENGINEERS SPECIFY EGEN potentiometers —

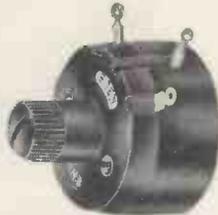
Egen Potentiometers are based on long experience of requirements of television and electronic equipment manufacturers. In design, dependability, accuracy and freedom from wear they are *outstanding*, but, above all, they are completely NOISELESS.



**DUAL POTENTIOMETERS** with concentric operating spindles. The new Egen Dual Potentiometers incorporate all these outstanding design features — multiple contact rotors, smooth easy movement, thorough screening between sections, plus a convenient soldering tag for earthing screened connections.

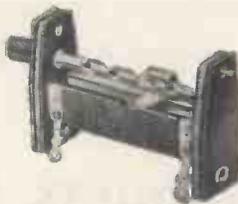
on each metal case. Switch and Potentiometer soldering tags are of high-grade brass heavily silver plated for easy soldering; they are positively located and withstand soldering heat and bending without loss of rigidity. Control spindles can be supplied to suit customers' requirements.

**PRE-SET POTENTIOMETERS.** Completely enclosed in high-grade phenolic mouldings. Solder tags heavily silver plated for quick soldering. Fully insulated spindles with integral control knobs. Tapped for 2-hole 6 B.A. fixing on 3" centres. Type 126, wire-wound. Type 127, carbon.



**STANDARD CARBON POTENTIOMETERS.** Made by an entirely new method ensuring a highly stable resistance element, which is also very durable. Silent and smooth in operation, these controls offer both mechanical and electrical reliability. Soldering tags are heavily silver plated to resist oxidation, and the mains switch has an efficient quick make-and-break action.

**PRE-SET RESISTOR.** This has a wire-wound resistance element, traversed by a nickel-silver slider. Adjustment is effected by a worm drive spindle fitted with a knurled and slotted knob. This component is smooth and noiseless in action and is designed to meet the many and varied requirements of the Electronic Industry. Egen pre-set resistors can be supplied in multi-bank assemblies to suit individual requirements. There are also twin-track models, and types with an electrically divided slider, giving adjustment on two resistors with one operation.



**EGEN ELECTRIC LTD.** Charfleet Industrial Estate, Canvey Island, Essex • Phone: Canvey Island 691/2

# MAINS TRANSFORMERS

FULLY INTERLEAVED

SCREENED AND IMPREGNATED. ALL GUARANTEED

ALL PRIMARIES ARE 200/250 v. Half Shrouded.

HSM 63 (Midget). Output 250-0-250 v. 60 m/a., 6.3 v. at 3 amps., 5 v. at 2 amps. ....	16/3
HS63. Output 250-0-250 v. 60 m/a., 6.3 v. at 3 amps., 5 v. at 2 amps. ....	16/6
HS40. Windings as above. 4 v. at 4 amps., 4 v. at 2 amps. ....	16/6
Output.	
HS2. 250-0-250 v. 80 m/a. ....	19/-
HS3. 350-0-350 v. 80 m/a., 19/-.	19/-
HS30. 300-0-300 v. 80 m/a. ....	19/-
HS2X. 250-0-250 v. 100 m/a., 21/-.	21/-
HS75. 275-0-275 v. 100 m/a. ....	21/-
HS30X. 300-0-300 v. 100 m/a., 21/-.	21/-
HS3X. 350-0-350 v. 100 m/a. ....	21/-

Fully Shrouded

FSM63 (Midget). Output 250-0-250 v. 60 m/a., 6.3 v. at 3 amps., 5 v. 2 amps. ....	16/9
Output	
FS2. 250-0-250 v. 80 m/a. ....	21/-
FS30. 300-0-300 v. 80 m/a., 21/-.	21/-
FS3. 350-0-350 v. 80 m/a. ....	21/-
FS2X. 250-0-250 v. 100 m/a., 23/-.	23/-
FS75. 275-0-275 v. 100 m/a. ....	23/-
FS30X. 300-0-300 v. 100 m/a., 23/-.	23/-
FS3X. 350-0-350 v. 100 m/a. ....	23/-
All the above have 6.3 4-0 v. at 4 amps., 5-4-0 at 2 amps.	
FS43. Output 425-0-425 v. 200 m/a., 6.3 v. 4 amps., C.T. 6.3 v. 4 amps., C.T. 5 v. 3 amps. Fully shrouded. ....	47/6
FS50. Output 450-0-450 v. 250 m/a., 6.3 v. 2 amps., C.T. 6.3 v. 4 amps., C.T. 5 v. 3 amps. Fully shrouded. ....	67/6
FS3X. Output 350-0-350 v. 250 m/a., 6.3 v. 6 amps., 4 v. 8 amps., 4 v. 3 amps., 0-2-6.3 v. 2 amps. Fully shrouded. ....	65/-
FS160X. Output 350-0-350 v. 160 m/a., 6.3 v. 6 amps., 6.3 v. 3 amps., 5 v. 3 amps. Fully shrouded. ....	44/-
FS43X. Output 425-0-425 v. 250 m/a., 6.3 v. 6 amps., 6.3 v. 6 amps., 5 v. 3 amps. Fully shrouded. ....	63/6
HS6. Output 250-0-250 v. 100 m/a., 6.3 v. 6 amps., C.T. 5 v. 3 amps. For receiver R1355. Half shrouded. ....	26/6
HS150. Output 350-0-350 v. 150 m/a., 6.3 v. 3 amps., C.T. 5 v. 3 amps. Half shrouded. ....	27/9
F36. Output 250-0-250 v. 100 m/a., 6.3 v. 6 amps., C.T. 5 v. 3 amps. Fully shrouded. ....	29/6
FS120. Output 350-0-350 v. 120 m/a., 6.3 v. 2 amps., C.T. 6.3 v. 2 amps., C.T. 5 v. 3 amps. Fully shrouded. ....	29/9
PR1/1. Output 230 v. at 30 m/a. 6.3 v. at 1.5/2 amps. ....	21/-
FS150X. Output 350-0-350 v. at 150 m/a., 6.3 v. at 2 amps., C.T. 6.3 v. at 2 amps., C.T. 5 v. at 3 amps. Fully shrouded. ....	31/6
The above have inputs of 200/250 v.	

## OUTPUT TRANSFORMERS

MIDGET OP. 5,000Ω to 3Ω	3/9
8,000Ω to 3Ω	3/9
OP10. 10/15 watts output. 20 ratios on Full and Half Primary	17/9
OP30. 30 watts output, 20 ratios on Full and Half Primary	25/9
Williamson's O.P. Transformer to Author's specification ...	£4/13/6
Chokes for Williamson's Amplifier, 30 H. at 20 m/a.	16/6
10 H. at 150 m/a.	32/-

## FILAMENT TRANSFORMERS

All 200/250 v. Input

F3. 6.3 v. @ 3 amps. ....	9/6
F4. 4 v. @ 2 amps., 7/6.	7/6
F6X. 6.3 v. @ 0.3 amps., 5/6.	8/-
F12X. 12 v. @ 1 amp. ....	8/-
FU6. 0-2-4-5-6.3 v. @ 2 amps., 10/-.	10/-
F12. 12.6 v. tapped 6.3 v. @ 3 amps. ....	16/6
F24. 24 v. tapped 12 v. @ 3 amps. ....	23/6
F29. 0-2-4-5-6.3 v. @ 4 amps., 18/9.	17/6
FU12. 0-4-6.3 v. @ 3 amps. ....	17/6
FU24. 0-12-24 v. @ 1 amp. ....	17/6
FS. 6.3 v. @ 10 amps. or 5 v. @ 10 amps., or 12.6 v. @ 5 amps., or 10 v. @ 5 amps. ....	34/-
F6/4. Four windings at 6.3 v. tapped 5 v. @ 5 amps. each, giving by suitable series and parallel connections up to 6.3 v. @ 20 amps. ....	51/6

Quotations, etc., stamped addressed envelope please.

C.W.O. (add 1/6 in £ for carriage).

Export enquiries invited.

**H. ASHWORTH (Dept. W.W.),**  
676, Gt. Horton Road, Bradford 7, Yorks.



THE  
*Concertone*



*for*

*Incomparable*

★ *perfection* ★

*and*

★ *fidelity* ★

*in*

**TAPE RECORDING**



**48 GMS.**  
COMPLETE

TRADE  
ENQUIRIES  
INVITED

MAGNETIC RECORDER

Meticulously recording every tonal facet with complete mastery, the "Concertone" tape recorder will give you the ultimate listening pleasure that comes from superb music faultlessly recorded and reproduced.

The "Concertone" will re-create, in the home, the true image of the original performance. Whether it be Solo Violin, or Oboe, or a Full Organ with its demanding power and range, the "Concertone" with its wide frequency response, and extended dynamic range, will satisfy the connoisseur of fine music.

Simple, absolutely reliable, rugged, compact, lightweight, and easily portable, the "Concertone" will, wherever there are sounds to be recorded, serve faithfully, earning, justly, unqualified praise for its faultless performance.

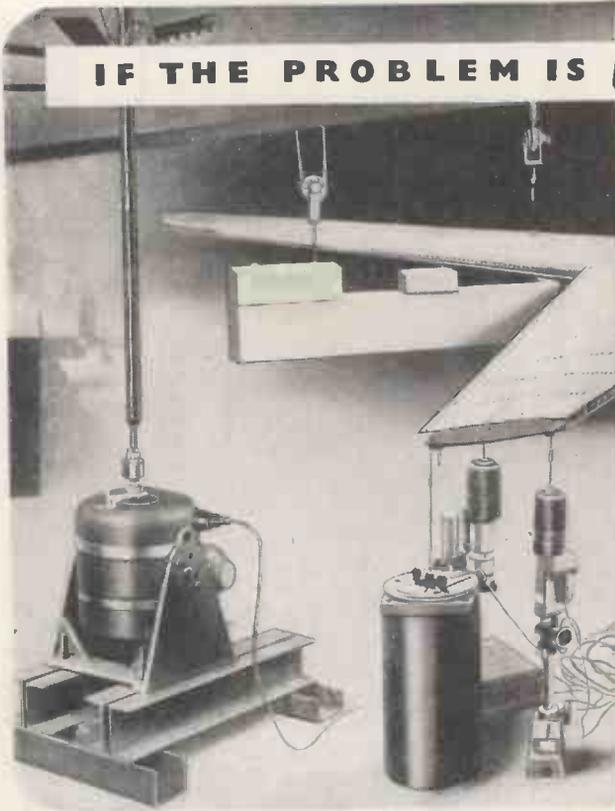
Manufactured by the company in its own precision machine shop, the tape mechanism employs three motors and a special design servomatic brake. The brake not only locks the spools securely during transit but, of greater importance, it is completely free from fade, being self-compensating for wear. Unique is the provision of a mechanical interlock which prevents faulty operation.

All Export enquiries to:—  
BARNETT SHIPPING CO.  
25 MONUMENT ST.,  
LONDON, E.C.3

Entirely Manufactured by  
**FISHER ELECTRONICS COMPANY LTD.**

ASK YOUR DEALER FOR  
A LEAFLET. IN CASE OF  
DIFFICULTY WRITE  
DIRECT (s.a.e. please).

70 BREWER STREET · LONDON · W.1      TELEPHONE · GERRARD 3376



**IF THE PROBLEM IS VIBRATION INVESTIGATION**

— the solution may be in

**GOODMANS**

**VIBRATION GENERATORS**

Today the significance of vibration—its cause and effect—is more pronounced by reason of ever faster speeds of aircraft, automobiles and many mechanisms in Industry. The higher frequencies encountered bring new problems, not the least important of which is the nature of metal fatigue. Goodmans Vibration Generators have given yeoman service in this sphere of investigation. These equipments are daily being applied to fatigue testing, electronic component testing, valve microphony testing, torsional and flexure testing in metals and plastics, etc.

*If vibration presents a problem to your products—consult Goodmans. Write for technical data to "Vibration Dept. W."*

**GOODMANS INDUSTRIES LIMITED**

AXIOM WORKS · WEMBLEY · MIDDX.

Telephone: Wembley 1200 (8 lines)

**RADIO  
EXPORT**

**TUBES  
ONLY**



1,000 types  
of Receiving and  
Transmitting Radio  
Tubes available ex stock.

**HALL ELECTRIC LTD**  
Haltron House, 49-55 Lisson Grove,  
London, N.W.1.

Tel.: Ambassador 1041 (5 lines) Cables: Hallectric, London

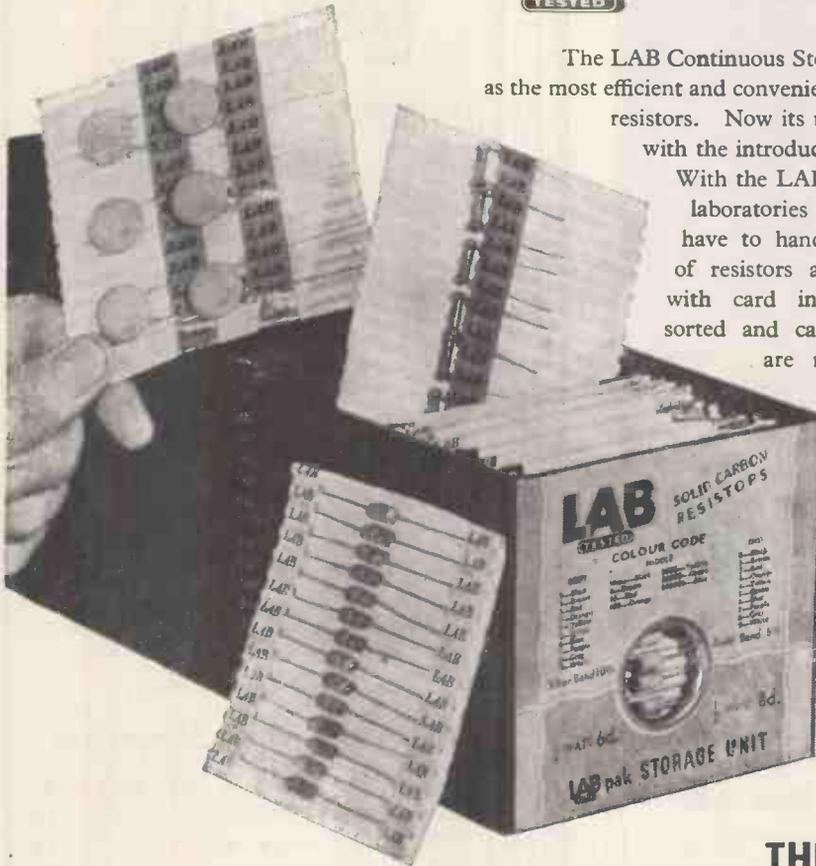
# And NOW—a range of 'CERAMICAPS' for your

## LAB Storage Unit!

The LAB Continuous Storage Unit is widely acknowledged as the most efficient and convenient method of storing and selecting resistors. Now its usefulness is still further extended with the introduction of LAB pak'd 'Ceramicaps'.

With the LAB Unit, research and experimental laboratories and small production groups have to hand immediately, a complete range of resistors and 'Ceramicaps', easily selected with card index simplicity from some 700 sorted and carded components. Empty cards are merely replaced with full ones from stock.

The LAB unit is supplied FREE with initial purchase to your specification. Standard assortments available. Each LAB Unit can be used to store one type of component exclusively, or quantities of the complete range of resistors and 'Ceramicaps'. Full details and illustrated list will be sent on application.



## THE LAB CONTINUOUS STORAGE UNIT

Ref.	Type	Loading	RESISTORS Max. Volts	Range	Dimensions
T	½ watt	½ watt	250	10 ohms to 10 megohms	3" x 3½"
R	½ watt	1 watt	500	10% 5% Tolerance available ±20%, 10%, 5%	4" x 4"
HS3	½ watt	½ watt	750	1 ohm to 500 megohms	1.1" x 0.1"
Tolerance available ±5%, 2%, 1%					
WIREWOUND RESISTORS 5 ohms to 100K ohms — 5-10 watts					
'CERAMICAPS' Tubulars 3 - 470 pf      Tolerances ±2%, 10% 500 - 5000 pf              Hi-K					

The Lab Continuous Storage Units are available from your normal source of supply, but more detailed information can be obtained from

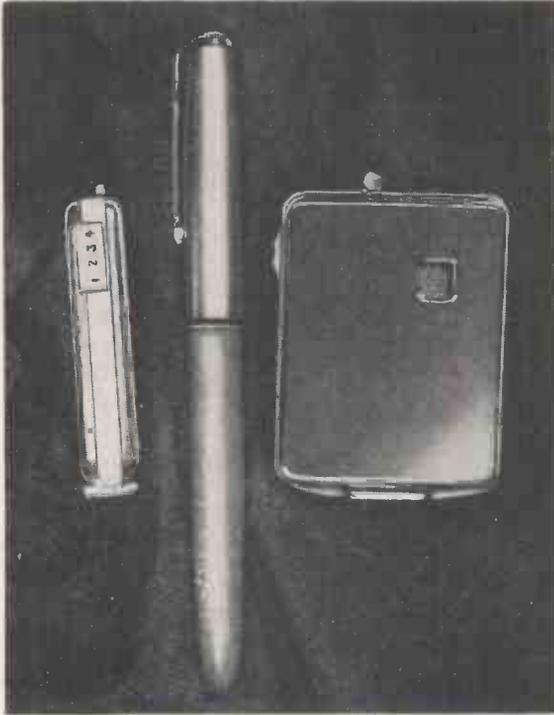
- ★ Continuous Storage for Resistors and 'Ceramicaps'
- ★ Values separately carded
- ★ Finger-tip Selection

**THE RADIO RESISTOR COMPANY LTD**  
50 ABBEY GARDENS      LONDON      N.W.8      Telephone: Maida Vale 5522

# MULTITONE

SPECIALIZE

in equipment for the DEAF  
and for PHYSIOTHERAPY



## The MINUET

### ALL-TRANSISTOR HEARING AID

This 4-stage Resistance Capacity Coupled Transistor Amplifier has a crystal microphone and is powered by the small Mallory cell Type RM625. It is, we believe, the lightest, slimmest and most elegant 4-stage Hearing Aid in existence.

- ★ Weighs only 1½ oz. complete.
- ★ Can be worn by ladies in the hair; by men, behind a coat lapel or necktie.
- ★ The single battery lasts approx. 200 hours. NO high tension battery required.
- ★ Two-position Tone Control; ample volume for the majority of the hard-of-hearing.

*Inquiries should be addressed to*

**MULTITONE ELECTRIC CO. LTD.**

223-227 St. John Street, London, E.C.1.

PIONEERS IN SOUND AMPLIFICATION

# for SELENIUM RECTIFIERS

consult

# ELECTRIX

WHETHER the need is for a single unit or a supply running into thousands . . . if it's a Selenium Rectifier that must fulfil critical requirements and maintain its characteristics over long periods . . . the answer is to be found with Electrix.

- Electrix Rectifiers are characterized by their cool running and consistent long-life conformity to stated specification.
- Manufacturers, Traders and Electronic Engineers, send us your specific requirements.
- Your needs may possibly be met from "standard" types, or
- "To specification" models can be quickly prepared.
- Quotations by return . . . and deliveries a matter of days only.
- We welcome export enquiries.

Here are some typical "standard" full-wave types each

Output 12/15 Volts D.C. 1 Ampere.	List Price	9/-
Output 12/15 Volts D.C. 2.5 Ampere.	"	13/6
Output 12/15 Volts D.C. 4 Ampere.	"	22/6
Output 12/15 Volts D.C. 6 Ampere.	"	35/-

New range H.T. Rectifiers (½ Wave)

Max. A.C. Input	Max. D.C. Current	List Price
125 Volts	80 mA	4/3
250 Volts	50 mA	8/-
250 Volts	300 mA	18/-

*Trade supplied*

- We use only freshly manufactured selenium plates and components, no ex-W.D. materials whatsoever

**HOUSEHOLD ELECTRIX LTD**

47-49 HIGH ST., KINGSTON-ON-THAMES

Telephone: KINGston 4585



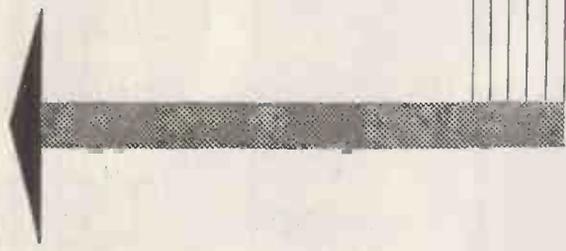
# ELECTRONIC DEVICES

OF INTEREST to all engineers, this new publication forms an invaluable reference to current G.E.C. electronic products suitable for such industrial applications as control instruments, scientific measurement, counting, radio-active indication, photoelectric alarms and indicating devices and electronic relays and voltage stabilisation. The technical information which includes ratings, dimensions, base connection diagrams and screen characteristics, enables the potential

**The contents include:**

- Barretters
- Cathode ray tubes (instrument and special types)
- Electrometer valves
- Geiger Muller tubes
- Photoelectric cells
- Photoelectric industrial aids
- Semi-conductors
- Voltage stabilisers

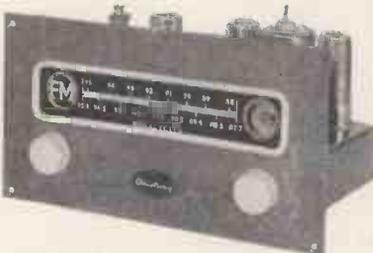
user to choose the device most suitable for a particular application.



Write to  
OSRAM VALVE AND ELECTRONICS DEPT. FOR

**OV 2507**

**THE NEW ARMSTRONG F.M.56  
F.M. TUNER**



85-95 Mc/s; High Impedance Output. Magic Eye Tuning Indicator, £21.

**AND THE ARMSTRONG F.C.48.**

8 Valves, incl. 2 double triodes. 8 watts output. Provision for using F.M. adaptor. Separate Bass and Treble controls. 2 shorts, medium and long wavebands ..... £23 18 0  
Or £8 dep. and 29/2 monthly.

**ALSO AVAILABLE FROM STOCK.**

**F.M. UNITS.** By Lowther, Chapman and Sound Sales.

**ANOTHER NEW RELEASE.**

Chapman Combined F.M. and A.M. Tuner Unit, £32/10/-.



**LEAK DYNAMIC PICK-UP with diamond stylus.**

- Arm with L.P. or 78 head ..... £11 9 6
- Extra head ..... £7 15 3
- Mumetal cased trans. .... £1 15 0

**ALL SPECIFIED COMPONENTS FOR:**

Osram 912, Mullard 10 watt and Williamson Amplifiers and Amos & Johnson F.M. Unit.

**LATEST GRAMOPHONE UNITS**

- Collaro 3/554—3 sp. with Studio Pick-up ..... £8 18 4
- Collaro RC.54—3 sp. Auto, with Studio Pick-up ..... £13 4 2
- Garrard 301—Transcription Unit—3 speed ..... £25 3 6
- Garrard TA—3 speed Gram. Unit T/O Head ..... £10 16 0
- Garrard R.C.80M 3 sp. Auto, with Xtal T/O Pick-up ..... £17 9 6

Collaro 2000 and 2010 Transcription Units In very short supply. If you require one contact us, we may be able to give you immediate delivery.

**"Q-MAX" CHASSIS CUTTERS**

STILL the easiest and quickest way of cutting holes in SHEET METAL.

- each
  - or 2" ... 11/6
  - 1 1/2" or 1 3/4" ... 12/6
  - 1 1/4" or 1 1/2" ... 14/6
  - 1 3/8" or 1 1/2" ... 16/6
  - 1 1/2" ... 18/-
  - 2 1/4" ... 30/-
  - 2 1/2" ... 35/-
  - 1 square ... 23/-
- Keys, small, 10d.; medium, 1/3; large, 1/9.



Patent No. 619178

**"Q-MAX" MODEL G.D.O.I.A GRIP DIP OSCILLATOR**



is an ideal instrument for the determination of tuned circuit resonant frequency, tuning transmitters without application of power, for the determination of coil mutual and stray inductances and both fixed and stray capacitances. Covers 1.5 to 300 Mc/s. in eight ranges. PRICE: 12 Gns. Complete. (Or 4 Gns. Dep. and 12 monthly payments of 15/5.)

**TRANSISTORS,**

- Mullard
- O.C.51 Point type ..... 30/-
- O.C.70 } Junction Types ..... 40/-
- O.C.71 }
- S.T.C.
- 3X300N .....do ..... 4/-
- 3X302N .....do ..... 50/-

**HIRE PURCHASE FACILITIES AVAILABLE**

**BERRY'S (SHORT WAVE) LTD.**

25, HIGH HOLBORN, LONDON, W.C.1

Tel.: HOLborn 6231

Our 1955 Enlarged and Fully Illustrated Catalogue of "Hi-Fi" and Amateur Equipment is now available, 6d. post free.

**A SOUND TIE UP**



A.I.D. APPROVED

**"WILLESDEN" TRANSFORMERS**  
*for all*  
**ELECTRONIC & TELECOMMUNICATION REQUIREMENTS**

WILLESDEN TRANSFORMER CO. LTD., 2a, FRITHVILLE GARDENS, SHEPHERDS BUSH, LONDON, W.12. Telephone: SHE 5819, 2714.



# RCA TEST EQUIPMENT

PREFERRED BY PROFESSIONALS  
FOR RADIO—TELEVISION—ELECTRONICS



VOLTOHMYSTS



OSCILLOSCOPES



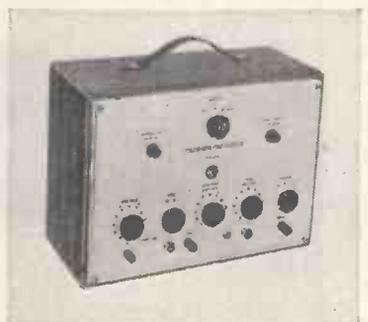
DC MICROAMMETER



SIGNAL GENERATORS



CRYSTAL-CALIBRATED  
MARKER GENERATOR



COLOR-BAR GENERATOR

For greater accuracy and reliability, technicians the world over choose RCA test equipment. That's because RCA instruments are the result of years of research at the bench and in the field. They combine convenience, accuracy and versatility . . . and each is dependable—built to take a maximum of rough and frequent use. Whatever your need in test equipment for radio, black-and-white and color TV, or other applications . . . *remember*, when you purchase RCA, you are investing in test equipment *preferred by professionals*.



TV SWEEP GENERATORS

FOR FULL DETAILS ON THESE UNITS AND OTHER  
INSTRUMENTS THAT COMPLETE THE LINE, SEE YOUR  
RCA DISTRIBUTOR OR WRITE:

MARCA(S) REGISTRADA(S)  
TRADEMARK(S) REGISTERED



RCA INTERNATIONAL DIVISION

**RADIO CORPORATION of AMERICA**

RCA BUILDING

30 ROCKEFELLER PLAZA, NEW YORK, N. Y., U. S. A.



DOT-BAR GENERATOR



## HARTLEY-TURNER SOUND EQUIPMENT

We should like once again to draw attention to the Hartley-Turner Super Control Pre-amplifier.

This unit is designed to feed the output from Tape recorders, Crystal and Magnetic Pick-ups and Radio Tuning Units to the main amplifier.

Employing sub-miniature valves and highest quality components throughout, this unit combines efficiency with simplicity of operation, reliability and compactness.



### Brief Specification:

4 Switched input channels. Input sensitivity 1 Volt, positions 1 and 2; 25 mV, positions 3 and 4 for 1V output from the Cathode follower output stage. Separate continuously variable Bass and Treble controls: Bass variable 0 db to + 25 db at 40 c/s. Treble variable - 10 db to + 10 db at 10 Kc/s.

Power requirements 250 V D.C. 3 mA.  
6.3 V 0.9 A

Whole unit completely screened and enclosed in metal case 10½ in. × 3½ in. × 3¼ in.

Price £8. 18. 6.

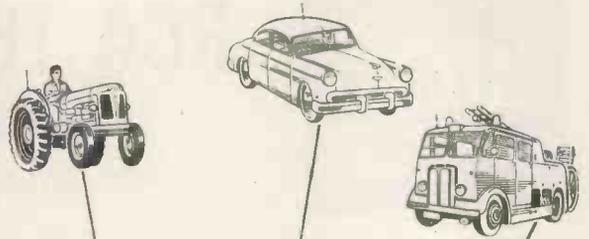
Full particulars sent free and post free on application to:—

**H. A. HARTLEY CO. LTD.**  
152, HAMMERSMITH ROAD,  
HAMMERSMITH, LONDON, W.6.

Telephone: RIVerside 7387

Special Note for Overseas Dealers:

If you require any items of communication equipment and are not already served, our Purchasing and Export Departments can help you. Let us know your requirements.



## RADIO TELEPHONE SYSTEMS

The Hudson range of highly efficient and economically operated two-way communication systems comprises equipment applicable to various requirements in all countries.

Consult  
**Hudson**  
OF LONDON

### LIST OF MODELS

- AM/250/M ... 6 watt Vehicle Station, 60 to 100 Mc/s.
- AM/150/M ... 5 watt Vehicle Station, 100 to 185 Mc/s.  
Single or up to 5 channels.
- AM/250/F ... 6 watt Fixed Station, 60 to 100 Mc/s.
- AM/150/F ... 6 watt Fixed Station, 100 to 185 Mc/s.  
Single or up to 10 channels.
- FM.102 ..... 10 watt FM Vehicle Station, 60 to 185 Mc/s.  
Single or up to 4 channels via remote control.
- FM.101 ..... 10 watt FM Fixed Station, 60 to 185 Mc/s.  
Single or up to 10 channels.
- HED.113 ... 50 watt AM or FM Fixed Station, 60 to 185 Mc/s.  
Up to 4 channels via remote control.

Hudson radio-telephone systems are used by the Ministry of Supply, Home Office Communications, General Post Office, British Electricity Authority, Eastern Electricity Board in addition to large numbers of commercial concerns.

**HUDSON ELECTRONIC  
DEVICES, LTD.**  
APPACH ROAD, LONDON, S.W.2

Telephone . TULse Hill 4861

Cables: HUDELECT, LONDON

## 20 Mc/s FREQUENCY MONITOR

The Automatic Frequency Monitor (20 Mc/s) is but one of a series of high grade monitors now in course of manufacture for the accurate measurement of frequency.

Employing hard valve techniques throughout, it will measure any frequency in the range 10 c/s to 20 Mc/s to an accuracy within  $\pm 1$  part in  $10^6$ .

The result, in decimal notation, is presented on eight panel mounted meters each scaled from 0 to 9 and the unknown frequency is automatically remeasured every few seconds.

This new equipment presents a considerable advance in frequency measuring techniques and apart from normal laboratory applications, is ideally suited for incorporation in production testing routines.

Full technical information on this and other frequency measuring equipment is available on request.



## CINEMA TELEVISION LTD

A COMPANY WITHIN THE J. ARTHUR RANK ORGANISATION

WORSLEY BRIDGE ROAD · LONDON · S.E.26

HITHER GREEN 4600

### SALES AND SERVICING AGENTS:

Hawnt & Co. Ltd., 59 Moor St. Birmingham, 4

Atkins, Robertson & Whiteford Ltd., 100 Torrisdale Street. Glasgow, S. 2

F. C. Robinson & Partners Ltd., 122 Seymour Grove, Old Trafford, Manchester, 16

**L**LIVINGSTON Laboratories Limited are proud to announce their association with the fine range of instruments manufactured by Tektronix.

We have accepted the responsibility in this country for ensuring that the Tektronix guarantee is implemented and all necessary service and maintenance work promptly carried out on all instruments of their manufacture.

Livingston Laboratories Ltd. are able to make available instruments of overseas origin, where no comparable instrument is manufactured in this country. Instruments from overseas, however, can be a liability if excellent service and spares facilities are not available. Realising this, we are insisting that satisfactory spares supplies and service material are available for all instruments we import.

This import service is a logical development of our trading policy, which is to sell to our customers not merely an instrument, but the right instrument for the job.



**LIVINGSTON LABORATORIES LTD**

RETCAR STREET · LONDON · N19 · Tel: ARCHway 6251

# NEW for fast-rise applications

(12 MILLIMICROSECONDS)

## Tektronix Type 545 and 541 CATHODE-RAY OSCILLOSCOPES



**TYPE 545**—This new high-speed laboratory oscilloscope, in combination with new Type 53K/54K Fast-Rise Plug-In Unit...opens the way to quicker, easier analyses of fast-rising waveforms...providing

faithful displays and accurate measurement facilities well beyond the range of previous oscilloscopes of its size and cost. The Type 545-Type 53K/54K combination offers a vertical-amplifier passband of dc to 30 mc (12-millimicrosecond risetime) at calibrated sensitivities to 0.05 v/cm, with a full 4-cm linear vertical deflection. A wide range of calibrated sweeps, with calibrated sweep delay from 1  $\mu$ sec to 0.1 sec, and high accelerating potential, 10 kv, fully complement this greatly extended vertical-amplifier range.

The Type 545 is the most versatile oscilloscope ever made, for it can be quickly converted to many other applications. By merely plugging in the appropriate Type 53/54 Plug-In Pre-amplifier you are ready for wide-band, wide-band high gain, dual-trace, high-gain differ-



ential, microvolt-sensitivity, or wide-band differential applications. It's a rare oscilloscope application that isn't easily handled by this modern method.

### Vertical-Amplifier Characteristics with Type 53K/54K Unit Plugged In

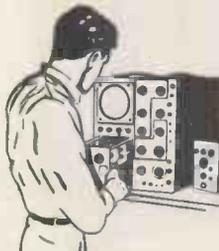
**Transient Response**—Risetime, 12 millimicroseconds.

**Frequency Response**—Passband, dc to 30 mc. (down 3 db  $\pm$  1/2 db at 30 mc, only 6 db at 45 mc).

**Input impedance** 20  $\mu$ f, 1 megohm.

**Sensitivity**—0.05 v/cm to 20 v/cm in 9 calibrated steps.

Price—\$125



### LOW INPUT CAPACITANCE

With Accessory Probes for Type 53K/54K

Probe	Input Impedance	Maximum Sensitivity
P405	11.5 $\mu$ f, 5 megohms	0.25 v/cm
P410	7.5 $\mu$ f, 10 megohms	0.5 v/cm
P420	4.5 $\mu$ f, 10 megohms	1 v/cm
P450	2.5 $\mu$ f, 10 megohms	2.5 v/cm
P4100	2.5 $\mu$ f, 10 megohms	5 v/cm

### Type 545 Oscilloscope Characteristics

#### Wide Sweep Range

24 Calibrated sweeps from 0.1  $\mu$ sec/cm to 5 sec/cm, accurate within 3%. Accurate 5-x magnifier extends calibrated range to 0.02  $\mu$ sec/cm. Continuously variable from 0.02  $\mu$ sec/cm to 12 sec/cm.

#### Wide Sweep-Delay Range

Additional delaying-sweep circuitry provides conventional, or triggered jitter-free delay, 1  $\mu$ sec to 0.1 sec in 12 calibrated ranges. Range accuracy within 2%. Incremental accuracy within 0.2% of full scale.

#### Versatile Triggering

Internal or external, with amplitude-level selection or AUTOMATIC TRIGGERING. High-frequency synchronization up to 30 mc.

#### Square-Wave Amplitude Calibrator

0.2 mv to 100 v in 18 steps, accurate within 3%.

#### New Cathode-Ray Tube

Tektronix T54P 5" precision metallized crt provides 4-cm vertical and 10-cm horizontal linear deflection, 10-kv regulated accelerating potential.

#### Balanced Delay Network

0.15  $\mu$ sec vertical signal delay.

#### DC-Coupled Unblanking

Uniform unblanking at all sweep speeds and repetition rates.

#### Electronic Voltage Regulation

All voltages affecting calibrations are fully regulated.

#### CRT Beam Position Indicators

**Type 545**—\$1450 plus price of desired plug-in units.

**Type 541**—Same characteristics, less delayed-sweep facility—\$1145 plus price of desired plug-in units.

Represented in London by Livingston Laboratories, Ltd., Archway 6251.

Prices f.o.b. Portland (Beaverton), Oregon

\*TYPE 545...\$560 \*TYPE 541...\$440 \*53K/54K...\$48.  
\*Delivered in Britain, plus duty if applicable.

# Tektronix, Inc.

P.O. BOX 831D • PORTLAND 7, OREGON, U.S.A.

CYpress 2-2611

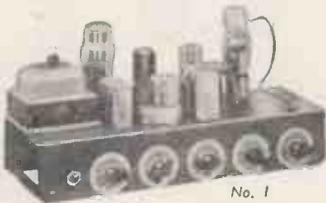
CABLE: TEKTRONIX

# REAL HIGH FIDELITY at modest cost . . .

## •Manufacturer-to-Consumer policy saves you at least one-third cost!

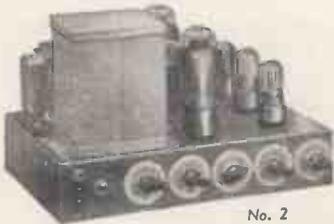
We are now specialising in the supply of units for making up high-fidelity Radio and Record-reproducing Equipments for use in the Home, small Halls, Schools and Gramophone Societies and single items for replacing in existing equipments and radiograms. Our Chief Engineer, who is operating a Technical

Guidance Service, is available daily, including Saturdays, from 10 a.m. to 6 p.m., or will deal with enquiries by return of post. Our new illustrated Catalogue and Supplement will be a great boon to those desiring high quality equipment for modest expenditure. Send two 2½d. stamps for your copy now. It may well save you pounds.



No. 1

No. 1 "SYMPHONY" AMPLIFIER 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. It is thus possible to arrange the frequency-response of the amplifier to a curve equal and opposite to the resultant curve of the other items in the chain so that what finally registers in the brain is as per original. This flexibility of control is far more important than mere nominal linear response of the amplifier, as the pick-up, speaker, etc., are not linear. Independent Scratch-Cut is also fitted and special negative-feedback circuit employed. The Amplifier can accommodate a wide variety of records from old 78's to new L.P.'s. Input is for all types of pick-up of 0.1 v. output or more and there is full provision (and power) for Radio Tuner. It is available to match 2/3 or 15 ohms speakers. Price: 10 gns. (carriage 5/-). Fitted in portable Steel Cabinet, 35/- extra.



No. 2

No. 2 "SYMPHONY" AMPLIFIER as No. 1 but with 10-watt Push-pull triode output and triodes throughout. Woden mains and output transformers and choke. Full provision and power for Tuner. Output tapped 3, 7.5 and 15 ohms. Competes with the most expensive amplifiers on the market yet costs only 15 gns. (carriage 5/-). 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.

"STUDIO SYMPHONY" AMPLIFIERS, Models 1 and 2, new models specially designed to get the maximum out of the revolutionary new Collaro Studio pick-ups and heads type "P" or Transcription. Specification as per our Standard Symphony models but with high-gain, low-noise, built-in Pre-amplifier stage with separate switched correctors for Std. and L.P. Third position on switch provides input matching for Acos and similar output pick-ups. These remarkable new models thus provide all the facilities and matching of our Standard Symphony Amplifiers PLUS the specialised Collaro matchings. Send for copy of "The Gramophone" review of these instruments. Price: No. 1, 12 gns.; No. 2, 17 gns. Carriage 5/-.

### CURRENT GARRARD PRODUCTS AVAILABLE FOR IMMEDIATE DELIVERY FROM STOCK AT PRESENT.

**MODEL TA** 3-speed unit, with plug-in turnover head Type G.C.2, £10/16/-, or with Acos HGP 33 or 37 heads, £10/14/-, or with two separate high fidelity Acos HGP35 heads, £12/17/- Unit less heads, £8/11/-, post 2/6. Heads, 42/3 each, post 1/-.  
**MODEL TB** as above, but with long pickup arm. Less heads, £8/11/-, post 2/6.

Heads to fit this unit: Decca XMS, 54/6, Decca Crystal, 30/-, Garrard Standard Magnetic, 28/-, miniature magnetic low impedance, 28/-, miniature magnetic high-impedance, 38/-. Post on heads 1/-. Unit can be supplied with any combination of above heads and is carefully adjusted for stylus pressure on despatch.

**MODEL RC80M**, less heads, £15/5/-, with new turnover head, £17/9/6, with two separate Acos HGP35 heads £19/9/-, carriage 5/-.

**COLLARO PICKUPS AND HEADS** Studio Pickup Arm, 13/10. Studio Pickup head type "O" or "P", £3/0/9. Pickup complete £3/14/7. Studio Transcription Pickup Arm with Studio "P" head, £4/15/9. Ditto with Transcription head, £5/2/5.

### TRANSCRIPTION MOTORS IN STOCK.

**COLLARO TRANSCRIPTION MOTOR**, Model 2000, Mk. II, £13/9/6. Model 2010, including Transcription pickup and PX cartridge, £18/12/-. Carriage 5/- in either case. Immediate delivery at present.

**NEW CONNOISSEUR** variable speed on all 3 speed £25/15/5.

**GARRARD Model 301**, £25/3/6.

Cabinets available to house any of the above motor. together with pick-up, price £3/7/6. Carriage 5/-.

### SNIP NO. 1

**GARRARD LATEST MODEL RC80M AUTO-CHANGER**. Fitted with full-length Pick-up Arm to take 3-pin plug-in heads, manufactured end of Oct. 1954. PRICE LESS HEADS, £15/5/-, carriage paid. These extraordinarily versatile units can be supplied fitted with the following combinations of Pickup Heads at the following prices:

With two Decca XMS ferr Magnetic Heads, £20/15/-

With two Decca Crystal Heads, £18/10/-.

With Decca Crystal for L.P. and Garrard Miniature Mag. for Std. Takes miniature fibre or steel needles. £18/13/-.

With two Acos HGP39-1 Heads, £20/5/-.

With one Acos HGP39-1 Head for L.P. and Garrard Miniature Mag. High Impedance for Std. Takes miniature fibre or steel needles, £19/17/-.

The above combinations of heads are matched for output and the stylus pressure is carefully adjusted before despatch. Carriage paid.

Above mounted in Portable Cabinet 90/- extra, IMMEDIATE DELIVERY from STOCK guaranteed.

"MONARCH" latest model, 3 speed AUTO CHANGER with latest ACOS HGP37 turnover head, with two sapphire styli, price £13/10/- Carr. 5/-. Leaflet 2½d. Mounted in Portable Cabinet. £16.10.0 carr. 7/6.

"SYMPHONY" BASS REFLEX CABINET KITS 30in. high, consist of fully-cut 3in. thick, heavy, inert, non-resonant patent acoustic board, deflector plate, felt, all screws, etc., and full instructions, Bin. speaker model, 85/-; 10in. speaker model, 97/6; 12in. speaker model, £5/7/6. The design is the final result of extensive research in our own laboratory and is your safeguard of optimum acoustic results. Carriage 7/6. Ready built, 10/6 extra.

### HIRE PURCHASE FACILITIES NOW AVAILABLE on orders of £15 or over.

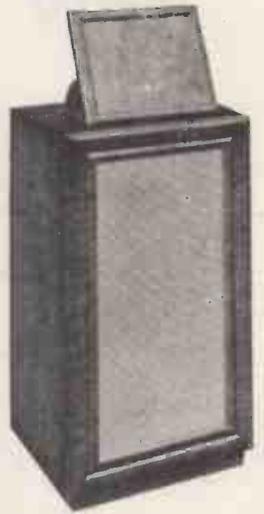
Send one-third deposit with order, balance over 6 or 12 monthly instalments. State which required

## NORTHERN RADIO SERVICES

11, KINGS COLLEGE RD., ADELAIDE RD  
LONDON, N.W.3. Phone: PRImrose 8314

Tubes: Swiss Cottage and Chalk Farm.

Buses: 2, 13, 31, 113, 187.



"SYMPHONY" BASS REFLEX CABINETS, fully finished in figured walnut, oak or mahogany to our own design and to match our Console Amplifier Cabinet, enabling the housing of a whole equipment in a two piece suite; cost: 12in. speaker model, £11/10/-; 10in., £11; 8in. £10/10/- Carriage according to area. The 10in. model is ideal for the WB HF 1012 (see "The Gramophone" review March).

TREBLE Baffle veneered to match, optional extra 50/-.



CONSOLE AMPLIFIER CABINETS (above), 33in. high, lift-up lid with piano hinge, take Tape Deck, Gram Unit or Auto-changer, Amplifier, Pre-Amplifier and Radio Feeder Unit finished medium walnut veneer. De Luxe version, price 10 gns. Oak or Mahogany veneers 10/- extra. Special finishes to order. Carriage according to area, we will quote.

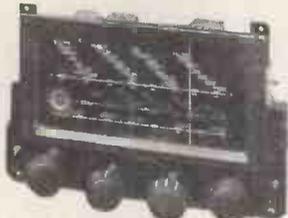
# Northern Radio Services (CONTD.)

## "SYMPHONY" RADIO FEEDER UNITS



**NO. 1 "SYMPHONY" TUNER.** A T.R.F. model designed for the quality reception of local stations. Quality is adequate for amplifiers of the highest fidelity class. Infinite impedance detection. Controls: gain, wave-change and radio/gram switch. Illuminated engraved glass dial. Latest miniature valves. Overall dimensions: 9in. wide x 6in. deep x 6in. high. Power required: 6.3 v. at 1 amp. and 250/300 v. at 15 m/a. Price £7-7-0 Carr. & pkg. 5/-.

**NO. 2 "SYMPHONY" SUPERHET TUNER.** Three wave-bands, advanced circuit, very newest valve types, floodlit glass dial with bronze escutcheon provided. Suitable for use with the best amplifiers. Overall dimensions: 12in. wide x 8 1/2in. high x 7 1/2in. deep. Controls: on/off gain, radio/gram, wave-change and tuning. Dial cut-out: 8in. x 4 1/2in. reading horizontally or vertically (state which required). Tuner can be readily mounted at any angle. Requires 6.3 v. at 1.5 amp. and 250/300 v. at 20 m/a. Price £11-11-0 Carr. & pkg. 5/-.



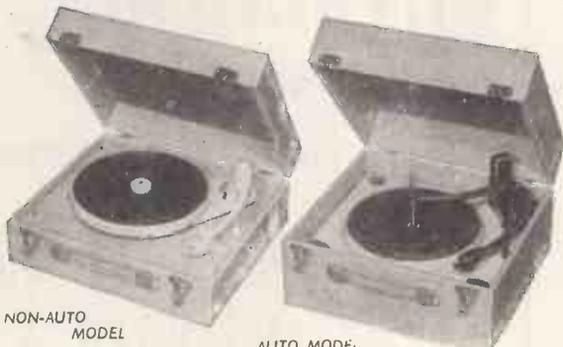
**NO. 2/VS "SYMPHONY" SUPERHET TUNER.** As No. 2 but incorporating on the wave-change switch an extra position for radio, thus making two radio positions. One is the standard one with 9 kc. separation and the extra one providing virtually T.R.F. band-width and quality on local stations. Price £13-13-0. Carr. & pkg. 5/-.

All above tuners are made to plug in to any of our "Symphony" Amplifiers in a matter of seconds by means of the octal plug fitted at the end of a flexible multi-cable. They are ideal for providing in conjunction with our "Symphony" Amplifiers, the same high quality on radio as is obtained from these amplifiers on gramophone, but they are equally suitable for use with other high fidelity amplifiers, and where the output circuit requires modification to match a given amplifier this can be carried out free of charge. Either of the two Superhet models can be fitted with a magic eye tuning indicator for £2-2-0 extra. Furthermore, they can be fitted with a pre-amplifying stage to match the Decca Magnetic Pickups or the Collaro Studio type "P" pickup head for use with amplifiers which would not otherwise have enough gain for these comparatively low output pickup heads. In these cases, two separate correction circuits—one for standard and one for LP as recommended by the pickup manufacturers—are incorporated in the radio/gram switch. Please send for our catalogue giving further details.

## TAPE DECKS AND AMPLIFIERS

**TRUVOX TAPE DECK MARK III.** TR2/U. Latest version to take pre-recorded tapes. Price 22 gns. Illustrated leaflet 2 1/2 d.  
**TAPE AMPLIFIER TYPE C,** expressly designed by Truvox to work perfectly with their Deck, 3 valves plus rectifier and Magic Eye level indicator. Price 16 gns.

## NEW MODEL PORTABLE RECORD PLAYERS



We are pleased to announce the entry on to the market of two "Symphony" Record Players designed to represent the greatest value in this line ever offered. Model No. 1 contains the Collaro 3-speed single record playing unit AC3/554 and model No. 2 contains the Collaro Autochanger RC54. They are available with either Type "O" insert, "P" insert or transcription insert. Prices (in attractive rexine case), No. 1 £10-19-6, No. 2 £14-19-6. Carr. 7/6. Transcription insert 6/9 extra.



**GOODMANS CORNER CABINETS** (right) for the AXIOM 150 Mark 2 manufactured by us to Messrs. Goodmans' specification and approved by Messrs. Goodmans. Height, 44in. Price: complete kit in plain board with 1in. thick felt, 8 gns. Price: ready built, 10 gns. Finished in figured walnut, 16 gns. Other veneers to order. Carriage extra according to area. Quotation by return.

*Insist*

*on —*



**£1 RETAIL**

**FULL TRADE DISCOUNTS**

*The only  
tape giving*

*a perfect performance at low price*

**SALFORD ELECTRICAL INSTRUMENTS LTD.**

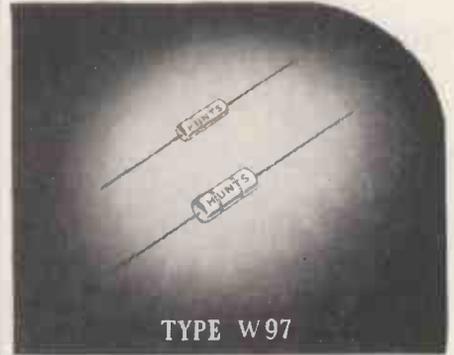
**PEEL WORKS • SILK STREET • SALFORD 3 • LANCs**

**LONDON OFFICE : MAGNET HOUSE • KINGSWAY • WC2 • Tel: Temple Bar 4669**

A Subsidiary of THE GENERAL ELECTRIC COMPANY LTD OF ENGLAND

# REVOLUTIONARY

*in design—  
and performance!*



## HUNTS "THERMETIC" MIDGET METALLISED PAPER CAPACITORS WITH A TRUE HERMETIC SEAL

FULLY APPROVED TO JOINT SERVICES STANDARD R.C.S.136/A  
CATEGORY 40/100, CLASS H.1.

**TEMPERATURE RANGE:  $-100^{\circ}\text{C}$  to  $+100^{\circ}\text{C}$**

The W97 capacitor, although of diminutive size, is an extraordinarily robust unit. Most miniature units are prone to weakness in end connections and general mechanical flimsiness. Such undesirable features are eliminated in the W97 by the special processes used and extreme care in manufacture.

### CAPACITOR UNIT

A single metallised paper is used to wind this unit which is made possible by the use of Hunt's Patent covering the "castellated" pattern. Recent development by Hunt on a special impregnating material gives the unit remarkable brackets of operating temperature.

### CASING

Hunt's patented double metal tube, sealed with the special "Thermetic" compound, provides positive closure on the casing and lead entry, ensuring positive hermetic sealing.

### INSULATION OF CASING

The capacitors are supplied without an insulating medium on the case. If specially requested they can be supplied with an approved plastic sleeve which increases the dimensions by 0.07" in length and 0.03" in diameter.

### TERMINATIONS

The terminations are of 24 gauge tinned phosphor bronze wire having a nominal length of 1". Special attention is paid to the retinning of the wires after the capacitor is fully processed. Connection is made to the unit by applying copper spray to the metallising. The pigtail is soldered to this bond giving a perfect connection of exceptional strength.

### INDUCTANCE

W97 "Thermetic" Midgets have a very high self resonant frequency—the following figures are quoted as a guide. 50 pF at 600 volts, which is the lowest capacitance in the range, has a self resonant frequency of 280 megacycles. At the other end of the range, 0.04  $\mu\text{F}$  200 volts, which is the maximum capacitance, it is 8.5 megacycles.

### INSULATION RESISTANCE

This is measured at working voltage at a temperature of 20°C. The minimum capacitance in the range, 50 pF at 600 volts, has an insulation resistance greater than 2,000,000 megohms. The maximum capacitance in the range 0.04  $\mu\text{F}$  at 200 volts, has an insulation resistance greater than 25,000 megohms. The intermediate capacitances are approximately pro rata.

### POWER FACTOR

Less than 2% at 1,000 cycles per second at 20°C.

### CAPACITANCE TOLERANCE

Standard  $\pm 20\%$ . Closer tolerances are available, for capacitances exceeding 500 pF.

### TYPE W97 STANDARD RANGE

LIST NO.	CAP $\mu\text{F}$ .	DIMENSIONS (inches)	
		L.	D.
200 volts D.C.			
BM7	0.002	0.610	0.135
BM8	0.004	0.610	0.135
BM11	0.004	0.500	0.180
BM9	0.005	0.610	0.135
BM12	0.005	0.500	0.180
BM13	0.01	0.500	0.180
BM14	0.02	0.610	0.180
BM15	0.03	0.610	0.260
BM16	0.04	0.610	0.260

LIST NO.	CAP $\mu\text{F}$ .	DIMENSIONS (inches)	
		L.	D.
400 volts D.C.			
BM4	0.0004	0.610	0.135
BM5	0.0005	0.610	0.135
BM6	0.001	0.610	0.135
BM18	0.002	0.500	0.180
BM19	0.003	0.500	0.180
BM20	0.005	0.610	0.180
BM21	0.01	0.610	0.260

LIST NO.	CAP $\mu\text{F}$ .	DIMENSIONS (inches)	
		L.	D.
600 volts D.C.			
BM25	50 pF.	0.500	0.180
BM1	0.0001	0.610	0.135
BM26	0.0001	0.500	0.180
BM2	0.0002	0.610	0.135
BM27	0.0002	0.500	0.180
BM28	0.00022	0.500	0.180
BM29	0.00025	0.500	0.180
BM3	0.0003	0.610	0.135
BM30	0.0003	0.500	0.180
BM36	0.0004	0.500	0.180
BM31	0.0005	0.500	0.180
BM32	0.001	0.500	0.180
BM33	0.002	0.610	0.260
BM34	0.003	0.610	0.260
BM35	0.004	0.610	0.260

**W97 IS A 'MUST'**

for the

**MAKERS OF ELECTRONIC EQUIPMENT**

A. H. Hunt (Capacitors) Ltd, Wandsworth S.W.18 · BAT 1083  
And in Canada: HUNT CAPACITORS (Canada) Ltd., AJAX, ONTARIO.

REGISTERED TRADE MARK

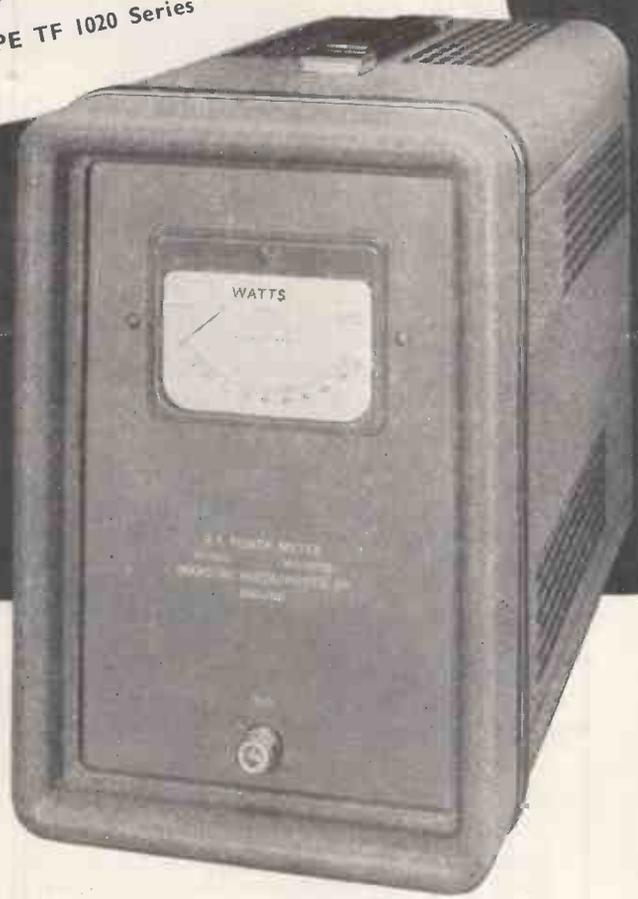
**HUNTS**  
**CAPACITORS**

THE TRADE MARK OF RELIABILITY

**TWO** *New* **MARCONI**  
**R.F. POWER METERS**  
 TYPE TF 1020 Series

**POWER RANGE**  
**0 to 100 Watts**

**FREQUENCY RANGE**  
**D.C. to 250 Mc/s**



Both instruments have a linear power scale and accurately register mean power input regardless of waveform. The TF 1020 has an input impedance of 75 ohms; The TF 1020/1, an input impedance of 50 ohms.

## MARCONI INSTRUMENTS

SIGNAL GENERATORS · BRIDGES · VALVE VOLTMETERS · Q METERS · WAVEMETERS  
 FREQUENCY STANDARDS · WAVE ANALYSERS · BEAT FREQUENCY OSCILLATORS

MARCONI INSTRUMENTS LTD · ST. ALBANS · HERTS · Telephone: ST. ALBANS 6160/9  
 30 Albion Street, Kingston-upon-Hull. Phone: Hull Central 16144. 19 The Parade, Leamington Spa. Phone: 1408

*Managing Agents in Export:*

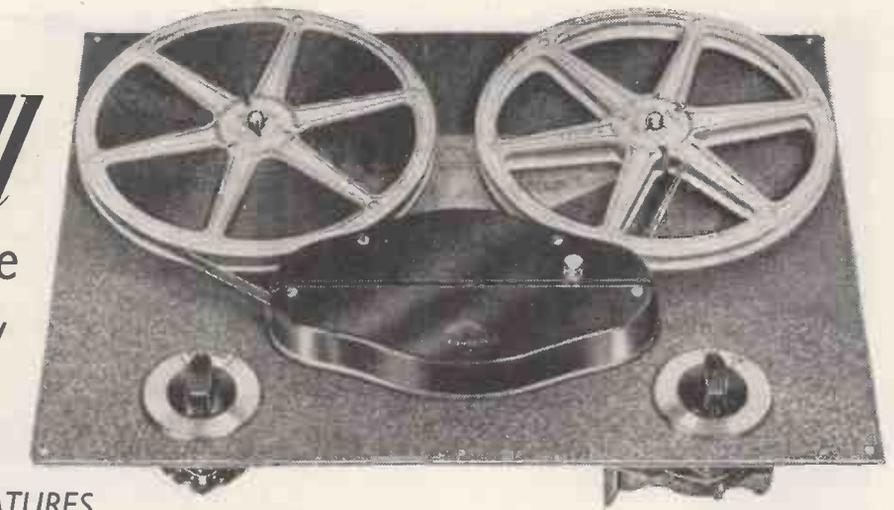
MARCONI'S WIRELESS TELEGRAPH CO. LTD · MARCONI HOUSE · STRAND · LONDON · W.C.2

# Brenell

-best value  
in quality  
Tape Decks

WITH  
ALL THE FEATURES

—at a price  
anyone can afford  
**18 GNS**



- Heavy Duralumin Baseplate 15" x 11½"
- Three independent motors
- Three speeds: 3½, 7½ and 15 i.p.s.
- Twin-track recording, 7" reels (1,200 ft.)
- Foolproof "drop in" tape loading
- Simple two-knob control
- Positive mechanical braking
- Interlocked switching
- Visual playing time indication
- Fast forward or reverse in 45 seconds
- Plays all makes of pre-recorded Tapes
- Azimuth adjustment to Record/Playback Head

From your

Wireless Dealer  
or in case of difficulty write  
to sole manufacturers:

BRENELL RECORDING AMPLIFIER ALSO AVAILABLE 16½ GNS  
BRENELL ENGINEERING CO. LTD., 2 NORTHINGTON, ST., LONDON, W.C.1.

## Protection against damage from IMPACT and VIBRATION



"BARRYMOUNT" cup-type isolators are designed primarily to absorb high-impact shocks with concurrent isolation of frequencies above 40 c.p.s. and general sound isolation. Utilisation of rubber in compression with substantially equal stiffness in all directions provides a smooth load-deflection curve.

Load ratings indicated for Mobile Applications (including shipboard installations) are such as to ensure a vertical natural frequency between 25 and 35 c.p.s. The design and assembly of the metal parts are such that they are self-captivating for maximum security.

*Samples are available immediately ex stock*

There are also air-damped types available for the protection of airborne equipment. "Barrymount" isolators are made in England under licence from Barry Controls Incorporated of U.S.A.



**DESIGNED FOR:—**

- ★ MOBILE electronic and electrical equipment.
- ★ MILITARY and GUIDED MISSILE instrumentation.
- ★ SHIPBORNE sensitive equipment.
- ★ PROVIDING the optimum combination of impact isolation, vibration isolation, noise reduction, stability for the mounted unit.

CEMENTATION (MUFFELITE) LTD., 39 VICTORIA STREET, LONDON, S.W.1

**m-i-n-u-t-e-s** into seconds...

with the brilliant **NEW**  
**Superspeed**  
**SOLDERING IRON**

MANUFACTURED FOR ENTHOVEN SOLDERS LTD. BY SCOPE LABORATORIES, MELBOURNE, AUSTRALIA



### STAR FEATURES

- ★ Heats up from cold in 6 seconds—by a light thumb pressure on the switch ring.
- ★ When not in use, current is automatically switched off—thus greatly reducing wear of copper bit. Electricity consumption is correspondingly reduced.
- ★ It is 10" long, weighs 3½ ozs., can be used on 2.5 to 6.3-volt supply. 4-volt transformer normally supplied.
- ★ More powerful than conventional 150-watt irons and 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 cost over a period.
- ★ Can be used from a car battery.
- ★ It is by far the most efficient and economical soldering iron ever designed for test bench and maintenance work.



### STAR APPLICATIONS

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, particularly for all SERVICE work. For general purpose work the Superspeed Iron is the ideal stand-by soldering tool.

The **Superspeed** soldering iron is available **NOW**

Write for full particulars, including guarantee terms and free trial facilities, to the sole concessionaires in this country—

**ENTHOVEN SOLDERS LIMITED**  
 (Industrial Equipment Division), 89 Upper Thames St.,  
 London, E.C.4. Telephone: MANSion House 4533

# EDDYSTONE

## V.H.F. COMMUNICATIONS RECEIVERS

MODEL 770R - 19 Mc/s. to 165 Mc/s. CONTINUOUS

MODEL 770U - 150 Mc/s. to 500 Mc/s. CONTINUOUS

FOR MONITORING, FIELD TESTS, LABORATORY PURPOSES ETC.



- A. C. operation. 110-250 volts, 40-60 cycles.
- Dimensions 16 $\frac{3}{4}$ " x 15" x 8 $\frac{3}{4}$ ".
- Weight 60 lbs.

- Highly efficient signal frequency circuits.
- Substantial diecast rotary coil turret.
- Excellent frequency stability and selectivity.
- Accurate re-setting and ease of handling.
- High sensitivity and excellent signal-to-noise ratio.
- For AM and FM.
- Robust construction and outstanding reliability.
- "S" Meter. Noise Limiter.
- Preferred type valves.
- Finest workmanship.

PLEASE WRITE FOR FULL SPECIFICATION TO THE MANUFACTURERS:

STRATTON & CO. LTD., ALVECHURCH ROAD, BIRMINGHAM, 31

## Simon is Sound

When you listen to a Simon Portable you're hearing sound Recording at its lively best. Ask your dealer for a demonstration. Try its simple controls. Hear its faultless reproduction of speech and music—remember that for P.A. or record reproduction you can use the high fidelity amplifier independently of the recorder.

SIZE:..... 18in. x 15in. x 10in

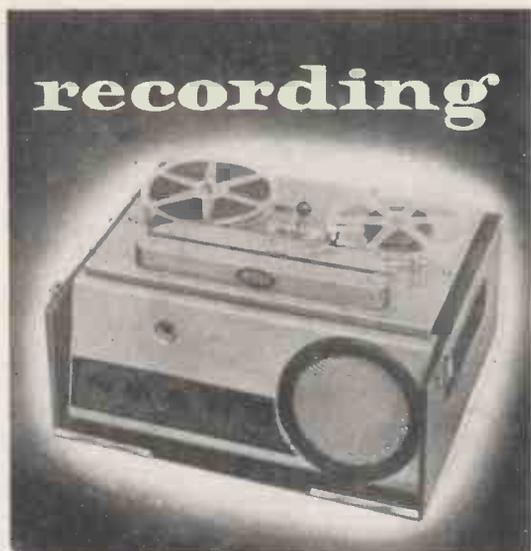
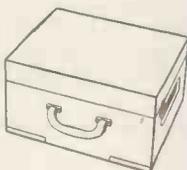
LOUDSPEAKER:..... 6 $\frac{1}{2}$ in. built-in Monitor

POWER SUPPLY:..... 200/250 v. 50 cycles A.C

INPUT CHANNELS:..... High impedance for microphone;  
low or high impedance for radio

POWER CONSUMPTION:..... 100 watts approx

RESPONSE:..... 50-12,000 c.p.s.  $\pm 3$ db



PORTABLE TAPE RECORDER **79** GNS  
MODEL SP/1

H.P. FACILITIES WITH PLEASURE

Ask for illustrated literature  
and Information Sheet T1/6.

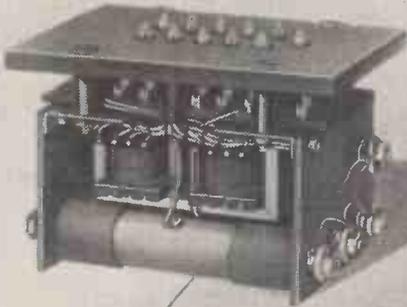
**SIMON SOUND SERVICE LTD.** (Dept. W.),  
48-50 GEORGE ST., LONDON, W.1. Phone: WELbeck 2371 (5 lines)

- ★ Monomaster Finger-tip control
- ★ 2-stage capstan
- ★ Three motor drive
- ★ 10 watts push-pull output
- ★ Simple loading

- ★ Fast rewind and wind-on

Servo self-energising brakes  
provide very rapid stop from  
full speed

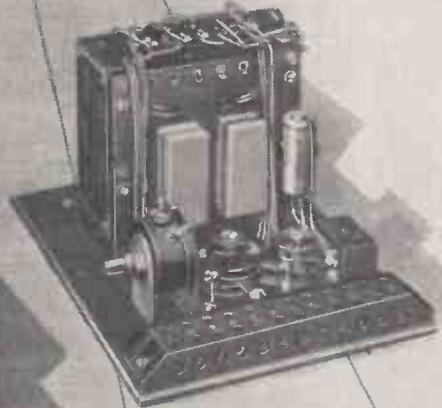
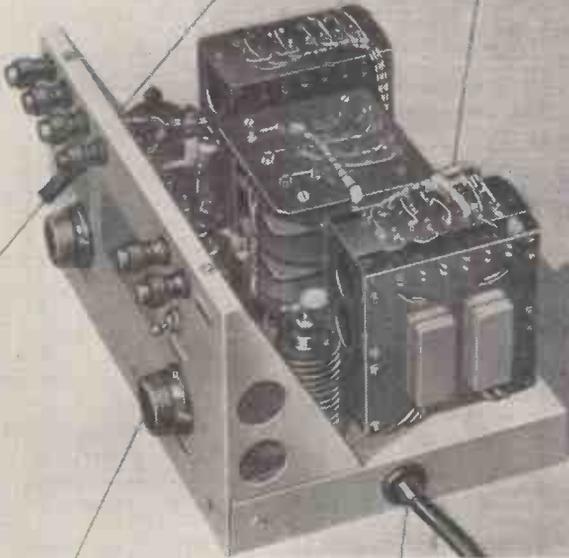
# HIGH-STABILITY Magnetic Amplifiers



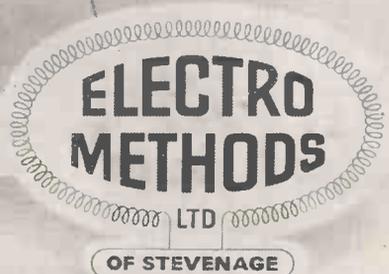
**SINGLE-STAGE OR PUSH-PULL**

*An extensive range of standard types  
always available for prompt delivery*

**SPECIAL TYPES DESIGNED  
TO SUIT YOUR NEEDS**



THE WORLD-RENOWNED SPECIALIST DESIGNERS  
AND MANUFACTURERS OF MAGNETIC AMPLIFIERS



*Now FREE to all!*

**THE E-M TECHNICAL ADVISORY SERVICE**

Regardless of whether your magnetic amplifier problem is simple or complex, the fact remains that the only reliable solution is that which entirely eliminates risk.

We therefore respectfully invite you to avail yourself of the wide resources of technical knowledge and practical experience possessed by the specialist technicians of our Magnetic Amplifier Division.

*Full technical data  
and illustrated leaflets  
promptly forwarded  
on request!*

**ELECTRO METHODS LTD. 12-36 CAXTON WAY, STEVENAGE, HERTS. Phone: STEVENAGE 780**

where  
small size  
and  
performance  
count



**VENNER**  
**ACCUMULATORS**



The Venner Lightweight Silver-Zinc Accumulator is ideal in every application where minimum size and weight are essential. It is particularly suitable for radio and "walkie-talkie" equipment.

Write for full particulars and catalogue WW.

**VENNER ACCUMULATORS LTD.,**  
KINGSTON-BY-PASS, NEW MALDEN, SURREY.

Phone: MALden 2442.

Associated Companies: Venner Limited — Venner Electronics Ltd

# "WEYRAD"

## COIL PACKS AND I.F. TRANSFORMERS

### FOR HIGH PERFORMANCE

### THE B.30 SERIES

These packs have been developed to provide an answer to the problem of reliable operation on overcrowded broadcast bands. The use of an R.F. stage results in much improved sensitivity and selectivity.



#### UP TO 4 WAVE BANDS — GRAM. SWITCHING

Fully tropicalised, iron-cored coils wound on moulded bakelite formers. Ceramic based, compression-type trimmers. Close tolerance silvered mica paddlers.

**B30/G — TUNING CAPACITY 483-532 pF.**  
**B31/G — " " 354-399 pF.**  
Coverage 12.5-550 m. in 4 bands.

**B32/G — TUNING CAPACITY 483-532 pF.**  
**B33/G — " " 354-399 pF.**  
Coverage 12.5-37, 33-100, 190-550 & 800-2,000 m.

**B34/G — TUNING CAPACITY 483-532 pF.**  
**B35/G — " " 354-399 pF.**  
Coverage 16-50, 190-550 & 800-2,000 m.

PRICES: B30-33 93/9 + 30/6 P.T.

B34-35 84/5 + 27/5 P.T.

#### FOR USE WITH THESE I.F. TRANSFORMERS

**WEYRAD**  
**TYPES**  
**P.3, P.4,**  
**P.5 or P.6.**  
Operating at  
465-479 Kc/S.



A very wide choice of I.F. stage arrangements is possible. The types listed cover transformers of the highest possible electrical and mechanical quality, low cost versions for manufacturers and special types providing variable selectivity characteristics.

P.3.A & P.3.B .....	9/10 each
P.4 .....	7/6 each
P.5 .....	8/6 each
P.5.A .....	10/- each

**WEYMOUTH RADIO MFG. CO., LTD.**  
CRESCENT STREET, WEYMOUTH, DORSET



## ANNOUNCEMENT FM RECEIVER ALIGNMENT GENERATOR MODEL 1324

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

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

## COSSOR Model 1322

## Telecheck and Marker Generator for Bands I and III

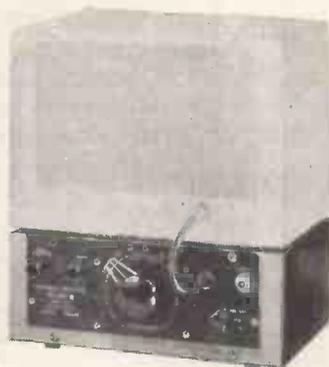
Model 1322 — used in conjunction with a cathode ray oscillograph — provides equipment for the display, measurement and correct adjustment of RF and IF response curves of television receivers. This entirely new instrument comprises a swept oscillator covering the Television BANDS I and III (5-75 Mc/s.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

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

### TELECHECK CONVERTER FOR BAND III

### Model 1321

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



# COSSOR

## ELECTRONIC INSTRUMENTS

Write for illustrated leaflets about both these instruments :

COSSOR INSTRUMENTS LIMITED (Dept. 1) Highbury Grove, London, N.5.

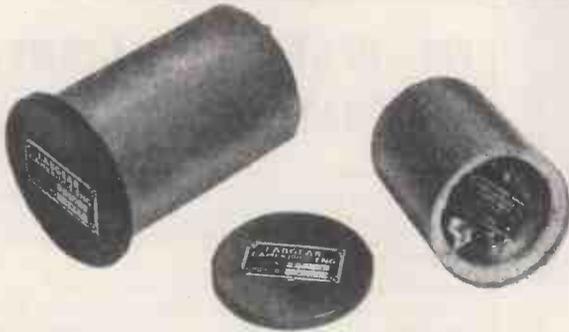
CI.60

Telephone : CANonbury 1234 (33 lines)

Telegrams : Cossor, Norphone, London

Cables : Cossor, London.

## FOR ACCURATE FREQUENCY CONTROL



### CRYSTAL OVEN TYPE E.5101

- ★ For 10X, 10XJ and B Style crystals
- ★ 11 watt heater—6.3 v. A.C. or D.C.
- ★ Temperature differential 1.5°C.
- ★ Thermostat range.—1°C. to +104°C.
- ★ Nominal setting 45°C.
- ★ Price £7/10/-.

### CRYSTAL DRIVE UNIT TYPE E.5102

A crystal controlled drive unit for transmitters requiring a frequency stability of better than  $\pm 0.003\%$ .

- ★ Uses temperature controlled oven E.5101
- ★ Built-in power supply
- ★ 250 mW. output
- ★ 2-6 Mc/s fundamental frequency range



PLEASE SEND FOR INFORMATION ABOUT OUR PRODUCTS OF  
SPECIAL INTEREST TO THE COMMUNICATIONS ENGINEER

**Labgear (Cambridge) Limited** WILLOW PLACE,  
CAMBRIDGE, ENG.

Telephone : 2494 (2 lines)

Telegrams : "Labgear, Cambridge"

## The latest GOLDRING

VARIABLE RELUCTANCE CARTRIDGE No. 500

is the complete answer . . .

SEE TECHNICAL REPORT: "THE GRAMOPHONE," JAN. 1955

The No. 500 High-fidelity pickup cartridge, is earning a great reputation as a faultless link between records and amplifiers of the present day.

DIAMOND STYLI NOW AVAILABLE

### ★ GOLDRING HIGH QUALITY TRANSCRIPTION ARMS

The new Goldring High-quality transcription arm which features a cantilever counterbalance adjustable to give a range of stylus pressures, and is designed primarily as a worthy housing for the high-quality No. 500 cartridge. It is precision engineered, and, with the No. 500 cartridge, is virtually resonance-free. Two versions are available, one for home installations, and the other for professional use. Transcriptions up to 17" diameter may be reproduced by the latter version.

TYPE TR/1 For Connoisseur HOME APPLICATION. TYPE TR/2 For PROFESSIONAL APPLICATION

Write for descriptive leaflets and technical information to:



**THE GOLDRING MANUFACTURING CO. (GREAT BRITAIN) LTD.**

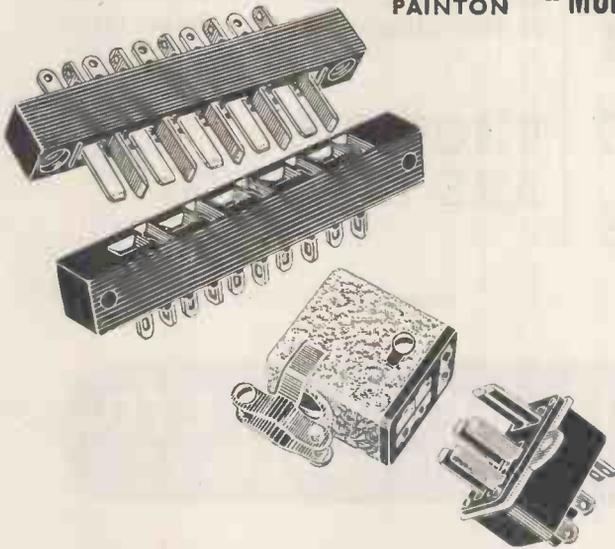
49-51A, DE BEAUVOIR ROAD, LONDON, N.1

Telephone: Cllssoled 3434



*By Appointment to the Professional Engineer*

**PAINTON "MULTICON" PLUGS AND SOCKETS**



**COMMERCIAL RANGE**

2 pole 4 pole 6 pole  
8 pole 12 pole 18 pole  
24 pole 33 pole  
and 10-in-line unitor.

Voltage Rating: 500 volts.  
D.C. or A.C. Peak.

Current Carrying Capacity :  
5 amps. D.C. or A.C. (R.M.S.)  
per contact.

Average Contact Resistance :  
Less than 0.005 ohm.

Single-piece moulding ensures  
satisfactory operation under  
severe tropical and  
climatic conditions.

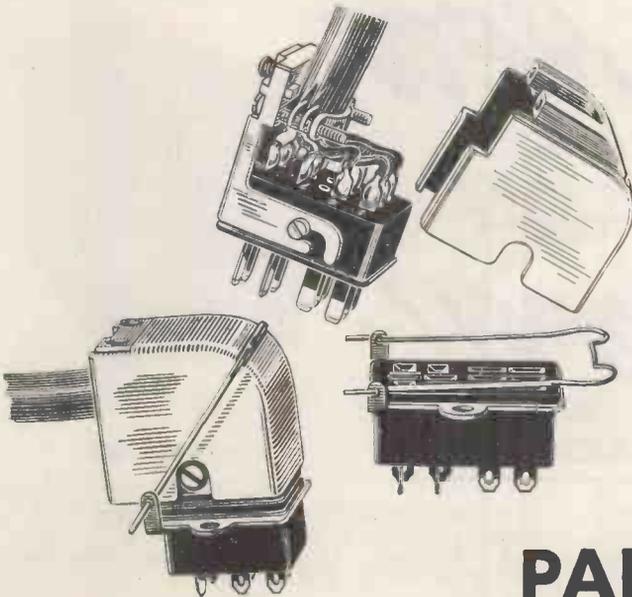
**SERVICES RANGE**

6 pole 12 pole  
18 pole 24 pole

Voltage Rating, Current  
Carrying Capacity and Average  
Contact Resistance are the same  
as for the Commercial Range.

Two-piece die-cast cover  
enables soldered joints and  
cable-clamping arrangements  
to be inspected easily.

Single-piece moulding ensures  
tropical and climatic  
performance in accordance  
with RCS.321 standards.



**PAINTON**

*Northampton England*

# RELAYS

## AMERICAN RELAYS FOR OFFSHORE CONTRACTS

We are already tooled to manufacture many types of these relays, and through our association with the Guardian Electric Manufacturing Company of Chicago, we have access to full information on other types.

ENQUIRIES  
ARE INVITED

PHONE: NEWMARKET 3181-2-3

TELEGRAMS: MAGNETIC NEWMARKET



**MAGNETIC DEVICES LTD**  
EXNING ROAD, NEWMARKET

M.D.7A



Type O-120

Portable, Lightweight, High-sensitivity Audio 'scope. 4mV/cm. r.m.s. (max.). Push-pull Plate deflection. External terminal connections to "X" Amplifier and C.R.T. available. 3c/s to 25Kc/s.

*Two NEW*

*Furzehill*

*'Scopes!*

**MAY WE SEND  
YOU PARTICULARS?**



Type O-100

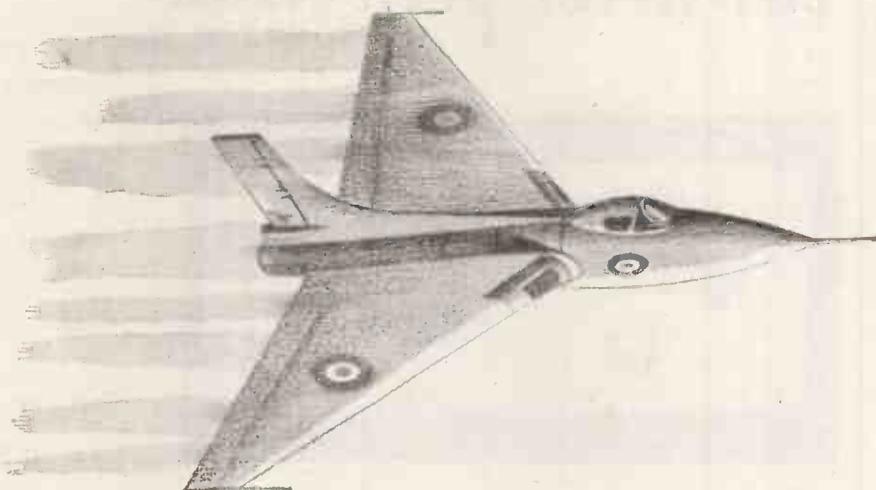
Servo and General Purpose 'scope. 7mV/cm. r.m.s. (max.). Direct coupled, symmetrical "X" and "Y" Amplifiers. Triggered Time Base. Time and Voltage calibration. D.C. to 4Mc/s.

*Furzehill Laboratories Ltd.*

57, CLARENDON ROAD · WATFORD · HERTS.

Cables: FURZLAB, LONDON.

Tel.: Gadebrook 4686/7



## *You are there...*

The scream of a jet plane and the roar of a blast furnace  
run from one end of the audio frequency range to the  
other, but for really good reproduction a loud-speaker  
must have much more than just a wide frequency range.

Suitably mounted and driven, R. & A. reproducers  
have all the attributes to take you there.

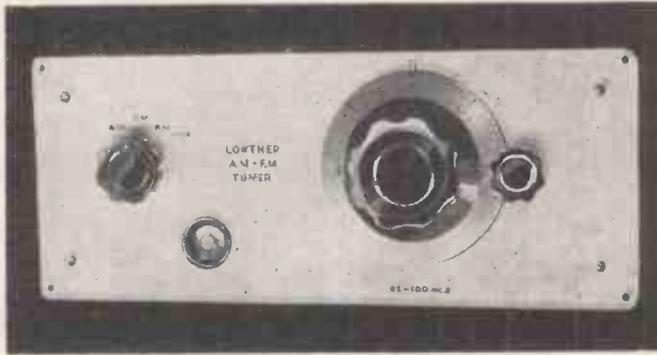
**R & A**

---

LOUD-SPEAKER MANUFACTURERS TO THE RADIO INDUSTRY SINCE 1930  
REPRODUCERS AND AMPLIFIERS LIMITED . WOLVERHAMPTON . ENGLAND

# -towards perfection-

*F.M. reception  
± 1% distortion*



The Lowther F.M. Tuner incorporates the desired features referred to by S. W. Amos, B.Sc.(Hons.), A.M.I.E.E., and G. C. Johnstone, B.Sc.(Hons.), in "Design for an F.M. Tuner." See "Wireless World" April issue.

*Enjoy better listening  
with Lowther*

Price £22. Plus £7/6/4 P. Tax.  
(Cream or Gold Panel Finish.)

LOWTHER MANUFACTURING COMPANY, LOWTHER HOUSE, ST. MARK'S ROAD, BROMLEY, KENT  
Telephone: RAVensbourne 5225

## Cellular Polythene

**75 ohm. T.V. DOWNLEAD CABLE**  
Nominal Attenuation at 50M/cs: 2.5dB/100 ft.

P.V.C Sheath.....

Plain Copper Wire Braid.....

Cellular Polythene Insulated to 0/129" Diameter.....

1/029" Annealed Copper Conductor.....

## A Glover Product



**Specialists in  
Plastic Extrusion**

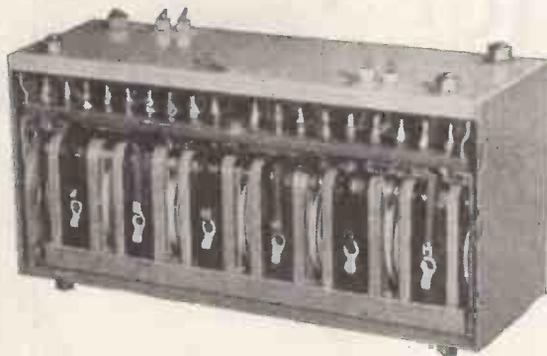
**W.T. GLOVER & CO. LTD.**

MEMBERS OF THE C.M.A.

TRAFFORD PARK MANCHESTER 17  
TRAFFORD PARK 2141



# Improved filter units



**with Ferroxcube pot cores**

- 1 *High performance combined with small size and light weight.*
- 2 *Designed and built to customers' individual requirements.*
- 3 *Long term stability, even under conditions of temperature variation.*

High quality electrical filter units built around Ferroxcube cores can now be supplied to communications equipment designers' individual specifications. These filter units have significant advantages over comparable types designed without the use of Ferroxcube, particularly in the frequency range 300 c/s to 500 kc/s. For audio frequencies the use of Ferroxcube cores permits the winding of compact coils with very high inductances. This results in a considerable reduction in the size and cost of the associated condensers and hence of the filter unit as a whole. The high Q values obtained for a given volume, especially above 10 kc/s, enable sharp cut off characteristics and low pass-band losses to be achieved, while negligible stray flux facilitates the production of compact and mechanically robust filters. Electrical filter units are among a number of high quality components now being made available by Mullard. Full details of the complete series of components will be gladly supplied upon request.

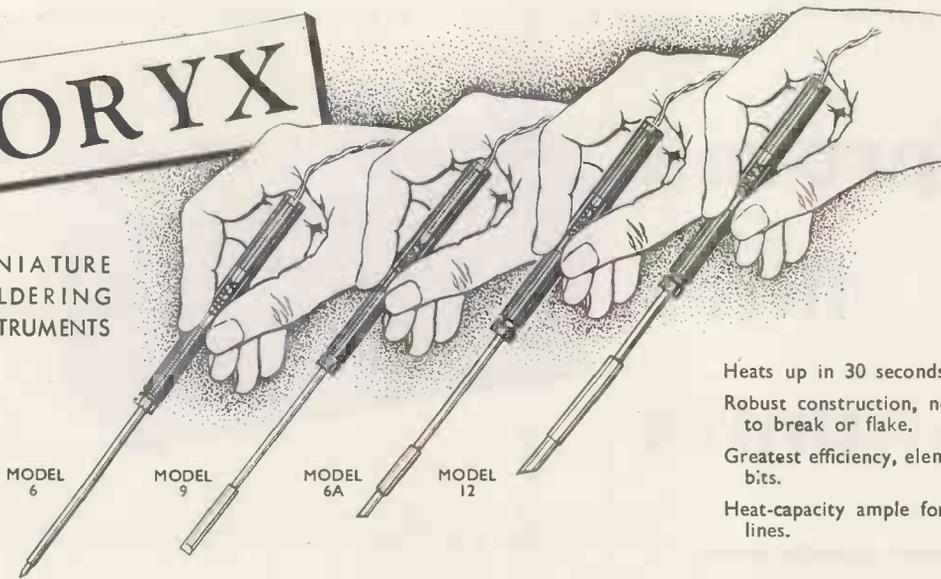
## Mullard



'Ticonal' permanent magnets  
Magnadur ceramic magnets  
Ferroxcube magnetic cores.

# ORYX

MINIATURE  
SOLDERING  
INSTRUMENTS



\*  
AS LONG  
AS THIN  
AS LIGHT  
AS A PENCIL

Heats up in 30 seconds.

Robust construction, no ceramics or mica to break or flake.

Greatest efficiency, elements situated under bits.

Heat-capacity ample for use on production lines.

Sole Distributors

**ANTEX** 3, TOWER HILL,  
LONDON, E.C.3.

Phone: ROYal 4439. Grams: (Overseas) "Antexlim London"

SUPPLIERS TO H.M. & FOREIGN GOVERNMENTS, LEADING ELECTRONIC, HEARING AID, INSTRUMENT, RADAR, RADIO, T/V, & ELECTRO MEDICAL MANUFACTURERS, HOSPITALS & UNIVERSITIES THROUGHOUT THE WORLD

Model	Consumption	Voltage	Bit Diameter	Weight	Length	Price	Spare Bits
12	12 watts	6, 12, 24 or 50	3/16" (4.8 mm)	0.5 oz	6½"	25/-	2/-
11*	10 watts	6 only	5/32" (4 mm)	0.5 oz.	6"	35/-	7/6
9	8.3 watts	6, 12 & 24	5/32" (4 mm)	0.25 oz.	6"	25/-	1/8
6A	6 watts	6 only	3/32" (2.4 mm)	0.25 oz.	6"	25/-	1/8
6	6 watts	6 only	1/16" (1.6 mm)	0.25 oz.	6"	25/-	fixed bit

\* Model 11—Special High Temperature Model.

## OSCILLOSCOPE MODEL 2300

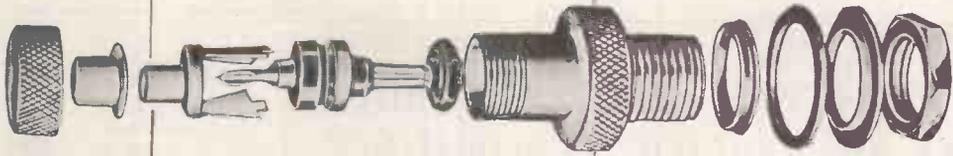
This Model meets the need for a compact and robust instrument in which nothing has been sacrificed in order to achieve true portability. It has many of the facilities required in the laboratory as well as ruggedness demanded in the field. Note these features:

- Cathode Ray Tube diameter 2¼ in.
- Square Wave Response adequate for Television synchronising wave-forms.
- Direct-coupled X and Y Amplifiers.
- Hard-valve Time Base-range 7 c.p.s. to 50 Kc/s.
- Deflection Sensitivity 50 mV. R.M.S./cm.
- Trace Expansion control from zero to 15in.
- Frequency Response D.C. to 3 Mc/s.
- Weight: 6¼ lbs. Size: 7¼ x 4¼ x 7¼ in.

Full details of this and other instruments on application to:



**INDUSTRIAL ELECTRONICS** MAGNET WORKS  
DERBY ROAD, EAST SHEEN, LONDON, S.W. 14. Phone: PRO 8211



# MINIATURE

## CO-AXIAL SEALED PLUGS AND SOCKETS



732560  
732557



732561  
732558



732564  
732563



732562  
732559

**TYPE APPROVED—  
COMPLYING WITH R.C.S. 322  
PRESSURE SEALED AND  
100% TESTED  
USED WITH UNIRADIO 43 CABLE**

A.I.D. & A.R.B. — APPROVED

EXNING RD., NEWMARKET

**POWER CONTROLS**  
LIMITED

PHONE: NEW 3181/2/3

SPECIAL EDITION

# Osmor News

OSMOR RADIO PRODUCTS

Limited (Dept. W66)  
418 BRIGHTON ROAD,  
SOUTH CROYDON, SURREY.  
CROYDON S148/9 (Trade Enquiries Invited)

PUBLISHED MONTHLY

VOL. 1. No. 2.

JUNE 1955

## NEW MINIATURE HIGH 'Q' COILS CAPABLE OF TERRIFIC PERFORMANCE

**F.M.** Frequency Modulation comes to the design of coils and a really first-class circuit of complete receiver and tuner. Free circuit, point to point wiring diagram, and full constructional information. (Send 5d. in stamps.)

### OSMOR 'Q' COIL PACKS

Size only  $1\frac{1}{2} \times 3\frac{1}{4} \times 2\frac{1}{4}$  with variable iron-dust cores and Polystyrene formers. Built-in trimmers. Tropicalised. Prealigned Receiver-tested and guaranteed. Only 5 connections to make. All types for Mains and Battery Superhets and T.R.F. receivers. Ideal for the reliable construction of new sets, also for conversion of the 21 Receiver. TR1196, Type 18, Wartime Utility and others.



The NEW Osmor 'SWITCH PACK' is now ready! Complete and Prealigned full circuit included. State which station required. 2 M.W., 1 L.W. or 3 M.W. 48/- Inc. P. Tax.

### SUPER 'Q' For Maximum Selectivity

A full range is available for all popular wavebands and purposes. The magnetic screening of the cup prevents other components from absorbing the coil's power, thus maintaining the high "Q" value. Simple one-hole fixing. ★ Only 1in. high. ★ Packed in damp-proof containers. ★ Adjustable iron-dust cores. ★ Fitted tags for easy connection. L. or M.W. 5/- inc. CIRCUIT.



## FREE!

Send 5d. (stamps) for fully descriptive literature including Circuit and practical Drawings. "The really efficient 5-valve Superhet," 6-valve s'het., 3-valve (plus rectifier) T.R.F. circuit. Battery portable Superhet circuit, Coil and Coilpack leaflets, and full radio and component lists, and interesting miniature circuits, etc.

### OSMOR STATION 7/6 SEPARATOR COMPLETE

The Separator may easily be tuned to eliminate any one station within the ranges stated and fitting takes only a few seconds. Sharp tuning is effected by adjusting the brass screw provided.



Plugs into receiver

TYPE METRES	TYPE METRES	TYPE METRES
1-141-250	4-319-405	7-1450-1550
2-219-293	6-395-492	8-410-850 k/c.
3-267-341	6-435-567	

Our Technical Dept. will be pleased to answer any enquiry by manufacturers and others relating to circuits which OSMOR coils or coil packs are used or are intended to be used.

### READERS' QUERIES!

Dears Sirs,  
I want to add a little negative feed-back to my 5-valve superhet. Please give me a simple scheme.

The simplest way to apply a measure of N.F. is to omit the bias decoupling capacitor of the output valve.

Dears Sirs,  
I wish to insert a meter as an indicator when peaking your coilpack, and to determine the optimum signal. Please state a position which will not entail too much destruction of the wiring.

The meter may be placed across the bias resistor of the frequency changer. The meter must be a high-impedance RF meter.

# NEW! and NOW available... FERROVOICE PLASTIC TAPE

Incorporating all the latest developments in tape production

PRE-STRETCHED PVC  
BROWN OXIDE  
HIGH OUTPUT  
LOW BACKGROUND NOISE  
EASE OF ERASURE  
HIGH TENSILE STRENGTH  
NON-CURLING

The QUALITY tape at  
a competitive price...  
32/6 per 1200 ft reel

On the well-known universal Ferrovoice Spool

600 ft 19/6

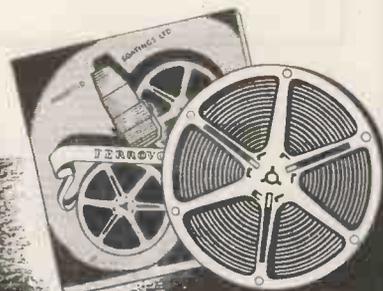
300 ft 12/6

The popular FERROVOICE PAPER TAPE is still available

## MAGNETIC COATINGS LIMITED

38 GROSVENOR GARDENS LONDON SW1 Telephone: SLOANE 9129

WORKS & LABORATORY: 25 DASHWOOD TRADING ESTATE  
LARCH ROAD · LONDON · SW12 BALHAM 5579





FOR SOUND REPRODUCTION

We are proud of the vast number of our loudspeakers incorporated in radio and television receivers used throughout the world. Their quality of reproduction and unfailing performance have been amply proved over many years in every climate and condition of service.

Rola Celestion Ltd.

FERRY WORKS, THAMES DITTON, SURREY  
TELEPHONE: EMBerbrook 3402/6

# Perfection in Miniature

ARANEUS DIADEMATUS  
(the common garden spider)

weaves its web with a thread 0.007mm in diameter, with a tensile strength of about 2 grams.

The "40 series" valves, one of the Hivac ranges of highly specialised subminiature types, uses a tungsten filament of approximately the same diameter but having a tensile strength more than five times as great.

## Hivac Limited

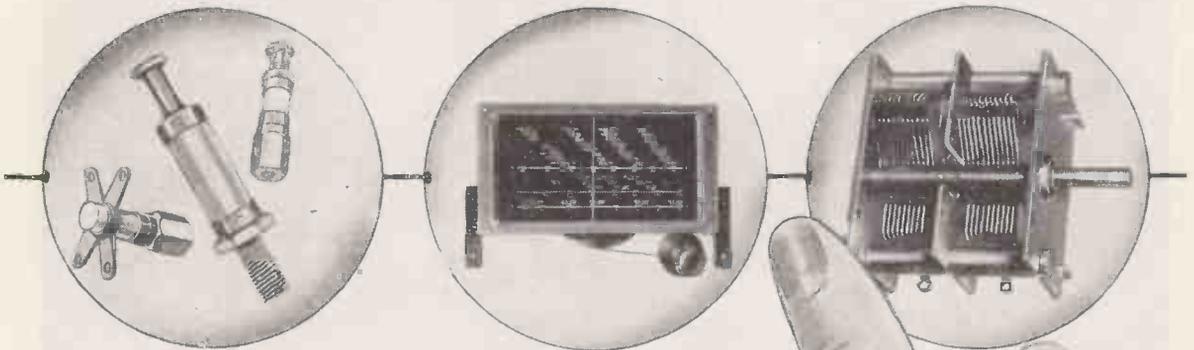
STONEFIELD WAY, VICTORIA ROAD,  
SOUTH RUISLIP, MIDDLESEX.

Subminiature, miniature and midjet valves, electrometers, cold cathode tubes, transistors, indicator and switchboard lamps, neon indicator lamps.



TELEPHONE: Ruislip 3366

P5



**You can count on these . . .  
. . . for a reliable performance**

**STAND-OFF INSULATORS.** Working voltage 1,500/5,000. Very high insulating resistance. Ceramic non-tracking. Silicone treated to repel moisture (ideal for tropics). Tag or spill end. We have a full range to cover most needs.

**S.L.8 SPIN WHEEL DRIVE.** A precision slide rule drive complete with 3 band glass scale. The spin wheel drive gives perfect control through ratio 24:1. Fitted with constant velocity coupling, eliminating strain on condenser and providing mechanical and electrical isolation from vibration and noise.

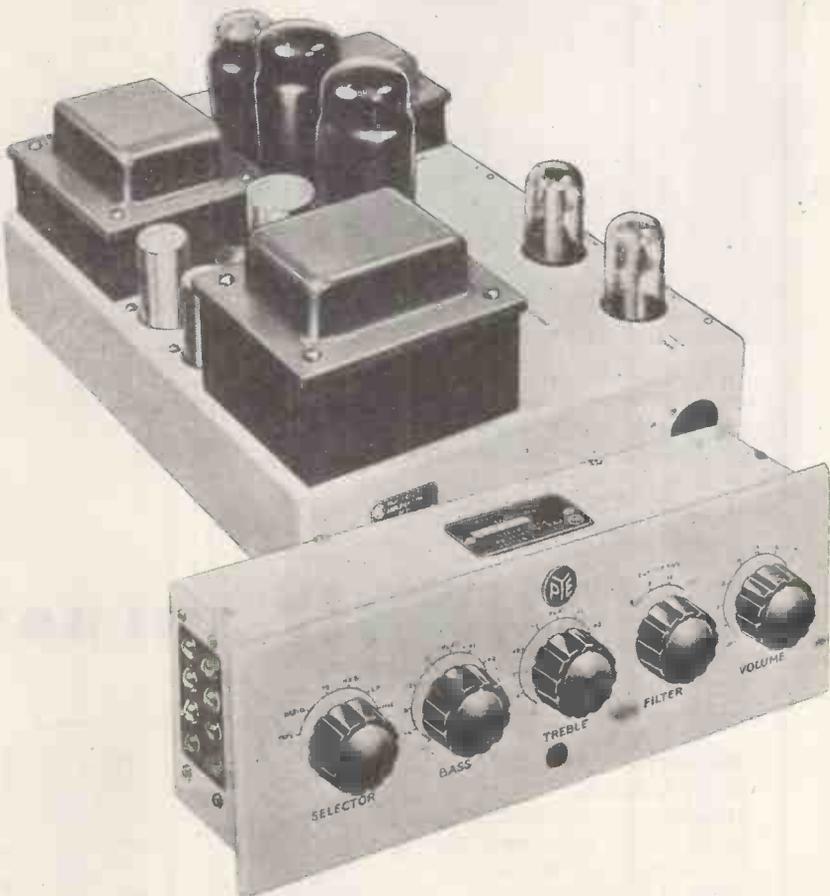
**M.G. GANG CONDENSER.** Available as 1, 2 or 3 gang, 490 p.F. nominal capacity, matched and standardised to close limits. Cadmium plated steel frame. Aluminium Vances. Low loss non-hygroscopic insulation. Length excluding spindle: 1 gang—1 1/4 in. to 3 gang—3 3/8 in. Price 1 gang, 9/3. 2 gang, 14/-. 3 gang, 18/3

Write for full details of the complete range of precision-built components for Radio and Television industry.

**JACKSON BROS. (London) LTD.,** KINGSWAY · WADDON · SURREY  
Telephone: CROydon 2754-5. Telegrams: WALFILCO, SOUPHONE, LONDON.

the versatile *Hi Fi*

**AMPLIFIER**



**PF91**  
**Power Amplifier**  
 Undistorted output  
 up to 12 watts.  
 Frequency response  
 substantially flat  
 from 2 to 160,000 c.p.s.  
 Infinite damping  
 factor.  
 Model PF91 28 Gns.  
 Model PF91A 12 Gns.  
 4 ft. of cable supplied  
 free

The brilliantly versatile combination of the **PYE PF91/91A** Amplifier and Remote Control Unit is acclaimed by enthusiast and engineer alike as the heart of any top quality Hi Fi system. For realistic reproduction from record player, tape recorder, microphone and radio tuner inputs, it stands supreme. Both units are beautifully designed and compactly proportioned, and are supplied with four feet of linking cable for easy, practical mounting in the widest variety of Hi Fi installations. Please write for a fully illustrated booklet to Pye Ltd., Box 49, Cambridge.



**PYE LIMITED** - **CAMBRIDGE** - **ENGLAND**  
 and **EIRE** - **AUSTRALIA** - **NEW ZEALAND** - **CANADA**  
**SOUTH AFRICA** - **U.S.A.** - **MEXICO**

**CONTACT-COOLED RECTIFIERS  
FOR RADIO AND TELEVISION**

Write for Publication C.C.2, to:—  
**Dept. W.W.8, WESTINGHOUSE BRAKE & SIGNAL CO. LTD.**  
 82 York Way, King's Cross, London, N.1. TERminus 6432

Publication CC 1000 2

**6. HALF-WAVE CENTRE TAP AND VOLTAGE DOUBLER CIRCUITS**

Rectifier catalogue number	Circuit	Max. input volts (RMS)	Nominal output voltage	Max. output current (mA) (mean)	Condenser details			Con- nection diagram
					No. needed	Cap. $\mu$ F	Work's voltage	
18RC.1-1-16-1	Half-wave	250	280	—	—	—	—	—
18RA.1-1-16-1	"	125	140	20	1	4	450	1
18RD.2N-1-16-1	"	250	280	60	1	32	200	1
14RA.1-2-8-2	"	250	280	150	1	16	450	1
14RA.1-2-8-3	"	250	280	200	1	32	450	2
18RD.2N-1-16-1	Centre tap	250-0-250	280	300	1	64	450	3
14RA.1-2-8-2	Voltage doubler	125	280	150	1	100	450	3
14RA.1-2-8-3	"	125	270	200	2	24	450	4
	"	125	270	300	2	100	450	5

**7. BRIDGE CIRCUITS**

Rectifier catalogue number	No. needed for bridge connection	Max. input volts (RMS)	Nominal output voltage	Max. output current (mA) (mean)	Condenser details			Con- nection diagram
					No. needed	Cap. $\mu$ F	Work's voltage	
18RA.1-1-16-1	4	250	270	—	—	—	—	—
14RA.1-2-8-2	2	250	270	120	—	—	—	—
14RA.1-2-8-3	—	250	—	—	—	—	—	—

# McMURDO MICRONECTORS

**MICRONECTORS** are precision miniature connectors, designed for instrument and aircraft applications where space is limited.

Plug and socket bodies moulded in Nylon Loaded P.F.

Contacts finished in pure gold plating to ensure ease of soldering, low contact resistance, and long storage life without corrosion.

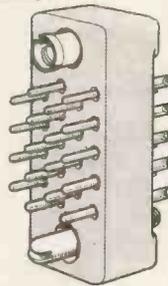
Covers made of anodised aluminium fitted with sturdy cable clamp.

The full range, which will shortly be available, will include: 9, 18, 26 and 34 way.

New Wholesale Agents:—Lugton and Company Limited,  
 209-212, Tottenham Court Road, London, W.1.  
 Telephone: MUSeum 3261.



Socket MS18

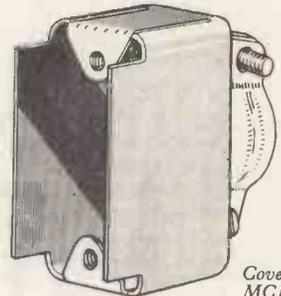


Plug MP18

Actual size

**18** way

now available



Cover MC18/A

For full details apply to:—

**THE McMURDO INSTRUMENT COMPANY LTD.,** Victoria Works, Ashted, Surrey. Tel.: Ashted 3401.

*Ferranti Valves for Radio and Television*



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

FERRANTI LTD · FIELDS NEW ROAD · CHADDERTON · OLDHAM

London Office : KERN HOUSE, 36 KINGSWAY, W.C.2

# BBC training manuals for radio and television technicians

## Studio Engineering for Sound Broadcasting

By members of the Engineering Division.  
BBC. General Editor: J. W. Godfrey.

Explains the principles underlying current operational procedures at BBC studio centres. Covers the whole range of equipment used in BBC studios: amplifiers, control room apparatus, Post Office lines, monitoring and communication systems.

8½ × 5½ in. 208 pp. *Illus.* 25s. net.  
By post 25s. 6d.

## Television Engineering

By S. W. Amos, B.Sc. (Hons.), A.M.I.E.E. and D. C. Birkinshaw, M.B.E., M.A., M.I.E.E., in collaboration with J. L. Bliss, A.M.I.E.E.

Volume One: Fundamentals, Camera Tables, Television Optics, Electron Optics.

Covers basic theory of the signal, all types of modern camera tubes, theory of light, mirrors and lenses as applied to television, and electron optics, including electron lenses.

8½ × 5½ in. 302 pp. *Illus.* 30s. net.  
By post 30s. 8d.

## Sound Recording and Reproduction

By J. W. Godfrey and  
S. W. Amos, B.Sc. (Hons.), A.M.I.E.E.

This book covers the theory and practice of disc, magnetic and film recording, with special reference to the equipment used by the BBC. No student or sound engineer can fail to find the book of interest, filling, as it does, a noticeable gap in telecommunication literature.

8½ × 5½ in. 271 pp. *Illus.* 30s. net.  
By post 30s. 8d.

## Microphones

By the Staff of the  
Engineering Training Department, BBC.

Originally written as a textbook for BBC engineers, this book has been made available for general publication. The requirements of microphones in a broadcasting service are considered, followed by the theory of the subject, and descriptions of studio microphones including ribbon, moving-coil, crystal and condenser types.

8½ × 5½ in. 114 pp. *Illus.* 15s. net.  
By post 15s. 5d.

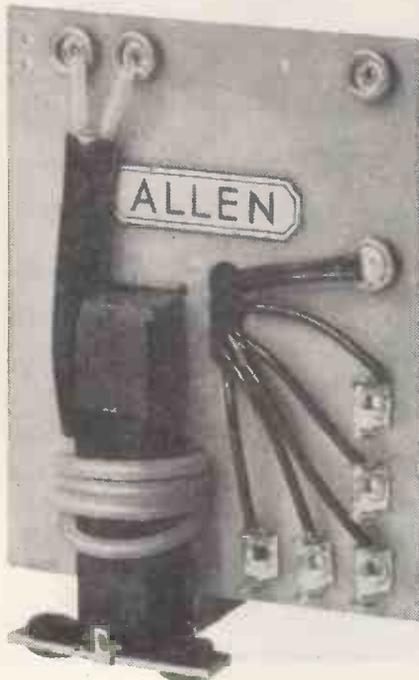
## Published for "Wireless World"

Obtainable from booksellers or direct from :-

ILIFFE & SONS LTD., DORSET HOUSE, STAMFORD STREET, LONDON, S.E.1

# LINE OUTPUT TRANSFORMER

## TYPE L.O. 352



"L.O. 352" IS THE TYPE NUMBER OF AN ENTIRELY NEW ALLEN LINE OUTPUT AUTO-TRANSFORMER NOW AVAILABLE.

Note the following "Star" features:

- ★ E.H.T.: 14 to 18 KV.
- ★ E.H.T. Regulation: Better than 5 M.Ω
- ★ Audible Whistle: Negligible.
- ★ Application: Self-running, Square-wave or Sawtooth driven.
- ★ Associated Valves: PL81, PY81.
- ★ Associated Yoke: Allen Type DC605/C.
- ★ H.T. Rail: 190 volts for 14KV.
- ★ Core Material: Mullard Ferroxcube (earthed).
- ★ Scanning Angle: 72 degrees.
- ★ Suitable C.R.T.s: Any "wide-angle" tube, from 14 to 21in.

Manufacturers are invited to write for further details and prices. Home-Constructors: Please send S.A.E. for recommended circuit diagram and details.

# ALLEN COMPONENTS LTD.

(Specialists in high-grade television components)

197, LOWER RICHMOND ROAD, RICHMOND, SURREY



Built by Craftsmen . . . . . Assembly of Scalamp Galvanometers Cat. Nos. W.W. 7901/S-4/S

*The*  
**SCALAMP**  
*Range*

You are invited to write for details of the instruments illustrated here.

The *Galvanometers* and *Electrostatic Voltmeters* are available in a range of sensitivities—the *Fluxmeter* has a very high performance and a unique return-to-zero device. Outstanding SCALAMP attributes include a truly functional dustproof case, mains or battery operation, and an easy-to-read hairline spot.



Fluxmeter Cat. No. W.W. 8834



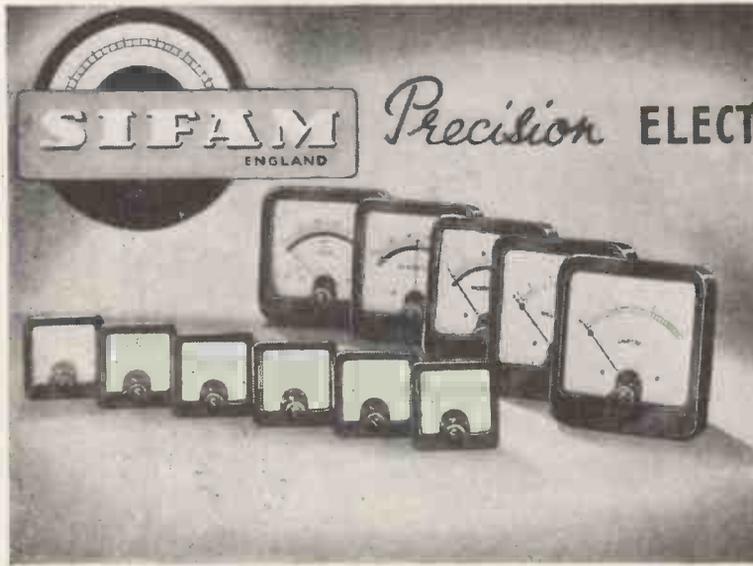
Electrostatic Voltmeter  
Cat. Nos. W.W. 11308-11310

STANDARD EQUIPMENT IN MANY LEADING LABORATORIES

SCIENTIFIC  INSTRUMENTS

W. G. PYE & CO. LTD. GRANTA WORKS · CAMBRIDGE · ENGLAND  
WG.54

# FOR THE LABORATORY and PRODUCTION LINE



SIFAM Electrical Instruments fully meet the high standards of accuracy and reliability demanded by modern industrial techniques, production control laboratory testing, etc.

Write for illustrated catalogue detailing the wide SIFAM range.

**SIFAM ELECTRICAL INSTRUMENT CO. LTD.** LEIGH COURT · TORQUAY

Telephone: TORQUAY 4547-8

In addition to our well-known standard ranges of 2in. to 4½in. square and round panel-mounting instruments, the following are a few examples of special types which we have developed to meet industrial requirements:—

- Audible Braille Multi-range milliammeters.
- Contact instruments.
- Semi log scaled instruments.
- VU indicators and decibel meters.
- Modulation meters with special ballistics.
- Temperature measuring equipment.
- Airborne instruments of special design.
- 6in. and 8in. portables for precision and industrial use.

See our exhibits  
on Stand

**27**

Block 'C'

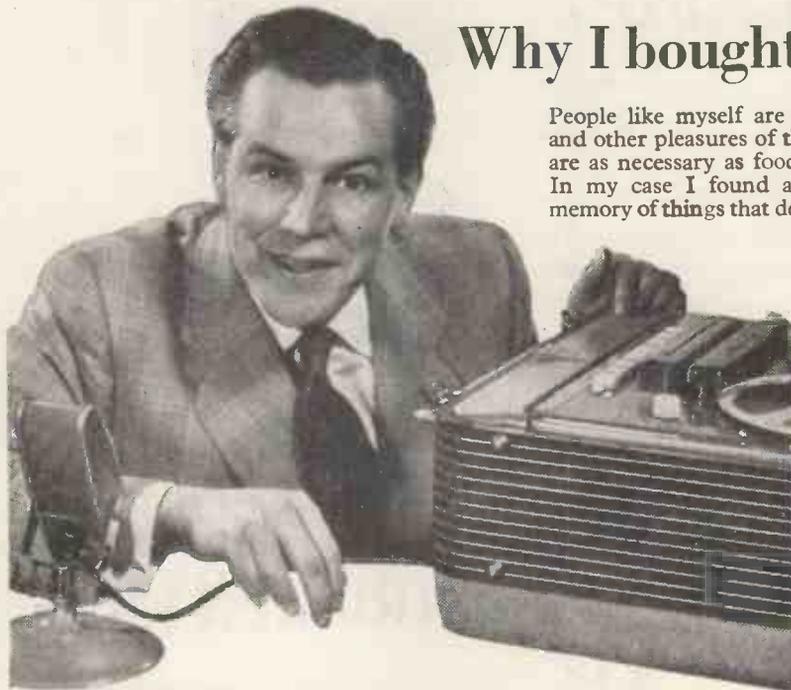
**BRITISH  
INSTRUMENT  
INDUSTRIES  
EXHIBITION**



EARLS  
COURT  
LONDON

June 28 - July 9 1955

## Why I bought a **GRUNDIG**



People like myself are inveterate listeners. For us, music and other pleasures of the mind—drama, discussion, verse—are as necessary as food.

In my case I found a need to "capture and keep" the memory of things that delighted my ear—to record the peerless performance or the subtle interchange between accomplished speakers.

For this, my Grundig Tape Recorder is perfect. It has a wide range, high fidelity reproduction and simple controls, looks that match its performance.



The Grundig TK 819 95 gns. plus  
microphone from 6 gns.  
Attractive h.p. terms available.

**GRUNDIG**

**THE FINEST TAPE RECORDERS IN THE WORLD**

See your nearest Grundig dealer or write to us for full details.

**GRUNDIG (GT. BRITAIN) LTD.** (Dept. W) 39/41 NEW OXFORD STREET, W.C.1.  
(Electronics Division, Gas Purification & Chemical Co. Ltd.)

G/R103

# miniature HT RECTIFIERS for domestic RADIO and TELEVISION receivers

## FEATURES

- Withstand overloads such as charging current of deformed electrolytic capacitors
- Instant starting — no warming-up period
- Unlimited instantaneous overload
- Practically indestructible in service.
- No limit to size of reservoir capacitor
  - Simple wiring — two connectors only.
  - Simple mounting — no valve holder
  - Small size . . . low weight
  - Low heat dissipation
  - Low cost

TYPE	RM0	RM1	RM2	RM3	RM4	*RM5
Maximum ambient temperature	35°C	55°C	35°C	55°C	40°C	55°C
Maximum output current (mean)	30mA	15mA	100mA	60mA	250mA	125mA
Maximum input voltage (r.m.s.)	125V	350V	125V	350V	250V	700V
Maximum peak inverse voltage	Unlimited	350V	Unlimited	Unlimited	Unlimited	Unlimited
Max. instantaneous peak current	0.82 oz.	1 oz.	1.4 oz.	2 oz.	4.5 oz.	Unlimited
Weight	* For use in voltage doubler circuits the peak inverse and maximum input voltages are halved. Current output being 25 for half wave operation.					



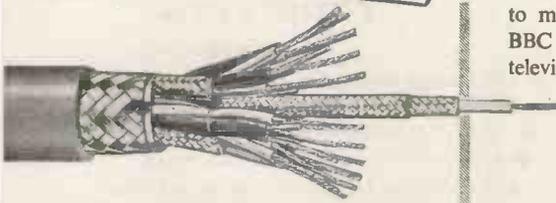
*Standard Telephones and Cables Limited*

Registered Office: Connaught House, Aldwych, London, W.C.2

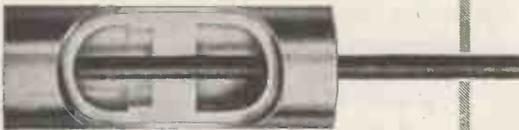
**RECTIFIER DIVISION: Edinburgh Way, Harlow, Essex**

**TELCON****and TELEVISION**

Many years' experience in cable making enables Telcon to meet every television and VHF requirement, from BBC transmission lines to down-leads for domestic television receivers.

**CAMERA LEADS**

One of many specially manufactured multicore cables for trailing camera leads, capable of withstanding continuous flexing.

**TRANSMITTER AERIAL FEEDERS**

Thimble-type air-spaced coaxial, as used as feeder cables at all the B.B.C. Television Transmitters.

**TELEVISION RECEIVER DOWNLEADS**

Type BA.24, PSM. 80-ohm balanced twin for "fringe area" reception.

**THE TELEGRAPH CONSTRUCTION & MAINTENANCE CO. LTD.**

Head Office: 22, OLD BROAD STREET, LONDON, E.C.2. Telephone: LONDON Wall 7104  
Enquiries to: TELCON WORKS, GREENWICH, S.E.10. Telephone: GREENWICH 3291



# Industry is Solving Valve Testing Problems

WITH THE

## Mullard HIGH SPEED VALVE TESTER



Industries which deal extensively with radio and other electronic equipment are finding the Mullard High Speed Electronic Valve Tester ideal for routine checks. This instrument provides the quickest method of checking large quantities of valves, and can be operated if necessary by non-technical personnel after only a few minutes' instruction. Write for full details and a copy of the folder "High Speed Testing in Industry" to Department E.V.D. at the address below.

# Mullard



MULLARD LTD., CENTURY HOUSE, SHAFTESBURY AVENUE, W.C.2

# V.H.F. v. F.M.

## *—what's in a name?*

The B.B.C. will soon be referring to F.M. as V.H.F. This is not a very startling decision, and it won't make much difference to us. For, F.M. or V.H.F., call it what you will, we have the widest selection of V.H.F. (or F.M.) units in the country—and of T.R., Hi-Fi and amplifiers too. Customers are often surprised when they see the choice we have to offer, and the opportunities of side-by-side comparison which we provide. But it's not so surprising really when you realise that we are distributors for all the leading manufacturers including such names as

***Tape Recording enthusiasts*** will be interested to hear that we have been appointed special distributors for **BRITISH FERROGRAPH TAPE RECORDERS.**

In our special showroom we have the widest selection of Tape Recorders and unusual facilities for comparative demonstration.



Send for our comprehensive 2 colour catalogue (6d. in stamps U.K. only; 1/- Special Export edition; Airmail Extra)

Quad  
Leak  
Goodsell  
Lowther  
Armstrong  
Decca  
Reslo  
Chapman  
Rogers  
Goodmans  
Wharfedale  
W.B.  
Pye  
Pamphonic  
Grundig  
M.S.S.  
Ferrograph  
G.B.  
E.M.I.

to name but a few

*—there's a good deal in the name*

# CLASSIC

ELECTRICAL COMPANY LIMITED

SPECIALISTS IN T.R., HI-FI AND F.M. (OR V.H.F.)

352-364 LOWER ADDISCOMBE ROAD, CROYDON, SURREY.

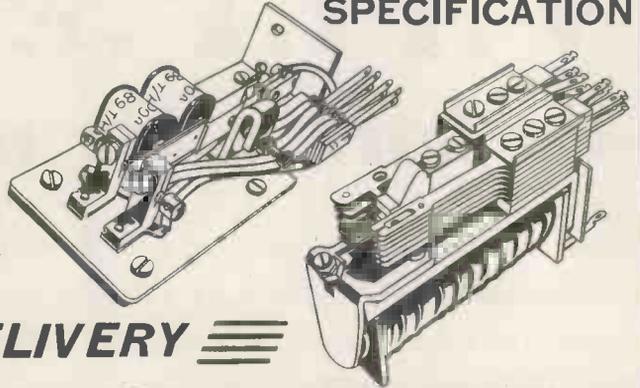
Telephone: ADDiscombe 6061

# R-E-L-A-Y-S

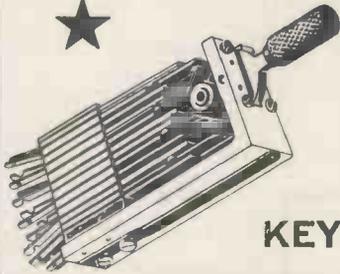
**3000 TYPES**

1 $\Omega$  to 80,000 $\Omega$  COILS 1 Make to 8  
c/o CONTACTS. 600 and HIGH-  
SPEED TYPES also supplied.

**P.O. TYPES TO YOUR  
SPECIFICATION**



**PROMPT DELIVERY**



**LARGE  
STOCKS  
OF**

**KEYSWITCHES**

The

**KEYSWITCH CO.**

ALL POST OFFICE EQUIPMENT

Enquiries to Sales Manager,  
126, KENSAL ROAD, LONDON, W.10  
Telephone LAD 0666 and 4640



GARDNERS RADIO

There are 399 Standard types  
of 'SOMERFORD' Transformers  
and Chokes IN STOCK . . . . .



GARDNERS RADIO LTD., SOMERFORD, CHRISTCHURCH, Hants. Tel. 1024

# WAVEFORM MEASUREMENT

## DUAL TRACE OSCILLOSCOPE L.101

The L.101 is a well engineered and reliable instrument incorporating two identical Y amplifiers with sensitivities of 20 mV/cm over a bandwidth of 4 Mc/s. Full screen (10 cm) undistorted deflection is available with negligible interaction between channels.

The time base may be free running, synchronised or triggered and its velocity is variable between 0.1  $\mu$ s/cm and 10 ms/cm. Calibration accuracies are: voltage  $\pm 5\%$ , time  $\pm 10\%$ .



**AT YOUR  
FINGERTIPS**



**VALVE  
VOLTMETER  
E. 7556**

An a.c. amplifier instrument covering the range 0.5 mV to 300 V r.m.s. Frequency response constant to within 2% between 20 c/s and 1 Mc/s.



**VALVE  
VOLTMETER  
E. 7555/2**

A balanced d.c. amplifier instrument fed direct or via a probe, giving a level frequency response from 30 c/s to 100 Mc/s. Full-scale readings from 0.5V peak to 15 kV peak.



**VARIABLE CUT-OFF FILTERS  
GFF. 001/01 & /02**

High-pass and low-pass filters with ten cut-off frequencies in the range 400 c/s to 17 kc/s. Stop-band attenuation 50 dB; pass-band 5 dB. Input and output impedances 600  $\Omega$ .



**WIDE-BAND  
OSCILLOSCOPE E.7581**

A precision laboratory instrument with a direct coupled amplifier giving a sensitivity of 20 mV/cm at 15 Mc/s. Time calibration accurate to 3% and voltage calibration accurate to 2%. Sweep speed .05  $\mu$ s/cm to 6 ms/cm.

# Mullard



**SPECIALISED ELECTRONIC EQUIPMENT**

See Mullard Instruments on  
**STAND 10 BLOCK C**  
**BRITISH INSTRUMENT INDUSTRIES  
EXHIBITION**

EARLS COURT · 28th JUNE TO 9th JULY

# Armstrong RADIOGRAMS

Specialists in High Quality Reproduction for over 20 years



**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 (31½ in. high, 27 in. wide and 14½ in. deep) soundly constructed, and finished in elegant Walnut veneer. Twin 10 in. P.M. Speakers give faithful reproduction, free from distortion and resonance, and the latest COLLARO RC54 Auto-changer is fitted. The radio chassis is housed in a unique "hopper" arrangement permitting armchair control over all operations.

## 57 GUINEAS

The heart of the matter . . .

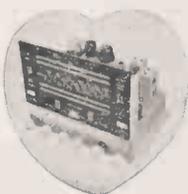
The versatile F.C. 48 Chassis, hand-built by craftsmen, which is fitted in both these fine Radiograms. The F.C. 48 has been specially designed to take the fullest advantage of modern High Fidelity recordings, and the unsurpassable quality of the new F.M. transmissions. This very latest ARMSTRONG 8-valve Chassis is the result of over 20 years of specialisation in high quality Radiogram Chassis. The Push-Pull Tetrode Output Stage will give more than 8 watts, with a Frequency Range

of 20-20,000 cps. and due to the Negative Feedback employed distortion is negligible and transient response exceptional.

BASS and TREBLE controls are independent and continuously variable, and both LIFT as well as cut. A novel Thermometer type of visual indicator is provided for both Controls. An accessible socket at the rear enables an F.M. Tuner to be simply plugged in when required. We recommend, of course, the ARMSTRONG F.M. 56.

**THE STANDARD** is a full-size Radiogram (35 in. high, 41 in. wide, 19 in. 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 a Collaro RC 54 fully mixing auto-changer fitted with the Studio Turnover Crystal Pickup Head. The Speaker is a 10 in. GOODMAN P.M. having a very high flux density (12,000 lines).

## 69 GUINEAS



PRICE

£23 . 18 . 0

★ All our models are sold under full and unconditional money back guarantee of satisfaction. Prices quoted include Purchase Tax. Hire Purchase Facilities are available.

We shall be glad to give you a free demonstration of these, and other models at our *Wartlers Road Showroom*, on weekdays from 9 until 6 p.m. (Saturdays 5 p.m.). Special High Fidelity demonstrations are given on Thursday evenings from 7 p.m.

If you are unable to visit us please write for booklet W.J.

ARMSTRONG WIRELESS & TELEVISION CO. LTD., WARTLERS RD., LONDON, N.7 Telephone: NORth 3213

# Connoisseur VARIABLE 3-SPEED GRAMOPHONE MOTOR



**CONNOISSEUR Super Lightweight 3-head Pick-up with Sapphire Stylus**

Prices: Complete Pickup with one head (either Standard 78 r.p.m. or Microgroove 33½ or 45 r.p.m.) £4 10s. 0d. + P.T. £1 12s. 1d. Total £6 2s. 1d. Each additional head £2 10s. 0d. + P.T. 17s. 10d. Total £3 7s. 10d. Replacement Armature 10s. 3d. + P.T. 3s. 8d. Total 13s. 11d.

Fitted with Diamond Stylus, complete Pickup with one head £7 12s. 9d. + P.T. £2 14s. 5d. Total £10 7s. 2d. Each additional head £5 12s. 9d. + P.T. £2 0s. 2d. Total £7 12s. 11d. Replacement Armature £3 13s. 0d. + P.T. £1 6s. 0d. Total £4 19s. 0d.

We present an entirely new three-speed unit operating at 33½, 45 and 78 r.p.m. The full 12" turntable is lathe-turned and manufactured of non-ferrous material. The main spindle is precision ground and lapped to mirror finish and runs in phosphor bronze bearings. The synchronous motor is dynamically balanced and resiliently mounted, making it virtually vibrationless, with low noise level and low hum induction.

The speed change is arranged mechanically and gives a 2% variation on all speeds, the synchronous motor running at constant speed at all settings. No braking action is employed to obtain speed change.

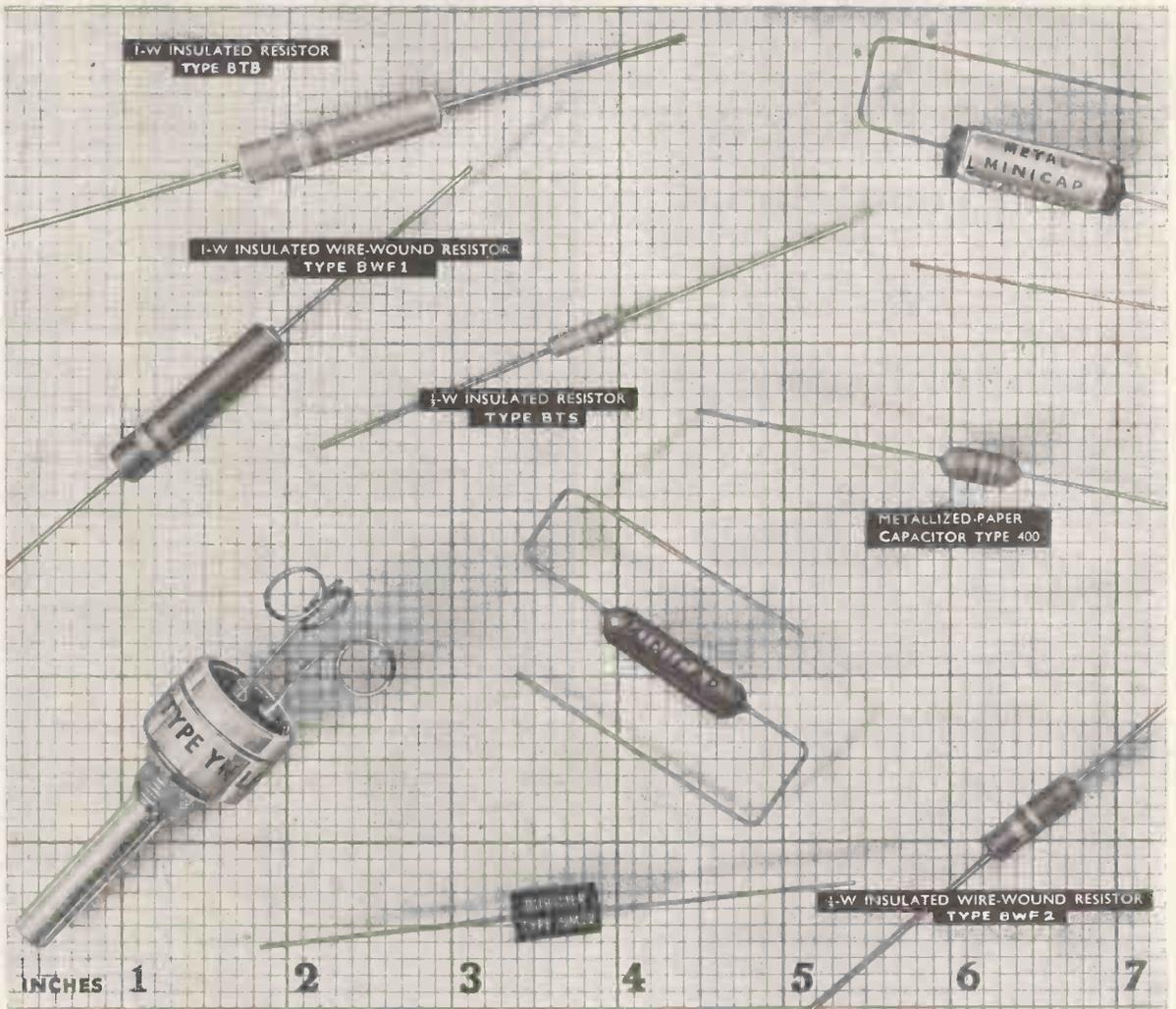
It is suitable for playing standard transcription and micro-groove recordings. Input voltages 200/250 v. A.C. 50 cycles or, as specified to order for 200/250 v. A.C. 60 cycles, or 110 v. A.C. 50 or 60 cycles. Mounted on ¼" die-cast board 15½" x 13½" with 3½" clearance distance below motor-board. Speed selector turret is fitted at left rear of motor-board. On-off switch at left front also releases pressure on the rubber drive assembly. All motorboards are drilled to take Connoisseur Standard and Super Lightweight Pickups unless otherwise ordered. When used with these pickups mounted in position, 3½" clearance above motorboard is recommended.

Price: £19 + P.T. £6 15s. 5d. Total £25 15s. 5d.

OVERSEAS AGENTS: S. Africa: W. L. Proctor (Pty.) Ltd., 63 Strand Street, Cape Town. Australia: J. H. Magrath & Co. Pty. Ltd., 208 Little Lonsdale Street, Melbourne. 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. Malaya: (Main Distributors) Eastland Trading Co., 1 Prince Street, Singapore. U.S.A.: (Main Distributors) Danby Radio Corporation, 2042 Chestnut Street, Philadelphia, 3, Pa. Audio Supply Laboratories, Nickels Arcade Buildings, Ann Arbor, Michigan.

**A. R. SUGDEN & CO. (Engineers) LTD.**  
WELL GREEN LANE : BRIGHOUSE : YORKSHIRE  
Phone: Halifax 69169. Grams: Connoisseur, Brighouse

# MINIATURIZATION



Tiny valves and transistors demand tiny components to accompany them. Whether you are working on television for Bands III and IV, Band II Radio, computers, industrial electronics or test gear, these components will undoubtedly interest you. Deserving of special mention are the tiny BTS type  $\frac{1}{2}$ -W. resistor measuring only  $\frac{3}{8}$ "  $\times$   $\frac{1}{8}$ " and the type 400 metallised paper capacitor in its melt-proof cover. For those of you concerned with tropicalization, BTS, BTB and BWF<sub>2</sub> resistors, YN-potentiometers and metal 'minicap' capacitors will be of special interest. To those of you engaged on Government contracts we should like to mention that the metal 'minicap' capacitor and the type BTS and BTB resistors are type-approved. Send for samples and catalogues by dropping us a line on your company's letter-heading.

# DUBILIER

DUBILIER CONDENSER CO. (1925) LTD., DUCON WORKS, VICTORIA ROAD, NORTH ACTON, LONDON, W.3  
 Telephone: ACOrn 2241. Telegrams: Hivoltcon, Wesphone, London. Marconi Int. Code.

an open  
*Invitation*  
to all manufacturers

*of*

**Photo Flash Equipment**

**Deaf Aids**

**Private Telephone  
Installations**

**Amplifiers**

**D.C. Power Units**

**Spot Welding Equipment**

**Test Gear**

**Magnetisation Equipment**

You are invited to regard the **TECHNICIANS** at **DALY** as a part of your own technical staff. Non-standard components are invariably a source of worry, therefore the Electrical Industry find the **DALY** "made-to-measure" service for individual requirements specially helpful and a great time-saver.

For **URGENT** problems a telephone request will bring us post haste to your factory for consultation without obligation—and you will find our readiness to help both valuable and economic.

*DALY ELECTROLYTICS for ELECTRONICS and COMMUNICATIONS . . . MOTOR START . . . RADIO and T.V. . . are in great demand throughout the world; send for appropriate pamphlet.*

# 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: DALYCON, LONDON*

## M. R. SUPPLIES Ltd.

For over twenty years we have held the proud reputation of supplying the right goods at the right price. Immediate delivery, carefully packed.

**TIME SWITCHES.** Exceptional offers. Synchronous 200/250 v. 50 cycles. Can be set to switch on and off at any desired time during the day. Load capacity 3 amps. A.C. (250 v.) in wall-mount metal housing with glass window. Secondhand, perfect, 58/6 (despatch 2/-). Also self-winding type (Vernier) operating from 200/250 v. A.C./D.C. The precision spring-driven movement is automatically kept fully wound by the mains and will continue to operate in the event of mains failure. A limited number of these very expensively made units, in standard cast metal housing with glass window at only 62/6 (des. 2/6). We handle large numbers of time switches and the above are the best offers we have yet made. Also brand new Sangamo Time Switches, 200/250 v. 50 c. in compact plastic housing only 4in. diameter by 3 1/2in. deep, providing up to 3 on-off sequences per day, with day-omitting device (use optional) and switching capacity up to 20 amps, 25/8/6 (des. 2/-).

**SENSITIVE GALVANOMETERS.** (Ex W.D., brand new.) Centre-zero deflection 2-0-2 Microamps (range can be increased to 10-0-10 Microamps). In plastic housing 3 1/2in. x 3 1/2in. x 3 1/2in., with zero setter. Fine precision instruments mostly by Tinsley and fine value at 32/6 (des. 2/-).

**LONDEX MAINS RELAYS** (Miniature type 2 1/2in. x 2 1/2in. x 1 1/2in. 230 v. A.C. coil with 2-pole c.o. 6-amp. switching, brand new, 27/6 (des. 9d.).

**STUART No. 10 CENTRIFUGAL PUMPS.** Large stock for immediate delivery. Operation 220/250 v. A.C., delivery 120 g.p.h. These direct-coupled motor pumps have no rival anywhere in the world for efficiency and economy. Fitted suppressors and fully guaranteed. Brand new 27/10/- (des. 2/6).

**LOW VOLTAGE MOTORS** (Klaxon) 6-volts D.C. for model makers, car fans (for which they were made), etc., 3in. dia. 2 1/2in. deep, with 1/2in. shaft projecting 1 1/2in. Genuine 6-volt motors are rarely available. 9/6 (des. 1/3.)

**MOVING COIL MICROPHONES**—various first-class makes. Usual 15 ohms impedance, all perfect 35/- (des. 2/-). Also a few Public Address Speakers, projector and mono-planar types, for callers only.

**S.T.C. SELENIUM RECTIFIERS.** D.O. delivery 80 volts 30 m.a. and suitable for operating relays, etc., a large quantity available at only 2/8 each.

**PUSH-BUTTON SWITCHES.** Two-button push-on push-off. Diamond H, capacity 5 amps. (250 volts), 2/6 (des. 6d.).

**CONNECTOR HEATERS,** 3 kilowatts, 230/250 v. 50 c. Fitted Deles induction motor, silent running. In 4 1/2in. housing 1 1/2in. square by 3in. deep by 1 1/2in. overall height. Many industrial and domestic applications. A few at approx. half-price, 28/18/6 (des. U.K. 6/-).

**SMALL GEAR BOXES.** Double worm gear, 300/1 reduction. In die-cast housing 2 1/2in. x 2 1/2in. x 2 1/2in. Final shaft 1/2in. dia. by 1 1/2in. proj. Ball bearings, transmission up to 1/10th H.P., 45/- (des. 1/6). Large Gear Boxes, ratio 3/1 up or down, trans. up to 1/4th H.P., 49/6 (des. 3/6).

**F.H.P. GEARED MOTORS**—we are the largest stockists in London and we invite interested firms to send for our net List GM355 in which will be found details. Final speeds from 1 r.p.m. to 100 r.p.m. and final torques from 3 lbs./ins. to 75 lbs./ins. Prices from 25/17/6. Dimensional drawings available. Immediate delivery of many ratings.

**SYNCHRONOUS ELECTRIC CLOCK MOVEMENTS.** 200/250 v. 50 cycles, with spindles for hours, minutes and seconds hands, in plastic dust cover, 3 1/2in. dia., 2 1/2in. deep, with flex, ready for use, 27/6 (des. 1/-). Set of three hands, in good style, for 5/7in. dial, 2/-.

**M. R. SUPPLIES, Ltd., 68 New Oxford St., London, W.C.1**  
Telephone: *MUSEum 2958*

## TRY the new **PRIMAX** for **SOLDERING**

**70/-**  
Post free



now in the  
sensational  
**UNBREAKABLE CASE**

NEW MODEL can now be used **ALMOST CONTINUOUSLY** without overheating. Improved easily replaceable switch. Weighs only 24 oz. Loop for hanging now provided.

The ideal tool for any **RADIO - TV - TELEPHONE** mechanic or amateur.

Available in 110, 200/220, 220/250 v. for A.C. only. 50/60 Cycles (60 w.).

## BALANCED GRIP SOLDERING GUN

Specially designed for soldering on hard-to-reach jobs.

★ **INSTANT HEATING**  
—Ready for soldering in 6 seconds.

★ **EXCLUSIVE ALLOY TIP**—lasts indefinitely under normal use and care.

★ **One year's guarantee.**

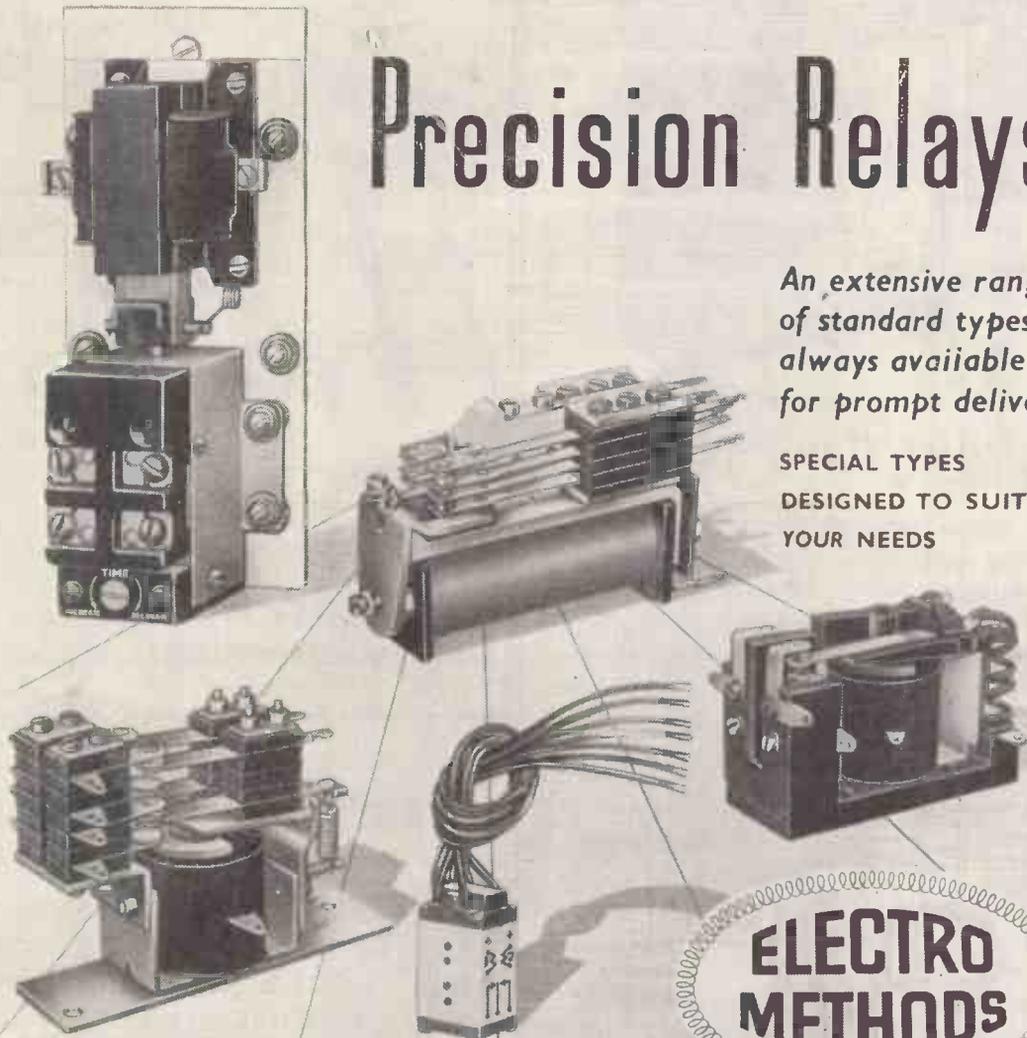
**Sole Distributors: S. KEMPNER LTD.**  
29, Paddington St., London, W.1

Phone: *HUNTER 0755*

# Precision Relays

*An extensive range  
of standard types  
always available  
for prompt delivery*

**SPECIAL TYPES  
DESIGNED TO SUIT  
YOUR NEEDS**



**— THE WORLD-RENOWNED SPECIALIST DESIGNERS  
AND MANUFACTURERS OF ALL TYPES OF RELAYS**



***Now FREE to all!***

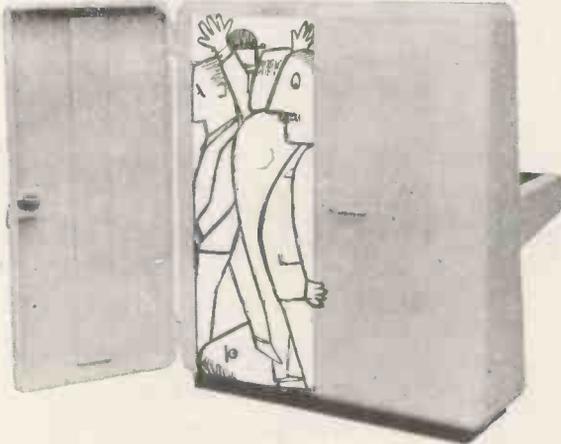
**THE E-M TECHNICAL ADVISORY SERVICE**

Regardless of whether your relay problem is simple or complex, the fact remains that the only reliable solution is that which entirely eliminates risk.

We therefore respectfully invite you to avail yourself of the wide resources of technical knowledge and practical experience possessed by the specialist technicians of our Relay Division.

**Full technical data  
and illustrated leaflets  
promptly forwarded  
on request!**

**ELECTRO METHODS LTD. 12-36 CAXTON WAY, STEVENAGE, HERTS. Phone: STEVENAGE 780**



## *the housing problem*

Lots of people come to see us about their housing problems. Mostly manufacturers—domestic and industrial: instrument makers, communications, radar, oscilloscope makers, and so on. They either know of us direct or have heard us talked about—Imhof's, sheet metal *specialists*.

They come and look at our metal housings: see and feel the finish, inspect thoroughly (as these technical chaps will do). They select from our varied standard range of cases, cabinets, racks and control consoles . . . And then confirm the order next day! Sometimes, of course, modifications are wanted. All well and good.

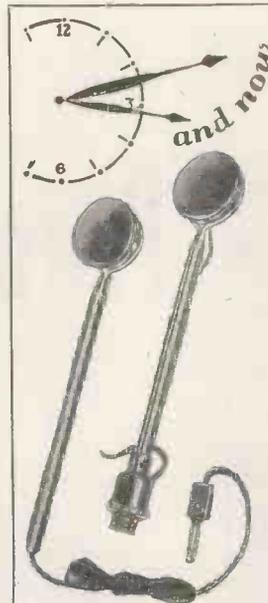
More rarely, a totally new housing is requested—to fulfil specific requirements. But with a design team second-to-none, that's not difficult! Have you a "housing" problem? Write or phone for further particulars of our "standards"—or call in personally—anytime!

*for worthwhile cases,  
racks, cabinets and consoles*

# **IMHOFS**

**ALFRED IMHOF LTD., Dept. P1,  
112-116 New Oxford Street, London, W.C.1**

MUSEUM 7878



## **S. G. Brown AUDIO AIDS**

Handphones with individual volume control. Ideal for use with church and cinema deaf aid installations or for individuals with impaired hearing. They provide the essential clarity of reception when listening to Radio and T.V.

Send for Brochure "W" of all types available. If desired, advice is given on selection of type most suited to individual needs.

S. G. Brown provide Headphones and associated equipment for all known purposes.

## **S.G. Brown, Ltd.**

**SHAKESPEARE STREET, WATFORD, HERTS.**

Telephone: Watford 7241

(5)

## **CAPACITY IMMEDIATELY AVAILABLE**

**FOR WIRING AND ASSEMBLY.  
TRANSFORMERS, CHOKES  
AND COILS WOUND TO  
SPECIFICATION.**

**IN ADDITION  
TO THE ABOVE MANY OF THE  
LARGEST MANUFACTURERS  
HAVE USED OUR RESOURCES  
FOR THE PRODUCTION OF  
SPECIAL EQUIPMENT, TESTING  
INSTRUMENTS AND PROTO-  
TYPES.**

**IF WE CAN ASSIST YOU OUR  
REPRESENTATIVE WILL BE  
PLEASED TO CALL.**

Contractors to the Ministry of Supply.

**HOMELAB INSTRUMENTS LTD.,  
615/617, HIGH ROAD, LEYTON, LONDON, E.10  
Phone: LEYtonstone 5651 Grams: HOMELAB LEYSTONE LDNDON.**

# The **NEW** "TRANTESTA" For Fly-Back and Iron Core Transformers



**IN YOUR  
HANDS  
for**

**17 GNS.**

**ORDER  
NOW!**

Subject to usual  
Trade Terms

FROM YOUR  
WHOLESALER

Provides an immediate and positive check of fly-back and most iron cored transformers either in or out of the set. Tests continuity of wiring revealing even one shorted turn. Indispensable to the Television Service Engineer and Research Technician.



**FARNELL INSTRUMENTS LTD.**

**15 PARK PLACE • LEEDS 1 • Phone: Leeds.32958/9**

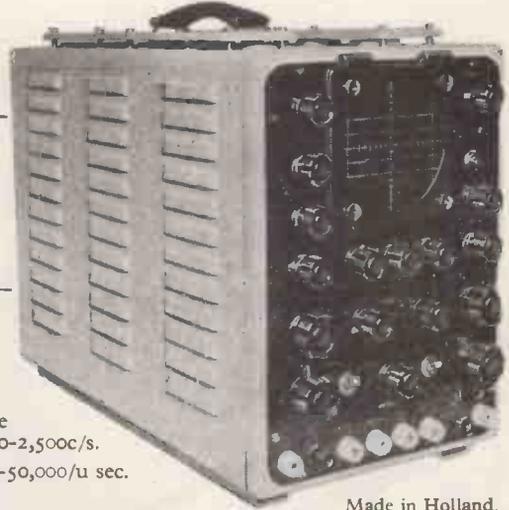
# PHILIPS

# Present...

## GM 5660 HIGH SPEED OSCILLOSCOPE FOR PULSE, RADAR AND T.V. APPLICATIONS

### Features:

- 1 Vertical sensitivity 100mVrms/cm.
- 2 Vertical amplifier 15 c/s—10 Mc/s (-3dB).
- 3 Amplifier gain 90 X.
- 4 Vertical input 1 M.ohm and 40 pF (Max.)
- 5 Built in pulse generator 220-2,500c/s.
- 6 Time base 2-50,000/u sec. in 5 ranges.
- 7 Built in post acceleration voltage.
- 8 Screen 10 cms. diameter.



Made in Holland.



# PHILIPS ELECTRICAL LIMITED

INDUSTRIAL PRODUCTS DEPARTMENT, CENTURY HOUSE, SHAFESBURY AVENUE, LONDON, W.C.2.

**"THE OSCILLOSCOPE AND ITS APPLICATIONS"** As a result of the great demand for the original book we have now reprinted the above publication. The new edition has been brought up to date and contains new data on the design of Oscilloscopes for pulse work and television. All the original information is still included, together with one hundred illustrated samples of the use of modern Oscilloscopes and associated equipment. *The "Oscilloscope and its Applications" can be obtained from us post free, at 5s. od. per copy.*

416 REV.

## Commercial TV

### GRAVE SHORTAGE OF TRAINED TECHNICIANS

### an opportunity for enterprising men

The Independent Television Authority's TV transmitters are due to start from London in September and from Birmingham and Manchester early in 1956. The whole Television Industry is growing rapidly. There is room for many more TRAINED men in transmitting stations, in

producing and manufacturing companies and in the service and maintenance of receivers. Is this your opportunity? If you get up-to-date TV training NOW from ICS, you will find your services in great demand and you will establish yourself as a qualified technician.

I.C.S. offer courses of instruction in:

**T/V TECHNOLOGY · RADIO ENGINEERING  
RADAR · ADVANCED SHORT-WAVE RADIO  
RADIO SERVICE ENGINEERING · BASIC ELECTRONICS · FREQUENCY MODULATION**

I.C.S. will also coach you, until successful, for the following examinations: B.I.R.E.; P.M.G. Certificate for Wireless Operators; Radio Servicing Certificate (R.T.E.B.); C. and G. Tele-communication, etc.

Fees include all books.  
Reduced terms for H.M. Forces.  
**POST THIS COUPON TODAY**  
For free descriptive booklet on the subject which interests you.

**INTERNATIONAL CORRESPONDENCE SCHOOLS,**  
Dept. 223F, International Bldgs., Kingsway, London, W.C.2

Please send Booklet on subject.....

Name..... Age.....

(Block letters please)

Address.....

**REDUCED SUMMER TERMS—**

This coupon will save you money



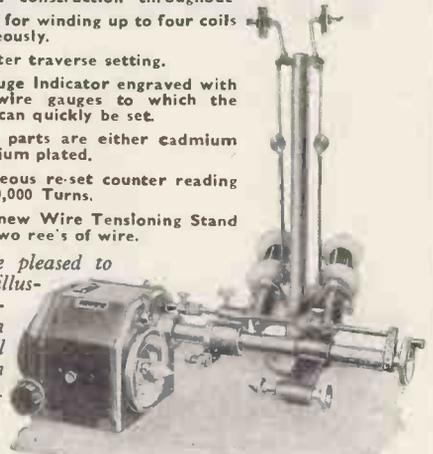
## AUTOMATIC COIL WINDING MACHINE

Type A1/1. (25-50 S.W.G.) Type A1/X. (19-46 S.W.G.)

This machine is the most modern on the market and it possesses many exclusive refinements including:

- Dustproof construction throughout
- Provision for winding up to four coils simultaneously.
- Micrometer traverse setting.
- Wire Gauge Indicator engraved with various wire gauges to which the machine can quickly be set.
- All steel parts are either cadmium or chromium plated.
- Instantaneous re-set counter reading up to 100,000 Turns.
- Entirely new Wire Tensioning Stand to hold two ree's of wire.

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

# RD JUNIOR — "Designed exclusively for home High Fidelity systems"

CORNER HORN AND AMPLIFIER/CONTROL UNIT



Designed to form the nucleus of all but the most ambitious home high fidelity installations, the general performance of the RD JUNIOR is in keeping with the standard which has come to be expected of the modern high fidelity amplifier. It is, however, the many unique and novel features which have been incorporated in the design which distinguish it from its contemporaries and place it in a class apart, unrivalled by any other equipment approaching it in price. Outstanding amongst these features is the inclusion of an INDEPENDENT LOW PASS FILTER, virtually essential when dealing with worn records or bad radio transmissions, but normally only associated with the highest priced equipment. Exclusive features include "Impedance Plug" loudspeaker matching and the provision of four alternative Panel and Control Knob colours. Anticipating the use of an FM Unit a second radio input is provided, whilst the availability of ample spare power avoids the added expense of an additional power pack. An unusually high standard of materials and workmanship combine to provide absolute reliability, a factor reflected in the unconditional TWO-YEAR GUARANTEE covering both units.

**PRICE £26 COMPLETE**

12-page Illustrated Booklet post free on request.

Available from Specialist Dealers in London and the Provinces, or if in any difficulty, please apply direct. Agents in the majority of overseas countries. Trade and Export enquiries invited.

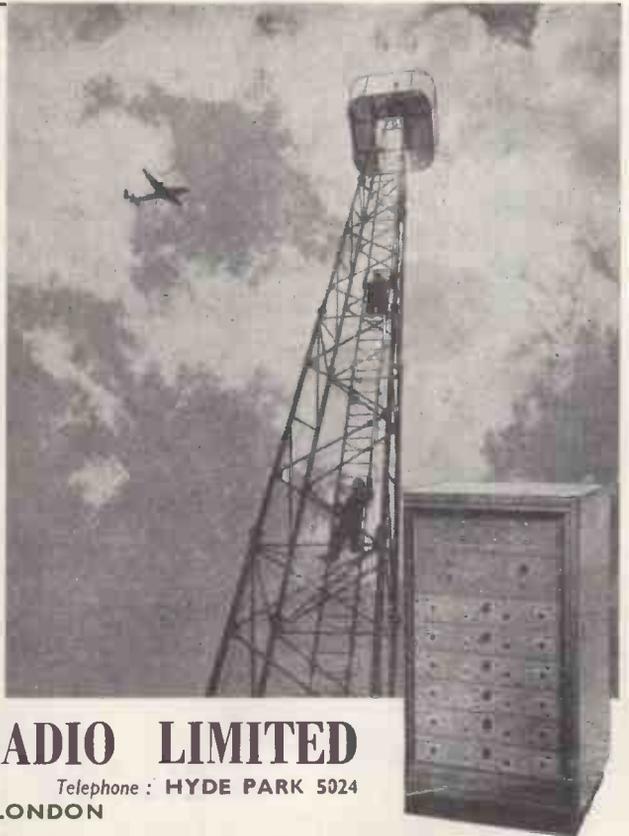
## ROGERS DEVELOPMENTS Co.

"Rodevco House," 116, Blackheath Rd., S.E.10. TIDeway 1723

## THE I.A.L. BEACON MONITOR RECEIVER

The value of navigational aids—dependent on accurate and continuous operation—can only be assured by constant checking. IAL Beacon Monitor Receivers (which fully conform to ICAO standards) provide automatic monitoring of high- and low-power MF beacons. The constant watch they keep is a vital link in the navigational chain—their vigilance providing maximum homing safety.

International Aeradio provides the following services to aviation: Installation, operation and maintenance of telecommunications, radio and radar aids to navigation; airport management; air traffic control and Aeradio training schools; briefing; Aeradio and navigation consultants; systems planning; Aeradio engineering layouts; flight guides; trunk route manuals; maps, charts and other navigational needs.



## INTERNATIONAL AERADIO LIMITED

40 PARK STREET, LONDON, W.1.

Telephone: HYDE PARK 5024

Cables: INTAERIO, LONDON

# PREMIER RADIO CO.

B. H. MORISS & CO. (RADIO) LTD. EST. 40 YRS.

(Dept. W.W.) 207 EDGWARE RD., LONDON, W.2. Tel: AMBassador 4033 & PADdington 3271

MAY BE  
BUILT FOR  
**£30.0.0**  
including all valves  
(plus cost of CRT)



THE COMPLETE TELEVISOR IS SAFE TO HANDLE, BEING COMPLETELY ISOLATED FROM THE MAINS BY A DOUBLE WOUND MAINS TRANSFORMER. ALL PRESET CONTROLS CAN BE ADJUSTED FROM THE FRONT, MAKING SETTING UP VERY SIMPLE.



## CONSOLE CABINETS

For 14", 16" and 17" Televisors

A handsome Walnut Cabinet that will be a fitting housing for a first-class Televisor.

Folding doors are fitted to cover the Cathode Ray Tube when not in use. A flap is provided which gives access to the preset controls on the front edge of the Chassis. A baffle board suitable for a 10in. Loudspeaker and all the necessary Tube and Chassis bearers are included. The overall dimensions of the Cabinets are the same: Height 38½in. Width 19in. Depth Top 19in. Depth Bottom 21in.

### TUBE ESCUTCHEONS

17in. White Moulded .....	21/- (pkg. & post 1/6)
17in. Bronze Moulded, complete with Protective Glass .....	48/- (pkg. & post 2/6)
14in. Black Moulded .....	7/6 (pkg. & post 1/-)
Dark Screen Filter suitable for 14in. Tube .....	21/- (pkg. & post 1/6)
Dark Screen Filter suitable for 16in. and 17in. Tubes .....	25/- (pkg. & post 1/6)
Polystyrene Mask for E.E.T.901 .....	45/4 (pkg. & post 2/6)
Rubber Ring (anti-Cornna) for E.E.T.901 .....	6/3
Polystyrene Shroud for E.E.T.901 .....	6/2

PRICE **£13-10-0** PLUS 21/- PKG. & CAR H.P. TERMS: DEPOSIT £3.7.6 & 12 MONTHLY PAYMENTS OF 18/9

TERMS OF BUSINESS: Cash with order or C.O.D. over £1. Please add 1/- for Post Orders under 10/-, 1/6 under 40/-, unless otherwise stated.

The NEW

## PREMIER TELEVISOR

SUITABLE FOR USE WITH ANY POPULAR WIDE ANGLE TUBE

Brief Technical Details are as follows:

20 valves (plus tube) Superhet Receiver, tunable from 40-68 Mc/s without coil or core changing. Wide Angle scanning Flyback EHT giving 14 kV. Duomag Focalsier, permanent magnet focusing with simple picture centring adjustments, suitable for any wide angle Tube, may also be used with a 12in. Tube with very minor modifications.

**VISION CIRCUIT.** Common RF Amplifier, single valve frequency changer, two IF stages, Video Detector and Noise Limiter followed by special type of Video Output Valve. ALL COILS PRE-TUNED ASSURING ACCURATE ALIGNMENT AND EXCELLENT BANDWIDTH.

**SOUND CIRCUIT.** Coupling from anode of frequency changer, two IF stages, Double Diode Triode detector and first LF Amplifier, Diode Noise Limiter and Beam-type Output Valve, feeding a 10in. Speaker. ALL COILS PRE-TUNED.

**TIME BASES.** 2 valve sync. Separator, giving very firm lock and excellent interlace.

**LINE TIME BASE.** Blocking Oscillator using a pentode driving a high efficiency output stage comprising Ferroxcube Cored Output Transformer with Booster Diode.

**FRAME TIME BASE.** Blocking Oscillator driving a Beam Output Valve coupled through a Transformer to the high efficiency FERROXCUBE Cored Scanning Coils.

**POWER PACK.** Double wound Mains Transformer supplying all L.T. and H.T. using two full-wave Rectifiers.

The Televisor may be constructed in 5 easy stages: (1) Vision, (2) Time Base, (3) Sound, (4) Power Pack, (5) Final Assembly. Each stage is fully covered in the Instruction Book, which includes layout, circuit diagrams and point-to-point wiring instructions.

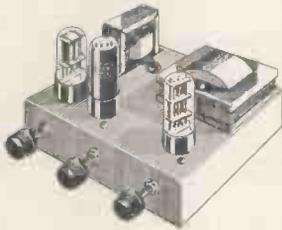
The Instruction Book also includes full details for converting existing Premier Magnetic Televisors for use with modern wide angle tubes. All components are individually priced.

Instruction book 3/6, Post Free.

MULTI-CHANNEL TUNER AVAILABLE SHORTLY — WATCH FOR ANNOUNCEMENT

# PREMIER RADIO COMPANY

## 4-WATT AMPLIFIER



MAY BE BUILT FOR **£4.10.0** Plus 2/6 Pkg. & Carr.

Valve line-up 6SL7, 6V6 and 6X5, FOR A.C. MAINS 200/250 VOLTS. The twin triode 6SL7 is used for preamplification and also for a comprehensive tone control circuit, which includes two very wide range and continuously variable tone controls for bass and treble. The output Valve is of the beam type and feeds 4 watts into a specially designed output Transformer which is suitable for either 3 ohm or 15 ohm Speakers. Negative feed-back is applied from the secondary of the output Transformer over the whole Amplifier to the input stage giving an excellent frequency response. Due to the high gain and wide range tone controls any type of pick-up may be used. Overall size 9x7x3in. Price of Amplifier complete, tested and ready for use, £5/5/-, plus 3/6 pkg. and carr.

INSTRUCTION BOOK, 1/- (Post Free) which includes Assembly and wiring diagram, also a detailed Stock List of priced components.

### UNITELEX 5-watt Amplifier Type MG4/MG4A

For Gramophone and Microphone operation, enclosed in metal case, output suitable for 15 and 3 ohms Speakers, switched input BVA miniature Valves, separate treble and bass tone controls, for A.C. mains 200/250 v. Price, enclosed in metal case, £9/19/6. Price, less metal case, £8/18/6. Packing and Postage 7/6.

### RECTIFIERS

E.H.T. Penoil Type S.T.O.		H.T. Type S.T.C.	
Type K3/25	550 v. 1 mA.	RM1	125 v. 60 mA.
" K3/40	3.2 kV. 1 mA.	" RM2	125 v. 120 mA.
" K3/46	3.6 kV. 1 mA.	" RM3	125 v. 125 mA.
" K3/50	4 kV. 1 mA.	" RM4	250 v. 250 mA.
" K8/100	8 kV. 3 mA.	L.T. Type Full Wave	
" N3/160	12 kV. 1 mA.	6 v. 1 amp.	4/-
" K3/180	14.4 kV. 1 mA.	12 v. 1 amp.	8/-
		12 v. 2 amp.	10/9
		12 v. 4 amp.	19/6

### BATTERY CHARGERS

200-250 v. A.C. Will charge 2 v., 6 v. and 12 v. Car Battery at 1 amp. Housed in strong metal casing. Finished in Green Hammered enamel. Size 6in. long, 3 1/2 in. wide, 3 1/2 in. high. Guaranteed 12 mths. The above unit is manufactured by PREMIER and does not contain Ex - Govt. components. Plus 2/6 P. and P. **35/6**



### BATTERY CHARGER KITS

All incorporate metal rectifiers. Transformers are suitable for 200-250 v. A.C. cycle mains. Cat. No.

2002 Charge 6 volt accumulator at 1 amp. Resistor, supplied to charge 2-volt Accumulator **13/6**

2004 Charges 2, 6 and 12 v. accumulators at 1 amp. **19/11**

### ALUMINIUM CHASSIS 18 s.w.g.

Substantially made from Bright Aluminium with four sides:

7 x 6 1/2 x 2 1/2 in. . . . .	4/-	10 x 9 x 3 1/2 in. . . . .	7/-
7 x 3 1/2 x 2 1/2 in. . . . .	3/9	12 x 10 x 3 1/2 in. . . . .	7/9
9 1/2 x 4 1/2 x 2 1/2 in. . . . .	4/3	14 x 10 x 3 1/2 in. . . . .	7/11
10 x 8 x 2 1/2 in. . . . .	5/6	16 x 10 x 3 1/2 in. . . . .	8/3
12 x 9 x 2 1/2 in. . . . .	7/-	16 x 8 x 2 1/2 in. . . . .	8/-
14 x 9 x 2 1/2 in. . . . .	7/6		

### ALUMINIUM PANELS 18 s.w.g.

7 x 6 in. . . . .	1/3	7 x 4 in. . . . .	1/-
9 1/2 x 6 in. . . . .	1/8	9 1/2 x 4 in. . . . .	1/5
10 x 9 in. . . . .	2/2	10 x 7 in. . . . .	1/11
12 x 9 in. . . . .	3/8	12 x 7 in. . . . .	2/5
14 x 9 in. . . . .	3/2	14 x 7 in. . . . .	2/11
16 x 9 in. . . . .	3/8	16 x 7 in. . . . .	3/5
20 x 9 in. . . . .	4/8	20 x 7 in. . . . .	4/5
22 x 9 in. . . . .	5/2	22 x 7 in. . . . .	4/11

### CABINETS—PORTABLE

#### Model PC/1

Brown Rexine covered 15/11  
Overall dimensions 15in. x 13 1/2 in. x 5 1/2 in.  
Clearance under lid when closed 2 1/2 in.

#### Model P2/C

Grey Lizard Rexine covered 45/-  
Overall dimensions 15in. x 13 1/2 in. x 6 in.  
Clearance under lid when closed 3 in.

#### Model PC/3

Rexine type covering in various colors, 69/6  
Overall dimensions 16 1/2 in. x 14 1/2 in. x 10 1/2 in.  
Clearance under lid when closed 6 1/2 in.



All the above Cabinets are supplied with Panel, Carrying Handle and Dials.  
Packing and Postage 2/6.

## Famous Manufacturer's Surplus of ANTI-INTERFERENCE AERIALS offered at a fraction of original cost.

The aerial is designed for reception of long, medium and short waves, with any ordinary or communications receiver, having an input impedance greater than 1,000 ohms long/medium waves and 150 ohms short waves. The installation discriminates against locally generated electrical interference, especially on the short wavebands. The equipment enables the installation of an 8.3 Mc/s. flatly-tuned dipole which operates as a "T" aerial on medium and long waves. The aerial and receiver transformers are intended to be interconnected with a 70 ohms co-axial cable.

### COMPONENT PARTS

Aluminium Aerial Transformer Assembly. Comprising one each: Aluminium transformer, Transformer clip rubber sucker, 1/2 in. x 1/2 in. brass screw, 4BA x 1/2 in. brass bolt, 4BA nut. Receiver Transformer. Complete with insulators, clips, etc.; porcelain insulators, 2 each, 60ft. insulated aerial wire, 60ft. screened co-axial down lead. Installation instruction leaflet included. **LESS CO-AXIAL CABLE & AERIAL WIRE, 15/-, plus 1/6 pkg. and carr. COMPLETE, 35/-, plus 1/6 pkg. and carr.**

**\*QUALITY CRYSTAL PICK-UP ROTHERMEL TYPE U48 26/-** Plus 1/6 Pkg. and Carr.

# The New "PREMIER PORTABLE" TAPE RECORDER

USING THE NEW LANE 2-SPEED TAPE UNIT MARK 6

COMPLETE **39** GNS CASH

Packing & Carriage 1 gn.

(Including Reel of Scotch Boy Tape and Microphone)

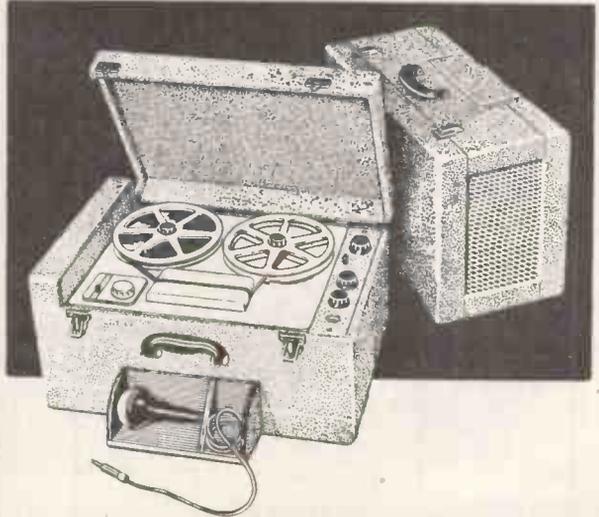
H.P. Terms: Deposit £10.4.9 and 12 monthly payments of £2.16.11,

or Complete Kit Including All Parts, Valves, Speaker Cabinet, Tape Unit, Reel of Scotch Boy Tape, Rewind Spool and Microphone at **£37.4.0** plus pkg. & carr. 15/-.

H.P. Terms: Deposit £9.6.0 and 12 monthly payments of £2.11.9.

### SPECIFICATION

- ★ TWO SPEEDS 7 1/2 in. AND 3 1/2 in. ★ 7-VALVE HIGH QUALITY PER SECOND. AMPLIFIER.
- ★ THREE SPECIALLY DESIGN-★ INDEPENDENT TREBLE AND ED RECORDING MOTORS. BASS CONTROLS.
- ★ 1,200ft. TAPE REELS PRO-★ MAGIC EYE RECORD LEVEL VING PLAYING TIMES OF INDICATOR. 1 HR. AND 2 HRS.
- ★ DROP-IN TAPE LOADING. ★ AMPLIFIER MAY BE USED FOR RECORD REPRODUCTION OF HIGH QUALITY.
- ★ EASY FORWARD OR RE-★ COMPARTMENT FOR HOUS- WIND WITHOUT REMOVING ING MICROPHONE. TAPE.
- ★ ONE KNOB DECK OPERA-★ SPECIALLY DESIGNED MIC- TION. ROPHONE BY A LEADING MANUFACTURER.



### SEPARATE UNITS CAN BE SUPPLIED AS LISTED BELOW:—

- Amplifier (built, wired and tested with Speaker). £14/15/-, plus postage and carriage 7/6.
- Hire purchase terms, Deposit £3/13/9 and 12 monthly payments of £1/0/6.
- Amplifier Kit (including Speaker). £11/-/- plus packing and carriage 5/-.
- Hire purchase terms, Deposit £2/15/- and 9 monthly payments of £1/0/7.
- New Lane 2-speed Tape Unit Mark 6. £18/10/- plus packing and carriage 7/6.
- Hire purchase terms, Deposit £4/12/6 and 12 monthly payments of £1/5/9.
- Portable Cabinet (rexine covered). £4/19/6, plus postage and carriage 5/-.
- Microphone, £2/15/-, plus postage and carriage 1/-.
- Reel Scotch Boy Tape MC2-111 (1,200ft.), £1/15/-, plus packing and carriage 1/-.
- Instruction Booklet. 2/6. Post free.

# PREMIER RADIO COMPANY

## WILLIAMSON AMPLIFIER KIT 15 gns. plus 7/6 p & p.

H.P. Terms: Deposit £3.18.9 & 12 m'thly payments of £1.11  
This Kit is absolutely complete and all components are guaranteed exactly to author's specification

## WILLIAMSON OUTPUT TRANSFORMER

Author's Specification 3.6 ohms secondaries £4.4.0

## MAINS TRANSFORMER SP425A (Completely Shrouded)

This Transformer has an additional 6.3 v. 3 A. and is capable of supplying an extra 50 mA. for Pre-amp or Feeder unit. £2.12.6

### WILLIAMSON CHOKES

12H 150 mA. Fully shrouded ..... 19/6  
30H 20 mA. Fully shrouded ..... 11/9

## METERS

Full Scale Deflection	External Dimensions in.	Movement	
3.5 A. .... 2 1/2 x 2 1/2		B.F. Thermo ..	7/6
20 A. .... 2 1/2 round		M/C .....	8/6
40 A. .... 2 1/2 round		M/C .....	8/6
500 mA. .... 2 1/2 round		M/C .....	10/6
30 A. .... 2 1/2 x 2 1/2		M/C .....	8/6
50 mA. .... 2 1/2 x 2 1/2		M/C .....	7/6
20 V. .... 2 1/2 x 2 1/2		M/C .....	6/6
40 V. .... 2 1/2 x 2 1/2		M/C .....	8/6
1 mA. .... 2 1/2 round		M/C .....	22/6
1 mA. .... 2 1/2 round		Desk type M/C	25/-

## PREMIER MAINS TRANSFORMERS

All primaries are tapped for 200-230-250 v. mains 40-100 cycles. All primaries are screened.

SP175B, 175-0-175, 50 mA., 4 v. @ 1 a., 4 v. @ 2-3 a. .... 15/-

SP350A, 350-0-350, 100 mA., 5 v. @ 2-3 a., 6.3 v. @ 2-3 a. .... 21/-

SP351A, 350-0-350, 150 mA., 4 v. @ 2-3 a., 4 v. @ 3 a., 4 v. @ 1-2 a., 4 v. @ 1-2 a. .... 30/-

SP352, 350-0-350, 150 mA., 5 v. @ 2-3 a., 6.3 v. @ 2-3 a., 6.3 v. @ 2-3 a. .... 30/-

SP425A, 425-0-425, 200 mA., 6.3 v. @ 2-3 a., 6.3 v. @ 3-5 a., 5 v. @ 2-5 a. .... 52/6

250-0-250, 30 mA., 6.3 v. @ 4 a., 5 v. @ 2 a. .... 19/6

350-0-350, 30 mA., 5.3 v. @ 4 a., 5 v. @ 2 a. .... 19/6

300-230-250 output 3 v.-30 v., @ 2 a. .... 17/6

E.H.T. primary 230 v., secondary 1.75 Kv., 2x4 v. tapped 2 v. .... 37/6

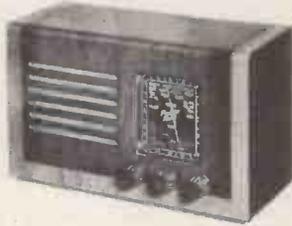
E.H.T. TRANSFORMER, primary 210 v., 230 v., 250 v., secondary 4 Kv. and 2 v. .... £3/7/6

E.H.T. TRANSFORMER, primary 210 v., 230 v., 250 v., secondary 6Kv. and 2 v. .... £3/12/6

SEND 2 1/2 d. STAMP FOR OUR 1955 CATALOGUE

## Build these NEW PREMIER DESIGNS

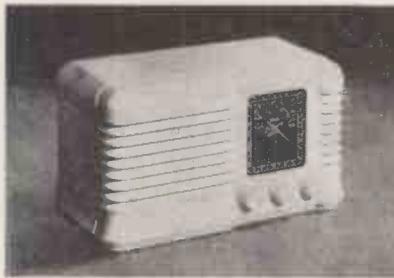
### 3-BAND SUPERHET RECEIVER



MAY BE BUILT FOR **£7.19.6** Plus 2/6 pk. & Carr.

Latest type Superhet Circuit using 4 valves and metal rectifiers for operation on 200/250 volts A.C. mains. Waveband coverage—short 16-50 metres, medium 180-550 metres, and long 900-2,000 metres. Valve line-up 6K8 freq. changer, 6K7, IF, 607, Detector AVC and first AF, 6V6 output. The attractive cabinet to house the Receiver size 12in. long, 6 1/2in. high, 5 1/2in. deep can be supplied in either WALNUT or IVORY BAKELITE or WOOD. Instruction Book 1/- post free, which includes assembly and wiring diagrams, also a detailed stock list of priced components.

### TRF RECEIVER



MAY BE BUILT FOR **£5.15.0** Plus 2/6 Pk. & Carr.

The circuit is the latest type TRF using 3 valves and Metal Rectifiers for operation on 200/250 A.C. mains. Waveband coverage is 180-550 metres on medium wave and 800-2,000 metres on long wave. The dial is illuminated and the Valve line-up is 6K7 H.F. Pentode 6I7 Detector and 6V6—Output. The attractive Cabinets to house the Receiver size 12in. long, 6 1/2in. high, 5 1/2in. deep, can be supplied in either WALNUT or IVORY BAKELITE or WOOD. INSTRUCTION BOOK 1/- (post free) which includes Assembly and wiring diagrams, also a detailed Stock List of priced components.

### ALL-DRY BATTERY PORTABLE RADIO RECEIVER



MAY BE BUILT FOR **£7.8.0** Plus 2/6 Pkz and Carr.

4 miniature Valves in a Superhet Circuit covering medium and long waves. Rexine covered Cabinets 11 1/2in. x 10in. x 5 1/2in. in two contrasting colours. Wine with Grey Panel, or Blue with Grey Panel, please state choice when ordering. THE SET MAY BE USED EVERYWHERE—home, office, car or holidays. INSTRUCTION BOOK, 1/6 (Post Free) which includes Assembly and wiring diagrams, also a detailed Stock List of priced components.

### DECCA MODEL 33A RECORD PLAYER

ADAPTABLE FOR STAND, OR L.P.



Includes crystal pick-up with sapphire stylus and a light-weight plastic spring balanced arm. Heavy gauge pressed steel case with brown enamel finish in good quality for operation on A.C. mains 200/250 v. 50 c.p.s. Supplied complete with single head (either standard or long playing). £4.19/6. Extra Head can be supplied. Plus Pkg. and carr. 5/-.

### 3-SPEED AUTOMATIC RECORD CHANGER

Made by World-famous manufacturer. The Unit designed to play 12in., 10in. and 7in. Records intermixed in any order at 33 1/3, 45 or 78 r.p.m. Capacity 10 records. New reversible dual stylus crystal Pick-up has extended frequency range. For use on 100/125-200/250 volts 50 cycles, A.C. mains. LIMITED QUANTITY ONLY. Plus packing and carriage 5/-. BRAND NEW guaranteed and in manufacturers' original carton. **£9.19.6** LIST PRICE £16/10/-.



LATEST TYPE 3-SPEED SINGLE PLAYER By famous manufacturer with crystal turnover head, for use on 100-250 v. 50 cycle A.C. mains. £7.19.8. plus Pkg. and carr. 5/-.

### MINIATURE TUNING CONDENSERS

2-gang .0005 mfd. with trimmers ..... 6/9

### PREMIER VARIABLE IMPEDANCE "MATCHMAKER" M.O.15 OUTPUT TRANSFORMERS

Designed to meet the demand for an efficient variable ratio Output Transformer 11 ratios from 13:1 to 80:1 all centre tapped and can be used to match any output valve either single or push-pull Class "A" "AB1" "AB2" or "B" to any low impedance speech coil or combination thereof. Primary Inductance 50 henries 15 watts audio 100 mA. Price 45/-.

### LOUDSPEAKERS

ELAC—2 1/2in. dia., Moving Coil, 15 ohm imp. .... 15/-  
ELAC—8in. dia. Moving Coil 3 ohms imp. .... 19/6  
PLESSEY—8in. dia., Mains Energised, 3 ohms imp. (600 ohms field) with Pentode Transformer 22/6  
PLESSEY—8in. dia., Mains Energised, 3 ohms imp. (600 ohms field) ..... 19/6  
PLESSEY—10in. dia. Moving Coil, 3 ohms imp. .... 23/6  
GOODMANS—12in. dia., Moving Coil, 15 ohms. Plus 5/- packing and carriage ..... £8/12/6  
VITAVOX—K12/20 12in. dia., Moving Coil 15 ohms. imp. .... £11/11/- Plus 5/- packing and carriage.

### CRYSTAL MICROPHONE INSERTS

Ideal for tape recording and amplifiers. No Matching transformer required, 8/6 post free.

### ACCUMULATORS

2 volt 10 amp. (by famous maker) ..... 4/11  
2 volt 16 amp. .... 5/11

### MOVING COIL METER

A super quality Moving Coil Meter basic movement 2 mA. and 4 mA. Scale dimensions 2 1/2in. Overall dimensions 2 1/2in. dia. 1 1/2in. deep. Bakelite Case projecting type. At present scaled 1 amp. R.F. By removing thermocouple, reversing scale and recalibrating the meter, a high grade test instrument with any range above the basic F.S.D. may be built up. Price 2 mA., 5/9, 4 mA., 4/9.

### MICROPHONES

LUSTRAPHONE: Moving Coil; High Impedance, Stand Type: £5/15/6—Hand Mike £8/6/-.  
RONETTE—Crystal Mike Incorp. the Filter Cell Insert; High Impd. Ball Type, £2/10/-.  
CRYSTAL MICROPHONE—Rothermel 2AD56. Especially recommended. £2/15/- Table stands for all the above 10/6 and 17/6.  
ACOS. High Impedance Crystal Microphone, type 33-1, 25/-.  
ACOS. High Impedance Crystal Microphone, type 33-1, £2/10/-.  
ACOS. "MIC30" Impedance Crystal Microphone £2/10/- (This Microphone can be used as either Hand or Desk type.)

### CRYSTAL MICROPHONE

An entirely insulated crystal microphone which can be safely used on A.C./D.C. amplifiers. High impedance. No background noise, really natural tone. The Ideal Mike for tape, wire and sound projectors, price 19/6

### MAINS NOISE ELIMINATOR KIT

Two specially designed chokes with three smoothing condensers with circuit diagrams. Cuts out all mains noise. Can be assembled inside existing receiver, 4/11. plus 6d. pkg. and carr.

Germanium Crystal Diodes. G.E.C. wire ended, 2/6 24/- doz.

# PREMIER RADIO COMPANY

## 1155 RECEIVER UNIT

### NEW CONDITION

In original cast complete with 10 valves. Frequency range 15.5 Mc/s. 75 Kc/s. in 5 wave-bands, £11/19/6. Plus 10/6 packing and carriage.

Hire Purchase Terms: £2/19/11 deposit and 10 monthly payments of £1.



## POWER SUPPLY UNIT WITH OUTPUT STAGE FOR ABOVE

Jones plugs for connecting the Power Pack to the Receiver are included. The 6V6 output stage complete with Output Transformer and 6in. speaker is built into the unit. Price £5/5/- plus 6/- packing and carriage. The two above Units together on Hire Purchase Terms £4/6/2 deposit and 12 monthly payments of £1/3/11 plus 15/8 pkg. and carriage.

## PUSH-PULL OUTPUT TRANSFORMERS. 2x6V6 into 2/3 ohms, 5/6, post free.

T.1154. BRAND NEW COMPLETE WITH VALVES, £2/19/6, post and carriage 7/6.

METER RECTIFIERS. Miniature type with leads 1.5 m. 6/9 post paid.

SLIDER RESISTANCE. Gearing adjustments, 7.5 ohms, 4 a., 12/6, postage and carriage 1/6.

HEAVY DUTY L.T. TRANSFORMER. Primary tapped 150-230 volts, 50 cycles. Secondaries 4.2 v. 10 a. 4.2 v. 10 a., 25/-, postage and carriage 2/6.

ROTARY RESISTANCE. Wire wound heavy duty 14 k. ohms, 7/6, postage and carriage 1/-.

## LATEST TYPE RUBBER ESCUTCHEON

Suitable for 17in. rectangular tubes, offered at the very special price of 10/-, plus pkg. and carr. 1/6.

## LIMITED QUANTITY RADIOGRAM CHASSIS PUSH-PULL OUTPUT

PRICE £11-19-6

Plus packing and carriage 10/-.

A 6-valve 3-waveband superhet receiver covering short 16-50 metres, medium 187-550 metres, and long 900-2,000 metres. Negative feed-back over the entire audio stages. Valve line-up: 6BE6, 6BA6, 6AT6, 2X6BW6, and 5V4. For operation on A.C. mains, 100-110 volts, and 200-250 volts. Dial aperture 8½x4¼in. Available on H.P. Terms. Deposit £2/19/11 and 10 monthly payments of £1.

## SELECTION OF H.P. ITEMS

GRUNDIG TK.819. Cash price £99/15/-, Deposit £24/4/-, 12 monthly payments £7. Postage and packing 21/-.

GRUNDIG TK8. Cash price £68/5/-, Deposit £17/1/-, 12 monthly payments £4/15/-, Postage and packing 15/-.

LEAK TL10 AMPLIFIER AND PREAMPLIFIER. Cash price £23/7/-, Deposit £7/2/-, 12 monthly payments £1/19/6. Post and packing 7/6.

LEAK DYNAMIC PICKUP WITH DIAMOND STYLI. (A) Cash price £11/9/6. Deposit £2/17/6, 9 monthly payments £1/1/4 (B) with Extra head. Cash price £19/5/3 Deposit £4/18/8, 12 monthly payments £1/8/4. Metal Transformer £1/15/-, Post and packing 8/-.

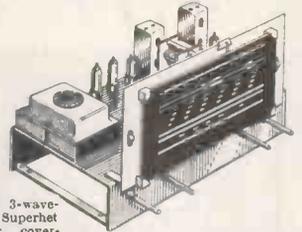
TRUVOX TYPE C AMPLIFIER. Cash price £16/18/-, Deposit £4/2/-, 12 monthly payments £1/3/6. Post and packing 7/6.

TRUVOX MK. III DECK. Cash price £23/2/-, Deposit £5/17/-, 12 monthly payments £1/12/-, Post and packing 7/6.

ELPIDO TUNER UNIT MODEL RF/720. Cash price £15/15/-, Deposit £3/18/8, 12 monthly payments £1/1/11. Post and packing 6/-.

GARRARD CHANGER TYPE RC80. A.C./D.C., with turnover head. Cash Price £22/8/5, Deposit £6/14/5, 12 monthly payments of £1/16/-, plus pkg. and carr. 7/6.

## RADIOGRAM CHASSIS



5 Valve 3-waveband Superhet Receiver covering short, medium and long waves. Using the latest miniature all glass valves, overall chassis size 13½in. x 7in. high x 6in. deep, dial aperture 10in. x 4½in. BRAND NEW, READY FOR USE AND GUARANTEED.

£10-5-0

Packing and postage 10/-, Or on Hire Purchase Terms, deposit £2/11/3 and 6 monthly payments of £1/1/9.

CABINET available for above Chassis in figured walnut lined with white sycamore, size 3ft. wide, 2ft. 5in. high, 1ft. 5in. deep, £25/15/-, Or on Hire Purchase Terms, deposit £3/18/9 and 12 monthly payments of £1/1/11. Packing and Carriage extra.

## PORTABLE TAPE RECORDER CABINETS

All Rexine covered

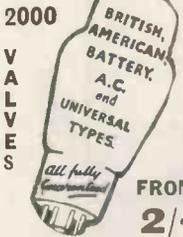
TAPE DECK	AMPLIFIER	TYPE	PRICE
Lane Mk. VI	Premier	Mk. VI	£4/19/6
Truvox Mk. III	E.A.P.	T.D.1	£4/4/-
Truvox Mk. III	Premier	T.D.2	£4/4/-
Truvox Mk. III	Truvox C	T.D.3	£4/4/-

Plus Postage and Packing 3/-.

We carry a comprehensive stock of components by all leading Manufacturers.

## Great Britain's Valve Mail-Order House

### SALE



FROM 2/-

OZ4	6/-	834	21/-
OIA	3/-	954	5/6
IA4	5/-	955	6/6
IB4	5/-	958	3/-
IE6	3/-	11225	7/-
ILN5	7/-	1299A	7/-
2A6	2/-	1825	9/6
2A7	3/-	DD207	4/-
6A7	11/-	EP6	17/6
6AQ7	18/-	HLL320	5/-
6B5	11/-	P2	3/-
6BF6	14/-	P215	2/-
12A	2/-	PO220	17/6
19BF5	6/-	ARF3	7/-
31	2/-	ARF4	5/6
32	3/-	ARF12	3/6
48	4/-	CV124	5/-
50Y6	8/-	VR18	5/-
71A	2/-	VR65	2/-

Post 9d.

### STOP PRESS

574	12/10	14B5	10/-
6N7	10/8		
6X4	10/-	24	17/6
788	10/-	39/44	10/-
7C7	9/-	46	10/6
777	10/-		
10L1	5/-	58	10/6
11D5	11/7		
129C7	9/-	84/824	9/6
14A7/15B7	12/-	1904	10/-

Post 9d.

### One Year's Guarantee

IB5	16/5	EOC40	22/1
IB4	14/6	EOC81	22/1
IB5	16/5	EOC82	22/1
IT4	14/6	EOC83	22/1
384	14/6	EOC91	31/6
3V4	14/6	RCH3	22/8
IA7GT	18/11	EOH38	20/2
IC6GT	14/6	EOH42	20/2
IH6GT	14/6	EOH81	20/2
IN6GT	14/6	EOI80	23/4
3A4	18/11	EP9	19/6
3A5	31/6	RF37A	22/1
5Y3GT	13/3	EF59	18/5
6A4	15/1	EF40	22/5
6AL5	11/4	EF41	16/5
6AQ5	16/5	EF42	22/1
6AT6	15/1	EF50	22/1
6AD6	22/1	EF60	22/1
6BA6	16/5	EP21	22/1
6BE6	20/2	EP93	16/5
6J6	31/6	EK32	22/8
6SA7GT	20/2	EK90	20/2
6SK7GT	16/5	EL3N	20/2
6SQ7GT	15/1	EL33	16/5
8V6GT	16/5	EL27	22/1
8X4	13/3	EL38	25/2
6X6GT	13/3	EL41	16/5
12A7	22/1	EL42	16/5
12AU7	22/1	EL54	16/5
12AX7	22/1	EL60	16/5
12S4GT		EMI	18/5
	20/2	EM4	16/5
12SK7GT	16/5	EM34	16/5
	16/5	EY1	25/2
12SQ7GT		EZ35	13/3
	15/1	EZ40	13/3
2516GT	16/5	EZ41	13/3
32Z6GT	13/3	EZ80	13/3
50L6GT	16/5	EZ90	13/3
80	13/3	GZ34	18/11
AZ1	13/3	PL81	22/1
AZ31	13/3	PL22	16/5
AZ50	13/3	PL83	22/1
CB11	22/1	PY80	15/9
CL4	20/2	PY81	18/11
CY1	30/3	PY82	13/3
EA60	11/4	UF42	17/1
EAB680	8/5	UC241	15/1
EA42	17/8	UBEL21	20/2
EB690	15/1	UCH21	20/2
EB41	11/4	UCH42	20/2
EB91	11/4	UF41	16/5
EB338	15/1	UF42	21/7
EB641	15/1	UL41	16/5
EBF69	13/3	UL44	25/2
EBL1	22/1	UY41	13/3
EBL21	20/2		

Post 9d.

### DEMORVED VALVES MANUAL

2/6

Giving equivalents of British and American Service and Cross Reference of Commercial Types with an Appendix of B.V.A. Equivalents and Comprehensive Price List. We have still some Valves left at very old Budget Prices (33%) which are actually sold at the old price. (1951 rate).

### PIFCO



All-in-one Radiometer A.C./D.C. Tests everything in Radio. Complete with Test prods.

29/6 Post 1/6.

### Chassis Cutters with Keys

The easiest and quickest way of cutting holes in sheet metal. The cutter consists of three parts: A die, a punch and an Allen screw. The operation is quite simple. Prices incl. key (1in., 12/4; 1½in., 13/4; 1½in., 14/6; and 1½in., 16/- each; 1½in. and 1½in., 18/- each; 1½in., 19/9; 2in., 31/9; 2½in., 36/9; 1in. square, 24/3. Post 1/-.

5/- U.S.A. MICROPHONE U.S.A. 5/- This U.S.A. Throat Mike made by Universal Microphone Company, in California, is highly sensitive. Complete with neck piece clip and illustrated 4-page specification and in original carton. Bargain Price. Only fraction of original cost. Limited quantity. Post 9d. (ideal for Electric Guitars, etc.).

### UNIQUE SERVICE



SERVICE SHEETS The one you require enclosed if available in a dozen assorted of our best choice, 10/6.



### RADIO BULLS VALVES

246, HIGH ST., HARLESDEAN, W. 14

### 1in. MICROMETER

Exceptional purchase enables us to offer a 1in. precision micrometer at the very low price of 10/-. A micrometer is an essential part of an engineer's equipment. You will have found the need for one on many occasions in the past for measuring wire gauge, etc. Price 10/- post free

B.T.H. GERMANIUM CRYSTAL DIODE. Complete with Blue 2/- print and operating instructions

ROD ANTENNAS. 1ft. sections interlocking and extending, copper plated steel. BARGAIN. 2/6 Dozen

7/6 REDUCED FROM 21/- 7/6

Pre-heated Electric Soldering Irons. 24 v. 36 Watts. Press button switch fitted. Corrosion-free Bit. Specially designed for fine work. Limited quantity.

EX-GOVT. LIGHTWEIGHT HEADPHONES

Brand new, in original boxes. Complete, a pair Also 4,000 18/9. 7/- Post 1/-

### SALE of shop-soiled METERS

AVO minor Universal	£7
Perranti Universal	£6
B.P.L. Universal	£5
Taylor 70A	£9
E.I.C. Universal	£5
Taylor 110B	£9
U.S.A. Triplet	£9
Hunts Bridge	£13
AVO 40	£16

A rare opportunity.

### CLEVELAND CAR BATTERY CHARGER

Gives 1½ amp. charge - uses everlasting metal rectifier and robust double wound mains transformer in metal carrying case with leads and croc. clips. 6 and 12 volts 39/6, post 2/6.

### Electric PAINTSTRIPPER

Outdates blow-lamp. It's a unique foolproof electric tool. Easier and faster. Clean and safe. Old paint goes like magic. Cost 1d. per hour. A.C./D.C. Complete. Guaranteed one year. Tax Free 37/6 Post 1/3 Usually 39/6

# Introducing

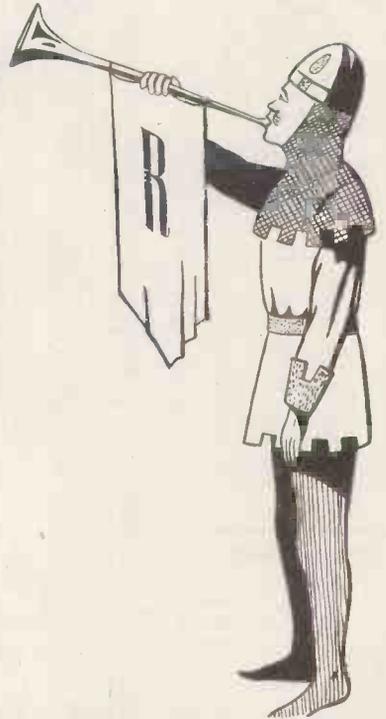


## THE REGENT H.F.100

Here is a brilliant new high-fidelity single record player which brings top quality reproduction within the reach of all record lovers.

The Regent HF.100 is built to the same high standard as the Monarch Autochanger. It plays all records, all speeds, all sizes. Its many features include: a new lightweight pickup incorporating a high-fidelity turnover crystal cartridge with dual sapphire styli; a concealed automatic stop which operates on all records, irrespective of run-off groove diameter; powerful constant-speed 4-pole motor ensuring smooth power and the well-known "Rotocam" speed change.

*We shall be pleased to send you literature on request.*



BIRMINGHAM SOUND REPRODUCERS LTD., OLD HILL, STAFFS

# Wireless World

RADIO, ELECTRONICS, TELEVISION

Managing Editor:  
HUGH S. POCOCK, M.I.E.E.

Editor:  
H. F. SMITH

JUNE 1955

## *In This Issue*

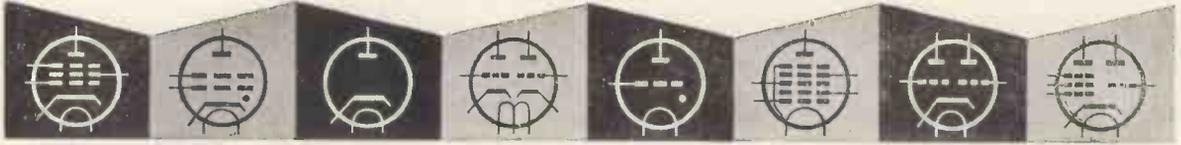
Editorial Comment .. .. .	251
V.H.F. Broadcasting Starts .. .. .	252
Tropospheric Scatter Propagation .. .. .	253
World of Wireless .. .. .	255
Components Exhibition .. .. .	258
Wide Range Electrostatic Loudspeakers—2. <i>By P. J. Walker</i>	265
Letters to the Editor .. .. .	269
Physical Society's Exhibition .. .. .	271
Test and Measuring Gear .. .. .	274
Valves and Semi-conductors .. .. .	277
Design for a 20 - Watt High - Quality Amplifier — 2. <i>By W. A. Ferguson</i> .. .. .	279
Wobbulator Adaptor for Band III. <i>By G. H. Leonard</i> ..	283
Some Problems in Television Lighting. <i>By W. C. Pafford</i>	288
B.B.C. Television Frequencies .. .. .	291
Cathode Followers — <i>By "Cathode Ray"</i> .. .. .	292
Short-wave Conditions .. .. .	296
F.M. Tuning Indicator. <i>By J. R. Davies</i> .. .. .	297
Random Radiations. <i>By "Diallist"</i> .. .. .	300
Unbiased. <i>By "Free Grid"</i> .. .. .	302

VOLUME 61 NO. 6

PRICE: TWO SHILLINGS

FORTY-FIFTH YEAR  
OF PUBLICATION

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: "Ethaworld, Sedist, London." Annual Subscription: Home and Overseas, £1 7s. 0d. U.S.A. \$4.50. Canada \$4.00. BRANCH OFFICES: Birmingham: King Edward House, New Street, 2. Coventry: 8-10 Corporation Street. Glasgow: 26B Renfield Street, C.2. Manchester: 260 Deansgate, 3.



# VALVES, TUBES & CIRCUITS

## 30. GERMANIUM DIODES FOR TELEVISION RECEIVERS

### Advantages and Disadvantages

The point-contact germanium diode can often be used with advantage in place of its thermionic counterpart. Its compactness and long life make it suitable for inclusion in a coil unit. It is robust and non-microphonic. The inter-electrode capacitance is low. There is no heater, therefore supplies are simplified and a possible source of hum is eliminated. And the forward resistance is low, giving improved detection efficiency.

The main limitations of the germanium diode, namely its reverse current at negative voltages and its relatively large temperature dependence, can be easily allowed for in circuit design and chassis layout. Earlier diode troubles, such as sensitivity to atmospheric moisture, have been eliminated by present-day manufacturing techniques.

The characteristic, as it changes from the positive to the negative region, passes through the origin, therefore at zero voltage there is no current flow. In the immediate vicinity of this point (say within  $\pm 10\text{mV}$ ) the ratio of forward to reverse resistance becomes small, and detection efficiency is much reduced.

### High and Low Current Types

The steeply rising forward characteristic of a high-current type of germanium diode implies a comparatively large reverse current and a comparatively low turnover voltage. Conversely, the less steep forward characteristic of a low-current type gives an extended reverse characteristic. These contrasted pairs of features are the basis of the possible range of diode types. They are the key to the choice of type for a particular application, and they are important influences on circuit design.

### Temperature Effects

Germanium diodes are affected by temperature, and all ratings apply at specified temperatures. It is necessary for the circuit designer to take into account not only the air temperature which is likely to occur in the receiver but also any heat which may be transmitted through the chassis. The appropriate forward current and reverse voltage ratings must be observed if the diode itself is not to generate destructive heat. It is not to be assumed, however, that a germanium diode is excessively sensitive in this respect. The dangers have been mentioned only in order to draw attention to the temperature rating—a rating which is not normally of much consequence where thermionic valves are used.

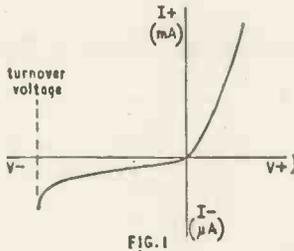


FIG. 1

### The Diode Characteristic

The general form of the germanium diode current/voltage characteristic is shown in Fig. 1. There are certain significant differences from the characteristic of a thermionic diode. The comparatively steep rise of the positive portion obeys an exponential rather than a three-halves power law, with forward currents which are normally of the order of 5 or 10mA at 1 or 2V. At high positive voltages, beyond the normal working range, the characteristic becomes nearly linear (that is resistive), without the saturation effect which is seen in a thermionic diode.

The negative characteristic shows not only a negative current for negative voltages, but also a rapid growth of this current if the voltage is made sufficiently great. In this region (which is well beyond the working range) *turnover* takes place, and the characteristic reverses. This condition produces overheating and a destructive runaway. The normal reverse currents are quite small (a few microamps) and, if the published temperature and peak reverse voltage ratings are observed, reverse currents have no harmful effect.

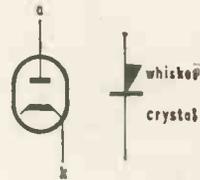


FIG. 2

Fig. 2 shows the standard symbol for a germanium diode in parallel with the familiar diode valve symbol. The figure is intended to assist in the reading of circuit diagrams. The differences between the two kinds of diodes should, of course, be borne in mind.

Further advertisements in this series will discuss the employment of the diode characteristic in a number of typical applications in television and f.m. receivers.

Reprints of this advertisement, supplemented by data for Mullard diode types, are available without charge.



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

# BRIMAR TELETUBES

**FIRST** *for picture quality*

Another first from BRIMAR—still another natural choice for the manufacturer who is looking for the finest. Here's a tube designed to be the finest. Here's a tube tested (and re-tested) at every stage of manufacture to meet the exacting demands of equipment manufacturers.

These are the features that have contributed to the Brimar success.

- Rectangular shape with maximum viewing area.
- Flat-faced to give wide-angle viewing.
- Double-aluminised screen for extra bright pictures.
- Highly efficient ion trap to minimise burns.
- External conductive coating.

Brimar by constant research and the use of modern manufacturing techniques will continue to meet the ever changing demands of electronic and radio engineers, by producing the efficient cathode-ray tube that the public demands.

*Consult* **BRIMAR**

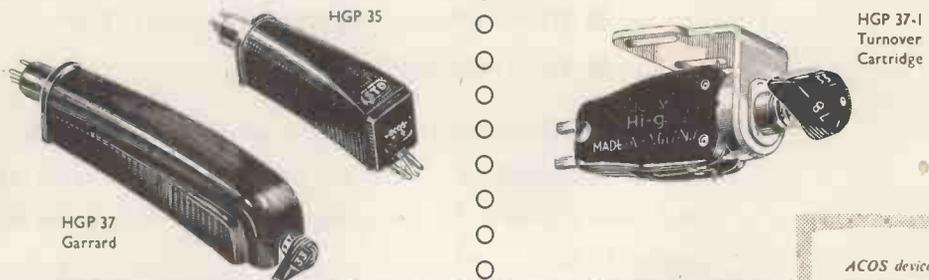
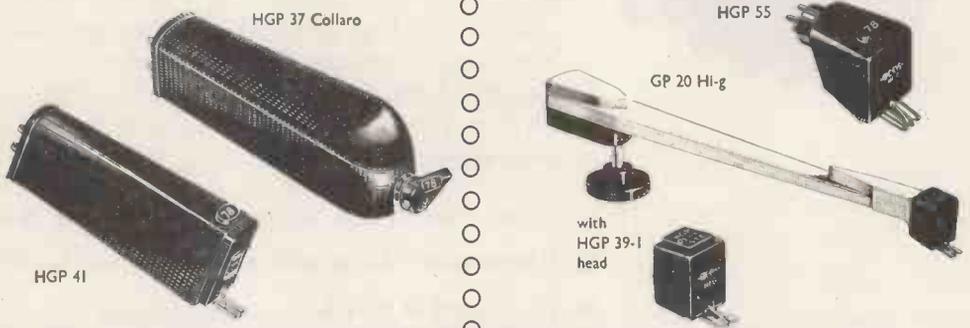
*—the people who know—for  
your future equipment  
requirements.*

*Standard Telephones and Cables Limited*

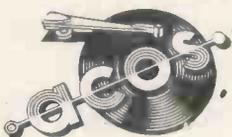
FOOTSCRAY : SIDCUP : KENT.

Telephone: FOOTscray 3333

*All these* **ACOS** *CRYSTAL PRODUCTS*  
*—and more too—go to show that*  
**FAITHFUL REPRODUCTION NEED NOT BE EXPENSIVE**



*ACOS devices are protected by patents, patent applications and registered designs in Great Britain and abroad.*



*.....always well ahead*

# "BELLING-LEE"

## NOTES



There may be many readers who do not know the "Q Code." Q.S.L.? means "can you give me acknowledgment of reception," whilst Q.S.L. means "I am receiving you." It is customary amongst amateur transmitters and operators generally to acknowledge the reception of a signal by sending a "Q.S.L." card. We are following the practice, and are sending a card, reproduced above, as acknowledgment of every report of reception of G9 A.E.D., i.e., the "Belling Lee" experimental band III T.V. transmitter on the I.T.A. site at Beulah Hill, Croydon.

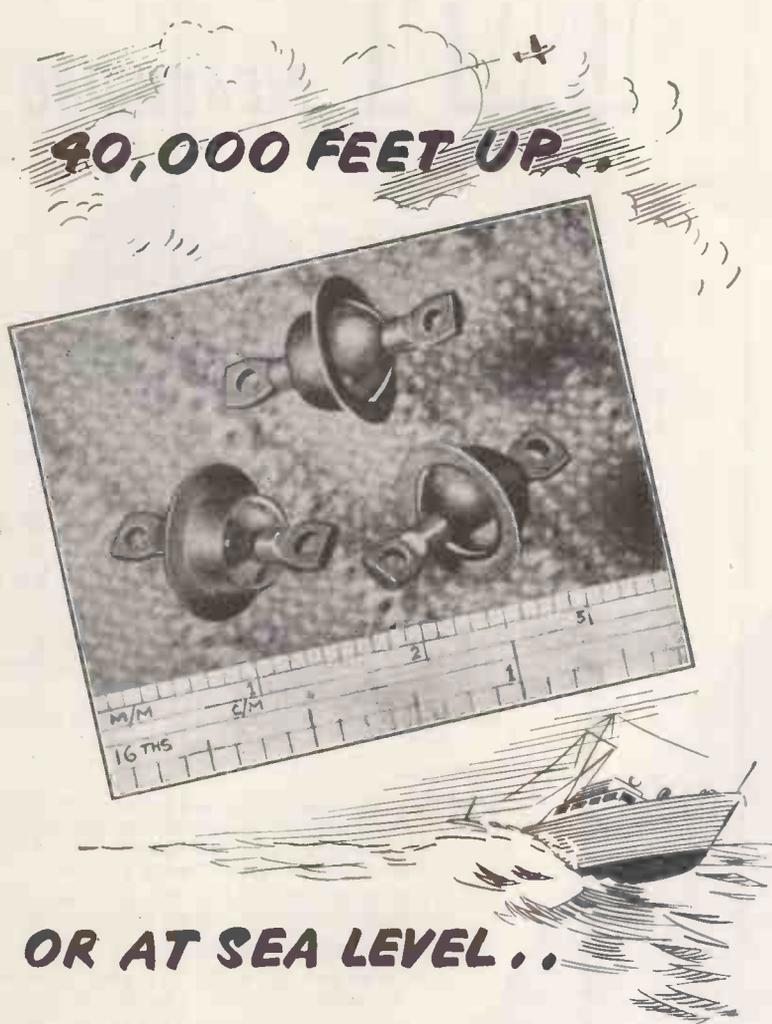
We would like the report to give the following information, name and address, type of aerial, nearest higher ground, height of aerial, type of receiver, interference (a) ghost (b) ignition. Sensitivity setting, picture quality, better/equal/worse combined with band I. Date and time of observation.

The hundreds of reports already show a very healthy pattern over the whole of the service area shown by the I.T.A. map. When the I.T.A. go on the air with 60 Kw. against the "Belling Lee" 1 Kw., it will mean that everybody who received our transmitters will receive a picture about 10 times better. This will be due to the increased power and increased mast height. "Wireless World" readers will not need to be reminded that this does not mean reception at ten times the distance.

The report received at the date of going to press indicates that our suspicions and fears regarding ghosts have been justified, but the cure is easier than we thought possible, even if in our favour. Tests have been made with a band III dipole as a reference, and ghosts are received from church towers, lightning arrests, electrical pylons and countless new objects, but in most cases they can be "laid" by the use of a multi-element array.

Generalising, the coverage from G9 A.E.D. is more satisfactory than we expected, but as we are still uncertain as to the effect that roofing materials will have on higher frequencies, we are uncertain as to the ranges that are possible with indoor and loft mounting aerials. We have a reported case of reception on a "doorod" at twelve miles, but we do not attach a lot of importance to it. We believe it to be freak reception.

Advertisement of  
**BELLING & LEE LTD.**  
 Gt. Cambridge Rd., Enfield, Middx.  
 Written 18th April, 1955



## OR AT SEA LEVEL..

### L.576 HERMETICALLY SEALED TERMINALS

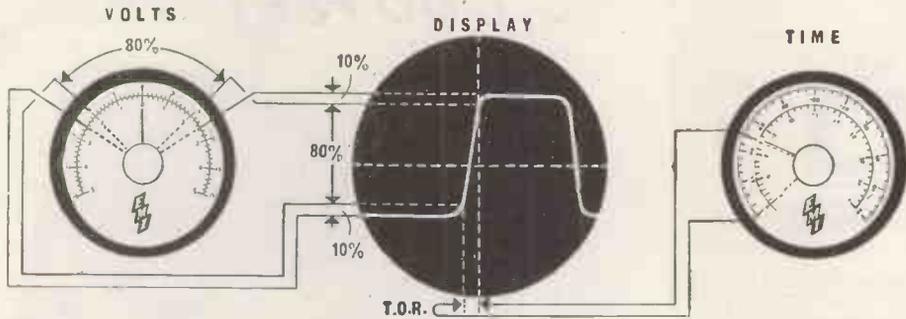
750V. d.c. Working at 40,000 feet  
 1,500V. d.c. Working at sea level

These terminals, employing glass-to-metal seals, are made for bringing connections out of sealed transformers or other sealed components. Very useful as insulated pillars where high insulation is required. When mounted, they withstand instantaneous and repeated thermal shocks of at least 250° C., and will support at least 40 lbs. per sq. in. air pressure without leakage. They are self-capacitance 1.45 mfd. Supplied tin-plated to permit soldering with modern resin cored solders, solder pastes, or solder rings.



**BELLING & LEE LTD**  
 GREAT CAMBRIDGE RD., ENFIELD, MIDDXX., ENGLAND

# E.M.I. MEASURING OSCILLOSCOPE



## Special Features of Type W.M.5

### NUMBER 1—TIME AND VOLTS MEASURING SYSTEM

The unique E.M.I. visual null bridge measuring system with meter presentation of time and voltage, gives rapid and precise measurements which are independent of variations in amplifier or CRT linearity sensitivity or supplies

The illustrations show how easily various voltage or time-of-rise measurements can be made.

#### PROCEDURE:—

1. Measure Waveform volts peak to peak (using metered Y shift volts control).
2. Align 10% point with cursor line junction (using metered X and Y shift controls).
3. Align 90% point with cursor line junction (using metered X and Y shift controls):
4. Read indicated time-of-rise from time meter.

Time Measurements: 100 ms—10  $\mu$ s (11 ranges) accuracy  $\pm 2\%$  FSD.

Voltage Measurements: 100 mV—500V AC/DC (7 ranges) accuracy  $\pm 2\%$  FSD.

#### BRIEF SPECIFICATION:

Y Amplifier: DC—25 Mc/s Bandwidth. Differential dual input.

X Amplifier: DC—8 Mc/s Bandwidth. Differential dual input

Y Sensitivity: 20 mm/V (Can be extended to 400 mm/V).

Y Input: up to 500 V peak DC/AC.

Sweep; repetitive triggered or delayed\* speed  
150 cm/ $\mu$ s—33 cm/s.

- \* An additional linear sweep of controlled duration may be used to display signals which occur during the delay period.

CRT EHT continuously variable 1-10 KV

Photography: special facilities for transient recording.

## E.M.I. ELECTRONICS LTD.

HAYES, MIDDLESEX

Telephone: SOUTHALL 2468

Extensions 857, 858 and 555





# MARCONI CRYSTALS for Stability and Precision

The experience gained in manufacturing quartz crystals to the stringent requirements of our own apparatus and those of the Services, enables us to offer a comprehensive range of crystals covering the frequency band 1.6 Kc/s to 55 mc/s.

Years of intensive research and development work in this field guarantee the reliability and quality of this Marconi Product.



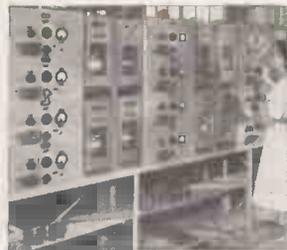
*Surface Grinding*



*Planetary Lapping*



*Finishing to Frequency*



*Testing—Grid Current Recording*

**Lifeline of communication**

# MARCONI

*Partners in progress with the 'ENGLISH ELECTRIC' Company Limited*

**MARCONI'S WIRELESS TELEGRAPH CO, LTD., CHELMSFORD, ESSEX**  
CR 1





## Why Ediswan Clix P.T.F.E. Valveholders are widely used in B.B.C. Television equipment

Large quantities of Ediswan Clix P.T.F.E. Valveholders are used in B.B.C. Television equipment. Only the combination of the finest insulation—P.T.F.E., the most efficient contact material—Beryllium copper—and Ediswan Clix design and manufacture can match the requirements of efficiency and reliability in this and all other

stringent valveholder applications. Ediswan Clix P.T.F.E. Valveholders are fully type approved for Services Grade 1, Class 1 conditions. Full details of these valveholders and other components in the Ediswan range are given in catalogue CR.1681. Manufacturers and Development Groups may have a copy on request.

# EDISWAN

## CLIX

**RADIO, TELEVISION & ELECTRONIC COMPONENTS**

THE EDISON SWAN ELECTRIC COMPANY LIMITED, *Member of the A.E.I. Group of Companies*  
155 Charing Cross Road, London, W.C.2 and Branches. Telephone: Gerrard 8660. Telegrams: Ediswan, Westcent, London  
CR3  
Radio Components Sales Office: 21 Bruton Street, London, W.1. Telephone: Mayfair 5543

**NEW!**

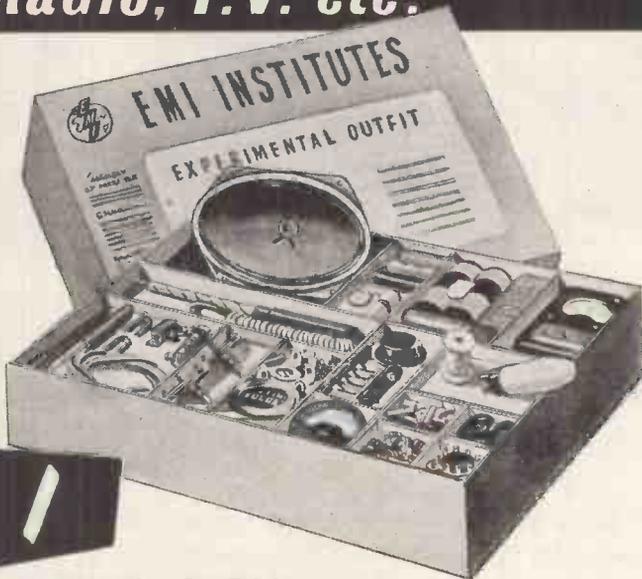
# EXPERIMENTAL KITS in Radio, T.V. etc.

## LEARN THE PRACTICAL WAY

Specially prepared sets of radio parts with which we teach you, in your own home, the working of fundamental electronic circuits and bring you easily to the point when you can construct and service radio sets. Whether you are a student for an examination; starting a new hobby; intent upon a career in industry; or running your own business—these Practical Courses are intended for YOU—and may be yours at very moderate cost.

### EASY TERMS FROM 15/- A MONTH

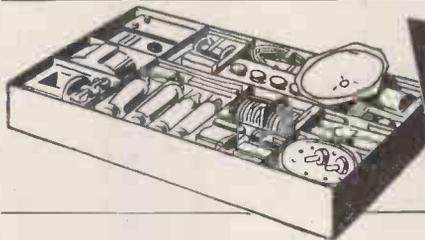
With these outfits, which you receive upon enrolment, you are instructed how to build basic Electronic Circuits (Amplifiers, Oscillators, Power Units, etc.) leading to complete Radio and Television Receiver Testing and Servicing.



### BEGINNER'S RADIO OUTFITS

— For carrying out basic practical work in Radio and Electronics, from first principles and leading to the design and building of simple Receivers.

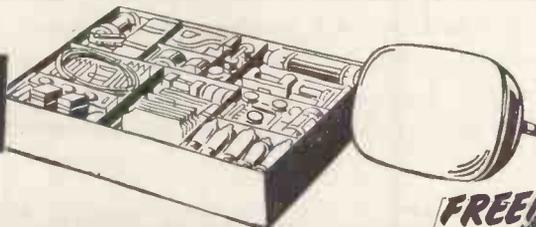
**ALL EQUIPMENT SUPPLIED IMMEDIATELY AND REMAINS YOUR PROPERTY**



### ADVANCED RADIO OUTFITS

— With this equipment, you are instructed in the design, construction, testing and servicing of complete modern TRS. Superhet Radio Receivers.

**TELEVISION** Outfit No. 3 — With this equipment you are instructed in the design, construction, servicing and testing of a modern high-quality 15" Television Receiver.



### OTHER COURSES WITH EQUIPMENT INCLUDE:

**MECHANICS · ELECTRICITY  
CHEMISTRY · PHOTOGRAPHY  
CARPENTRY**

**ALSO DRAUGHTSMANSHIP · COMMERCIAL ART  
AMATEUR S.W. RADIO · LANGUAGES · ETC.**

### POST THIS COUPON TODAY

Please send me your FREE book on Practical Courses.

Subjects of Interest.....

To: E.M.I. INSTITUTES, Dept. 127x, Grove Park Road, London, W.4.

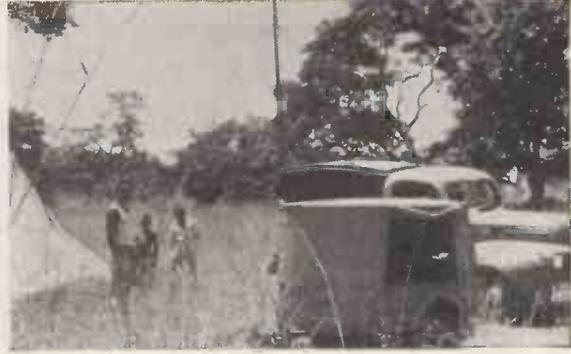
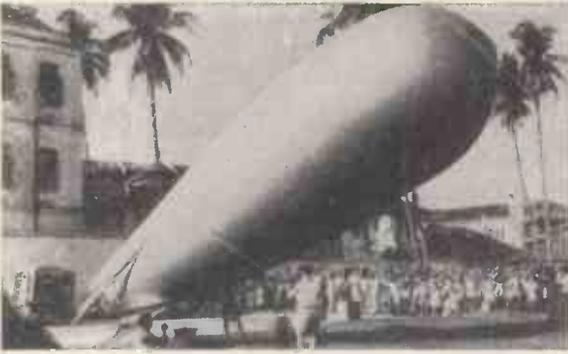
NAME .....

ADDRESS .....

JUNE



**E.M.I. INSTITUTES** The only Postal College which is part of a world-wide Industrial Organisation



## Marconi Surveying Service

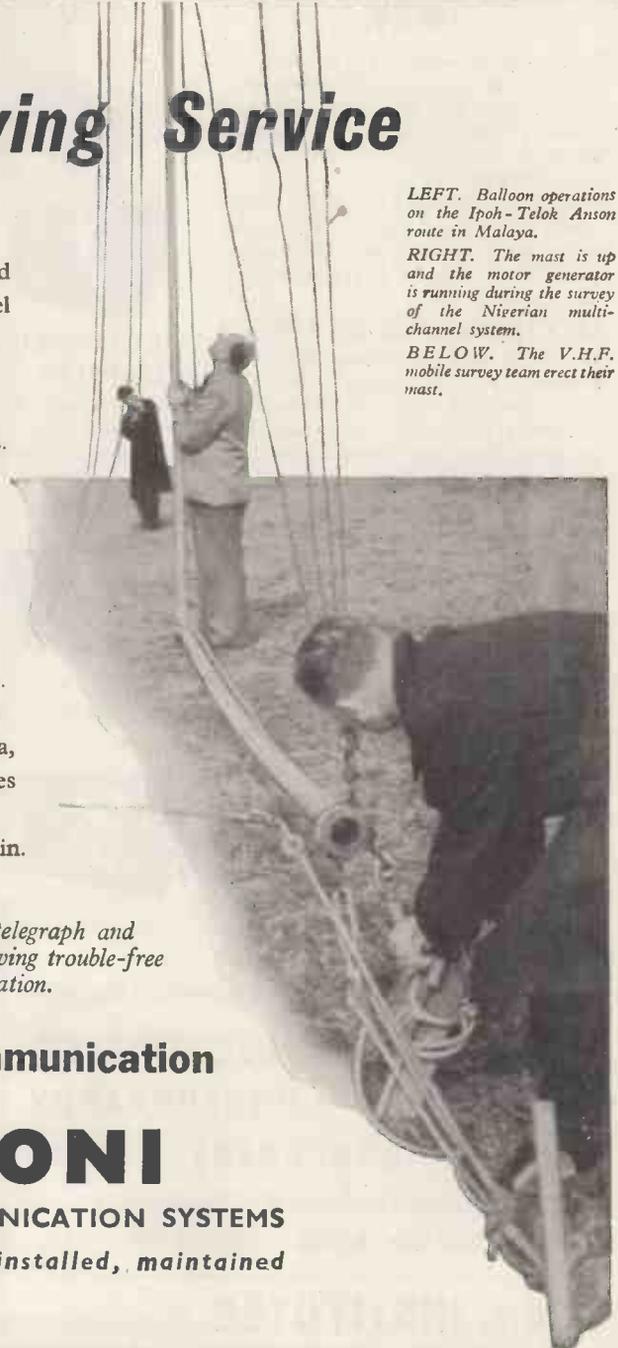
Before planning any communication system, and particularly a microwave or V.H.F. multichannel system, a survey of the propagation conditions over the proposed path or area is essential. Similar, but less exhaustive surveys, are also necessary before planning V.H.F. mobile systems. Such surveys are undertaken by Marconi's, one of the very few radio manufacturers who do so. The teams engaged in the work may be called upon to operate in desert, swamp and jungle, over which line and cable routes would be impractical, on windswept moorlands or in densely populated city and suburban areas. Surveys are being, or have already been carried out all over the world, including: Uganda, Kenya, Tanganyika, Nigeria, Gold Coast, Tangier, Azores Norway, Turkey, Greece, Malaya, Ceylon, West Indies, Sweden, and also, of course, in Britain.

*Over 80 countries now have Marconi-equipped telegraph and communications services. Many of these are still giving trouble-free service after more than twenty years in operation.*

*LEFT. Balloon operations on the Ipoh-Telok Anson route in Malaya.*

*RIGHT. The mast is up and the motor generator is running during the survey of the Nigerian multi-channel system.*

*BELOW. The V.H.F. mobile survey team erect their mast.*



**Lifeline of communication**

# MARCONI

**COMPLETE COMMUNICATION SYSTEMS**

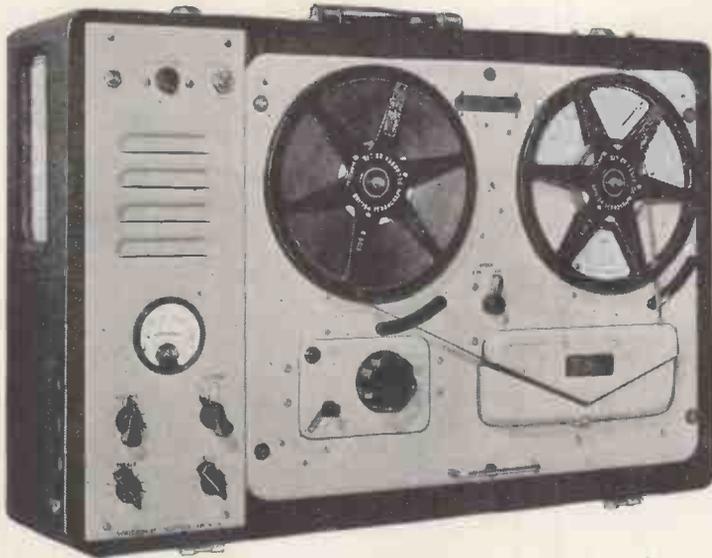
*Surveyed, planned, installed, maintained*

MARCONI'S WIRELESS TELEGRAPH CO., LTD., CHELMSFORD, ESSEX

LC 10

# VORTEXION

# HIGH QUALITY TAPE RECORDER



The amplifier, speaker and case, with detachable lid, measures 8½ in. x 22½ in. x 15½ in. and weighs 30 lb.

**PRICE, complete with WEARITE TAPE DECK** ..... £84 0 0

- ★ 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 1,750ft. reels, with the lid closed.

★ The total hum and noise at 7½ inches per second 50-12,000 c.p.s. unweighted is better than 50 dbs.

★ 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 .5 megohm input is fully loaded by 18 millivolts and is suitable for crystal P.U.'s, microphone or radio inputs.

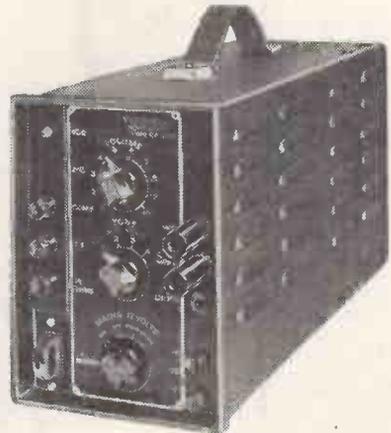
★ A power plug is provided for a radio feeder unit, etc. Variable bass and treble controls are fitted for control of the play back signal.

★ The power output is 3.5 watts heavily damped by negative feedback and an oval internal speaker is built in for monitoring purposes.

**POWER SUPPLY UNIT** to work from 12 volt Battery with an output of 230 v., 120 watts, 50 cycles within 1%. Suppressed for use with Tape Recorder. **PRICE £18 0 0.**

## TYPE C.P.20A AMPLIFIER

For A.C. Mains and 12 volt working giving 15 watts output, has switch change-over from A.C. to D.C. and "Stand-by" positions. Consumes only 5½ amperes from 12 volt battery. Fitted with mu-metal shielded microphone transformer for 15 ohm microphone, provision for crystal or moving iron pick-up with tone control for bass and top. Outputs for 7.5 and 15 ohms. Complete in steel case with valves. **PRICE £30 16 0.**



*Manufactured by*

**VORTEXION LIMITED, 257-263, The Broadway, Wimbledon, London, S.W.19**

Telephones: LIBerty 2814 and 6242-3

Telegrams: "Vortexion. Wimble. London"

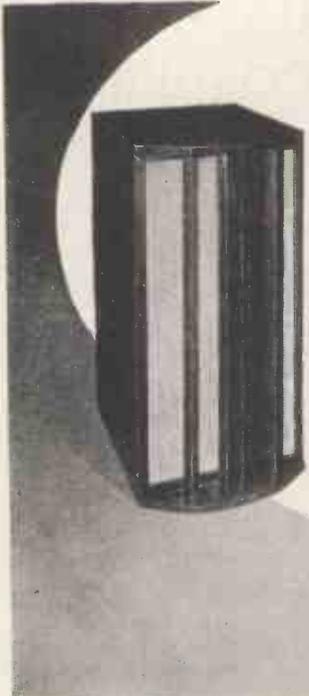
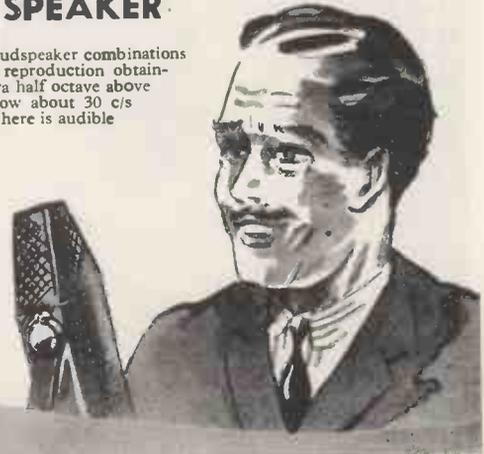
# The Cultured Voice of Quality

## SOUND SALES PHASE INVERTER SPEAKER

For its size, this is one of the most attractive loudspeaker combinations I have yet come across... "the standard of reproduction obtainable must be heard to be believed." That extra half octave above about 12 kc/s and the corresponding one below about 30 c/s usually cost an awful lot of money. The range here is audible from below 30 up to above 13,000 c/s!

TECHNICAL REPORT by P. WILSON, M.A.,  
of "THE GRAMOPHONE"

Price **£14.10.0**  
complete with cabinet



OBTAINABLE FROM ALL LEADING STOCKISTS  
WEST STREET, FARNHAM, SURREY

Tel.: FARNHAM 6461/2/3

### SOUND SALES LIMITED

Manufacturers of Electronic Equipment

Established since 1931

Extract from two of many letters received:—"SEVENOAKS—I am delighted with the performance of your new speaker unit. Have had one concert which was very much enjoyed." "BRIGHTON—I am certain that anyone who desires high fidelity at moderate cost will find the Phase Inverter Speaker their complete answer."



## POST THE COUPON TODAY FOR OUR BROCHURE ON THE LATEST METHODS OF HOME TRAINING FOR OVER 150 CAREERS & HOBBIES

### PRIVATE AND INDIVIDUAL TUITION IN YOUR OWN HOME

- |                          |                            |                        |                     |
|--------------------------|----------------------------|------------------------|---------------------|
| Building                 | Electronics                | Police                 | Shorthand & Typing  |
| Business Management      | Fashion Drawing            | Production Engineering | Short Story         |
| Carpentry                | Heating & Ventilating Eng. | Public Speaking        | Writing             |
| Chemistry                | Industrial Administration  | Radar                  | Sound Recording     |
| Civil Service            | Journalism                 | Radio & Television     | Structural Eng.     |
| Civil Engineering        | Languages                  | Service                | Telecommunications  |
| Commercial Subjects      | Marine Engineering         | Radio Engineering      | Television          |
| Commercial Art & Drawing | Mathematics                | Refrigeration          | Time & Motion Study |
| Customs & Excise Officer | M.C.A. Licences            | Retail Shop Management | Tracing             |
| Draughtsmanship          | Mechanical Engineering     | Salesmanship           | Welding             |
| Economics                | Motor Engineering          | Sanitation             | Works Management    |
| Electrical Engineering   | Photography                | Secretaryship          | Workshop Practice   |
|                          | P.M.G. Licences            | Sheet Metal Work       | and many others.    |

Also courses for University Degrees, General Certificate of Education, B.Sc.Eng., A.M.I.Mech.E., L.I.O.B., A.C.C.A., A.C.I.S., A.M.Brit.I.R.E., A.M.I.I.A., City & Guilds Examinations, R.S.A. Certificates, etc.

**The Advantages of E.M.I. Training** ★ The teaching methods are planned to meet modern industrial requirements. ★ We offer training in all subjects which provide lucrative jobs or interesting hobbies. ★ A tutor is personally allotted by name to ensure private and individual tuition.

★ Free advice covering all aspects of training is given to students before and after enrolment with us. ★ Equipment supplied upon enrolment and remains your property.

### POST THIS COUPON TODAY

Please send without obligation your FREE book.

**E. M. I. INSTITUTES** (Dept. 127k)  
Grove Park Road, London, W.4

NAME \_\_\_\_\_

ADDRESS \_\_\_\_\_

SUBJECT(S) OF INTEREST \_\_\_\_\_  
JUNE \_\_\_\_\_

**NEW! LEARN THE PRACTICAL WAY**  
**COURSES WITH EQUIPMENT**  
With many courses we supply actual equipment thus combining theory and practice in the correct educational sequence. This equipment, specially prepared and designed, remains your property. Courses include: Radio, Television, Mechanics, Electricity, Draughtsmanship, Carpentry, Photography, Commercial Art, etc.

**COURSES FROM 15/- PER MONTH**

**EMI INSTITUTES**  
The only Postal College which is part  
of a world-wide Industrial Organisation

# A HIGH $\mu$ PENTODE with low hum, noise and microphony

### TYPICAL OPERATING CONDITIONS

Anode Voltage ( $V_a$ )	... .. 250	250	250	250	
Screen Voltage ( $V_{g2}$ )	... .. 80	100	160	200	
Grid Bias ( $V_{g1}$ )	... ..	1.25	1.7	2.75	3.5
Anode Current (mA)	... ..	7.8	7.9	10.5	12.3
Screen Current (mA)	... ..	2.45	2.5	3.3	3.85
Mutual Conductance (mA/V)		7.0	7.0	7.45	7.6
Anode AC Resistance ( $r_a$ ) (Megohms)		0.55	0.55	0.4	0.3
Input Capacity (Hot) ( $\mu F$ )	... ..	20	19.9	19.7	19.5

### RATING

Heater Voltage	... ..	$V_h$	4.0
Heater Current (Amps)	... ..	$I_h$	1.0
Maximum Anode Voltage	... ..	$V_a$	250
Maximum Screen Voltage	... ..	$V_{g2}$	250
Mutual Conductance (mA/V)	... ..	$g_m$	7.7
Taken at $V_a=250$ ; $V_{g2}=100$ ; $V_{g1}=1.5$			

### BASE

British 7 pin	Pin No. 5 Heater
Pin No. 1 Metallising	Pin. No. 6 Cathode
Pin No. 2 Anode	Pin No. 7 Screen ( $g_2$ )
Pin No. 3 Suppressor-Grid ( $g_3$ )	Top Cap Control Grid ( $g_1$ )
Pin No. 4 Heater	

The AC/SP3 RH is available in two grades. The valves in both grades are characteristically identical, the grading 'A' or 'B' relating only to relative levels of hum, noise and microphony. B Grade valves are suitable for the majority of applications, but for particular applications where the noise level is very important Grade A may be preferred.

Under typical operating conditions with  $V_a=250v$ ,  $R_a=150 K\Omega$ ,  $R_g=150 K\Omega$ ,  $R_{g2}=500 K\Omega$ ,  $R_{k}=1 K\Omega$ , with the heater fed from a centre-tapped A.C. supply the equivalent hum voltage at the grid of an average grade A valve is approximately  $5\mu V$ , whilst the combined noise (excluding hum generated by the valve and grid resistances, using a high quality A.F. amplifier) is not greater than  $8\mu V$ .

The following table compares the noise, hum and microphony from the two grades of valve.

HUM		NOISE	
'A' $\times$ 5.6 down on 'B'		'A' $\times$ 2 down on 'B'	
MICROPHONY			
'A' $\times$ 8 down on 'B'			

SV3



### THE EDISWAN MAZDA AC/SP3 RH

is an indirectly heated Pentode with a special heater construction designed to reduce hum due to A.C. fields within the valve.

Provided precautions are taken to minimise hum due to external wiring, the AC/SP3 RH may be used in the early stages of amplifiers where the reduction of hum, noise and microphony is of primary importance.

*Full technical information on request.*

# EDISWAN

## MAZDA

### VALVES & CATHODE RAY TUBES

The Edison Swan Electric Co. Ltd.  
155 Charing Cross Road, London, W.C.2  
and Branches

*Member of the A.E.I. Group of Companies*

Telephone: Gerrard 8660. Telegrams: Ediswan, Westcent, London

*There's a wonderful future  
for you in -*

# **ELECTRONICS**

Every day the demand for the expert in electronics grows. Radio, television, radar and the whole field of industrial electronics are rapidly expanding, and the trained specialist in these fields is assured

of a well-paid career in this quickly developing profession. Here is your opportunity to acquire specialist knowledge. Write for our free brochure giving details of the following courses:

## **3-year Course**

in Telecommunication Engineering (including opportunity for nine months' practical attachment in

E.M.I. Laboratories and Workshops). Next course commences on 14th September, 1955.

## **4-year Course in Electronic Engineering**

Intended for outstanding Science sixth-formers who are capable of training into future team leaders in scientific applications. Final qualifications

are B.Sc. and City and Guilds Full Technological Certificate in Telecommunication Engineering. Next course commences on 4th October, 1955.

# **E.M.I. INSTITUTES**

Dept. 127K, 10 Pembridge Square, London, W.2.

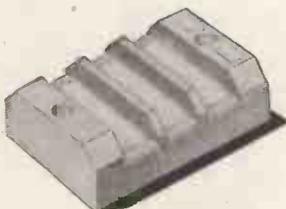
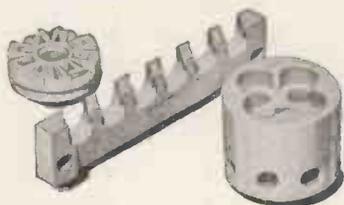
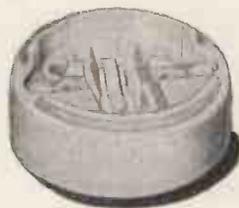
Telephone : BAYswater 5131/2

*The College associated with a world-wide electronics industry, including "His Master's Voice," Marconiphone, Columbia, etc.*

1A32

## **Bullers CERAMICS FOR INDUSTRY**

High quality material and dimensional precision are attributes of Bullers die-pressed products. Prompt delivery at competitive prices.



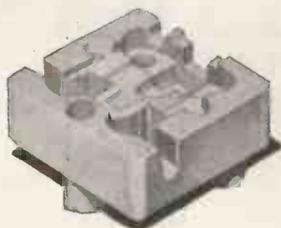
*We specialise in the manufacture of*

**PORCELAIN**  
for general insulation

**FREQUELEX**  
for high-frequency insulation

**REFRACTORIES**  
for high temperature 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

BL10B



# In the U.S.A.

and all over the world  
you will find



EQUIPMENT

This advertisement, prepared by our American Agents, is appearing in current U.S.A. technical publications and is reproduced here for the interest of our friends in this country.

Leonard Carduner (President, British Industries Corp., New York): Mr. Leak, please tell our readers what the "Point One" amplifier combination does in a high fidelity music system.

H. J. Leak: As you know, Mr. Carduner, the amplifier is actually the "heart" of the system. Your record player, radio tuner, or tape recorder feeds electrical impulses into the pre-amplifier and amplifier. These, in turn, strengthen the signals and feed them into a speaker

It is difficult to strengthen a signal without distortion. "Point One" means that the Leak reproduces voice and instruments with insignificant harmonic distortion of 0.1% at 8 watts! This gives the illusion of the actual "presence" of the performer.



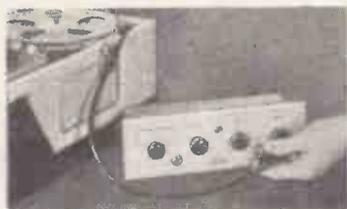
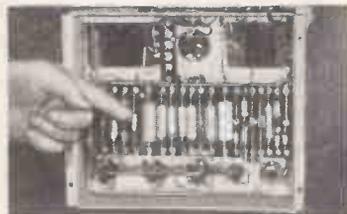
L.C.: In demonstrating the "Point One" amplifier at Audio Fairs, the most impressive thing we do is to turn the amplifier on its side, show people the terminal board "custom" construction used in American scientific instruments, almost never in radios.

H.J.L.: We had a practical reason for this . . . because every terminal connection is easily accessible. It keeps servicing costs down .

L.C.: Yes, and many have praised the control panel of the "Point One" pre-amplifier, because it offers every sensible adjustment to match the new hi-fi records . . . and full 25 db bass and treble range.

H.J.L.: In fact, the "Point One" has more adjustments than the Leak amplifiers supplied to the B.B.C., but no superfluous settings to add unnecessary cost.

L.C.: Well, you have one very important exclusive feature. Plug-in jacks on the Leak front panel make it easy to give any tape recorder the full benefit of the Leak circuit, in recording and playback. People with portable tape recorders, who put them away when not in use, can connect them instantly. Practical features like this make the "Point One" most enjoyable to use.



**TL/10 & POINT ONE** 27 Gns. COMPLETE, in Great Britain.  
AMPLIFIER PRE-AMPLIFIER A price made possible only by world-wide sales.

Write for illustrated literature W.

H. J. LEAK & CO. LTD., BRUNEL ROAD, WESTWAY FACTORY ESTATE, ACTON, W.3  
Phone: SHEpherds Bush 1173/4      Telegrams: Sinusoidal, Ealux, London      Cables: Sinusoidal, London

# 10,000 plus, satisfied customers



### CHASSIS ASSEMBLY

3-colour, 3 waveband scale covering standard, Long, Medium, and Short wavebands, scale pan, chassis, punched for standard 5-valve superhet, pulley driving head, springs, etc., to suit. Scale size 14 1/2 in. x 3 1/2 in. Chassis size 15 1/2 in. x 5 1/2 in. x 2 in. deep. Price 15/- plus 1/6 post note.—This is the one that fits our 37/6 table cabinet.

### DECCA CRYSTAL PICK-UP

A snip for the connoisseur—turnover head suitable all records—limited quantity 29/6, plus 2/- post and packing.

### G.E.C. METAL CONE SPEAKER

This fine speaker is coming to the front rapidly—price £8/15/-. Octagonal cabinet made to maker's specification. £11/10/-, walnut or oak.

### SOMWEAVE



This really lovely loud speaker fabric we offer at approximately a third of to-day's cost. It is 42 in. wide and our price is 12/- per yard, or panels 12 in. x 12 in., 1/8 each. This is also very suitable for covering plain wooden cases, for portable radio amplifiers, etc.

### RESISTORS



50 assorted 1/2 and 1 watt resistors. Ranging between 10 ohm. and 10 megohm. (Our selection.) Price 5/- pkt. 50 at 1 watt, 7/6.



### EX-ROYAL NAVY SOUND POWERED TELEPHONE

These require no batteries, and will go for long periods without attention. Complete with generator and sounder which gives a high pitched note, easily heard above any other noise. Also fitted with an indicator lamp which in quiet situations can be used instead of the sounder, or where several headphones are used together will indicate which one is being called. Size 7 1/2 in. x 2 1/2 in. x 7 1/2 in., wall mounting, designed for ships' use, but equally suitable for home, office, warehouse, factory, garage, etc. Price 57/6 each, plus 4/6 carriage.

### NOW—

### A.C./D.C. MULTI-METER KIT

The Multi-meter illustrated measures A.C./D.C. volts and D.C. m/amps and ohms. It has a sensitivity of 200 ohms per volt and is equally suitable for the keen experimenter, service engineer or student. All the essential parts including 2 1/2 in. moving coil meter, selected resistors, wire for shunts, 8-point range selector, calibrated scale, stick-on range indicator and full instructions for making are available as a kit, price 19/8 plus 9d. post and packing.

### VALVE HOLDER PLUGS



Each is fitted with a rubber shroud. For BTG button base and type 2 for B9A. Price 2/- each, discounts for quantities.

## BAND III

A SIGNAL AND BAR PATTERN GENERATOR COMPLETE WITH CALIBRATION EQUIPMENT, 25/- POST FREE.

With the inception of Band III the home constructor is working on new ground and accurate checking instruments are a MUST.

THE "ELPREQ" BAND III SIGNAL GENERATOR is the very efficient and inexpensive answer. It—

1. Will provide the signal for tuning to any Band III station.
2. Can be used as a grid-dip meter for checking the frequency of Band III T.V. aeriels, Coils, etc.
3. Can be made to give a pattern on T.V. Receiver screen.
4. Can be accurately calibrated with included equipment.

All the parts including valves, tuning condenser and metal chassis are available as a Kit at 25/- post free. Constructional data free with Kit or available separately price 2/6.

## The "CONVERTIBLE"

BATTERY PORTABLE WHICH CONVERTS TO

A RECORD PLAYER

- ★ Sensitive 4-valve superhet
- ★ Attractive 2-tone case and three-colour scale
- ★ 7 inch elliptical speaker
- ★ Full A.V.C. and fixed tone correction
- ★ Space for Mains Unit
- ★ Factory-built look



The Elpreq "Convertible" is an all-dry battery operated superhet using frame aerial and 1.5 volt valves Type 1R5, 1T4, 1S5, and 3S4. It is particularly selective and gives powerful results on long and medium waves. Battery consumption, however, is quite low. The cabinet is ultra-modern and finished crocodile and/or lizard skin in two shades. The control-board is similarly finished, and with the three-coloured dial, gives the whole a factory-built aspect.

Full constructional details of this superhet and of the Picnic Player unit which, by the undoing of four screws, slips into the cabinet in place of the radio, will be found in our booklet "The Convertible" price 2/6 (returnable if parts purchased).

Cost of portable cabinet and all parts for Convertible, including valves, speaker, but not batteries, is £7/7/6 (H.P. deposit 22/6 carriage 5/-). Cabinet available separately, price 37/6, plus 3/6 postage.



## BETTER VIEWING with NOVASPEX

- Improve contrast and definition.
- Suppress incident light.
- Sharpen focus, increasing picture depth.
- Permit comfortable viewing in total darkness.
- Banish eye-strain and headaches.

Novaspex are as comfortable as sun-glasses. Send your order today and enjoy better T.V. tomorrow. Price only 6/6, post free. Full money back guarantee.



### THE BATTERY-MINI

This efficient little receiver will add to the pleasure of your picnics and evenings in the garden, etc., it is an entirely new design based upon the latest ideas of circuitry which gives remarkable results on long and medium waves, with only an internal aerial. Special features are:—

- Ferrite Rod Aerial.
- Very Low Consumption from Internal Batteries.
- Neat Bakelite Cabinet with Carrying Handle.
- Uses three BTG Low Drain Valves.

The total building cost is only £4/18/6, plus 3/6 postage which includes cabinet and everything except batteries. Constructional Data free with components, or separately price 2/6.

**HIRE PURCHASE TERMS.**—Any goods costing £5 or more may be purchased by extended payments—deposit 15% (or more)—balance spread over 12 months.

## BARGAINS TO CLEAR

### 2-VOLT ACCUMULATORS

Made for the Forces by one of the most famous firms in the world. 15 amp-hour, size approx. 6 x 1 1/2 in. square in ebonite case, pre-charged, only need filling with acid, 2/6 each, plus 9d. post and insurance.



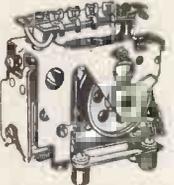
### PORTABLE CABINET

This is ultra-modern, two-tone, Bakelite with integral moulded handle. We can supply, where required, the metal chassis, dial, and all other parts necessary to make a Mains or Battery portable. Note: All of these cabinets have slight imperfections; these are hardly noticeable however, and will not impair the performance or safety of the set. Price 7/6 each, post and insurance 3/6.



### REMOTE CONTROL

With only one pair of wires and a simple push button you can select any one of four stations. This is just one of the many applications of our impulse relay. There are many other purposes to which it can be put. Note they are somewhat soiled, due to storage but mechanically O.K. Price 1/8, post 6d.



### 5-AMP. SURFACE SWITCHES—HICRAFT

Oblong Brown 1-way 1/- each. Oblong White 1-way 1/- each. Oblong Brown 2-way 1/3 each. Oblong White 2-way 1/3 each. Round Brown 1-way 10d. each. Round White 1-way 10d. each. Round Brown 2-way 1/- each. Round White 2-way 1/- each.



### WAVE-CHANGE SWITCHES

One dozen assorted wave-change switches, ideal for experimenters. Note: these are unused and not removed from equipment. Price 5/-, post and packing 1/-.



### 110-VOLT 2-AMP. RECTIFIER UNIT

This is an excellent unit suitable for driving 110 v. D.C. equipment from 230 v. A.C. mains or for charging batteries for stand-by lighting, etc. Made for the Government—new and unused, with switchgear. Price £17/10/- each.

### NAIL INSULATORS

Suitable for electric fences, indoor aeriels, etc., 3/- per dozen, post and packing 1/-.



### WESTINGHOUSE RECTIFIER

Full wave—suitable for up to 80 volts at 15 milliamperes. Ideal for relays, meters, etc. Price 2/6, post 6d.

**SPADE TERMINALS**  
Heavy duty type made for M.O.S. Price 7d. each, 6/- per dozen.



# for the best equipment of its kind

## GENUINE HALF-PRICE OFFER BEETHOVEN CHASSIS

Extremely well built on chassis size approx. 9 1/2 x 7 1/2 x 8 1/2, using only first-class components, fully aligned and tested, 110-240-volt A.C. mains operation. Three wave bands covering medium and two shorts. Complete with five valves, frequency changer, double diode triode, pentode output and full wave rectifier. Special cash-with-order price this month, £5/19/6, carriage and insurance 7/6.

## MADE-UP—READY TO WORK

The astonishing "Occasional 55"—two wave band T.R.F.—completely assembled and ready to switch on—complete with all valves and 5in. speaker—Covers both medium and long wave bands and uses dust core coils in a unique modern circuit which gives almost superb performance. Price £8/5/-, plus 3/6 post—Bakelite or wooden cabinet available price 18/6, post 2/6.



## BENDIX RA-1B COMMUNICATIONS RECEIVER

Originally intended for the American Forces this fine receiver. (A small quantity of which has been released by the Ministry of Supplies) available to you if you act promptly. Designed to receive C.W. or E.T. It uses probably the finest Vernier tuning and band spreading arrangement possible, it covers the following bands—

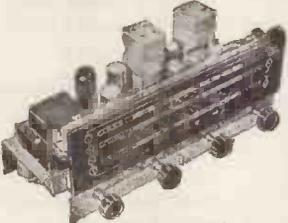
Band 1	.15 to .315 mc.	} i.e. 20 to 200 metres.
Band 2	.315 to .680 mc.	
Band 3	.680 to 1.5 mc.	
Band 4	.18 to 3.7 mc.	
Band 5	3.7 to 7.5 mc.	
Band 6	7.5 to 15.0 mc.	

The sensitivity is 4 micro volts for full output. It uses 8 valves and operates from batteries (12 or 24 volt) or from the mains through a power pack. It has built-in outstage with a jack socket for phones. Controls, all of which are brought to the front panel, include: serial switch, serial compensating condenser, main tuning condenser, band selector, C.W. switch, power on/off switch, and volume control. Very compactly built in crackle finished case, these sets are brand new having never been used and in perfect working order—special price this month is £14/10/- each or 45/- deposit, balance over 12 months—carriage and insurance 10/- . Order now to avoid disappointment. Circuit diagram and component data given free with sets, or available separately price 2/6, post free. Mains Power Pack for Bendix RA-1B. £3/10/-.



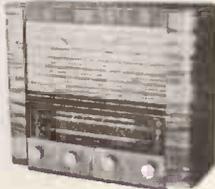
## THE "WINDSOR 5"

This is a 5-valve A.C. superhet covering the usual long, medium and short wave-bands. It has a particularly fine clear dial with an extra long pointer travel. The latest type local valves are used and the chassis is complete and ready to operate. Chassis size 15in. x 6in. x 6in. Price £9/19/6 complete with 8in. speaker. Carriage and insurance 10/- . H.F. terms if required.



## TABLE RADIO CABINET

Due to a special purchase, we are able to offer this very fine cabinet, size approx. 15 1/2 x 14 x 8 1/2in. Walnut veneered and satin finished, 37/6, carriage and packing 3/6. Note—This cabinet is the correct one for the Windsor chassis above with 6in speaker.

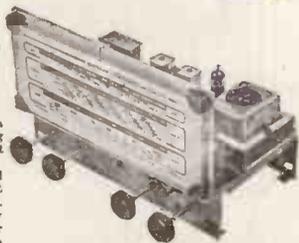


## THE CLEVELAND "ORGANTONE"

The Cleveland "ORGANTONE" is a 5-valve 3-wave superhet covering long, medium and short waves. Built to a very stringent specification. Osram miniature valves are employed and low loss iron cored coils account for an excellent signal to noise ratio. Full A.V.C. is applied to both frequency changer and I.F. stages, and particular care has been taken to ensure freedom from frequency drift.

The output stage utilizes variable negative feed back for tone control, and, but for stand ard pentode correction, no cut in the ordinary sense is applied. A gram. position is provided and reproduction of records is particularly good. An amply proportioned power transformer with a primary tapped for 110-280 volts gives complete isolation from the mains.

Chassis size is 12in. x 7in. x 7in.—Scale size is 10 1/2in. x 4 1/2in. This receiver has been tested in particularly difficult areas and its stability and noise projection have produced exceptional results. Price £11/10/- or £1/5/- deposit—carriage, etc., 7/6. Circuit diagram and photograph available price 2/- post free.



## ANOTHER CLEVELAND CHASSIS—"THE TREMENDO"

The first Cleveland chassis was good, but this one is really superb. It has a 7-valve circuit with 6 watts output, fitted with independent bass and treble controls. It is really an efficient R.F. circuit coupled to a high-fidelity amplifier. The chassis size is the same as the Organtone, namely 12 x 7 x 7 with the 10 1/2 x 4 1/2 multi-coloured scale, and it is built to the same exacting specification as the Organtone. Price £14/10/-, carriage and packing 7/6. H.F. terms if required.

## RECORD PLAYER BARGAIN

3-speed record player with pick-up using the famous Acos "Hi G" turnover crystal—motor also by very famous maker—speed selection is by Bakelite knob. All on unit board ready for installation. A wonderful bargain at £6/10/- plus 5/- carriage—Hire Purchase 15/- deposit.



## ELPREQ TAPE RECORDER

This instrument combines the Mk. IIIU Truvox Tape Deck and the Cleveland Wide Band Amplifier with a special high flux speaker and forms one of the finest tape recorder combinations available to-day. It will, of course, play pre-recorded tapes as well as make its own recordings of radio, music, meetings, telephone conversations, letters, etc., etc. The price, complete with reel of tape and ready to operate, is

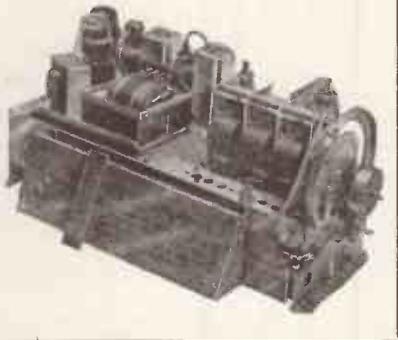
**39 Gns.**

Carriage and insurance 12/6. Hire Pur chase terms if required.



## 10- SECURES THIS BARGAIN

The set, a product of one of our famous manufacturers, has H.F. stage, tuning indicator, and all modern refinements, covers 5 wavebands including short waves to 11 metres. Offered less valves, power-pack, scale and drive, otherwise complete and unused. Price £5. or 10/- deposit, balance over 12 months, carriage 7/6 (uses octal range valves).



## THE CLEVELAND OCTAVIAN

In this instrument is combined the exceptional qualities of the G.E.C. metal cone loud-speaker in its ideal cabinet (the Octagonal illustrated below) and a most modern 3-valve amplifier. This combination will give a realism of musical reproduction not easily obtained even at twice or three times its price and is definitely the reproducer for bringing out the full frequency now available in long playing microgroove recordings. If you can, please come to one of our branches and hear this fine instrument—failing this, then take our word that it is really good and send an order today. Price 27 guineas or £4/10/- deposit, balance over 12 months. Amplifier available separately at £10/10/-.



## OCTAGONAL SPEAKER CABINET

Conforming exactly to the designer's specification—for G.E.C. metal cone speaker—price £12/10/- or 37/6 deposit, carriage and insurance 5/- extra. G.E.C. metal cone (extra octave) speaker £8/15/-

# ELECTRONIC PRECISION EQUIPMENT LTD.

249, Kilburn High Road, Kilburn. (Now Open)

42-46, Windmill Hill, Ruislip, Middlesex. Phone: RUISLIP 5780. Half-day Wednesdays.

152-153, Fleet Street, E.C.4. Phone: CENTRAL 2833. Half-day Saturday.

29, Stroud Green Road, Finsbury Park, N.4. Phone: ARCHWAY 1049. Half-day Thursdays.

Post orders should be marked "Dept. 2" and addressed to our Ruislip dept.

# RADIO TRADERS LTD.

23 WARDOURST., LONDON, W.1. (Coventry Street end)  
Phone No. GERrard 3977/8 Grams: "Radlotrade"

### BARGAIN OFFER OF BATTERIES

4½ v. Heavy Duty Bell Battery. Size 6½ x 4½ x 2½ in.	4/6
72 v. H.T. 1.5 v. L.T. Size 6 x 5 x 1½ in.	5/6
150 v. H.T. Size 2½ x 5½ x 1½ in.	5/6
67½ v. Size 2½ x 1½ x 3½ in.	6/6

All batteries sealed and unused. All plus 1/6 post and pkg. Special reduction for quantities.

ELECTROLYTIC CONDENSERS	Per doz.
16 mfd. 375 v., 2/- each	21/-
16 x 16 mfd. 350 v. 3/6 each	39/-
16 x 24 mfd. 350 v. 2/6 each	27/-
16 x 32 mfd. 275 v. 1/6 each	15/-
20 x 20 mfd. 275 v. 2/3 each	24/-
24 mfd. 350 v. 1/6 each	15/-
24 mfd. 450 v. 2/3 each	24/-
Condenser Clips for above	3/6
BIAS CONDENSERS	
50 mfd. 12 v. Single Hole Fixing 1/- each	10/6
100 mfd. 6 v. Tag End 10d. each	9/-
100 mfd. 25 v. Tag End 1/3 each	12/-
BLOCK PAPER CONDENSERS	
4 mfd. 400 v. D.C. 3/6 each. Many other types in stock. Your enquiries invited.	
LARGE ASSORTMENT OF TUBULAR CONDENSERS	6/-
MIDGET MICA CONDENSERS. .0001, .0002, .0003, .0004, .0005	5/-
200 Assorted Moulded Micas. Popular Values	£2 10 0
200 Assorted Silver Micas. Popular Values	£2 10 0
200 Assorted Carbon Resistors: ¼, ½ and 1 watt. Good selection	£1 10 0

### SPECIAL OFFER

0.1 mfd. 12,000 volts test Mansbridge Condensers. Height 6½ in. Width 3½ in. Depth 2½ in. Fixing Centres 4 in. Plus 1/- post	5/6
--	-----

**PAXOLIN SHEET**  
18 x 4½ x 1/16 in., 1/- each; 10 x 10 x 1/16 in., 1/6 each; 20 x 10 x 1/32 in., 1/6 each; 20 x 10 x 1/16 in., 3/- each.

**RESISTORS**  
Carbon ½ watt 2/6; ¼ watt 3/-; 1 watt 4/-; 2 watt 6/- per doz.  
**WIRE WOUND AND VITREOUS.** 5 watt 1/6; 10 watt 2/6; 15 watt 3/-; 20 watt 3/6 each.  
**HIGH STABILITY.** ½ watt 5% 6d.; ¼ watt 5% 9d.; 1 watt 5% 1/3 each. 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.W. V/CONTROLS.** ALL WELL KNOWN MAKES. Pre-set 2/6 each. Spindle types 3/- each. Values from 5 ohms to 50k.  
**V/CONTROLS WITH SWITCH** 5k, 50k, ½ meg., 1 meg. ... 3/6 each  
V/Controls Less Switch. Most values spindle and preset ... 2/- each

### METERS

0-300 mA 2½ in. Flush Mounting. Brand new. Guaranteed	8/6 each
0-500 mA. 2½ in. Flush Mounting. Brand new. Guaranteed	10/6 each

TWIN GANG. .0005 Less Trimmers	6/6 each
4-Way push button units	2/6 each
Push Button Knobs	3/- doz.
TAG STRIPS. 3-way 2/-; 4-way 2/6; 5-way 3/-; 7-way 4/-; 28-way 12/- doz.	
SLEEVEING. 2 mm. 2/6; 3 mm. 3/6; 4 mm. 4/6; 5 mm. ... 5/6 per doz. yds.	
POINTER KNOBS. Small black with white line, standard ¼ in. spindle	7/6 doz.
WANDER PLUGS. Red and Black	2/- doz.
PHILIPS TRIMMER TOOLS. 1/- each	10/6 doz.
BELLING LEE FUSE HOLDERS. Type L356 (Pnl. Mtg.)	2/6 each
WEARITE COILS. PA4, PO4, PA5, PO5. 1/3 each	12/- doz.
VALVE HOLDERS. Moulded B9A 7/6; B7G 6/-; Int. Oct. 9/-; Eng. Oct.	4/6 doz.
VALVE HOLDER FITTED WITH LOWER CAN 1/6 per doz. extra.	
Screening Cans for B7G and B9A	6/- doz.
Paxolin V/H Int. Oct., B9A, B7G 5/- per doz.; Eng. Oct., 5-pin, 7-pin	3/- doz.
STANDARD SCREENING CANS 3-piece 1/- each; Spring Loaded	1/- each
BELLING LEE PLUGS AND SOCKETS, 5-pin 1/9; 7-pin 2/-; 10-pin	2/6 each
AIR SPACED TRIMMERS 5, 10, 15, 20, 25, 50 and 75 pf pre-set and spindle types 1/6 each	15/- doz.
PYE PLUGS AND SOCKETS 1/6 per pair, "Tee" pieced	1/9 each
GROMMETS 1 grs. assorted grommets ¼ in. to 1 in.	8/6 gross
POST OFFICE LAMP JACKS No. 10 1/- each.	9/- doz.
Lamp covers for same	3/- doz.

WESTINGHOUSE KHI Half-wave Rectifier, rating 6 v. at 10 mA., 2/6 each	27/6 doz.
---	-----------

OUTPUT TRANSFORMERS. Multi-ratio, 5/- each; Pentode or power	4/- each
DRUM DRIVES, 3½ in.	1/- each
WESTECTORS, WX6, WX12, W1, W12, W4, 1/- each	9/- doz.
ARCOLECTRIC (Whitney Lamp), Red, Green, Clear, 1/6 each	15/- doz.
SIGNAL LAMP HOLDERS. Panel mounting, complete with adjusting lampholder, 1/9 each	18/- doz.
JONES PLUGS AND SOCKETS. 4-pin 2/6; 6-pin, 3/-; 8-pin, 3/6; 10-pin, 4/-; 12-pin	6/- pair

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  
Callers Welcomed

WHOLESALE, MANUFACTURERS' AND EXPORT ENQUIRIES INVITED



# METERS

LARGE AND VARIED STOCKS AVAILABLE FOR IMMEDIATE DELIVERY

EXAMPLES FROM OUR RANGE OF 2½" FLUSH PATTERN MOVING COIL INSTRUMENTS (as illustrated)

AMPERES D.C. 0-1, 2, 3, 5, 10, 15, 20, 25, 30, 50.

MILLIAMPS. 0-1, 1-0-1, 0-5, 10, 15, 20, 25, 30, 50, 100, 250, 500.

MICROAMPS. 0-50, 100, 200, 250, 400, 500, 750, 50-0-50, 100-0-100, 250-0-250, 500-0-500.

MILLIVOLTS. 0-10, 25, 50, 75, 100, 500.

VOLTS D.C. 0-1, 5, 10, 15, 25, 50, 100, 250, 500, 750, 1,000.

VOLTS A.C. 0-5, 10, 15, 25, 50, 100, 250, 500, 750, 1,000.

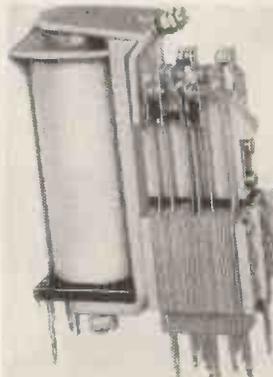
We can supply meters with NON-STANDARD CURRENT and VOLTAGE RANGES to any specification. DELIVERY 7-14 days.

MOVING IRON, THERMO & ELECTROSTATIC INSTRUMENTS ALSO AVAILABLE.

## ANDERS ELECTRONICS LTD.

91, HAMPSTEAD ROAD, LONDON, N.W.1.  
Telephone: EUSton 1539

Supplied to Government Departments, B.B.C.,  
Leading Manufacturers & Research Laboratories



Manufacturers of  
**POST OFFICE TYPE MAGNETIC RELAYS**  
3,000 and 600  
Contractors to:  
**H.M. GOVERNMENT AND LEADING MANUFACTURERS**  
COILS up to 80,000Ω.  
CONTACTS up to 8 amps.  
INSULATION up to 5 kv.

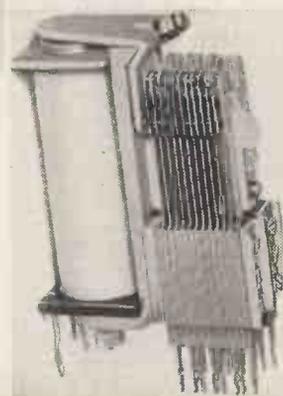
Specialists in Tropicalisation and Inter Services Jungle Finish

Conforming to A.I.D. and C.I.E.M.E. standards

PROTOTYPE Relays made to specification.

POST OFFICE TYPE KEYS supplied to specification.

Speedy Deliveries—  
Enquiries Invited



**A. D. S. RELAYS LTD.** Dept. W. W.  
12, STORE STREET, LONDON, W. C. 1.  
Tel.: MUSEum 2453

**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 in. x 5 1/2 in. x 2 1/2 in. Attractive Glass Dial 10 in. 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.U. sockets. Modern circuitry, all coils adjustable dust cored and only quality components used throughout. Delayed A.V.C. and nec. feed-back. A.C. mains 200/250 v. Double wound transf. isolates chassis from mains. Aligned and calibrated ready for use.

**BRAND NEW & GUARANTEED £9.15.0 Carr. and ins. 4/6.**  
 3-ohm speakers suitable for this chassis available 8" 17/6 10" 25/7  
 This chassis is a genuine bargain and delivery is reasonably good.

**BARGAIN VALUE IN RECORD PLAYERS**

By Plessey—3 speed Model 331, 45 and 78 R.P.M. This brand new autochanger Mixer Unit will play 7, 10 and 12 inch records. Xtal Cartridge Type Pick Up with Sapphire Stylus—plays 4,000 records. Spring mounting. Base board size 15 1/2 in. x 12 1/2 in. Height 6 1/2 in. Depth 2 in. Special Bargain Price whilst stock lasts.  
 Price 9 1/2 gns. only  
 \*MIXER TYPE MECHANISM — DUO POINT SAPPHIRE STYLUS\*

**WE SPECIALISE IN RADIO COMPONENTS**

The following are a few items from our stock—send for our Bargain Lists, price 3d.

**COAXIAL CABLE** Latest semi-air spaced Polythene insulated 80 ohm coaxial by leading manufacturer. Feeder losses out by 50 per cent (maker's guarantee) 1/2 in. diam., stranded conductor, highest quality. Only 9d. per yd. 8/9 per doz. yds. 50 ohm Standard Coaxial cable 1/2 in. diam., 5d. yd. Coaxial plugs 1/2. 80 ohm Twin Screened Feeder, 1/- yd. Coaxial sockets, 1/-. 80 ohm Balanced Twin Feeder 6d. yd. Outlet boxes 4/6.

**ELECTROLYTICS** Leading Makes New Stock

TUBULAR—wire ends	CAN TYPES
25/25 v., 80/12 v. .... 1/9	8+8/450 v. .... 4/6
50/50 v. 4/500 v. .... 2/-	8+16/450 v. .... 5/6
8/450 v. .... 2/3	8+16/500 v. .... 5/6
8/500 v. .... 2/9	16+16/450 v. .... 5/6
8+8/500 v. .... 4/6	16+16/500 v. .... 6/-
8+16/450 v. .... 5/6	32/350 v. .... 4/6
16/450 v. .... 3/6	32+32/450 v. .... 6/6
16+16/450 v. .... 5/6	60+350 v. .... 6/6
32/350 v. .... 4/6	60+100/350 v. .... 11/6
32/500 v. .... 5/6	100+200/275 v. .... 12/6
32+32/350 v. .... 5/6	1500/8 v. .... 4/6
32+32/500 v. .... 7/6	1000+1000 6 v. .... 6/6

**CLOSE TOLERANCE SILVER MICAS**

1% TYPE. 58 pf. to 500 pf., 1/9; 515 pf. to 5000 pf., 2/-; 1.5 pf. to 50 pf. (Tot. 1 pf.) 1/9.  
 10% TYPE. 5 pf. to 500 pf., 1/-; 600 pf. to 3000 pf. 1/3.

**QUALITY PUSH-PULL OUTPUT TRANS. 20w.**

Super Silenc Lams. Sectionalised windings. Prim. Ind. 75H. Leakage Ind. 075H Prim. Imp. to individual requirements. Sec. 3.75 and 15 ohms. Fully shrouded and terminated. 3 gns.  
 Ditto. as above with Primary Taps for Osram 912. £3/7/6.  
**MAINS TRANSFORMERS.** Soundmaster 35/-; Mullard Amp. F/shrouded 35/-; Osram 912 F/shrouded 35/-

**ALUMINIUM CHASSIS**

18 g. Plain undrilled. Folded 4 sides. riveted corners. latitudes fixing holes. Depth 2 1/2 in. 7 in. x 4 in., 4/8; 9 in. x 8 in., 5/9; 1 1/2 in. x 7 in., 6/9; 1 1/2 in. x 6 in., 8/8; 1 1/2 in. x 1 1/2 in., 10/6. etc.

**S.T.C. RECTIFIERS**

K3/25 2 kv. 4/8; K3/40 3.2 kv. 6/-; K3/45 3.4 kv. 6/8; K3/50 4 kv. 7/3; K3/100 8 kv. 12/6; K3/160 14 kv. 19/-; RM1 125 v. 60 mA., 4/-; RM2 125 v. 100 mA., 4/8; RM3 125 v. 120 mA., 5/9; RM4 250 v. 275 mA., 16/-; HT59 250 v. 200 mA., 26/6.

**SUB-MINIATURE VALVES**

Ex-Deaf Aid, XF, DF, and DL series. 6/6 ea.

**RESISTORS**

20% Tolerance, leading makes only. All values 10 ohms to 10 Megohms. 1/2 w., 3d.; 1 w., 5d.; 1 w., 6d.; 2 w., 9d. 1% HIGH STABILITY.

**WIRE WOUND RESISTORS**

Wire ends. Silicone coated. 25 ohms—10000 ohms, 5 w., 1/3; 10 w., 1/6; 15 w., 1/5.  
 15000 ohms—33000 ohms, 5 w., 1/9; 10 w., 2/3.  
 47000 ohms—50000 ohms, 5 w., 2/3; 10 w., 2/6.

**WIRE ROUND POTS**

Standard 3-watt type—long spindles. 100 ohms, to 50000 ohms, 5/8; 100000 ohms, 6/8.

**T.R.S. RADIO COMPONENT SPECIALISTS**  
 70 BRIGSTOCK RD., THORNTON HEATH, SURREY

Phone: THO 2188 Hours 9am—6pm. 1pm. Wed. Open all day Saturday. BY THORNTON HEATH STATION. BUSES 130A, 133, 159, 166, 190. Terms: G.W.O. or C.O.D. Post & Packing up to 1lb., 6d., 1lb., 1/-, 3lb., 1/6, 5lb., 2/- 10lb., 2/6.



Estd. 1925

EASY TERMS

**LEAK QUALITY EQUIPMENT for the Connoisseur**

If you want the Finest Quality Reproduction together with Workmanship of the Highest Order your choice must be LEAK.

AS USED BY BROADCASTING CORPORATIONS THROUGHOUT THE WORLD.

LEAK "TL/10" AND "POINT ONE" PRE-AMPLIFIER. Cash Price £28/7/-, or sent for £4/10/- Deposit and 18 monthly payments of 30/-, carr. and crate free.

LEAK TL/10 AND VARISLOPE MK. II PRE-AMPLIFIER. Cash Price £34/13/- or sent for £6 Deposit and 18 monthly payments of 35/-, carr. and crate free.

**LEAK DYNAMIC PICK-UP**

Complete with two detachable diamond heads and transformer. Cash Price £20/19/9 or sent for £3 Deposit and 10 monthly payments of 40/-. Post and packing paid.

Delivery of all the above is from stock. We can also supply Wharfedale, Goodmans and Tannoy loudspeakers, etc., Connoisseur Variable 3-speed Motors and all other Quality Equipment on EASY TERMS.

Please let us have your requirements.

**14 DAYS FREE TRIAL**

with the SUPERB NEW  
**REMINGTON '60'**  
 ELECTRIC SHAVER



**will convince you**

that it really does shave quicker and smoother than any other method. The extra long shaving heads are slightly arched to fit easily into those hard-to-shave spots.

SEND DEPOSIT OF ONLY 5/- FOR IMMEDIATE DELIVERY

Balance after 14 DAYS FREE TRIAL 15/-, and 8 monthly payments of 24/-. Cash Price £9.17.11. AC/DC 200-250v. Brand new. Sent post paid in silk lined presentation case.

WE WILL ALLOW YOU 40/- FOR YOUR OLD ELECTRIC SHAVER if you decide to keep the REMINGTON after trial. SEND FOR FREE BROCHURE



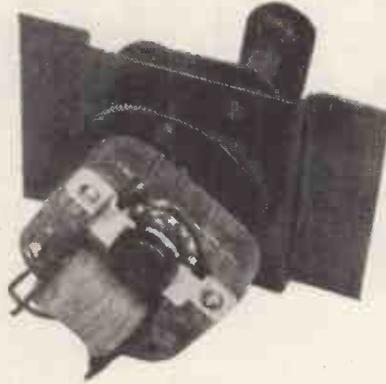
The L. R. SUPPLY Co. Ltd.  
 BALCOMBE · SUSSEX Phone 254

**"You can rely on us"**

**We offer at a fraction the real value these very useful motors with Reduction Drive**

**DATA**

200/240 v. A.C. shaded pole motor (speed approx. 2,000 R.P.M.), driving a reduction gear giving a final rotary speed of 6 R.P.M. and a reciprocating arm speed of 6 swings per minute. Arm movement or gearing can be easily removed.



**USES**

Tape Recorders, Gram. Drives, Models, Display purposes, Beam Aerial Drives, Timers, Machine Feeds, etc., etc. The above are only a few suggested uses.

**Price 12/8d. each**

Carriage 1/6d.

**Two For 22/6d.**

**RADIO SERVICING COMPANY**

82, SOUTH EALING ROAD, LONDON, W.5.

Telephone: EAL. 5737

Next to South Ealing Tube (TURN LEFT) 9 to 6 p.m. Wed. 1 o'clock.

Handles with many times the life of wood and blades of Sheffield steel chromium plated to prevent rust, combine to make screwmasters that will last a lifetime. Fully insulated to 5,000 volts.

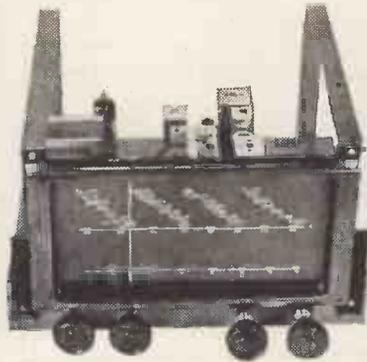
From suppliers everywhere

**STEAD**

**PLASTIC & AMBER HANDLED**

*Screwmasters*

Manufactured by J. STEAD & CO. LTD., SHEFFIELD, 2.



**VHF/FM  
BROADCAST  
RECEIVER  
TYPE CB4**

Constructed to VHF standards throughout. Covers the band 2 with RF, Mixer, 2-IF, and ratio detector stages. Provision is made for single or push pull output, or added Short Waveband. Although "hand built" in small quantities, an attractive price is maintained.

Model "A," FM tuner. A popular and small unit, with good sensitivity. These are in use from Bognor to Ely, and little changed since first described by Amos and Johnstone in the "Wireless World." New "hammer" finish front plate and tuning scale carries a magic eye; this and power unit are optional.

The "Mullard" 5-10 amplifier. Our version is condensed to only 12 x 5in. plan, with symmetrical front layout. With FM, a truly high fidelity outfit is possible under £35.

CB4 FM/MW feeder unit, mains driven...	£21 0 0
CB4/2, with push pull output.....	£26 0 0
"A" basic tuner.....	£11 17 6
"A" tuning scale, magic eye.....	£2 0 0
"A" power unit.....	£3 0 0
"Mullard" amplifier, our version.....	£14 10 0

Welcome to MARLBOROUGH YARD, N.19, evening demonstrations also arranged.

**BEL SOUND PRODUCTS CO. ARC. 5078**

# UNIVERSAL ELECTRONICS

OUR RANGE OF QUALITY EQUIPMENT IS MOST COMPREHENSIVE

Whether new or used, it is all guaranteed to be in perfect condition



## TS-13/AP PORTABLE SIGNAL GENERATOR

for 3CM operation with self contained Wavemeter and Power Monitor.

### 1. FREQUENCY RANGE

For general use  $9375 \pm 70$  mc/sec. Freq. sensitivity of power monitor  $\pm 1$  db in range  $9375 \pm 70$  mc/sec. Freq. sensitivity of calibrated attenuator  $\pm 2$  db from  $-13$  dbm to  $-65$  dbm in above frequency range.

### 2. FREQUENCY STABILITY

**Sawtooth Operation.** Frequency modulation of approximately 0.1 mc/v. **Thermal Drift.** Set stabilizes after approximately 3 minutes warm-up. **Frequency Stability.** Wavemeter calibration changes within limits listed below:

Temp. (°F.)	Limits (dial div.)
60	- 3 and + 1
75	- 2 and + 2
90	- 1 and + 3

### 3. VARIATION OF ATTENUATOR

The attenuator is individually calibrated to be accurate to  $\pm 2$  db at approximately 75°F.

### 4. PULSE CHARACTERISTICS

**Triggered Operation.** Positive trigger required:—Not less than 15 v., 1–20 microsecs. **Negative trigger required:**—Not less than 50 v., 5–20 microsecs (repetition rate 350–4000 c.p.s.). **Pulse width:**—Continuously variable

4 (contd.)—from less than 1 to greater than 2 microsecs, measured at half power points. **Pulse phasing:**—From 6 microsecs. minimum to 200 microsecs. maximum.

**Self Synchronous Operation.** Recurrence rate:—1000 c.p.s.  $\pm 20\%$ . **Duty cycle:**—Between 20 and 60%.

### 5. TYPES OF OUTPUT

Triggered operation with variable width, phaseable pulse output, self synchronous operation with short and long pulse output (square wave), CW, and FM (with sawtooth input).

### 6. PEAK POWER OUTPUT (CW) (Pulsed Modulated)

At least 50 microwatts for 1/2 of full scale of meter deflection. Peak power within 10% of CW power.

### 7. POWER LEAKAGE

Insufficient to interfere with normal operation.

### 8. SWITCHES AND FUNCTIONS

**POWER-ON/OFF.** Line switch.

**CALIBRATE/USE.** CW output in CALIBRATE position, permitting monitoring of output power. Triggered or self synchronous pulsed output in USE position.

**PULSE/SQUARE WAVE.** Selection of triggered or self synchronous operation.

**SYNC/SELF SYNC.** Pulsed output in synchronism with input trigger of 350 to 4000/sec. recurrence rate or Self synchronous square wave operation at approx. 1000 c.p.s.  $\pm 20\%$  recurrence rate.

## RECEIVERS · KLYSTRONS · MAGNETRONS

U.S.A. type. APR4 Receiver complete. 30–1,000 Mc/s., APR5 1,000–6,000 Mc/s.

Klystrons 723/AB 3 cm. 707A, 707B, 2K28, 2K33 (1.5 cm.) CV129.

Magnetrons. 725A, 2J32, 2K33, 2K25, 2J36, 2J39, 2J54, 2J22, TR cells 1B24, and many other items of equipment covering HF, VHF, UHF and centimetric bands.

### U.S.A. MICROWAVE TEST GEAR

No technical manuals for sale. Please write for prices. TS45 3CM Signal Generator. TS3. S band power frequency meter. TS13. X band signal generator. TS14. S band signal generator. TS120. X band pulsed signal generator. TS34. Radar Synchroscope. TS36. X band power meter. TS69. 300–100 Mc/s. frequency meter. TS127. 300–700 Mc/s frequency meter. TS174 (V.H.F. version of BC221) 20–250 Mc/s. TS175. 80–1,000 Mc/s. GENERAL RADIO type 804B. 8–300 Mc/s. signal generator.

All laboratory equipment may be inspected by appointment.

### BRITISH TEST EQUIPMENT

AVO Model 7 as NEW, £15. Model 40, £12. A.C./D.C. minor, £6/15/-. AVO electronic test meter, £30. Roller panel valve testers, £12. Wide range signal generator, £22. AVO valve characteristic meter, £50. AVO signal generator, £9. Taylor 65C signal generator, £13. 90A test meter, £10. 260A TV Wobbulator, as NEW, £30. Evershed Wee meggers 500 v., £14. Bridge type and others in stock. Cossor Double Beam oscilloscope, type 339 from £35. Mullard Valve Tester, complete with cards, £50.

### MANUALS

for the following receivers:

AR88D-LF, AR77E, Marconi CR100, S20, S20R, SX24, SX28, R107. B2 Transmitter/Receiver, H.R.O.s Photostatic copies of originals £1/7/6, each.

### U.S.A.

### FREQUENCY METERS

#### TYPE BC221

125 kc/s–20 Mc/s. Complete with calibration charts.

Available from stock.

CONDITION PERFECT.

## MARCONI SIGNAL GENERATORS TYPE TF390G

Frequency range. 16–150 Mc/s. In first class operating condition. Laboratory checked.

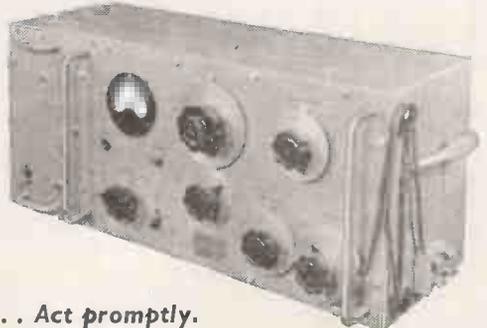
£25

NOTE: Also available BRAND NEW (ex-M.O.S.) in original transit cases with full spares.

£35

Transport extra at cost.

Limited supply available . . . Act promptly.



WE ARE ALWAYS PREPARED TO PURCHASE EQUIPMENT SIMILAR TO THE RANGE NOW OFFERED

22 LISLE STREET, LEICESTER SQ., LONDON, W.C.2

Shop hours : 9.30 a.m. to 6 p.m.

OPEN ALL DAY SATURDAY

Thursday 9.30 a.m. to 1 p.m.

Write, Call or Telephone  
GERrard 4447 and 8410 (Day)  
MEAdway 3145 (Night)

## BUILD THIS RADIO FOR 49/6



Build this exceptionally sensitive twin-triode radio. Uses unique assembly system and can be built by anyone without any radio knowledge whatever in 45 minutes. Handsome black-crackle steel case with specially made black and gold dial with stations printed. Size of radio only 6 1/2 in. x 5 in. x 3 in. Covers all medium and long waves, uses one only all-dry battery which lasts many months as H.T. Consumption is only 1 to 1.5 mA. Ideal for bedroom, garden, holidays, etc. Complete Kit only 49/6, post free (sent by return with full set of clear, easy-to-follow plans). All parts sold separately.

## BUILD THIS RADIO FOR £5-10-0

AMAZING VALUE! ... Complete kit of 3 valves, plus metal rectifier, A.C. Mains set, only £5-10-0. Terrific new circuit, with optional negative feedback circuit giving beautiful tone. Covers all Medium and Long Waves. Ready to use chassis (Punched, etc.). Every component tested before packing. Cabinet size 12 in. x 6 in. x 5 in. For A.C. Mains 200/250 volts. Complete kit with valves, speaker, ivory or black cabinet, etc., only £5-10-0 plus 2/6 post and packing. (Sent with full set of clear, easy-to-follow plans.) All parts sold separately. Parts lists, plans, etc. 2/-.



READ THESE TESTIMONIALS—  
Mr. Carter, of Worcester, writes: "Just a few lines to let you know how pleased I am with the midget portable radio. I was surprised at the number of stations I could get with a clear performance. The price was a real bargain."  
Mr. Norton, of Oxted, writes: "Yesterday evening on the medium waveband, I counted 32 separate stations: I am very pleased with the set, which is well worth the money."  
**SEND TODAY—**

**BRIGHTON RADIO & TELEVISION CO.,**  
(Dept. W.14.) 69, PRESTON STREET, BRIGHTON, 1

## HANNEY of BATH offers:—

OSRAM 612 Erie resistor-pot, kit with ceramic tube resistors, very highly recommended, 29/6; Lab resistor kit, 32/4; T.C.C. condensers, 55/-. PARTRIDGE Components, with loose lead terminations, Mains trans., 44/-; Smoothing Choke, 29/6; Output trans., 76/9. Price includes Partridge carriage/packing charge. Printed panel, 14/6. W.B. chassis, 28/6. DENC0 16 S.W.G. All-Chassis with beautiful Bronze Front Panel, 21/-. (Printed.) S.A.E. List.

MULLARD 5 VALVE 10 WATT AMPLIFIER. T.C.C. Condensers, 45/-; Erie resistor-pot kit, 37/6; Elstone Mains trans., 38/-; Elstone Output trans., 45/- (both types); Denco chassis, 14/6; Printed bronze panel 14 in. x 6 in., 6/6. Small parts as per our list. Matched valves available for both the above designs.

WILLIAMSON AMPLIFIER. Woden potted components. Output trans. WOT.25 (1.7Ω), 130/-; PTM 14 a. mains trans., 87/6; PCF.12 150 mA. choke, 44/-; PCF.22 30 H. 20 mA. choke, 30/-; PIM 25 (mains trans. for pre-amp.), 47/6. Resistor (RK and Condenser kits (CK) available, RK, main amplifier, 29/6; RK figs. 13 and 27, 12/6; RK fig. 15, 28/9; RK fig. 19, 36/-; RK fig. 29, 29/3; CK fig. 13, 15/-; CK fig. 15, 47/-; CK fig. 19, 54/6; CK fig. 27, 19/-; CK fig. 29, 54/6. 12 1% silver micas (fig. 19), 15/-; 7 5%, 7/-; Elstone output trans., 90/-; mains trans., 57/6; 1 OH 150 mA. choke, 20/-; 39 H. 20 mA. choke, 10/-.

FREQUENCY MODULATION. For Wrotham high fidelity transmissions. DENC0 technical bulletin giving circuit and point to point wiring diagram for building an F.M. Feeder unit, 1/9, post free. We have all components available. Priced parts list on application.

COILPACKS. DENC0, CP 4/L and CP 4/M, 33/4; CP 3/370 pf. and CP 3/500 pf., 42/8. OSMOR "Q" HO, 45/-; LM, 40/-; Bath., 50/-; TBF, 40/-; HF stage for HO pack, 20/-; ETA 4-station pack, 43/8. We stock COILS by Weymouth, Osamor, Wearite, Denco, Teleton and R.E.P.

WIDE ANGLE COMPONENTS. ALLEN. Teleging Chassis, 50/-; Collects (TK and Super-Visor), 44/6; LO.308, 40/-; FO.305, 21/-; DC.300c., 39/6; FC392, 31/-; GL.16 and 18, 7/6 each; SC.312, 21/-; AT.S10, 30/-; OE.117, 9/-; BT.314, 15/-; DENC0 Chassis Magnaview, 37/6; Chassis, Super-Visor, 51/6; Coil sets Magnaview, 41/2; WA/DCAL, 43/-; WA/FCAL, 31/-; WA/LCL and WCL, 7/6 each; WA/FMAL, 21/-; WA/LOT1, 42/-; WA/FBT1, 16/-.

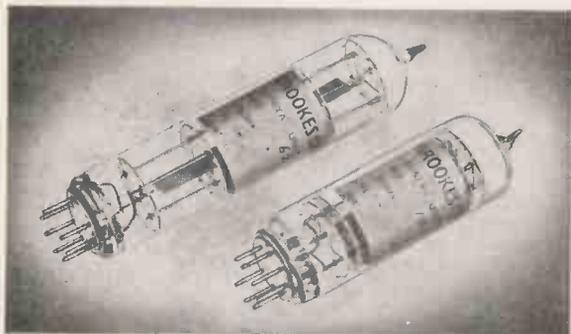
Send 6d. stamps for our General List of components for Viewmaster, Soundmaster, Williamson Amplifier, Teleging, Magnaview (Brimar and English Electric large screen TV), Super-Visor, Mullard Universal, Close tolerance Silver Micas, etc., etc. Please add 1/- postage to orders under £2.

## L. F. HANNEY

77 LOWER BRISTOL ROAD, BATH

Tel. : 3811.

## 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

JUST PUBLISHED

## AN INTRODUCTION TO COLOUR TELEVISION

G. G. GOURIET, A.M.I.E.E.

72 pages. 21 diagrams and 7 colour plates. Cloth 8/6  
This monograph contains the substance of a series of lectures delivered in 1954 to the Television Society. It explains the development and theory of the present American colour television system with a comment on future development in this country.

## SIMPLE ELECTRONIC MUSICAL INSTRUMENTS FOR THE CONSTRUCTOR

ALAN DOUGLAS

72 pages. 51 diagrams. 5/-

The growing demand for musical instruments in the home has been responsible for this book, which describes a number of different electronic instruments to satisfy the devotees of both light and serious music. The basic principles of music production are given together with full constructional details.

## THE "LODESTAR" TAPE RECORDER

A. S. TORRANCE

56 pages. 25 diagrams and half-tones. 3/6

Designed especially for the home constructor, this high-grade instrument combines precise mechanical engineering with an electrical design devoid of unnecessary frills, but allowing full advantage to be taken of the capabilities of modern magnetic tapes.

Complete list available

## NORMAN PRICE (PUBLISHERS) LTD.

283, CITY ROAD, LONDON, E.C.1

# BUILD THIS ATTRACTIVE F.M. TUNER

This tuner features good sensitivity and freedom from drift. Four Osram valves used and two C.EX 34 crystals.

Booklet by Data Publications Price 2/-

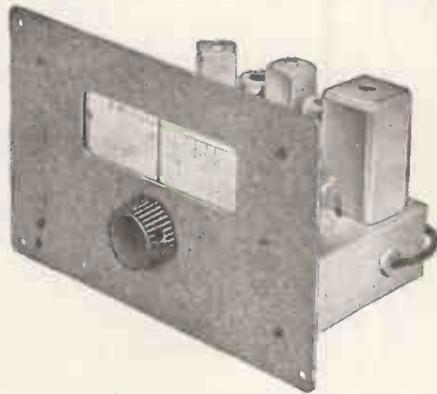
Chassis, Dial & Coils made by

**THE JASON MOTOR & ELECTRONIC CO.**

**328 CRICKLEWOOD LANE,  
LONDON, N.W.2**

Telephone: SPE 7050

ALSO AVAILABLE CHASSIS AND DIALS FOR 'WIRELESS WORLD' F. M. TUNER.



Mitcham Representative

## HOME RADIO OF MITCHAM

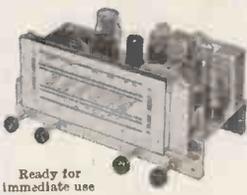
187 LONDON ROAD,  
MITCHAM

S.A.E. for complete price list.

Please call for a demonstration.

# Quality Equipment Designers Ltd.

75 GRAND PARADE, HARRINGAY  
LONDON, N.4. Phone: STA. 3712

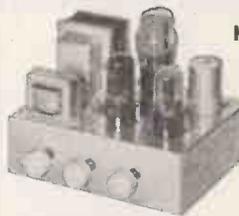


Ready for immediate use  
**£10-17-6** plus 5/- Pkg. etc.

### THE 'ROFTON' RADIO-GRAM CHASSIS

A 5-valve Radiogram chassis with appeal to the eye, and to the connoisseur of quality reproduction.

- ★ 3 colour tuning dial (10 x 4 in.) BLACK or CREAM ★ Twin panel lights ★ Wavebands L.M.S. ★ Gram position ★ Bass/Treble control ★ LS/PU sockets with plugs ★ Steel Chassis (overall 13 1/4 x 7 x 6 1/2 in.) ★ Latest type Coll Pack ★ Choice of GOLD RING KNOBS Ivory or Walnut ★ Superb workmanship throughout.
- Valve line-up: 6K8, 6K7, 6Q7, 6V6, 5Z4. Mains voltage 200/250 v. A.C.



Completely built and tested **£5-12-6** plus 2/6 pkg.; etc.

### THE 'ROFTON' FOUR HIGH QUALITY AMPLIFIER

- ★ Separate Bass ★ Separate Treble ★ Separate Volume ★ Fully shrouded Mains Transformer ★ Output 4 watts ★ Chassis sprayed Metallic Bronze ★ Engraved Control Knobs (Ivory or Walnut) ★ Negative feedback ★ LS/PU plugs and screen lead for P.U. provided.

Specifically designed for use with all leading makes of Gram units. V.L.U. 6SL7, 6V6, 5Z4. Mains voltage 200/250 v. A.C. The above unit can be supplied in KIT FORM at £4/15/- plus 2/6 pkg. Instructional book containing stock list, theoretical circuit, chassis layout, etc., 1/-.



### THE NEW LOOK T.R.F. RECEIVER

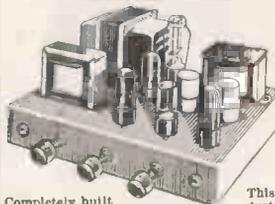
Build this superb radio at a total cost of only

**£5-15-0**

**Complete Set of Components**  
plus 2/6 pkg. and carr.

Choice of Walnut finish or Bakelite cabinet. This is a 3-valve T.R.F. plus Metal Rectifiers with a valve line-up as follows:— Medium wave, and 800/2,000 metres on Long wave.

6K7 (HF); 6J7 (DET); 6V6 (OUTPUT). Wave band coverage is 130/550 metres on Long wave. Assembly instructions 1/- (post free), include point-to-point wiring, chassis layout, etc. Also stock list of priced components (which may be purchased separately). This receiver may be purchased completely built and ready for use at total cost of £6/15/- plus 3/6 pkg. and carr. All components are guaranteed for one year. Valves 3 months.



Completely built and tested **£11-12-6** plus 5/- pkg., etc.

### THE 'ROFTON' HI-FI 8 AMPLIFIER

- ★ Separate Bass ★ Separate Treble ★ Separate Volume ★ Radio, Gram, Mike input sockets ★ Negative feedback ★ Fully shrouded Mains Transformer ★ O.P. Trans. tapped 3 and 15 ohms ★ Matched 6V6s ★ Chassis sprayed metallic bronze.
- Valve line up: 6SL7, 6SN7, 26V6s, 5Z4, mains voltage 200/250 v. A.C.

This Amplifier has passed all tests for true reproduction, placing it at the top in the Audio Field. Can also be supplied in KIT FORM at £10/7/6, plus 4/- pkg. Instruction book with theoretical circuit, stock list, chassis layout, etc., 1/-.

**MORE THAN OFTEN THE DEMAND IS 'ROFTON'.** We are sole distributors for 'Rofton' products.

#### 'ROFTON' MAINS TRANSFORMERS

Primary 210-220-250 (fully shrouded). 350-0-350. 120 mA. 6.3 v. C.T. @ 5 A. 5 v. @ 3 A. 47/3.	200/250 v. (fully shrouded). 250-0-250. 60 mA. 6.3 @ 3 A. 5 v. @ 2 A. 22/6.
---	---

#### PUSH PULL OUTPUT TRANS.

Tapped 3 and 15 ohms. 18/9.
CHOKES
15 H. 150 mA 200 ohms. 18/-
15 H. 60 mA 800 ohms. 6/6.

#### F.M. FEEDER UNIT

To Denco specification. Valve line up: 6AM6, 12AH8, EB91, 9-6AB6s. Complete kit, £8/7/6 (or supplied less valves) Point to point diagram and complete instructions, 1/6. Price: Less valves £4/16/1.

**TERMS:—** Cash with order or C.O.D. All orders for small items totalling over £2 post free unless otherwise stated. Write Dept. W.W.

ALL ITEMS LISTED ABOVE CAN BE SEEN AND HEARD WORKING IN OUR SHOWROOM.

Shoppers wishing to visit our premises ALIGHT AT HARRINGAY ARENA. OPEN 9 a.m.-6 p.m. MON.-SAT. (EARLY CLOSING WED.)

## THE OUTPUT MUST BE RESTRICTED

to maintain the waveform, so say all the books. But not so with the HATFIELD oscillator, nor is it necessary to work near the point of instability.

**COMPLETE STABILITY, LESS THAN 0.28 of 1% distortion, R.M.S. output voltage 50% greater than the H.T. voltage, 1 valve, 1 coil, simple circuit.**

Sounds, incredible, but it is **GUARANTEED.**

Send for copy of N.P.L. report and see our ad. in April Issue of "W.W." The HATFIELD oscillator is now made with 3 output impedances to suit any Head on the market. 45 Kc/s to 50 Kc/s.

**TAPE RECORDISTS!** Are you Completely satisfied with your recordings? Bad waveform in an oscillator can cause **DISTORTION** due to intermodulation, **NOISY BACKGROUND** due to D.C. component in an asymmetrical waveform and **INTERFERENCE** with radio due to harmonics beating with incoming signal. The fundamental cannot do this!

**COIL**, complete with circuit, 10/6 post free. Patent app. for.

### BIAS REJECTOR COILS

Even a small amount of bias frequency getting into the amplifier can cause a lot of trouble, and nearly all tape recorders need a rejector coil to prevent this.

**COIL**, complete with instructions, 5/6 post paid.

### MOTEK TAPE DECKS

The famous K6 deck; twin track, two speed, with push buttons and electronic braking, is a beautifully finished job at only £19/19/-. Post free. Or £3 down and 12 monthly payments of £1/10/-.

### TAPE AMPLIFIERS

The HATFIELD amplifier is complete with oscillator as above, and magic eye, less speaker, at £12/15/-. Or £2/10/- down.

### COMPLETE RECORDERS

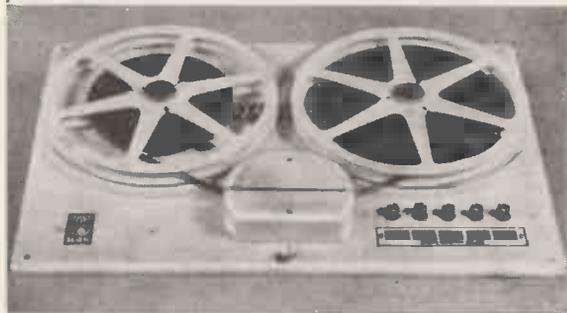
The HERGA recorder incorporates ALL the above items together with a first-class crystal mike and one reel of SCOTCH BOY tape in an attractive two-tone portable cabinet, absolutely complete at 39 gns. Or £7 down and 12 payments of £3.

Further details and H.P. forms from:

## HATFIELD RADIO

78 STROUD GREEN RD., LONDON, N.4

# MOTEK



TWO SPEED—SIMPLE PUSH BUTTON CONTROL

## THE NEW K6 UNIT

List Price **19 GNS.**

SEE AND HEAR IT AT YOUR LOCAL DEALER

## MODERN TECHNIQUES

138-144 Petherton Road, London, N.5

Tel.: Canonbury 5896

The new

## LUSTRAPHONE 'FULL VISION'

Model LFV. 59 Personal MICROPHONE

For television • recording  
• broadcasting • public address.

THE MODEL LFV. 59 is the acme of dynamic microphones for highest quality personal presentation in television, recording, broadcasting and public address. Its beautiful styling and high performance, plus extremely smooth frequency response and non-directional polar pattern, makes this handsome full vision microphone the finest obtainable.

MODEL LFV. 59 can be used anywhere—indoors or outdoors—in your hand—mounted on a floor—or table stand—with 'Stayput' flexible tube to tilt microphone to desired position. There is no need to shield the microphone when used in the open air, it is already protected from wind noise effects. Its design enables MODEL LFV. 59 to be used under all conditions—in all temperatures and it is unaffected by rapid climatic changes.



Miss Carole Carr using the LFV. 59

LUSTRAPHONE, the foremost name in MICROPHONES

Literature gladly sent on request.

## Lustraphone Ltd.

St. George's Works, Regent's Park Road, London, N.W.1.

Telephone: PRIMROSE 8844/6.

Telegrams: LUSTRAPHON NORWEST LONDON.

Cables: LUSTRAPHON LONDON.

**R.C.A. TRANSMITTERS.** Type 4331. 1 kW. (telephone); 1.4 kW. (telegraph). Frequency range 3 Mc. to 20 Mc.

**BC610 TRANSMITTERS** with speech amplifier, aerial tuning unit, etc. Brand new.

**RCA TRANSMITTERS.** Type ET-4336. Complete with original speech amplifier, crystal multiplier and VFO units. Unused and reconditioned. Can be supplied with very large quantity of spares.

**RCA TRANSMITTERS.** Type ET-4332 modified by R.A.F. for use on crystal or master oscillator. Complete with speech amplifier.

**MULTI CHANNEL TRANSMITTER T-4/FRC**, with modulators MD-1/FRC, 2 Mc/s to 18 Mc/s. Each channel 400 w. output. W.S. No. 19 & 22. Both complete with installation kit. Tropicalised. New.

**MAGNETO 10 LINE U.C. 40 Line F & F TELEPHONE SWITCHBOARDS** (complete).

**MARCONI SIGNAL GENERATORS** Type T.F. 144G. As new, checked.

**A.R.88D's, A.R.77's, S27's, HRO, BC.312, BC.342, R.109** and others.

**METAL RECTIFIERS** Type IB, D.C. output 10 amps at 22 v. input 220/250 v., 50 c/s.

All above items in excellent working condition. Working demonstration upon request.

**SPARES** A large selection available for SCR399 (BC610), ET4336, SCR610, EEB Telephones, and Teleprinters type 7B.

**TX VALVES** 805, 807, 813, 861, 66A, 100TH, 250TH, and many others.

Large stock of Tx' condensers, crystals and other components.

# P.C.A. RADIO

New Address, Offices and Works

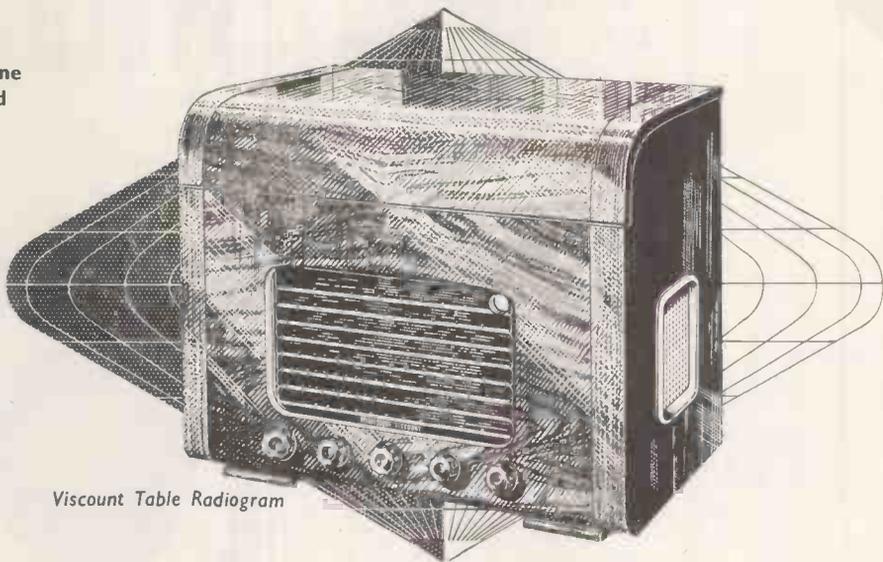
BEAVER LANE, HAMMERSMITH, LONDON, W.6

Telephone: RIV 8006/7

# for world wide reception

The Viscount Table Radiogram is a long range nine valve superhet with Garrard 3-speed Autochanger. Six electrically band-spread ranges in the 13, 16, 19-20, 25, 31 and 41 metre bands, M.S.W. and M.W. or M.W. and L.W., A.C. operation, push-pull output. Twin speakers. Large glass dial. 12½ in. scale length each band. Separate bass and treble controls. Tuning indicator.

Reports reach the factory daily as to the excellence of its performance in all parts of the world.



Viscount Table Radiogram

## the AMBASSADOR Viscount

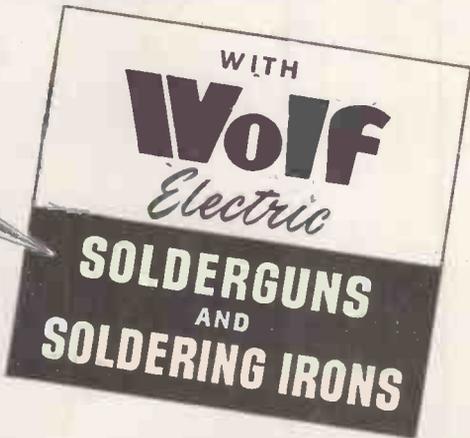
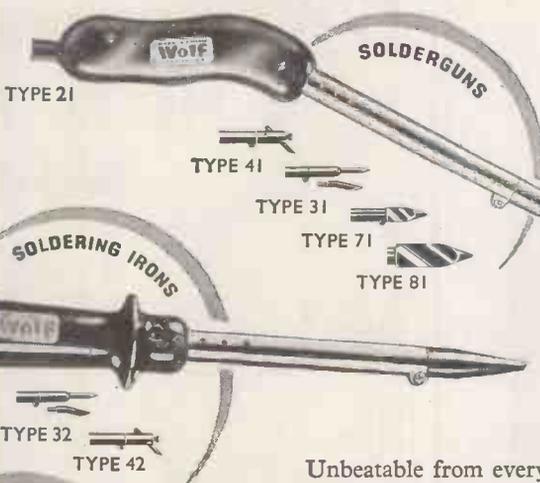
Full details on request.

AMBASSADOR RADIO AND TELEVISION

PRINCESS WORKS

BRIGHOUSE

# SPEED UP your SOLDERING



Unbeatable from every point of view, well able to withstand hard workshop treatment and ideal for continuous use. Features include rapid constant localised heat—solid sturdy construction—low current consumption—perfect balance—absolute dependability. A type and bit for every purpose from fine instrument to heavy industrial work. Each tool includes 5 feet tough rubber 3-core cable.

Obtainable from all leading tool merchants and factors. Fully descriptive Brochure free on request

Type No. 51 is designed specially for all assembly operations. Solder is fed automatically with trigger-action and two reels are supplied—one 15 ft. acid-cored and one 15 ft. resin-cored.

**WOLF ELECTRIC TOOLS LTD · PIONEER WORKS · HANGER LANE · LONDON · W.5**  
 Tel: PERIVALE 5631-4    Branches: BIRMINGHAM · MANCHESTER · LEEDS · BRISTOL · NEWCASTLE · GLASGOW

**direct TV REPLACEMENTS OFFER THE NEW CHANNEL TV BAND 3 CONVERTERS**

**TYPE C.1. Band 3 Converter.** Providing instant choice of two T.V. programmes—B.B.C. (Band 1) and any one programme in Band 3. 9 gns.

**TYPE C.2. Band 3 Converter.** Providing instant choice of four T.V. programmes—B.B.C. (Band 1) and three programmes in Band 3. 10 gns.

Plus 3/- post and pkg.

**THESE** self-contained tuner units have their own power supply and are very simple to fit. Place your Order today—delivery approximately 3 weeks.

Ferguson Tuner Units—Type A . . . . .	5½ gns. p. & p. 3/-
Ekco Tuner Units (Superhet Models) . . . . .	6 gns. p. & p. 3/-
H.M.V. Tuner Units (Superhet Models) . . . . .	5 gns. p. & p. 3/-
Ultra Tuner Unit—Model 81—91 Series . . . . .	6 gns. p. & p. 3/-
Pam Tuner Unit—self-contained with own power supply. Delivery from stock . . . . .	9 gns. p. & p. 2/6
Pam Band 3 Aerials complete with coaxial cable. Delivery from stock . . . . .	2 gns. p. & p. 2/-
Addex Type D. Band 3 Aerial adaptor for High-Band reception on all Dipole aerials—Type D . . . . .	7/6

Terms of Business C.O.D. or C.W.O.

**direct TV REPLACEMENTS**

134/136 LEWISHAM WAY · NEW CROSS · S.E.14 TIDeway 3696-2330

**BK CORNER HORN ENCLOSURES**  
Types H.C.8 & H.C.10

For use with high quality 8" and 10" loudspeaker units



Available in a wide range of hand-polished veneers in both contemporary and traditional designs.

Right: Traditional Design

H.C.8 £24

H.C.10 £26

H.P. TERMS AVAILABLE

★ Send for illustrated brochures

**B. K. PARTNERS LTD.**

229 REGENT ST., LONDON, W.1. (Entrance Hanover St.) Phone: REG 7363

These and other high fidelity equipments are demonstrated at our show-rooms. Daily 10.30 a.m.-5.30 p.m. Saturdays 10.30 a.m.-12.30 p.m.

**WEIR**



Instruments manufactured in Moving Coil and rectifier types to B.S. 89-1954.

**SMALL PANEL INSTRUMENTS**



2in., 2½in. and 3½in. enclosed in cases of black moulded insulating material and provided with scales printed in black on matt white enamelled metal dials.

Available as Ammeters, Voltmeters, Milliammeters and Microammeters.

MANUFACTURED BY

**WEIR ELECTRICAL INSTRUMENTS CO. LTD.**

BRADFORD-ON-AVON

WILTSHIRE

TELEPHONE 2378

*Superior* **SPRINGS, WIREWORK & METAL PRESS WORK**



**The HEATH SPRING & NOTION CO LTD**  
HEADLESS CROSS, REDDITCH, ENG.

Telephone REDDITCH 861-862

# SUPERIOR RADIO SUPPLIES

DEPT. WWJ, 37, HILLSIDE, STONEBRIDGE, N.W.10. Tel: ELGAR 3644

High Class Cabinets

## SUPERIOR BUREAU



An elegant cabinet in richly figured walnut veneer, internal panels in polished sycamore. A drop front lid covers a sloping, uncut control panel (14in. long x 10½in. high) alongside which is an uncut base-board (17½in. 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 (13½in. high, 7½in. wide, 16½in. deep). The lid and cupboard handles are in chased florentine bronze. Overall dimensions (33in. high, 34in. long, 16½in. deep). Price £17. Plus 15/- carr. Send for Cabinet Leaflet.

## THE HOME CONSTRUCTOR'S BATTERY PORTABLE The SUPEREX 55 ATTACHE

BUILDING COST £7.15.0 Plus 3/6 P.P.

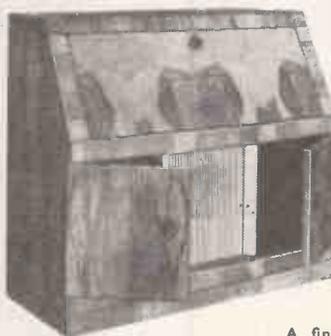


- Outstanding Quality
- 7 x 4in. Elliptical Speaker
- First Class Reception
- 4 Valve Battery Superhet
- Long and Medium Waves
- Cabinet 10½in. x 8½in. x 5in.

Send 1/6 for "Superex 55" Construction Booklet.

Ideal for Tape Recorders

## S. R. BUREAU



A fine multi-purpose cabinet, finished in well figured walnut veneer and built to the highest standards of workmanship. A blank motor-board size, (16in. long x 15in. deep). Available prepared Unpolished or Polished.

Price £16/10/- Polished. £13/10/- Unpolished. Plus 15/- Carr. Send for Cabinet Leaflet.

TERMS: Cash with order or C.O.D. Extra charge for C.O.D. U.K. and N. Ireland only.

PERSONAL SHOPPERS WELCOME

Shop open 9 a.m. to 6 p.m. Monday to Saturday, 1 p.m. Thursday.

# CITY SALE & EXCHANGE LTD

The High Fidelity Specialists

## OFFER FROM STOCK



**PART EXCHANGE** is our speciality.  
**EASY PAYMENTS** by 1/5th deposit and balance over 6, 12 or 18 months.

### AMPLIFIERS

The new Lowther T.P.10, 12 watts output, push pull EL 34's, 7 to 70,000 c.p.s. £40.

Leak T.L./10 amp. and pre-amp. 27 guineas.

Acoustical Quad II and control unit. £42.

R.D. Senior amp. and pre-amp. £43.

R.D. Junior and pre-amp. £25.

S/H Leak TL/12 amp. and pre-amp. £24.

S/H R.D. Baby de Luxe and Junior pre-amp. £18.

### SPEAKERS

Lowther T.P.I corner reproducer. £96.

Wharfedale Treble corner assembly. £23/10/-.

Chaffey corner cabinet. 37 guineas.

R.D. Junior corner horn. £18/17/6.

Units for above—Goodman Axiom 102, £9/18/2. Axiom 101, £6/12/1.

Wharfedale Super 8/AL, £6/6/7.

S/H Vitavon 12in. unit in reflex cabinet. £22. S/H Audiom. £7.

S/H B.T.H. 12in. unit. £3/10/-.

### MOTORS, etc.

T Lorens transcription motor. £32.

Connoisseur transcription motor. £25/15/5. Collaro. £13/9/6. S/H

Connoisseur 3-speed. £18. Ditto 2-speed. £13. Garrard RC.80.M

changer with either 2 Acos or Decca X.M.S. heads. £18.

### PICK-UPS

S/H Decca X.M.S. with 2 heads £5.

S/H Connoisseur super lightweight with 2 heads. £6.

S/H Acos A.P.20 p.u. 50/-.

Leak dynamic with 2 diamond heads and transformer. £20/19/9.

93-94 FLEET STREET, LONDON, E.C.4

Phone: CENTRAL 9391/2

# "Hi-Fi" EQUIPMENT and KITS

## TO SUIT ANY BUDGET

### TWO COMPLETE "Hi-Fi" AMPLIFIER KITS

#### "STERNS" HIGH QUALITY 8-10 WATT AMPLIFIER



Having a front panel which is very attractively finished in deep gold, and on which the controls are clearly identified. The ideal amplifier for general home use and for small halls, etc.

Price of COMPLETE KIT including Valves and Drilled Chassis, etc. (Plus 2/6 carr. and ins.) **£7/10/-**

We will supply it Completely Built for **£9/10/-** (Plus 5/- Carr. & Ins.)

Designed for high quality reproduction up to an output level of 10 watts, having 6V6s in Push-Pull and incorporating negative feedback. It is suitable for use with all types of Pick-ups and most types of microphones and the output transformer provides for use of 3 and 15 ohm speakers.

#### BRIEF FEATURES

- Valve line up 6Z5, 6SN7, 5Z4, with 6V6s in push pull.
- The undistorted output level of up to 10 watts is produced from an input of 25 volts.
- First class reproduction of Radio (where a Tuning Unit is used) and Record Playing.
- Separate Bass Boost and Treble Controls provide an excellent range of frequency control.
- Very satisfactory results are obtained with an average type of high impedance Moving Coil or Crystal Microphone, a clear speech level of approx. 5 watts output being obtained.
- Power supplies (HT and LT) are available for a Tuning Unit.
- For operation on A.C. Mains 200-250 volts 50 cycles.

THE ASSEMBLY MANUAL is available for 1/- and includes detailed layouts and component Price List.

#### "STERNS" 12 Watt "HIGH FIDELITY" Push-Pull AMPLIFIER



A very high quality Unit attractively finished in deep gold with each control clearly identified on the front panel.

Comprising a Main Amplifier Chassis, and a Remote Control Pre-Amplifier, Tone Control Unit. The remote control unit measures only 9x4x2 1/2 in. and contains four controls, being: Bass-Treble-Volume and a Radio, Gram, Microphone Switch control. It incorporates its own feedback circuit on the Base Channel. Loop negative feedback is employed on the Main Amplifier which has a valve line up of 6J5-6N7-5U4 with two 6X25's in push-pull and 6J5 and 68N7 are used in the remote control unit.

THE COMPLETE KIT IS AVAILABLE FOR **£14/-** (Carr. & Ins. 6/- extra). THE COMPLETE UNIT ASSEMBLED AND READY FOR USE **£17/-** H.P. Terms **£4/5/-** Deposit, 12 Months at **£13/11**. (Carr. & Ins. 7/6 extra.)

The measured frequency range of the amplifier with this unit shows an excellent response from 14,000 cycles down to 20 cycles, the bass and treble controls allowing independent control of gain at both ends of the frequency range from zero to a gain of 50. It can be seen, therefore, that ample correction is provided to suit any type of pick-up with any type or recording. Input voltage for maximum output is 70 mV and 6.3 volts at 2 amps, and 30 mA. H.T. is provided for tuning unit, etc. This Amplifier compares well with the Williamson and similar designs at a fraction of their cost. The complete set of assembly instructions is available for 2/-.

#### THE NEW "LEAK" TL/10 AMPLIFIER and "Point One" PRE-AMPLIFIER



This Amplifier has a maximum output of 10 watts and maintains in every respect the world renowned LEAK reputation for precision engineering, fine appearance, and fastidious wiring. The Pre-Amplifier will operate from any make or type of pickup. A continuously variable input attenuator at the rear of the Pre-amp. permits the instantaneous use of crystal, moving iron and moving coil pickups. H.T. and L.T. supplies are available for a Radio Tuning Unit. An input attenuator is fitted. S.A.E. for descriptive leaflet.

#### PRICES:

- (a) THE COMPLETE AMPLIFIER WITH PRE-AMPLIFIER, **£28/7/-**, or **£7/2/-** Deposit and 12 months at **£2**.
- (b) THE TL/10 MAIN AMPLIFIER ONLY: **£17/17/-**, or **£4/7/-** Deposit and 12 months at **£1/5/4**.
- (c) THE "POINT ONE" PRE-AMPLIFIER ONLY: **£10/10/-**, or **£2/12/6** Deposit and 12 months at **15/-**.

### !! ANOTHER OUTSTANDING OFFER !!

A PORTABLE RECORD PLAYER incorporating The New COLLARO 3-SPEED AUTOCHANGER MODEL R.C. 54 for only **£14/14/-** (Plus 7/6 carriage and insurance.)

H.P. TERMS: Deposit **£3/14/-** followed by 12 monthly payments of **£1/0/5**.

This is a really GENUINE BARGAIN . . .

The PORTABLE CASE is extremely well made and covered with grey rexine, and, as will be seen by the illustration, has space available to accommodate an Amplifier thereby enabling a complete "RECORD REPRODUCER" to be quite easily made.

THE COLLARO MODEL R.C.54 is a "mixer" 3-speed Autochange Unit incorporating the famous light-weight STUDIO "O" Crystal Pick Up, and it is undoubtedly one of the best Autochangers made.

Our MODEL AMP. 3 AMPLIFIER will operate perfectly with the Collaro Changer and can quite easily be accommodated in the above Portable Case. It comprises a 3 valve A.C. Mains design employing a 6K6 Output Valve for about 3 Watts and incorporates an efficient Tone Control. Price **£4/4/-** assembled and including a 6 1/2 in. P.M. Speaker.

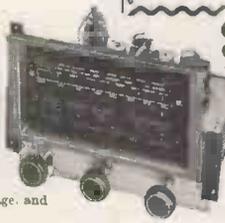


#### "STERNS" MODEL CP3G 3 WAVEBAND SUPERHET TUNING UNIT

A highly sensitive tuning unit providing for excellent reception of stations on the short wavebands (16-50 metres) medium waveband (200-350 metres) and the long waveband (800-2,000 metres). We can supply this tuner to correctly operate with each of the Amplifiers.

- Valve line-up: 6K9G (Frequency Changer), 6BZ7G (I.F. Amplifier), 6Q7G (Detector, A.V.C. and 1st A.F. Amplifier), and 5Z4g (rectifier).
- A gramophone position is incorporated with the wavechange switch and the 6Q7g valve becomes the 1st A.F. Amplifier for the gramophone pickup.
- The Tuner can be supplied with up to four controls—Tuning, Volume, Tone and the Wavelength Switch (Tone and Volume operate on both Radio and Gram.)—but if your Amplifier already has the Tone and Volume Controls we can omit both. When ordering please state what is required.
- Overall chassis dimensions are 12in. x 8 1/2 in. x 8in. including the full vision dial. Size 8 1/2 in. x 4 1/2 in.
- For A.C. Mains only, power supply required—H.T. 250 volts 30 mA., L.T. 6.3 volts 1 1/2 amp.

Price, completely assembled and including built-in power supply **£10/10/-**. H.P. Terms: Deposit **£2/12/6**. 12 months of **15/-**. Price completely assembled excluding Power Supply **£9**. Carriage and Insurance 7/6 extra. (Dial Escutcheon is 4/6 extra.)



#### A COMPLETELY ASSEMBLED "HIGH FIDELITY" PUSH-PULL AMPLIFIER. Supplied Complete with THE STERN'S DUAL CHANNEL TONE CONTROL PRE-AMPLIFIER UNIT FOR ONLY **£13/13/-**

(plus 7/6 Carr. & Ins.)

H.P. TERMS DEPOSIT **£3/8/-** and 12 monthly payments of **19/2**.

We are able to offer this equipment at such an attractive price only because of a bulk purchase of PARMEKO TRANSFORMERS, CHOKES, etc.

It is designed for really good reproduction, employing two 6F6's in push pull for approximately 10 watts output. A total of 7 valves are employed, the main Amplifier having 6J5-68N7—two 6F6's and 5 Volt Rectifier and the separate Control Unit, which is identical to that supplied with the 12 Watt "Hi-Fi" Amplifier described above, has types 6J5 and 68N7. Loop Feedback is employed over the whole of the main Amplifier and the PARMEKO OUTPUT TRANSFORMER ensures really good reproduction. Power take off socket is provided for an external Radio Tuning Unit, the POWER SUPPLY AVAILABLE being 200 to 250 Volts at 45 mA. and 6.3 Volts at 1 1/2 amps. WHEN ORDERING PLEASE STATE WHETHER FOR 3 OR 15 ohm SP EAKER.

#### WE HAVE IN STOCK . . . THE DENCO F.M. FEEDER UNIT

Consisting of a 5 valve Superhet design incorporating R.F. (6AM6) and F/O (12AH9) Stages followed by Two I.F.'s (6BA6's) and Ratio Discriminator 6A05, the coverage provided being 88-100 Mc/s.

THE COMPLETE KIT including VALVES and DRILLED CHASSIS is available for **£6/13/6**

It is suitable for use with any type of High Fidelity Amplifier. (Plus 4/- Carr. and Ins.) The descriptive manual, including circuit and Component Layout, etc., is available for 1/6.

THE COMPLETELY ASSEMBLED CHASSIS, ready for use, aligned and tuned **£8/17/6** Plus 6/- Carr. & Ins. EACH PRICE INCLUDES TWO I.F. STAGES.

#### WILLIAMSON AMPLIFIERS BY GOODSSELL

These Amplifiers hardly need enlarging upon, it being sufficient to say that they have now become the accepted standard for quality reproduction by which all others are judged. Two Models are available:

MODEL G.W.18. (Plus 7/6 Carriage and Insurance.) H.P. Terms Deposit **£3/9/-** and 12 months at **£2/7/5**.

MODEL G.W.12. Uses slightly lower H.T. voltage to produce 10-12 watts output but otherwise is built completely to specification. H.P. Terms Deposit **£6/17/6** and 12 months at **£11/8/8**.

THE MODEL P.F.A. TONE CONTROL UNIT This Control Unit has established a reputation for its excellent quality of reproduction and ability to give adequate gain for any type of pick-up.

Price **£20/-** (Plus 7/6 Carriage and Insurance.) H.P. Terms. Deposit **£5** and 12 months at **£18/2**.

WE HAVE THEM IN STOCK AND WILL BE PLEASSED TO DEMONSTRATE or send S.A.E. for illustrated and descriptive leaflet.

When submitting orders, please include postage and packing

# STERN RADIO LTD.

**RECEIVER CHASSIS**

*Modernise your old Radiogram*

**RECORD PLAYERS**

COMPLETE RADIOGRAM EQUIPMENT—QUALITY AT LOW COST

STERN'S DESIGN FOR HOME CONSTRUCTORS

**The "SUPER-SIX"**

A compact and highly efficient superhet Radio-Radiogram chassis of outstanding quality.

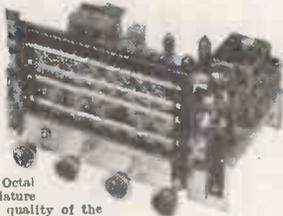
**YOU CAN BUILD IT FOR £10/7/6**

Including the OCTAL VALVE LINE-UP

(£12/7/6 with the miniature valves)

Incorporating the new B.V.A. Miniature Valve Line up. This receiver is designed to the very latest specification and provision is made to incorporate either the standard Octal Valve line-up or the new B.V.A. range of miniature valves. Great attention has been paid to the quality of the reproduction of both Radio reception and Record playings, and excellent clarity of speech and music is obtained.

- Covers 3 wavebands 18-50 metres, 190-550 and 800-2,000 metres.
  - Employs 6 valves having PUSH-PULL for 5-6 watts output.
  - Incorporates delayed A.V.C. on all wavebands and pre-selective feedback.
  - A 4 position Tone Control operation on both Radio and Gram.
  - Has independent mains supply socket for a Record Player.
  - Size of Assembled Chassis 12in. x 8in. x 8in. Dial aperture 8 1/2in. x 4 1/2in.
  - For operation on A.C. mains 200-250 volts 50 cycles.
- THE INSTRUCTION and ASSEMBLY MANUAL is available for 1/6. It contains very detailed practical drawings and circuit diagrams and a complete Component Price List.



**FAMOUS**

**3-SPEED AUTOCHANGER** is offered for **£9/19/6** (Plus 7/6 carr. & ins.) Normal Price £13/10/0

Hire Purchase Terms £2/9/6 Dep. and 9 months at 19/-

● These units will autochange on all three speeds, 7in., 10in. and 12in.

● They play MIXED 7in., 10in. and 12in. records.

● They have separate sapphire for L.P. and 78 r.p.m., which are moved into position by a simple switch.

● Minimum baseboard size required 14in. x 12in., 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.



**WE HAVE THE LATEST 3-SPEED AUTOCHANGERS IN STOCK**

SEND S.A.E. FOR DETAILS

**WE CAN ALSO OFFER THE LATEST 3-SPEED NON-AUTOCHANGE UNIT**

**!!! STERN'S AMAZING BARGAIN OFFER !!!**  
**WE HAVE BOUGHT THE ENTIRE STOCK OF THE FAMOUS MODEL B3PP RADIO or RADIOGRAM CHASSIS**

A 6 WAVEBAND SUPERHET with PUSH-PULL OUTPUT

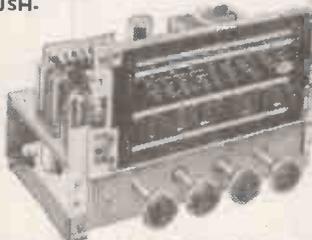
Thousands of these successful and very popular Receiver Chassis have been sold for £15/15/- each.

**WE CAN NOW OFFER THEM FOR £11/19/6**

(plus 7/6 carriage and insurance). H.P. Terms. DEPOSIT £3 and 12 Monthly payments of 17/5.

- GENERAL DETAILS**
- For use on A.C. Mains 100/110 Volts and 200/250 Volts.
  - Employs the latest Valves: 6BE6, 6BA6, 6AT6, two 6BW6's in push pull and 6X4 (or similar) Rectifier.
  - It has a Mains socket on the chassis for connection to Gram Unit.
  - Incorporates extension speaker and Pick-up sockets.
  - Overall size of Chassis is 11in. x 7 1/2in. x 3 1/2in. high.
  - Dial size 8 1/2in. x 4 1/2in.
  - A Bronze coloured Dial Escutcheon is available for 4/6.

- Waveband coverage is Shortwave 16 to 50 metres, Medium 187 to 550 and Longwave 900 to 2,000 metres.
- Has four controls: (1) Volume Control with on-off switch, (2) Tone Control (operative on Gram and Radio), (3) Wavechange Switch with Gram position, (4) Tuning Control (Flywheel type drive).
- Negative Feedback is employed over the entire audio stages.
- Excellent reproduction up to approximately 6 Watts output.



These Receiver Chassis have undoubtedly proved to be about the most popular and successful yet offered. They are designed to the most modern specification with great attention having been given to the quality of reproduction which gives really excellent clarity of speech and music on both Radio and Gram.

THEY ARE THE IDEAL REPLACEMENT CHASSIS FOR THAT "OLD RADIOGRAM," ETC.

ALL CHASSIS ARE BRAND NEW and GUARANTEED FOR 12 MONTHS (B.V.A. VALVES 90 DAYS).

**THE NEW ARMSTRONG F.C. 48**

A high quality replacement Radio or Radiogram Chassis having provision for an F.M. Feeder Unit.

PRICE ASSEMBLED and READY

FOR USE **£23/18/0**

(Plus 7/6 Carr. and Ins.)

H.P. Terms £5/18/- Deposit and 12 months at £1/13/6.

**OUTSTANDING FEATURES INCLUDE:—**

- 8 Valves including 2 double Triodes.
- 8 Watts output from push-pull tetrodes. Heavy negative feedback is used, resulting in negligible distortion and high damping factor.
- Provision for using F.M. adaptor to receive the present high quality transmissions from Wrotham and the new B.B.C. V.H.F. stations.
- An accessible socket at rear provides the power supply for this unit.
- Independent controls give BASS and TREBLE lift and cut with unique Thermometer visual indicator.
- Gram. position on wavechange switch.
- 4 Wavebands Coverage 18-51, 50-120, 190-550, 1,000-2,000 metres.
- Large four-colour illuminated dial.



**!!! THE LATEST !!!**

**RADIO-RADIOGRAM CHASSIS**

Model F3PP. A 7-valve 3-waveband Superhet Chassis with Push-Pull Stage. This Chassis has been designed with particular regard to the quality of reproduction. It incorporates SEPARATE BASS and TREBLE CONTROLS thereby ensuring the utmost flexibility of Tone on both Radio and Gram.

- Briefly:
- Waveband coverage 16-50, 190-550 and 900-2,000 metres
  - Valve line-up X79, 6BA6, 6AT6, ECC83, GZ30 and two 6AQ5's in push-pull for approx. 6 watts output.
  - Negative Feedback and delayed A.V.C.
  - Has independent mains supply socket for gram. connection.
  - Overall size of Chassis 12in. x 8in. high x 7in. with dial size 11 1/2in. long x 4 1/2in.



- For use on A.C. Mains 100/110 volts and 200/250 volts.

**£17/17/0**

(plus 7/6 carr. and ins.)

Cash Price, tested and ready for use £17/17/-

H.P. Terms: Deposit £4/7/- and 12 monthly payments of £1/5/4.

**SPECIAL REDUCTIONS FOR COMPLETE EQUIPMENT**

**SUMMARY—**Select a RECEIVER CHASSIS and we will supply IT TOGETHER WITH THE ABOVE 3-SPEED CHANGER AND AN 8-inch or 10-inch P.M. SPEAKER as follows:—

THE £9/19/6 AUTOCHANGE WITH A SPEAKER AND:—

	Cash Price	Deposit	Monthly
(a) With Model B3PP chassis .....	£22 19 0	£5 15 0	12 of £1 11 11
(b) " " " Armstrong F.C.48) includes Good-.....	£35 7 6	£8 17 6	12 of £2 9 2
(c) " " " F3PP) mans 10in. P.M. ....	£28 16 6	£7 4 6	12 of £2 0 1
(d) With Model AW3-7 (see overleaf) .....	£23 19 0	£6 0 0	12 of £1 13 4

An additional charge of 10/- is made in each case to cover Carriage and Insurance.

**109 & 115 FLEET ST.**  
**LONDON, E.C.4. Phone: CENTRAL 5812-3-4**

# !! Home Constructors !!

## YOU CAN ASSEMBLE The *Stern's* TAPE RECORDER "Fidelity" FOR ONLY £40



H.P. Terms are shown below.

**!! IT ONLY NEEDS CONNECTING UP !!**

We are completely satisfied that this Tape Recorder, although supplied at a Genuinely low price, provides absolute Fidelity Recordings and, in addition to being completely dependable, has a performance at least equal to recorders marketed at a far higher price. The actual assembly of the Tape Recorder is extremely simple and only involves a few connections. The Truvox Tape Deck and the Quality Amplifier are supplied tested and ready for use, and all that is required to complete the Recorder is to connect the two together (a connection chart is supplied for this purpose) and secure them by the screws provided into the Attache Case. The items illustrated and described below form the complete equipment.

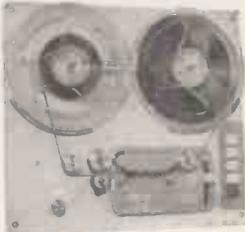
● WILL TAKE ALL STANDARD TAPES UP TO 1,200ft.

● WILL PLAY THE NEW PRE-RECORDED TAPES

● WILL PROVIDE 2 HOURS' PLAYING AT 3 1/2 in. or 1 hour at 7 1/2 in. per second.

● INCORPORATES AN ELLIPTICAL P.M. SPEAKER 7in. x 4in., with EXTENDED FREQUENCY RANGE.

SEND S.A.E. FOR DESCRIPTIVE LEAFLET.



### THE NEW TRUVOX MODEL TR7U TAPE DECK

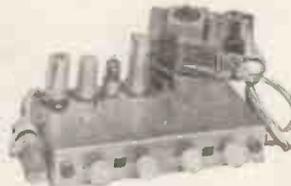
THE NEW TRUVOX MODEL TR7U TAPE DECK. 3 Shaded-Pole motors. Drop-in Tape Loading. Push Button Control. Separate Push Button Brake. Fast forward and fast-reverse. Silent drive eliminating Wow and Flutter. Half Track working and 2 speeds, 3 1/2 in. and 7 1/2 in. per sec. Positive Azimuth Adjustment. Overall size only 14 1/2 in. x 12 1/2 in.



ACOS CRYSTAL NEUTIC RECORDING MICROPHONE TAPE. Supplied with a MODEL MIC-33-1. 1,200ft. reel of Scotch Boy plastic tape famous for its true brilliant quality. A highly sensitive mike which accurately matches the input arrangement of the amplifier. The Recorder will take all standard makes of tape.

### MODEL T.R.I./F. QUALITY AMPLIFIER

This amplifier has been expressly designed to meet the requirements of enthusiasts for fidelity reproduction, and in particular to CORRECTLY operate the above TRUVOX DECK. It is supplied complete with a matched Elliptical 3 ohm P.M. Speaker, it incorporates an efficient Tone Control arrangement and has a Magic Eye Level Indicator (Operative on Record). In addition it can be used as a general purpose Amplifier for high quality reproduction of gramophone records direct from a Gram Unit.



### PORTABLE ATTACHE CASE

This, as may be judged from the illustration opposite, is a neat, compact and attractively finished case, being covered with maroon rexine and having an ivory coloured speaker escutcheon. It contains concealed pockets to accommodate the Microphone, Mains Lead and a spare 1,200ft. reel of tape.

GUARANTEED FOR 12 MONTHS (B.V.A. VALVES 90 DAYS)

### PRICE SUMMARY

WE WILL SUPPLY ALL FIVE UNITS LISTED ABOVE, i.e., THE COMPLETE BUT UNASSEMBLED RECORDER FOR £40/-/. H.P. Terms: Deposit £10 and 12 monthly payments of £2/15/10 or in two parts as follows:—

	CASH PRICE	DEPOSIT	12 monthly payments of
(a) TRUVOX Mk. TR7U TAPE DECK MODEL TRIF AMPLIFIER WITH SPEAKER, 1,200ft. REEL OF TAPE..	£33 10 0	£8 10 0	£2 6 8
(b) ATTACHE CASE AS ILLUSTRATED, ACOS CRYSTAL MICROPHONE }	£6 10 0	—	—

NOTE: Please send 30/- to cover cost of packing, carriage and insurance. We will refund £1 if the packing case is returned to us intact.

EACH UNIT IS AVAILABLE SEPARATELY AS FOLLOWS:

	CASH PRICE	DEPOSIT	12 monthly payments of
(a) TRUVOX Mk. TR7U TAPE DECK .....	£23 2 0	£5 17 0	£1 12 4
(b) AMPLIFIER MODEL TRIF WITH SPEAKER .....	£14 14 0	£4 16 6	£1 0 5
(c) PORTABLE ATTACHE CASE .....	£5 0 0	—	—
(d) ACOS CRYSTAL MIKE "33" .....	£2 10 0	—	—
(e) REEL OF TAPE 1,200ft. ....	£1 15 0	—	—

Please include £1 when ordering (a) or (c) for packing charge, this whole amount will be refunded if case is returned to us intact.

IT CAN BE SUPPLIED COMPLETE and READY FOR USE for £50

(as illustrated above).

FOR USE ON A.C. MAINS. H.P. Terms: Deposit £12/10/- and 12 monthly payments of £3/10/- including MIKE and 1,200ft. REEL of TAPE.

**STERN  
RADIO LTD.**

**CONSTRUCTORS say**  
**"IT'S STILL THE BEST MAINS OF"**  
**BATTERY PORTABLE SET"**



can be completely built for £23/16/3 (plus Mains Unit if required). Send 1/3 for the fully descriptive Assembly Book which includes Practical Layouts and complete Price List of Components. Portable case available separately, 37/6.

**"PERSONAL SET" BATTERY ELIMINATOR**

A complete Kit of parts to build a Midget "Alldry" Battery Eliminator, giving approx. 69 volts at 10mA, and 1.4 volts at 250 mA.

This eliminator is for use on A.C. mains and is suitable for any 4-valve Superhet Receiver, requiring H.F. and L.T. voltage as above, or approx. to 69 volts.

The Kit is quite easily and quickly assembled and is housed in a light-aluminum case size 4 1/2 in. x 1 1/2 in. x 3 1/2 in. Price of complete Kit with easy-to-follow assembly instructions, 42/6. In addition we can offer a similar COMPLETE KIT to provide approx. 90 volts at 10 mA, and 1.4 volts at 250 mA. Size of assembled unit 7 1/2 in. x 2 1/2 in. x 1 1/2 in. Price 47/6.



**A COMPLETE "CAR RADIO" FOR THE HOME CONSTRUCTOR**  
 11 1/2 in. x 4 1/2 in. x 3 1/2 in.

A design of a complete E-VALVE SUPERHET RECEIVER employing an R.F. Stage, and incorporating a separate VIBRATOR PACK size 4 1/2 x 2 1/2 x 6 1/2 in. for use on 6 or 12 volt D.C. supplies.

We can supply all components to build this complete Receiver and Vibrator Pack including a Metal Case, Valves, Drilled Chassis and 5in. P.M. Speaker for £13/9/6. (Carr. and Ins. 5/6 extra.) Or the Receiver Components for £20/19/6 and the Vibrator Components for £3/10/-.

This is NOT an EX-GOV'T. Receiver, it is a new design employing new Components. Send 2/8 for the complete set of ASSEMBLY INSTRUCTIONS, CIRCUITS and PRACTICAL LAYOUTS, including a complete individual Component Price List.



**A BULK PURCHASE ENABLES THIS SPECIAL PRICE REDUCTION OF THE FAMOUS**

**SHAFTESBURY PORTABLE AMPLIFIER**

Suitable for home use and small Halls. Has matched inputs for both Record Players and Microphone. Also provides for the "mixing" and "fading" of both Gram. and speech as request.



**COMPRISING**

- (a) A 4-Valve High Gain Amplifier for use on A.C. or D.C. mains 200-250 volts with 5 watts output. Incorporating independent Volume Controls for Mike and Gram., either of which can be faded at will, a variable Tone Control and independent input sockets for Mike and Gram.
- (b) A Transverse Carbon microphone which obtains its polarizing current from the amplifier—no batteries are necessary.
- (c) An 8in. Goodmans P.M. Speaker with the "Ticonal" magnet for first-class reproduction.

**THE COMPLETE EQUIPMENT is all contained in the PORTABLE CARRYING CASE £18'0'0**

Having been reduced from £30/9/-. HIRE PURCHASE TERMS. DEPOSIT £4/10/- and 12 monthly payments of £1/5/4 ● Light in weight ● Easy to CARRY ● GENUINELY PORTABLE. An illustrated leaflet containing free data is available on receipt of S.A.E.

**109 and 115 FLEET ST.**  
**LONDON, E.C.4. Phone: CENTRAL 5812-3-4**



**THE "MINI TWO-THREE"**

An "Alldry" Battery Portable of midget size, 6 1/2 in. x 4 1/2 in. x 3 1/2 in. designed to cover medium wave-band 190-559 metres, with use of short trailer aerial.

The simple design of this Receiver is so arranged that either a 2-valve set or a 2-valve (afterwards easily converted to the 3-valve) can be made.

Consists of a T.R.F. circuit using a regenerative detector with H.F. stage and a high gain output pentode. Valve line up IT4-IT4-DL94.

The 2-valve set can be completely built for £4/3/6 (less case) and the 3-valve for £5/3/- (less case) Each price includes valves, speaker and drilled chassis.

Send 2/- for the assembly instructions; they include simple and complete practical component layouts and diagrams.

**! ! CONSTRUCTORS ! !**  
**A NEW SUPERHET TRANSPORTABLE**  
**THE "SUPER THREE"**

Designed for local station reception without the use of an external aerial this design provides for a 3-valve (plus Metal Rectifier) Superhet Receiver incorporating a Frame Aerial for "room-to-room" use, provision is also made for a short external aerial if required, for the reception of Continental Stations.

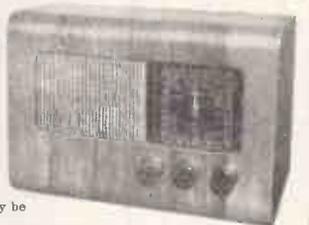
Briefly the features are as follows:—

- For use on A.C. Mains 200-250 volts.
- This set includes a Mains Transformer and Chassis is NOT live to mains (as many other sets of this type are) and consequently the Receiver can safely be used in the Kitchen, etc.
- Valve line up 6X5-6J7-KT61, plus Metal Rectifier.
- The I.F. Transformer is supplied "pre-aligned" and thereby ensures extreme simplicity of Tuning—in fact, more simple than most T.R.F. Receivers.
- Compact and easy to build simple "point-to-point" practical diagrams are supplied with a completely drilled chassis.

The complete Receiver Chassis can be built to cover the

Medium Waveband only for **£6 . 6 . 6**  
 Or to cover both Long and Medium Waves for **£6 . 16 . 3**  
 The attractive Polished Wood Cabinet 11 1/2 inches wide, 8 1/2 inches high and 6 inches deep illustrated above is **£1 . 1 . 0**

THE CONSTRUCTOR'S MANUAL is available for 1/-, this shows the component prices, which are all available for separate purchase.



**A DUAL-CHANNEL PRE-AMPLIFIER and TONE CONTROL UNIT**

Attractively finished in "Old Gold" and providing full control of BASS and TREBLE in conjunction with a main volume control.

It can be used with any amplifier and with any pick-up, the range of frequency control provided by the unit affording ample compensation for all types of pick-ups and all natures of recordings, i.e., English, American and long-playing without recourse to pick-up correction. The extreme flexibility of the bass and treble control is such that the level of bass and treble can be set to suit any conditions irrespective of the volume output of the amplifier. Response characteristics are given in 12-watt amplifier advt. The unit measures only 9 1/2 in. x 4 1/2 in. x 2 1/2 in., including self-contained power supply and can be accommodated either on or away from the main amplifier, i.e., on the front panel of a cabinet or any other position. Price including drilled chassis, valves (6B7 and 6J5), £3/18/9. Complete assembly data is available separately for 1/-. Completely assembled and ready for use, £5/5/.



**! ! THE IDEAL SET FOR USE IN CARAVANS, ETC. ! !**

**A 5-VALVE 2-WAVEBAND SUPERHET RECEIVER OPERATED FROM A 6-VOLT BATTERY**

**FOR ONLY £6'17'6**

(plus 5/- Carriage and Insurance.)

These Receivers, which we have recently acquired by bulk purchase, are ex-British Ministry of Supply, and are new and unused. They are a two-waveband Superhet with R.F. Stage, covering Short Wave 18 to 50 metres and Medium Wave 200 to 550 metres, fully calibrated on a clockface dial. A 5in. loudspeaker is built in and the whole Chassis is contained in a metal cabinet with lid and carrying handle which measures 12 1/2 in. x 7 1/2 in. x 7 1/2 in. overall. Valve line up is 7A7, 7Q7, 7A7, 7B6 and 7C5.

They are made for 6 VOLT D.C. supply and the current consumption is 4/5 amps. They possess excellent sensitivity and will give very good results on a very short aerial.



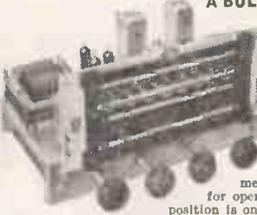
**A BULK PURCHASE ENABLES US TO OFFER THIS "PUSH-PULL" 7-VALVE SUPERHET RECEIVER £12'19'6**

For only £12'19'6

(Carr. & Ins. 7/6 extra)

H.P.—£3/4/6 Dep. 12 mths. at 18/4. These receivers Models AW3-7 are made by a well-known set of manufacturers and incorporate the latest Osram Valve Line-up of X79-W77-DH77-H77-U78 and two N78s in Push-Pull for approx. 7 watts output. They cover 3 wavebands 18-50 metres, 190-550 and 800-2,000 metres, and are for operation on A.C. mains 200-250 volts. A Gram position is on the Wavechange Switch.

They make an excellent replacement Radiogram Chassis having a P.U. connection on the Chassis. Extension speaker connection is also provided. Overall size of chassis: 12 1/2 in. long x 7 1/2 in. x 6 1/2 in. high, dial aperture 8 1/2 in. x 4 1/2 in. (Dial Escutcheon available for 4/9).



**SELENIUM RECTIFIERS**

L.T. Types		H.T. Type H.W.	
2/6 v. 1/2 a.h.w....	1/9	120 v. 40 mA....	3/11
6/12 v. 1/2 a.h.w.	2/9	250 v. 50 mA....	5/9
		250 v. 80 mA....	7/9
		250 v. 150 mA....	9/9
		RM4 250 v. 250 mA.....	11/9
F.W. Bridge Types		F.W. (Bridge Type)	
6/12 v. 1 a.....	4/11	300 v. 275 mA.	12/11
6/12 v. 2 a.....	8/9	250 v. 80 mA....	11/9

**CO-AXIAL CABLE.** 75 ohms 1/2 in., 7d yard. Twin screened feeder, 10d. yd.

**SILVER MICA CONDENSERS.** 5, 10, 15, 20, 25, 30, 35, 50, 100, 120, 150, 180, 200, 230, 300, 330, 400, 470, 500, 1,000 pfd. (.001μF), .002 mfd. (2,000 pfd.). All at 5d. each, 3/9 dozen one type.

**DIAL BULBS, M.E.S.,** 8 v. 0.15 a., 6/9 doz.; 6.5 v. 0.3 a., 6/9 doz.; 4.5 v. 0.3 a., 6/9 doz.

**ELECTROLYTICS** (Current production) NOT ex Govt.

Tubular Types		Can Types	
8μF 450 v. ....	1/9	16 mfd. 350 v....	1/11
8 mfd. 500 v....	2/6	16μF 450 v.....	2/9
16μF 350 v.....	2/3	24μF 350 v.....	2/11
16μF 450 v....	2/9	32μF 350 v.....	2/11
16μF 500 v....	3/9	32 mfd. 450 v....	4/9
32μF 350 v....	3/9	64 mfd. 450 v....	4/9
32 mfd. 500 v....	5/9	100 mfd. 450 v....	4/9
8-16μF 500 v....	4/11	8-8μF 450 v....	3/6
25μF 25 v. ....	1/3	8-8 mfd. 500 v.	4/9
50μF 12 v. ....	1/3	8-16μF 450 v....	2/11
100μF 50 v....	2/3	16-16μF 450 v.	4/11
100 mfd. 12 v....	1/9	16-32μF 350 v.	4/9
100 mfd. 25 v....	2/3	32-32μF 350 v.	4/9
Can Types		32-32μF 450 v.	5/11
8 mfd. 350 v....	1/3		
8 mfd. 450 v....	2/3		
16 mfd. 500 v.	3/9		

**VOLUME CONTROLS** with long spindles, all values, less switch, 2/9; with S.P. switch, 3/9.

**WIRE WOUND POTS:** 20 ohms, 500 ohms, 5K, 20K, 100K (medium length spindles), 2/9; 220 ohms, 2K, 10K, 20K, Preset type, 1/9 each.

**EX GOVT. AMMETERS.** Moving coil. G.E.C. 0-5 amps., 2in. scale, 11/9.

**EX-GOVT. E.H.T. SMOOTHING CONDENSERS**  
 25 mfd., 4,000 v. Blocks ..... 4/9  
 5 mfd., 2,500 v. Blocks ..... 3/9  
 5 mfd., 3,500 v. Cans ..... 3/3  
 1 mfd. plus 1 mfd. 8,000 v., large blocks (common negative isolated) ..... 9/6  
 1.5 mfd., 4,000 v. Blocks ..... 5/9

**EX-GOVT. BLOCK PAPER CONDENSERS**  
 2 mfd. 800 v. ... 1/9  
 4 mfd. 500 v. ... 2/9  
 4 mfd. 1,000 v. ... 4/3  
 4 mfd. 1,500 v. ... 4/9  
 4 mfd. 2,000 v. ... 6/9  
 4 mfd. 400 v. plus 2 mfd. 250 v., 1/11.

**M.E. SPEAKERS.** All 2-3 ohms, 8in. R.A. field, 600 ohms, 11/9. 10in. R.A. field, 1,500 ohms, 23/9. 10in. R.A. field, 1,000 ohms, 23/9.

**SPECIAL OFFERS.** Mains Trans. 200-250 v. 50 c/s. Primary Secs. 250-0-250 v. 200 mA. 6.3 v. 8 a. 5 v. 3 a., 21/9. Small output Transformer, 5,000 ohms to 3 ohms, 1/11.

**GOODMANS 3 1/2 in. P.M. SPEAKER** (ex equip.), with battery pentode trans., 12/9.

**HEAVY DUTY BATTERY CHARGER**  
 For normal 200/250 v. A.C. mains input. To charge 12 v. battery. Variable charge rate of up to 10 amps. Fitted Meter and Fuses. Guaranteed 12 months. Carr. 7/6. £6/19/6.

**DRYDEX HANDLAMPS.** Suitable for garage lights, etc. (Normal price 29/6). Limited number. Brand new boxed, fitted with bulb, 19/6.

**H.T. ELIMINATOR AND TRICKLE CHARGER KIT** with louvered crackle finished case. Mains input 200-250 v. Output 120 v. 40 mA., and 2 v. 1/2 a. Price with circuit, 29/6. Or in working order, 37/6.

**R.S.C. TRANSFORMERS**

**FULLY GUARANTEED, INTERLEAVED AND IMPREGNATED**

**MAINS TRANSFORMERS**

Primaries 200-230-250 v. 50 c/s.  
**FULLY SHROUDED UPRIGHT MOUNTING**

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.	18/9
250-0-250 v. 100 mA, 6.3 v. 4 v., 4 a., c.t., 0-4-5 v. 3 a.	26/9
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
250-0-250 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
300-0-350 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

**TOP SHROUDED DROP THROUGH TYPE**

250-0-250 v. 70 mA, 6.3 v. 2.5 a.	13/9
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. 2 a., 6.3 v. 2 a., 5 v. 3 a.	29/11
350-0-350 v. 150 mA, 6.3 v. 4 a., 5 v. 3 a.	29/9

**E.H.T. TRANSFORMERS.** 2,500 v. 5 mA., 2-0-2 v. 1.1 a., 2-0-2 v. 1.1 a., for VCR97, VCR517

**FILAMENT TRANSFORMERS**

Primaries 200-250 v. 50 c/s.

0.3 v. 1.5 a.....	5/9	0-4-0.3 v. 2 a....	7/9
0.3 v. 3 a.....	8/11	6.3 v. 6 a.....	17/6
12 v. 1 a.....	7/9	12 v. 3 a. or 24 v.	
0-2-4-5-6.3 v. 4a	16/9	1.5 a.....	17/6
6.3 v. 2 a.....	7/6		

**CHARGER TRANSFORMERS**

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., 18/9; 0-9-15 v. 5 a., 19/9; 0-9-15 v. 6 a., 23/9.

**ELIMINATOR TRANSFORMERS**

Primaries 200-250 v. 50 c/s. 120 v. 40 mA.

120 v. 40 mA., 5-0-5 v. 1 a.	14/9
------------------------------	------

**OUTPUT TRANSFORMERS**

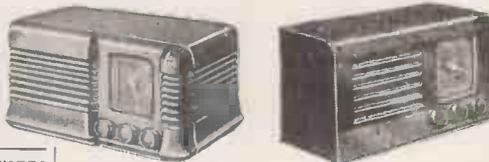
Midget Battery Pentode 66:1 for 3S4, etc.

Small Pentode, 5,000Ω to 3Ω	3/6
Standard Pentode, 5,000Ω to 3Ω	3/9
Standard Pentode, 8,000 to 3Ω	4/9
Battery Pentode, 10,000 ohms to 3 ohms.	4/9
Multi-ratio 40 mA. 30:1, 45:1, 60:1, 90:1, Class B Push-Pull	5/6
Push-Pull 8 Watts 6V6 to 3 ohms	8/9
Push-Pull 10-12 Watts 6V6 to 3Ω to 15Ω	15/9
Push-Pull 10-12 Watts to match 6V6 to 3-5-8 or 15Ω	16/9
Push-Pull 20 Watts high-quality sectionally wound, 6L6, KT66, etc., to 3 or 15Ω	47/9

**SMOOTHING CHOKES**

250 mA, 3 H., 50 ohms	11/9
150 mA, 7-10 H. 250 ohms	11/9
100 mA, 10 H., 150 ohms potted	9/9
100 mA, 10 H. 200 ohms	8/9
80 mA, 10 H. 350 ohms	5/6
60 mA., 10 H. 400 ohms	4/11

**THE SKY FOUR T.R.F. RECEIVER**



A design of a 3-valve 200-250 v. A.C. Mains receiver with selenium rectifier. For inclusion in either of cabinets illustrated above. It employs valves 6K7, SP61, 6F6G, 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, 2/6. This receiver can be built for a maximum of £4/19/6 including cabinet. Available in brown or cream bakelite, or veneered walnut.

**P.M. SPEAKERS.** All 2-3 ohms. 6 1/2 in. Plessey, 16/9. 8in. Plessey, 16/9. 10in. R.A., 26/9. 10in. Plessey, 19/9. 10in. Rola with Trans., 29/6.

**R.S.C. BATTERY CHARGER KITS.** For mains input 200-250 v. 50 c/s. To charge 6 v. accumulator at 2 amps., 25/9. To charge 6 v. or 12 v. battery at 2 a., 31/6. To charge 6 v. or 12 v. battery at 4 a., 49/9.

**ABOVE KITS CONSIST OF GREEN CRACKLE LOUVRED STEEL CASE, MAINS TRANSFORMER, FULL WAVE METAL RECTIFIER, FUSES, FUSE-HOLDERS AND CIRCUIT.** Any type assembled and tested for 6/9 extra.

**R.S.C. 6 v. or 12 v. BATTERY CHARGER**

For normal A.C. mains input 200-230-250 v., 50 c/s. Selector panel for 6 v. or 12 v. charging. Variable charge rate of up to 4 AMPS. Fused, and with 5 amp meter. Well ventilated metal case with attractive crackle finish. Guaranteed for 12 months, 69/6. Carr. 2/6.



**EX.GOVT. MAINS TRANSFORMERS**

All 230 v. 50 c/s. Input.

8.8 v. 4 a. ....	9/9
48 v. 1 a. ....	9/9
0-11-22 v. 30 a. ....	72/6
16-18-20 v. 35 a. ....	79/6
7.7 v. C.T. 7 amps., 4 times	25/9
480 v. 200 mA., 6.3 v. 5 a.	27/9
300-0-300 v. 80 mA. 5 v. 3 a.	8/11
278-0-278 v. 100 mA.	8/9
300-0-300 v. 150 mA., 610-0-610 v. 150 mA., 1,220 v. 350 mA.	29/6
400 v. C.T. 150 mA. 4 v. 5 a., 6.3 v. 6 a., 6.3 v. 0.6 a., 4 v. 6 a., 4 v. 6 a., 4 v. 3 a., 4 v. 3 a., 5 v. 2 a.	22/9

**EX-GOVT. AUTO TRANSFORMERS**

15-10-5-0-105-215-235 v. 500 watts	27/9
Double wound 10-0-200-240 v. to 10-0-275-295-315 v. 1,000 watts	69/6
Double wound 0-110-240 v. to 0-130-140-150-160-170 v. 1,500 watts	69/6
Carriage on any of above 5/- extra.	

**EX-GOVT. SMOOTHING CHOKES**

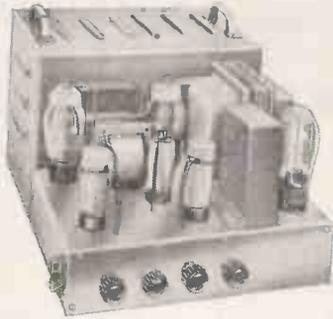
250 mA., 10 H. 50 ohms	14/9
250 mA., 10 H. 100 ohms	14/9
250 mA., 10 H. 50 ohms	8/9
150 mA., 10 H. 50 ohms	10/11
100 mA., 10 H. 100 ohms. Tropicalised	6/9
100 mA., 5 H. 100 ohms. Tropicalised	3/11
50 mA., 50 H. 1,000 ohms. Potted	8/11
90/100 mA., 10 H. 100 ohms. Potted	8/9
50 mA., 5-10 H.	2/9
L.T. type 1 amp.	2/9

**CHASSIS**

18 s.w.g. undrilled aluminium amplifier type (4-sided).	16 s.w.g. aluminium receiver type.
14in. x 10in. x 3in. 7/11	12in. x 8in. x 2 1/2 in. 5/3
16in. x 10in. x 3in. 8/3	16in. x 8in. x 2 1/2 in. 7/6
18 s.w.g. aluminium receiver type.	20in. x 8in. x 2 1/2 in. 8/11
6in. x 3 3/8 in. x 1 1/2 in. 1/11	16 s.w.g. aluminium amplifier type, 4-sided.
7 1/2 in. x 4 1/2 in. x 2 in. 2/9	12in. x 8in. x 2 1/2 in. 7/11
10in. x 5 1/2 in. x 2 in. 3/3	16in. x 8in. x 2 1/2 in. 10/11
11in. x 6in. x 2 1/2 in. 3/11	20in. x 8in. x 2 1/2 in. 13/6
	14in. x 10in. x 3in. 13/6

# R.S.C. HIGH FIDELITY 25 watt AMPLIFIER A4

**A NEW DESIGN FOR 1955**  
**HIGH GAIN "PUSH PULL OUTPUT."** BUILT-IN PRE-AMP. TONE CONTROL STAGES. INCLUDES 7 valves, sectionally wound output transformer, block paper reservoir condenser, and reliable small components. AN INPUT OF ONLY 20 millivolts IS REQUIRED FOR FULL OUTPUT. THIS MEANS THAT ANY TYPE OF MICROPHONE OR PICK-UP IS SUITABLE. Two separate inputs controlled by separate volume controls allow simultaneous use of "Mike" and Gram., or Tape and Radio, etc., etc. Individual controls for Bass and Treble "lift" and "cut" Six negative feedback loops giving total of 24 D.B. Frequency response  $\pm 3$  D.B. 30-20,000 c/s.



**H.P. Terms on assembled units.** Deposit 26/- and 12 monthly payments 20/-. Plus carr. 10/-  
 Terms to include cover, mike, speakers, etc., on request. Cover as illustrated if required, price 17/6 extra.

to-point wiring diagrams are supplied. **EXTRA HIGH SENSITIVITY, HIGHEST QUALITY for 9 Gns.**  
 Or assembled ready for use 50/- extra

Hum level 66 D.B. down. Certified total harmonic distortion of only 0.35% measured at 10 watts. Comparable with the very best designs. **SUITABLE FOR SMALL HOMES OR LARGE HALLS, CLUBS, GARDEN PARTIES, DANCE HALLS, etc., etc. FOR ELECTRONIC ORGAN OR GUITAR.** For STANDARD OR LONG PLAYING RECORDS. Size 12 x 10 x 9in. For mains A.C. 200-250 v. 50 c/s. Power consumption 175 watts. Outputs for 3 and 15 ohm speakers. The kit is complete in every detail. Chassis is fully punched. Easy to follow point-to-point wiring diagrams are supplied. **EXTRA HIGH SENSITIVITY, HIGHEST QUALITY for 9 Gns.**  
 Or assembled ready for use 50/- extra

**W.B. "STENTORIAN"** High fidelity P.M. Speaker HF1012. 10 watts, 15 ohm (or 8 ohm) speech coil. Where a really good quality speaker at a low price is required we highly recommend this unit with an amazing performance. **£3/17/6.**

**MICROPHONES.** Crystal, hand or Desk type, high fidelity Acos, 50/-. Stand type with base and adjustable stem, **£6/19/6.** Both suitable for use with our amplifiers.

**PLESSEY 3-SPEED MIXER AUTOCHANGERS** with crystal pick-up having alloy stylus with separate sapphire points for long playing or standard records. (Will play 2,000 records before replacement stylus required). Brand new, cartoned, guaranteed. For 200-250 v. A.C. mains. Limited stocks at only **10 gns. plus 5/- carr.**

**H.M.V. LONG PLAYING RECORD TURNTABLE COMPLETE WITH CRYSTAL PICK-UP (SAPPHIRE STYLUS).** Speed 33 $\frac{1}{3}$  r.p.m. BRAND NEW, CARTONED. Only **£3/19/6** (approx. half price). Carr. 5/- (for 200-250 v. A.C. Mains).

**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 millivolt 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. 25 mA. and L.T. of 5.3 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 200-250 v. 50 c/s. Chassis is not alive. Kit is complete in every detail and includes fully punched chassis (with baseplate), with green crackle finish, and point-to-point wiring diagrams and instructions. Exceptional value at only **£4/15/-**, or assembled ready for use 30/- extra, plus 3/6 carr.

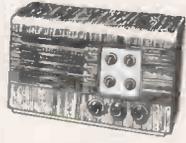
**COLLARO HIGH FIDELITY MAGNETIC PICK-UPS** High Impedance type. Limited number, brand new, boxed and perfect at fraction of normal price. Only **35/-**.

**DEFIANT RECORD PLAYING TURNTABLE COMPLETE WITH PICK-UP.**

(High Impedance Magneto Type). Unit is housed in a beautiful walnut veneered cabinet of attractive design. For all standard records (78 r.p.m.). Limited number. Brand new, cartoned **£5/19/6.** Carr. 5/-.

**A PUSH PULL 3-4 WATT HIGH GAIN AMPLIFIER FOR £3/7/6.**

For mains input 200-250 v. 50 c/s. Complete kit of parts including point-to-point wiring diagrams and instructions. Amplifier can be used with any type of feeder unit or pick-up. This is not A.C./D.C. with "live" chassis but A.C. only with 400-0-400 v. Trans. Output is for 2-3 ohm speaker. (We can supply a very suitable 10in. unit by Rola at 27/9). The amplifier can be supplied ready for use for 25/- extra. Full descriptive leaflet, 6d.



**R.S.C. MASTER INTERCOMM. UNIT.** with provision for up to 4 "Listen-Talk Back Units" Individually switched. A high gain amplifier enables speech and other sounds emanating from the rooms containing remote control units to be heard at the master control. The unit is in kit form and point-to-point wiring diagrams are supplied. A walnut veneered wood or Brown Bakelite cabinet is included. Mains input is 200-250 v. 50 c/s. H.T. line 300 v. CHASSIS IS NOT "ALIVE." Ideal for use as "Baby Alarm." Sound amplification 4 watts. Price only **£5/19/6.** "Listen Talk Back Unit" in bakelite or walnut veneered cabinet, can be supplied at 35/- each. The Master Unit can be supplied assembled and tested for 30/- extra.

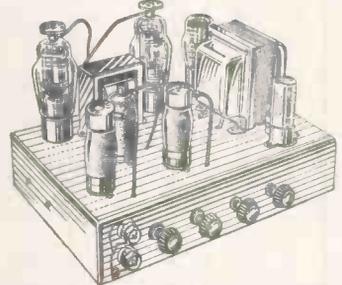
**ALL DRY RECEIVER BATTERY SUPERSEDER KIT**

All parts for an "All Dry" Battery Eliminator. Complete with case. Completely replaces 1.4 v. and 90 v. batteries where normal mains supply of 200-250 v. 50 c/s. is available. Prices with circuit, **39/9.** Or ready for use, **45/6.** Size of unit 6 $\frac{1}{2}$  x 4 $\frac{1}{2}$  x 2 $\frac{1}{2}$ in.

**BATTERY SET CONVERTER KIT.** All parts for converting any type of battery receiver to all mains. A.C. 200-250 v. 50 c/s. Kit will supply fully smoothed H.T. of 120 v. 90 v. or 60 v. at up to 40 mA., and fully smoothed L.T. of 2 v. at 0.4 a. to 1 a. Price complete with circuit and instructions only **45/9.** Supplied ready for use for 8/9 extra.

**R.S.C. A3 10 WATT "PUSH PULL" HIGH FIDELITY AMPLIFIER.**

With Self Contained Pre-amplifier and Tone Control.



This amplifier, whilst having sufficient output to fill a small hall, is the ideal amplifier for the quality enthusiast who knows that though the average listening level is less than one watt it is necessary, for the very highest quality to have an output of at least ten times this figure in order to obtain completely distortionless reproduction of sudden loud sounds.

The layout of the components has been planned to give the very maximum of performance with the minimum of constructional effort. Large safety factors in every component A.C. and H.T. tubes, punched chassis with baseplate, screened input plugs, valves, and with easy-to-follow point-to-point wiring diagrams. Everything is supplied down to the last nut and bolt.

Two independent inputs are provided with two associated independent volume controls so that programmes can be mixed together if desired, such as microphone announcements superimposed on a musical programme, or two independently controlled microphones, or even just gramophone/radio, faded over from one to the other. Variable base lift and cut with variable treble lift and cut tone controls are fitted, giving full long playing record equalisation for uncorrected pick-ups. They are also provided so that the user can alter the tonal value to suit his personal taste and surroundings. Because of the large negative feedback employed the output transformer can be so designed that it provides all the specified power even with large variations of loudspeaker impedance. Terminals are provided for 3 ohm and 15 ohm loudspeakers.

H.T. and L.T. available for the supply of a Radio Feeder Unit.

Six Negative Feedback Loops. 130 millivolts input only required for full output. Frequency response  $\pm 3$  DB 50-20,000 cycles. Negligible hum and distortion.

For A.C. mains input 200/250/250 v. 50 c/s.

**COMPLETE Kit of Parts 7 GNS.** (carriage 5/-) Supplied assembled and tested for 45/- extra.

**H.P. TERMS AVAILABLE ON ASSEMBLED UNITS**

**FOUR STAGE RADIO FEEDER UNIT.**

Design of a HIGH FIDELITY, L. and M. wave T.R.F. Unit with self-contained heater supply and thorough H.T. decoupling. Only 250-400 v. 15-20 mA. H.T. required from main amplifier. Three valves and Low Distortion Germanium Diode Detector. Flat topped response characteristic. Loaded H.F. coils. Two variable Mu controlled H.F. stages, 3 gang condenser tuning. Cathode follower output stage. Switch position for Gram. and Gram. input and output sockets. Performance comparable with the best in Feeder Units. For A.C. mains 200-250 v. operation. Size 11-6-7 $\frac{1}{2}$ in. Illustration, full set of easy-to-follow wiring diagrams and instructions and individually priced parts list 2/6. This unit can be built for only **£3/15/-**, including Dial and Drive Knobs and every item required.

**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/- extra under 10/- 1/6 extra under £2, 2/6 extra under £3, Full Price List 6d. Trade List 5d. Open to Callers : 9 a.m. to 5.30 p.m. Saturdays until 1 p.m.

# 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 ROAD, LONDON, N.W.1.

EUSTON 5533/4/5

**R1155A RECEIVERS** guaranteed serviceable in original packing cases. £7/19/6. Fully assembled Power Pack and output stage, to plug straight into R1155 for A.C. 200/250 volts at 79/6. We have a few brand new R1155A at £11/19/6, also in original packing cases—Deduct 10/- if purchasing either receiver together with power pack. Plus 10/- packing and carriage.

**R1184 RECEIVER UNIT.** Coverage 30-40 Mc/s. Including 6 valves—3 type 9D2, 1 each, 8D2, 15D2 and 4D1—5x valve screening cans, 24 ceramic trimmers, 5 ceramic valve holders, resistors, condensers, I.F.T.'s coils, etc. In very good condition, a bargain at 16/6 each only, plus 3/6 packing and postage.

**RECEIVER TYPE 25/73.** (The receiver section of TR1196). Supplied complete with full data for conversion to 3-wave-perfect receiver. Unit is complete with 6 valves 2-EP38, 2-EP38, PK32 and EDC33, also standard I.F.T.'s 465 Kc/s. Price 27/6 plus 2/6 P. & P.

**TR1196 TRANSMITTER PORTION.** We can also supply the transmitter portion of the above receiver incorporating valves, EL22, EF50, CV501, Type 600 relay transformer, coils, switches, etc. Limited quantity at 12/6 only, plus 2/6 P. & P.

**No. 17 Mk. II TRANSMITTER/RECEIVER.** Built into a strong wooden cabinet 15in. x 14in. x 9in. Complete with headphones and microphone. Range 5-8 miles with simple aerial. 44-61 mc/s. (5-7 metres). Uses standard 120 v. B.T. and 2 v. L.T. batteries. Illustrated instruction book supplied with each unit. 50/- each plus 7/6 post and packing.

**INDICATOR UNIT TYPE 302—A** bargain! Incorporates VCR97, Mu-metal shield, 4 valves, EF50, 3 type sFP61, 3 type EB34, EA50, 1 mfd. 2.5 Kv., 10 pots, etc., etc. 50/- only, plus 7/6 P. & P.

**U.S.A. PACKARD-BELL PRE-AMPLIFIER.** Incorporates valves, 6N7GT, 2N17GT, relay-plugs, sockets, condensers, etc. Brand new, with instruction booklet, 12/6 only.

**MAINS TRANSFORMER BARGAINS!** Limited quantities only. Manufacturers Surplus. 350-0-350, 80 mA., 6.3 v. 3 A., 5 v. 2 A., Half shielded, drop-through, 14/6 only, plus 1/6 P. & P. 0v/10/240 v., 1 unit, 350-0-350, 120 mA., 6.3 v. 6 A., 6.3 v. 1.5 A., 5 v. 3 A., tropicalised drop-through type, 21/- only, plus 2/6 P. & P. 110/240/240 v. Input, 250-0-250 mA., 6.3 v. 4 A., 8 v. 2 A. Upright mounting, 21/- plus 2/6 P. & P. 230 v. Input, 300-0-300 80 mA., 6.3 v. 3 A., 4 v. 2 A. Tropicalised drop-through type, 10/- only, plus 1/6 P. & P. Input 110/240 v., Auto load 230 v., 750 mA., 350-0-350 130 mA. Topped filament winding 6 v. 3 A., 15 v. 3 A., 21.5 v. 6 A., also 5 v. 2 A. Tropicalised drop-through type, 21/- plus 2/6 P. & P.

**L.T. TRANSFORMER — ADMIRALTY** Heavy duty type, 180/230 v. input, 4.2 v. plus 4.2 v. at 10 amp. 25/- only plus 1/6 P. & P.

**TELESCOPIC AERIAL MAST.** Ex-R.A.F. dinghy transmitter mast. Total length when extended, 17ft. Collapses into two sections each approx. 24in. Complete with dies and lashings. Lightweight duratamin construction, diameter at thickest point, 1 1/4 in. approx. tapering to 1/2 in. New condition. 32/6 Plus 2/- post and packing.

**COIL PACKS. MANUFACTURERS SURPLUS.** Few only, iron-cored, 7 waveband (2 medium, 5 short waves), consisting of 14 coils, trimmers, wave-change, switch, etc., etc., complete with copy of manufacturers' original circuit, 50/- only, tax paid. Completely assembled. Suitable Glass Dial, 3/6.

**SPECIAL PURCHASE.** We can offer a strictly limited supply of "dimple" telephone tape recorder attachments. Simply stick rubber suction pad to base of telephone and plug in to input-jack on your tape recorder. This automatically records incoming telephone conversations. Offer price absolutely complete with lead and jack plug, 17/6 only, post free!

**MINE DETECTOR UNITS.** Complete with 3-V2P3 Valves, 1 pair CHR. High resistance headphones, condensers, resistors etc. in web haversack, 19/6 only, plus 3/6 packing and carriage. New Condition.

### COLLARO RC/54 PLAYER!



Just released. Fawn leatherette covered portable case, incorporating very latest Collaro 3 speed mixer-changer. Cream finish. Lightweight turn-over every 5 seconds. Pick up head. Only £13/5/- cash, plus 5/- P. & P. Complete with 10 records.

### VERY LATEST 3-SPEED AUTO-CHANGER BY FAMOUS MANUFACTURER



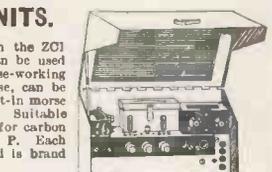
Further limited quantities, turn-over crystal head. Cream finish. Our Price £9.19.6 or 50/- deposit plus P. & P. and 10 monthly payments of 16/6.

65/- deposit plus P. & P. and 12 monthly payments of 18/7.

**LATEST 3-SPEED AUTO-CHANGER.** long arm model complete with C and D, high fidelity heads. Limited quantity at £16/10/- plus 5/- P. & P. H.P. terms available.

## REMOTE CONTROL UNITS.

These units originally intended for use with the ZOI transmitter/receiver, when inter-connected can be used as ordinary telephones or for practice Morse-working one-to-one. Complete in handsome steel case can be operated by ordinary torch battery. Has built-in Morse key and buzzer unit. Price for each is 15/-. Suitable headphones can be supplied at 7/6 plus 2/6 P. & P. Each unit includes full operating instructions—and is brand new.



**OTHER ACCESSORIES AVAILABLE.** Moving Coil Microphones for transmitter 7/6 each, 100 v. drum tone cable with plugs both ends, 10/-, 70 v. drum ditto, 7/-, etc., etc. M/C earphones 7/6. Aerial base 3/6. 12ft. Whip aerial (3 section) 7/6. Morse key with lead and plug 3/6. Battery lead and plug 2/6.

### METERS

F.S.D.	Size	Type	Fitting	Price
50 microamp	D.C. 2 1/2 in.	M.C.	R.P.	50/-
500 microamp	D.C. 2 1/2 in.	M.C.	F.R.	13/6
500 microamp	D.C. 2 1/2 in.	M.C.	F.R.	13/6
1 mA.	D.C. 2 1/2 in.	M.C.	F.R.	17/6
1 mA.	D.C. 2 1/2 in.	M.C.	F.R.	22/6
1 mA.	D.C. 2 1/2 in.	M.C.	Desk Type	27/6
5 mA.	D.C. 2 1/2 in.	M.C.	F. Sq.	7/6
10 mA.	D.C. 2 1/2 in.	M.C.	F. Sq.	8/6
10 mA.	D.C. 2 1/2 in.	M.C.	F. Sq.	8/6
50 mA.	D.C. 2 1/2 in.	M.C.	F. Sq.	8/6
150 mA.	D.C. 2 1/2 in.	M.C.	F. Sq.	7/6
200 mA.	D.C. 2 1/2 in.	M.C.	F. Sq.	10/-
1 amp.	R.F. 2 1/2 in.	Thermo	R.F.	10/-
3 amp.	R.F. 2 1/2 in.	Thermo	F. Sq.	6/-
5 amp.	D.C. 2 1/2 in.	M.C.	F. Sq.	13/6
6 amp.	R.F. 2 1/2 in.	M.C.	Thermo F.R.	7/6
20 amp.	D.C. 2 1/2 in.	—	R.P. (with shunt)	10/6
25 amp.	D.C. 2 1/2 in.	M.I.	F.R.	8/6
30 amp.	D.C. 2 1/2 in.	M.I.	F.R.	12/6
15 volt	A.C. 2 1/2 in.	M.C.	F.R.	10/-
20 volt	D.C. 2 1/2 in.	M.C.	F. Sq.	7/6
15-0-15 volt	D.C. 2 1/2 in.	M.C.	F.R.	17/6
150 volt	D.C. 2 1/2 in.	M.C.	F.R.	15/-

R.P. = Round projection. M.C. = Moving Coil. Thermo = Thermo-couple. F. Sq. = Flush Square. P.R. = Flush Round. M.I. = Moving Iron.

**METER RECTIFIERS.** 1 mA. by G.E.C., at 8/6, also 5 mA. by Westinghouse at 8/6.

**EX-W.D. CATHODE RAY TUBES.** Guaranteed full picture. VCR97 at 40/-, VCR97C at 35/-. Also VCR139A—ideal for oscilloscope 2 1/2 in. screen at 35/-. We also have VCR97 with slight cut-off, very suitable for oscilloscope, testing purposes, etc., at 15/- only. All these tubes are brand new, in original packing, and tested before despatch. Please add 2/6 packing and carriage for any of the above tubes.

**AMERICAN INDICATOR UNIT TYPE BC929A.** Brand new incorporating 3in. tube 3BP1, with mu-metal shield, 2-6N7GT, 2-8H6GT, 6X5G, 2X2, 6066, 9 potentiometers 24 v. aerial switch motor, transformer, and a host of small components. The whole unit which measures only 8 1/2 in. x 8 1/2 in. x 1 3/4 in. is brand new, enclosed in black crackle box, and can be supplied at 65/-, plus 5/- P. & P.

**BRAND NEW C.R. TUBES.**—By leading manufacturer. 14KP4A. Tinted. Latest type 1 1/4 in. rectangular 6.3 v. heater. 12-14 Kv. in. original sealed cartons. Limited quantity only at £13/19/6. Plus 16/- packing, carriage and insurance.

**HIRE PURCHASE**  
We are pleased to announce advantageous hire purchase facilities on any single item over £5. Ask for details, mentioning what you are interested in. We regret we cannot extend this facility to kits.

**CO-AXIAL CABLE.** Standard 80 ohms. brown, stranded centre, conductor, 8d. per yard only! Not Govt. Surplus. Min. 12 yds

**22 SET POWER UNITS NO. 4M11 ZA10478—** Complete with 4 metal rectifiers each 250 v. 80 mA. 2-12 v. 4 pin Mallory Vibrators, transformers, condensers, resistors, signal 1 amp. Indicator, etc., etc., in good condition. Complete in metal box size 10 1/2 in. x 6 in. x 8 in. Weight 19lb. 27/6, plus 5/- P. & P.

**L.T. RECTIFIERS TYPE R.K.** A newly manufactured range guaranteed 12 months.

- 6 or 12 v. 1 a. F.W. bridge type ..... 7/6
- 6 or 12 v. 1.5 a. F.W. bridge type .. 9/6
- 6 or 12 v. 2 a. F.W. bridge type ..... 11/3
- 6 or 12 v. 2.5 a. .... 12/6
- 6 or 12 v. 4 a. F.W. bridge type ..... 15/-

**CHARGER TRANSFORMERS.** Input 230 v.

- 6/12 v. 1 a. .... 9/9
- 2/6/12 v. 2 a. .... 14/6
- 2/6/12 v. 4 a. .... 17/6

**ROTHERMEL DA1 Crystal Microphone** Inserts. Brand new, 7/6 each, plus 9d. Post. We also have a limited number of Ronette type ZA crystal microphone inserts at 23/6.

**METER SPECIAL!** We have a limited quantity of aircraft electrical thermometers Brand new, by Weston. 2in. moving coil meter, flush square fitting. These meters use a luminated scale graduated 40-140 degrees centigrade, but the full scale deflection is approximately 150 microamp! Price 12/6 each only, plus 1/- P. & P.

**VIBRATOR PACK.** Brand new, by Mallory, 12 volt input, 150 v. 40 mA. output. Complete with synchronous vibrator, 27/6.

**DECCA LIGHTWEIGHT PICKUPS.** Complete with either standard or L.F. Crystal Cartridge Inserts. Complete with Rest and Tracking instructions, 32/6 plus 1/6 P. & P. Also their very latest type, as above, but with turn-over head 47/6 only! Plus 1/6 P. & P.

**6-VOLT VIBRATOR PACK.** Ex-W.D. 6-volt input, output 140 v. 30 mA. Fully smoothed and rectified, incorporating Wearite 6 volt 4 pin vibrator type N8B6. Unit size only 6 1/2 in. x 6 in. x 2 1/2 in. Price 15/- plus 1/6 P. & P. New condition.

**SPECIAL OFFER — TRANSMITTING VALVES.** These are brand new originally boxed, and guaranteed O.K. Type 813, 80/- ea. Type 866A, 17/- per pair, both post free. Also type 29C1 at 20/- 12E1 at 25/- ea.

**VALVES** We have a very comprehensive stock of surplus valves at competitive prices. A stamp will bring Valve Price List.

**SPECIAL OFFER—METERS.** Taken from equipment, but guaranteed perfect. 2in. round, 0-20 amp., 2in. round, 0-40 amp. 2in. round 0-50 volt, 3/8 ea., or 3 for 10/6 2 1/2 in. round panel-mounting 0-500 mA., 5/- All the above plus P. & P. please!

**R.F. UNITS.** All new condition and complete. Case size 9 1/2 in. x 7 1/2 in. x 6 in.

- Type 24—20-30 Mc/s. 15/-
- Switched Type 25—40 Mc/s. 9/6
- Switched Tuning. Type 27—45-86 Mc/s. 45/-
- Variable Tuning. Type 28—50-65 Mc/s. Variable Tuning 35/-

We have a limited supply of HF27 new condition and complete die cast mounting 0-500 mA., 5/- only 30/- each. ALL these units Post Free!

**LOUDSPEAKER SPECIAL 11** 12in. 3 ohm Plessey P.M. 37/6 plus 2/6 P. & P.

**L.F. TRANSFORMERS SPECIAL OFFER.** All iron-cored 465 Kc/s. Plessey—Iron-cored 2 1/2 in. x 1 1/2 in. x 1 in., 7/6 pr. Philips size 2 1/2 in. x 1 1/2 in. diameter (cylindrical), 7/6 pr. By Invicta—Cylindrical 2 1/2 in. x 1 1/2 in. diameter, 8/6 pr. Also our own special ultra midget size 1 1/2 in. x 1 1/2 in. x 1 1/2 in. Only 9/6 per pair. By Section, Type 501 and 602 12/6 pr. pair. M800 12/6 pr. pair.

**AMERICAN CONTROL UNIT C58/APTL** Box measure only 5in. x 8 1/2 in. x 2in. Incorporating 2in. round 0.1 mA. meter 200 ohm pot, 2 toggle switches, indicator lamp, etc. Price 22/6, post free.

**HEADPHONES.** Brand new, ex-Govt., by S. G. Brown. Type CLR. Low resistance, 7/6 per pair. Type CHR high resistance, 12/6 per pair.

**"VOLTALYTE"** type 20 60 amp. ACCUMULATORS MULTI-PLATE Type in Celluloid containers. Size 3in. x 2in. x 4 1/2 in. high at 9/6 each plus 2/- P. & P. Or 3 for 28/6, post free.

**No. 38 TRANSMITTER/RECEIVER WALKIE-TALKIE.** Range approx. 5 miles. Coverage 7-9 Mc/s. The set only, complete with valves at 30/-, in very good condition.

**24 VOLT ROTARY CONVERTER.** Input 24 v. D.C. Output 200/250 v. A.C. 100 watts. Complete in black steel box 18 1/2 in. x 11 1/2 in. x 8 1/2 in. Weight approx. 30lbs. Completely smoothed incorporates Sodium Lamp transformer. Brand new 92/6.

Please add postage under £1, C.O.D. or Cash with order. C.O.D. charge extra—open 9 a.m.-6 p.m. Monday to Friday. Sorry, but we close at 1.0 p.m. on Saturday.

**THE R.C. 3/4 WATT AMPLIFIER KIT**  
Just released! Compare the advantages! Treble, bass, AND mid die tone controls! For crystal or magnetic pickup! A.C. Mains. 200/250 v.

Valve line-up, 6V6GT, 6S07, 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 24/5/- 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 25/5/-, plus p. & p. Hearing is believing!

**THE R.E.P. ONE-VALVE BATTERY RECEIVER KIT.** Simple one-valve all dry battery receiver for headphones, easily built in one evening. All required components including headphones, can be supplied at inclusive cost of 42/- plus 1/- p. & p. Operated by Ever Ready B114 type battery available at 7/9. Full assembly details available separately at 9/6, plus 5d. post.

**THE NEW R.C. HIGH-FIDELITY AMPLIFIER.** P.P. 6V6 output. Freq. 25-18,000 cps-60 db at 6 1/2 watts. Treble boost and cut-Bass boost-L.F. correction. Provision for Feeder Unit Max. UNDISTORTED OUTPUT 91 watts. Price 14 gns. plus 7/6. NOW AVAILABLE -Kit of Parts, complete with fully illustrated instructions, 21/19/6, plus 5/- carriage. Illustrated booklet available separately at 1/6. Attractive metal cover, now available, with built in carrying handle 18/6.

We have in stock at our usual competitive prices, ALL the required components for Orson and Mullard amplifiers. Available ex. stock. The LEAK TL10 Amplifier complete, 27 guineas, or H.P. terms available.

We also have in stock-Connorsur 3 speed motors, pick ups. High ups and heads by Garrard, Decca, Caparo, Aco, Chancery, etc., etc., at current prices.

**ARMSTRONG P.C.48.** Their very latest high quality replacement chassis having provision for F.M. feeder unit, 8 valves, four wavebands. Independent bass and treble with unique thermometer visual indicator. Ready for use 223/18/- plus 5/- p. & p. or 25/18/- deposit and 12 monthly payments at 33/8.

**OUR NEW "POPULAR" AMPLIFIER. A.C.** Mains 2/3 ohms, 4 watts output. Suitable for either crystal or magnetic pickup. Valve line-up, 6V6GT, 6S17GT, 5Y3GT. Provision for radio feeder unit. Volume and tone controls. Built in enameled

finished steel box, with chrome carrying handle. Attractive bakelite engraved front panel. Box measures 9 1/2in. x 7 1/2in. x 6 1/2in. Price only 26/12/6 carriage paid. Ready for use.

Carrying cases in black leatherette finish An extremely well-made case with chrome locks and corner-pieces for extra strength. This cabinet will house any 12in. Hi-Fi speaker, but can be put to a number of uses. Front panel and lid are removable. Size: 16 1/2in. x 19 1/2in. x 16 1/2in. high, 47/6, plus 5/- post and packing. N.B. To the many previous purchasers of this cabinet at 55/- we are now no longer able to supply the baffie with cabinet. Thus the reduction!

**F.M.!! (Frequency Modulation)**

We are pleased to announce our complete Kit for the "Denco" F.M. Feeder Unit. This unit provides an A.F. output suitable for feeding into the audio section of a standard broadcast receiver where triode/pentode output are available. Within an average of 30 miles from a V.H.F. transmitter one I.F. stage should be adequate, but our complete Kit supplied includes all components and valves for an extra I.F. stage if necessary, or if the unit is used at greater distances. Full Constructional details, theoretical circuit and point-to-point wiring diagram can be supplied for 1/6 post free, or the complete Kit right down to the last nut and bolt, at only 26/7/6, plus 2/6 packing and postage. This unit can be supplied if desired, ready assembled, aligned and tested, at 28/10/- plus 2/6 packing and postage. If required we shall be pleased to align this unit for constructors not possessing the necessary equipment, for a charge of 7/6. N.B.—Valve line-up is 6AM6, 12AB6, 2-6BA6 and 6AL5. Chassis measures only 8 1/2 x 5 1/2 x 1 1/2 in. Demonstrations at 18, Tottenham Court Road!

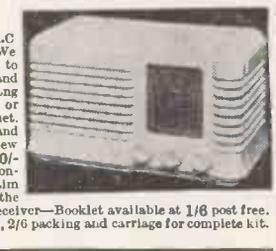


**THE "SUPERIOR" FOUR KIT.** Our new four-valve receiver. A.C. mains. 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2 6S07, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size, 10 1/2in. x 10in. wide. Maximum depth at base 5 1/2in. tapering to 3 1/2in. 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, 26/9/6 1/11. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket waverange switch, dial, pointer, drum pulleys, drive spindle, drive spring and knobs, at 45/-, plus 2/6 packing and carriage. N.B.—Our kits are even supplied with sufficient solder for the job.

**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 6J7, and 6V6. Chassis ready drilled—cabinet size 12in. long by 6in. high by 5in. 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 25/10/- 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. Please, 2/6 packing and carriage for complete kit.

N.B. All our T.R.F. Kit circuits now include specially wound Denco "Maxi-Q" coils on polystyrene formers, improved performance! Price remains the same.

**THE R.C. GRAM REPLACEMENT CHASSIS KIT**  
To meet the very great demand for this type of receiver, we have produced this unit. For line-up: 6K8 Frequency changer, 6K7, I.F. Amplifier, 6Q7 1st Audio, Detector and A.V.C. 6V6 Output, 6X5 Full-wave rectifier. For A.C. mains 200/250 volts, 4 watts output. Excellent quality. High sensitivity. Provision for gram. Attractive illuminated black, red, green and gold dial for horizontal tuning. Four controls are: Tuning, L/M/S (Gram), Volume/Off, Tone (variable), Chassis size: 13 1/2in. x 6 1/2in. x 2 1/2in. Dial size: 10in. x 4 1/2in. Assembly is simplified by the use of a 3-waveband coil pack, and pre-aligned 465 Kcs. I.F. transformers—high-grade drop-through half-shrouded Mains Transformer, with voltage adjuster panel. This chassis can easily be assembled in one evening. Illustrated pamphlet with full assembly instructions, practical and theoretical wiring diagrams and itemised price list, 1/6, post free. The main items for this receiver can be supplied separately, as under: Drilled chassis, complete with valve-holders, A/E panel, P/U panel, tuning condenser and ready-assembled dial and drive at 39/6. 3 waveband coil pack with gram position, 39/6, tax paid. Pair of 465 Kcs. I.F. Transformers, 9/6 pair. Half shrouded drop through Mains Transformer, 22/6. The total cost of ALL items purchased separately is nearly £10, but we shall be pleased to supply all the required components right down to the last nut and bolt, at a special inclusive price of 23/8/-, plus 2/6 packing and postage. A set of four small brown and cream engraved knobs to suit is available at 1/2 each knob. This chassis is a professional job in every respect and can be seen and heard at our premises. This chassis can also be supplied, ready assembled, in limited quantities at 29/19/6, plus 5/- carriage and packing.



**AM/FM.** We are now demonstrating the Chapman all wave FM/AM Turner at 232/10/-, tax paid. For those unable to call, illustrated literature is available, H.P. terms 232/10/- deposit, 12 monthly payments of 44/-. Also FM Tuner model FMS1 by Chapman at £21. Model FM58 by Armstrong, also £21. H.P. Terms available.

**Dulci Radio/Radiogram Chassis.** All latest models including F.3 and F.3 push-pull are in stock. Cash or H.P. Ask for illustrated leaflet.

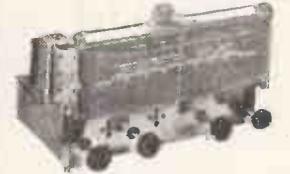
**COLLARO 2010.** Transcription motor with Studio Pick-up. This very popular unit can now be supplied from stock. £18/5/3. cash or 95/3 deposit, and 12 payments of 25/8. London's largest selection of Amplifiers, Recording equipment, etc., etc.

**THE "SUPERIOR" FOUR KIT.** Our new four-valve receiver. A.C. mains. 200/250 v. M. and Long waves. As with our very successful "Economy Four" all required components are supplied. Valve line-up: 2 6S07, 6X5GT and 6V6GT. Chassis ready drilled. Cabinet size, 10 1/2in. x 10in. wide. Maximum depth at base 5 1/2in. tapering to 3 1/2in. 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, 26/9/6 1/11. Please add 2/6 packing and carriage. If preferred, we can supply Cabinet Assembly only, comprising Cabinet and bracket waverange switch, dial, pointer, drum pulleys, drive spindle, drive spring and knobs, at 45/-, plus 2/6 packing and carriage. 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 can be supplied at 1/6 post free. This is a truly professional 4-valve superhet—all dry—for medium and long waves. A cream plastic top panel, with dial engraved in red and green, adds to the very imposing appearance of this model which is housed in an attractive cream and grey leatherette covered attaché case type cabinet; measuring only 9in. x 7 1/2in. x 5 1/2in. Weight less batteries, 4 1/2lb. with batteries 6 1/2lb. This set really has everything! Built-in frame aerial, high quality, extremely sensitive, and very adequate volume from the 6in. speaker. Valve line-up: 3V4, 1B5, 1S5, 1T4. Also the required components, exactly as specified, including cabinet, can be supplied from stock at the special inclusive price of 27/7/- plus 2/6 p. & p. (less batteries). Uses Ever-Ready 90 v. H.T. type B120 at 9/3. Also L.T. 1.5 v. A.D.35 at 1/4.



**RAMBLER MAINS UNIT!** At last we are able to offer our special mains units kit for using our popular all-dry "Rambler" on A.C. Mains. Complete kit, which when assembled fits snugly into battery compartment, can be supplied at 47/6, plus 1/6 packing and postage. Price includes all required components, and full assembly instructions. N.B.—This unit is completely self contained in a metal box measuring 7in. x 2 1/2in. x 1 1/2in. and is ideally suitable for ANY all-dry battery portable requiring 90 v. H.T. and 1.5 v. L.T.



**SUPER-QUALITY 6-VALVE RADIOGRAM CHASSIS**  
Very limited quantity of Britain's leading quality manufacturers, 3 waveband, superhet, valve line-up, 6V6G, E240, ECH22, L63, EP41 and EB04L. Combined pick-up amplifier and A.F. amplifier on Radio and Gram. Employs a special circuit for gram-phones pre-amplification. Large glass dial horizontal tuning measuring 1 1/2in. x 3 1/2in. Chassis measurement: 14 1/2 x 9 x 8 1/2in. This is a superior chassis designed to sell originally in a Radiogram costing 278. Our price is 212/19/6 only, tax paid, plus 5/- packing and carriage. We will gladly demonstrate this chassis or any other working item from our stocks, to personal callers!

**REGAL.** A well-made cabinet in medium quality coloured walnut veneer. Size 29 1/2 x 14 1/2 x 29 1/2in. Un-cut motor-board measures 25 1/2 x 13 1/2in. Record or tape storage aperture alongside motor board measures 3 1/2in. wide x 12 1/2in. deep. Price 29/19/6 plus 10/- P. & P. H.P. terms available.

**18, Tottenham Court Road, London, W.1.**

**F.L.P. RADIO LTD.**

# LASKY'S RADIO



## CLEARANCE OF EX-GOVT. ACCUMULATORS

2 volt, 10 a.h. Size: 1 1/2 in. square x 5 1/2 in. high. Made by Canadian Exide.

LASKY'S PRICE 4/6 post 1/-.  
3 for 13/- post free.  
12 for 40/- post free.

**ALL DRY BATT. MAINS UNITS**  
Replaces B103. Size: 8 x 5 1/2 x 2 1/2 in. 1 1/2 v. L.T., 90 v. H.T. 200-250 v. A.C. input.  
LASKY'S PRICE 39/6. Post 3/6.

**PLESSEY LINE E.H.T. TRANSFORMERS**  
Type CP.72036/2. 7 kv. incorporating double wound width control. List 63/-.  
LASKY'S PRICE 25/- Post 1/6.

**3-WATT MIDGET AC/DC AMPLIFIERS. P.P. VERY HIGH GAIN**

4 valves: 2 UL41 in push pull, 1 UCH42 and 1 UAF42. Input voltage 100/110 AC/DC. Very easily converted to 230 volts. Supplied with circuit diagram and full details. Size:—9 x 4 x 4 in. Uses 2 metal rectifiers, 1 each RM2 and RM3. Ideal for ships record players, tape recorders, home record players, baby alarms, etc., etc. Supplied complete fully assembled and wired, with 4 valves.  
LASKY'S PRICE 65/- Carriage free.



**LATEST 1955 MODEL 3-SPEED RECORD AUTO-CHANGERS. BRAND NEW AND UNUSED, IN MAKER'S CARTONS**

Take 10 records all sizes (mixed) in one loading. HGF.37 Crystal turnover pick-up, cream finish. LASKY'S PRICE £9/19/6. Post 3/6 extra.

**LATEST COLLARO RC.54 3-speed High Fidelity Mixer Changer, Studio crystal turnover p.u., in leatherette covered carrying case, £13/5/- Post 5/- extra.**

### COLLARO 3-SPEED RECORD PLAYERS

Complete with P.U. and ortho-dynamic switched head. P.U. transformer also included. Limited quantity only, £6/19/6. As above, with "Studio" turnover Crystal Pick Up (O or P), £8/18/4. Post, either type, 3/6.

## INEXPENSIVE RADIO YOU CAN EASILY BUILD

ALL COMPONENTS AND CABINETS AVAILABLE SEPARATELY



**PARCEL No. 1.** Contains everything to build a 4-valve, 3-wave Superhet for 200/250 A.C. mains. Uses 6K8, 6K7, 6Q7, 6V6 valves. Attractive Wood Cabinet, walnut veneer, or Plastic Cabinet as illus. Size 12 x 6 1/2 x 5 1/2 in. deep. CAN BE BUILT FOR £7/19/6. Carr. & Pkg. 2/6. INSTRUCTION BOOK and shopping list, 1/-, post free.

**PARCEL No. 2.** Contains everything to build a T.R.F. 3-valve Set for 200/250 A.C. mains, med. and long wave. Uses 6K7G, 6J7, 6V6, and metal rectifiers. Neat Plastic Cabinet, walnut or ivory finish, or Wood Cabinet. Size 12 x 6 1/2 x 5 1/2 in. deep. CAN BE BUILT FOR £5/10/- Carr. & Pkg. 2/6. INSTRUCTION BOOK and shopping list, 1/-, post free. CABINET ONLY, Plastic or Wood, 17/6. Carr. 2/6.

SAVE POUNDS! ORDER BY POST IF YOU CANNOT CALL

## OUTSTANDING NEW OFFER!

### 6-VALVE RADIOGRAM CHASSIS

Famous Manufacturer's Surplus Brand New and Complete with Valves

6 valve 3-wave Superhet, 13-50 m. short, 200-550 m. medium, 1,000-2,000 m. long. Brand new Mullard valves: ECH42, EF41, L63, EB41, 6V6 g.t., EZ40, and finest quality components. Gram. switch, 645 Kc/s I.F., tone control, 3-colour dial. Overall size: 13 1/2 x 5, height 12 1/2. Aperture required for dial and controls, 11 x 3 1/2 in. Complete with valves, output trans., knobs, etc.



LASKY'S PRICE £10/19/6 Carr. & Pkg. 7/6 extra.

### DRILLED CHASSIS & DIAL ASSEMBLY

Size 13 1/2 x 7 x 2 1/2 in., drilled for five latest type miniature valves, mains trans., I.F., etc. Dial 13 x 14 in., for horizontal or vertical mounting. Spin wheel tuning. All pulleys and spindle supplied. LASKY'S PRICE 19/6. Post 3/-.

### FREQUENCY MODULATION

**DENCO F.M. FEEDER UNIT.** All components and valves in stock. Uses 6AM6, 12AH8, EB91, and two 6AB6. COMPLETE PARCEL, £6/7/6. Post extra. All components available separately.

### LATEST DESIGN CONTINENTAL F.M. COMPONENTS.

**UT.340.** A self-contained V.H.F. front end Unit incorporating a grounded grid amplifier, mixer oscillator (ECC85) and first I.F. amplifier. Completely wired and tested, 59/9.

**UT.341.** As above but with baseplate and 2-gang condenser incorporating 1.3 reduction drive. Supplied pre-aligned 95/5.

**TA.350.** 6-button Coil Pack for long, med. and short waves, gram and off, together with a F.M. position which incorporates switching for change over from A.M. to F.M. Designed for use with UT.340 or UT.341. 85/-.

Ratio Discriminator Coils, URF, 10/- each.

10.7 mc/s. I.F. Trans., UF376, 7/- each.

**SET OF 3 COMBINED I.F. TRANS.,** for A.M. and F.M. 456/470 Kc/s. A.M.; 10.7 Mc/s. F.M. Variable selectivity on A.M., radio disc, on F.M. The set of 3 (KF360, KRF362, KSF361), 42/-.

As above but for 2 stages of I.F. amplification. No variable selectivity on A.M. Types KF363 and KRF364, the pair, 26/3.

**SPECIAL OFFER!**  
**MULTI-TEST METERS**

1,000 ohms per volt. Basic movement 400 microamp., 3in. A.C./D.C. 0-5000 v., 0-1 amp., 11 switched ranges; 2 resistance ranges 100,000 ohms and 1 meg., also decibel range. In polished wood carrying case (6 x 6 1/2 x 4 in. closed), with leather handle and space for test leads. Made in U.S.A. New and unused but cases slightly soiled.

LASKY'S PRICE 95/-  
Post and insurance 3/6.  
TEST LEADS, 3/6 extra.

### PERSONAL PORTABLE CONSTRUCTORS' PARCELS

**PP.1.** Containing 4 valves, R5, T4, S5, 3S4, min. 2-gang, .0005 u.f., 2 I.F. trans., 4 B7G valve-holders, 3in. P.M. speaker and min. output trans., med. wave osc. coil and Ferrite rod aerial. Price, complete, 70/- Post 1/- extra. Extra for dual wave, 7/-.

**PP.2.** As above but valves DK96, DF96, DAF96 and DL96. Complete, 80/- Post 1/- extra. Extra for dual wave, 7/-.

### MINIATURE COMPONENTS AVAILABLE SEPARATELY.

**CONDENSERS,** .1, .001, .0001, etc. Each, 7 1/2 d., 25 u.f., 25 volts, 1/6, 8 u.f., 150 volts, 1/-.

**GANGED CONDENSERS,** .0005 mfd. 2-gang with trimmers, 7/6. Less trimmers, 6/6.

3-gang, less trimmers, 10/6.

3in. P.M. SPEAKERS, 12/6.

OUTPUT TRANSFORMERS, 3/6.

### TELETRON FERRITE ROD AERIALS.

Med. wave, 5in. long, 8/9. Dual wave, 8in. long, 12/6.

**OSC. COILS,** iron dust cores. Med. wave, HO2, 3/- Long wave, HO1, 3/-.

**MIN. BATTERIES,** all types in stock.

MORE MONEY-SAVING LASKY BARGAINS ON NEXT PAGE

RADIO · TELEVISION · HI-FI · ELECTRONICS · RECORDERS

**HIRE PURCHASE**

terms on certain items. Please give details of your requirements.

**BUILD THE "TELE-KING"**

5 CHANNEL, 16in. or 17in. SUPERHET TV Full constructional data, wiring diagrams, circuit and detailed price list. Post free. **6/-** Every component supplied separately.

**SPECIAL PURCHASE 16" C.R. TUBES**

Famous make offered at nearly Half-Price. Metal cone, .3 amp. heater, e.h.t. required 10-14 kV.

**LASKY'S PRICE £12/19/6**  
Carr. & Ins. 22/6 ex.  
**16in. FILTER MASK ESCUTCHEON**  
to suit above C.R.T., 15/- Post extra.

**LASKY'S RADIO**

**VALUE IN MAGNIFICENT TV CABINETS**

**THE DE LUXE**

Complete with mask, glass, castors, shelf, bearers, C.R.T. neck end protector, back, speaker fret and baffle board. Finished in beautiful figured medium, light or dark walnut veneer, with high polish. Suitable for most home constructor TV Receivers, including the "Viewmaster," "Practical Television," "Tele-King," "Magnaview," "Wireless World" etc. Can be supplied with cut-out for 14in., 16in. and 17in. C.R. tubes at no extra cost.



An allowance of 4/6 will be made if the mask is not required.  
Inside Dimensions: Depth 16½in.; width 17½in.; height 28in. Overall height 32in. and width 18½in.

**WHY NOT CONVERT YOUR TABLE RECEIVER TO A CONSOLE MODEL?**  
Adaptor frames for fitting 9in. or 10in. C.R. tubes available if required.

**LASKY'S PRICE £8/10/0**  
Carriage 12/6 extra.

H.P. Terms. Dep. £2/17/- plus carriage. Balance plus charges spread over 12 mths.

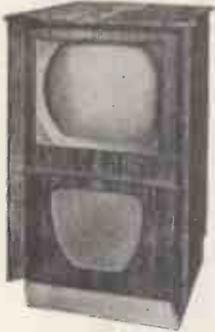
**THE ROTHESAY**

The last word in outstanding contemporary design. Absolutely rigid construction throughout with the finest laminated woods, veneered in walnut, polished light, medium or dark shade. Fitted with gold anodised speaker grille. The C.R.T. aperture frame is detachable, supplied to suit any size tube to order. Full length doors if required can be supplied with the cabinet. Veneered both sides, polished to match the cabinet, and mounted with full length piano hinges.

**NOTE THESE GENEROUS SIZES.**  
Outside dim. 34½in. high, 21½in. wide, 21½in. deep. Inside dim. 18½in. wide, 19½in. deep. Size of top 22½ x 21½in. Thickness ½in.

**LASKY'S PRICE £9/19/6**  
Carriage 15/- extra.

H.P. Terms. Deposit £3/10/- plus carriage charge. Balance plus charges spread over 12 months.



The Rothersey cabinet with doors. Price £14/9/6.

**SPECIAL PURCHASE OF TABLE RADIOGRAM CABINETS**

Solidly made of ½in. laminated wood, finished beautiful Walnut veneer. Panel (3in. x 16in.) for dial and controls, baffle for 8in. speaker, gold finish metal grille, fully hinged lid. Overall size: 18in. deep, 18in. wide, 13in. high. Slightly soiled. **LASKY'S PRICE £3/19/6**  
Carriage 7/6.

Cabinet complete with Collaro 3-speed Autochange and dual-purpose crystal pick-up. Brand new. £14/19/6. Carriage 12/6.



**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. 18/-.  
MBA/6. 325-0-325 v. 100 mA. 6.3 v. 3 a., 5 v. 2 a. With mains tapping board. 22/6.  
MBA/7. 250-0-250 v. 80 mA. 6.3 v. 3 a., 5 v. 2 a. Both filaments tapped at 4 volts. 18/-.  
MBA/8. Drop through type. 235-0-235 v. 60 mA. 6.3 v. 3 a. 12/6.  
MBA/9. 400-0-400 v. 60 mA. 6.3 v. 1 a., 4 v. 2.5 a. 12/6.  
AT/3. Auto trans. 0-10-120. 200-230-240 v. 100 watts. 17/6.

**ALUMINIUM CHASSIS. 18 S.W.G.,** undrilled, 4 sides, reinforced corners Depth 2½in.

6 x 4 4/-	12 x 8 7/-	16 x 10 8/3
8 x 6 5/-	14 x 9 7/6	12 x 3 4/9
10 x 7 6/-	16 x 9 8/-	12 x 6 6/6

Post 1/- per chassis extra.

**THE "UNIVERTER"**

A new book just published, giving full details of a new Band III Converter for any TV receiver, home constructed or factory made. All components and valves in stock, prices on request. Also available as a complete unit. Uses two 6AM6, one 12AT7, one 6X4. Contains its own power supplies. **THE BOOK**, containing full circuit diagram, wiring instructions and component lists. 3/6 post free.

**MICROPHONE BARGAINS**

ACOS crystal, MIC.33/1. List 50/- Lasky's price 32/6.

MIC.22/2, complete with table stand. List 4 gns. Lasky's price 42/-.

Moving Coil Hand Type with switch. List £5/5- Lasky's price 45/-.

All above, post 2/6.

**MANUFACTURERS' SURPLUS WIDE ANGLE 38 mm.**

Line E.H.T. trans., ferroxcube core. 9-16 kV. . . . .	25/-
Scanning Coils, low imp. line and frame. . . . .	25/-
Frame Output Transformer	10/6
Scanning Coils low, imp. line and frame. . . . .	17/6
Frame blocking, osc. transformer. . . . .	4/6
Line blocking osc. transformer, caslam cored. . . . .	4/6
Focus Magnets Ferroxcube	25/-
P.M. Focus Magnets. Iron Cored. . . . .	19/6
Duomag Focalisers. . . . .	29/6
300 mA. Smoothing chokes	15/-
Electromagnetic focus coil, with combined scan coils	25/-

**TV COMPONENT BARGAINS STANDARD 35 mm.**

Line Output Transformers No. E.H.T. 12/6. Line Output Transformers 6-9 kV. E.H.T. and 6.3 v. winding. Ferroxcube. . . . .	19/6
Scanning coils. Low imp. line and frame. . . . .	12/6
Scanning Coils. Low imp. line and frame, by Igranite	14/6
Line blocking oscillator transformer. . . . .	4/6
Frame blocking oscillator transformer. . . . .	4/6
Frame output transformer	7/6
Focus Magnets:	
Without Vernier. . . . .	12/6
With Vernier. . . . .	17/6
Focus Coils, Electromagnetic	12/6
200 mA. Smoothing chokes	10/6

**★ THE MULLARD 5/10 AMPLIFIER KIT**

All components, chassis and valves in stock. Available separately. **THE BOOK**, 2/6, post free.

**★ THE OSRAM 912 AMPLIFIER KIT**

All components in stock. Chassis, Partridge trans., chokes, W/B., etc. Available separately. **THE BOOK**, 3/6, post free.

**PRINTED CIRCUITS (by T.C.C.) for the MULLARD 5/10 and OSRAM 912 Amplifiers** now available. Demonstration models of these famous amplifiers built on printed circuits can be seen and heard at our Tottenham Court Road premises.

**LOUDSPEAKERS**

12in. Plessey, 3 ohms. . . . .	32/6
10in. heavy duty, aluminium speech coil, 3 ohms. . . . .	26/6
P.M. Speakers: 6½in., 17/6; 8in., 19/6; 10in. . . . .	19/-
Goodmans "Audium 60," 15-watt, few only. Listed £8/12/6.	
<b>LASKY'S PRICE £6/19/6.</b>	

**OUTPUT TRANSFORMERS**

Midget Pentode. . . . .	3/6
Miniature Personal, 35A, etc. 3/6	
Standard Pentode. . . . .	3/11
Push-pull, 6V6. . . . .	9/6
Multi Ratio, P.P. . . . .	12/6
Heavy Duty P.P. . . . .	14/11

**R1155 RECEIVERS**

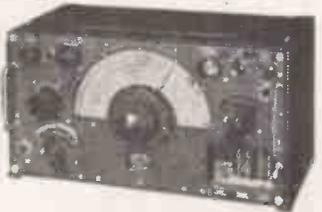
Now available on H.P. terms

5 Frequency ranges: 18.5-7.0 Mc/s; 7.5-3.0 Mc/s; 1,500-600 kc/s; 500-200 kc/s; 200-75 kc/s. Supplied in maker's original wood transit case.

**LASKY'S PRICE,**

Brand new. . . . .	£11 19 6
Secondhand, Grade 1. . . . .	£9 19 6
Secondhand, Grade 2. . . . .	£7 19 6

Carriage 17/6 extra, including 10/- returnable on packing case. Ask for details of the easy terms on which you can buy this famous receiver.



**ASSEMBLED POWER PACK/OUTPUT STAGE FOR R.1155 RECEIVER.** For use on 200-250 v. A.C. Complete with 2 valves. In metal case, size 12 x 7 x 5½in., 79/6. Carriage 5/- extra.  
**POWER PACK** as above, fitted with 6½in. P.M. Speaker, £5/5/- Carriage 5/- extra.

**LASKY'S (HARROW RD.) LTD..**

42, TOTTENHAM COURT ROAD, W.1.  
Between T.C.R. and Goode St. Stns. MUS 2605  
370, HARROW ROAD, PADDINGTON, W.9.  
Opposite Paddington Hospital, CUN 1979 & 7214

Open all day SAT. Half day Thurs.

**COMMUNICATIONS RECEIVER R.1155.** The famous ex-Bomber Command Receiver known the world over to be supreme in its class. Covers 5 wave ranges: 18.5-7.5 Mc/s., 7.5-3.0 Mc/s., 1,500-600 kc/s., 500-200 kc/s., 200-75 kc/s., and is easily and simply adapted for normal mains use, full details being supplied. Aerial tested before despatch, **BRAND NEW AND UNUSED IN MAKER'S TRANSIT CASES, ONLY £11/19/6.**

**BRAND NEW BUT SHOP-SOILED,** also tested working before despatch, **£9/19/6** (carriage 10/6).

**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 6in. P.M. Speaker, **£5/5/-**, **LESS** speaker, **£4/10/-** (carriage 3/6).

**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.

**RF UNITS TYPE 26 and 27.** For use with the R.1355 or any receiver with a 6.3 v. supply. These are the variable tuning units which use 2 valves EF54 and 1 of EC52. Type 26 covers 65-50 Mc/s (5-6 metres) and Type 27 covers 85-65 Mc/s. (3.5-5.0 metres). Complete with valves, and **BRAND NEW IN MAKER'S CARTONS. ONLY 29/6** each.

**"PYE" 45 MC/S I.F. STRIP.** Ready made for London Vision Channel, this 5-stage strip contains 6 valves EF50 and 1 EA50. Supplied with circuit and details of very slight mods. required. **BRAND NEW, ONLY 69/6** or less valves, 50/-.

**TRANSFORMERS.** Manufactured to our specification and fully guaranteed. Upright mounting, fully shrouded, normal primaries.

425 v.-0-425 v. 250 mA., 6.3 v. 4 a., 6.3 v. 4 a., 5 v. 3 a., 65/-.

350 v.-0-350 v. 160 mA., 6.3 v. 6 a., 6.3 v. 3 a., 5 v. 3 a., 47/6.

350 v.-0-350 v. 150 mA., 6.3 v. 5 a., 0-4-5 v. 3 a., 37/6.

250 v.-0-250 v. 100 mA., 6.3 v. 6 a., 5 v. 3 a., 37/6.

250 v.-0-250 v. 60 mA., 6.3 v. 3 a., 5 v. 2 a., 21/-.

Please add 2/- per transformer postage.

**TRANSFORMERS, EHT.** Upright mounting.

EHT for VCR97 Tube 2,500 v. 5 mA. 2 v.-0-2 v. 1.1 a., 2 v.-0-2 v. 2 a., 42/6.

EHT 5,500 v. 5 mA., 2 v. 1 a., 79/6.

EHT 7,000 v. 5 mA., 2 v. 1 a., 89/6.

EHT 7,000 v. 5 mA., 4 v. 1 a., 89/6.

Please add 2/- per transformer postage.

**L.T. HEAVY DUTY TRANSFORMER.** Has 3 separate windings of 5 v.-0-5 v. at 5 amps., and by using combinations will give various voltages at high current. **ONLY 39/6.** Please add 2/6 per transformer postage.

**MODEL MAKERS MOTOR.** Reversible poles. Only 2in. long and 1/4in. diameter, with 1/4in. long spindle. Will operate on 4, 6, 12 or 24 volts D.C. **ONLY 10/6.**

**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.**

**SUNDRIES.** Warning light assemblies, Red, Green, or Clear, 2/- ea. Miniature plugs and sockets, 3 way 7d. pair, 4-way 9d. pair, 5-way 10d. pair. Jack plugs, 2/- each. 1/4in. coil formers with slug 10d., 1/4in. 8d. Valveholders I.O. & M.O. Amphenol, 6d. ea., B3G (diode) 6d., B9G ceramic 10d., Brit. 5-pin Ceramic 1/-.

Co-axial plugs and sockets, Pye 6d. ea., Belling, plug 1/3, socket 1/4, coupler for joining cable 2/- (post 3d. per item).

**POTENTIOMETERS,** less switch, long spindle, 1K, 3K, 5K, 10K, 20K, 25K, 100K, 250K, 500K, 2M, 2/9 ea., short spindle 50K, 75K, 1M, 2/- ea. WIPH switch long spindle, 1K, 2K, 2.5K, 10K, 15K, 20K, 25K, 50K, 75K, 250K, 500K, 2M, 3/9 ea. (post 3d.).

**SPRAGUE** 1 mfd. 600 v. metal tubulars, 10d. ea., 9/6 dozen (add post).

**SILVER MICAS AND MICAS.** 2pf, 5pf, 10pf, 11.5pf, 15pf, 20pf, 25pf, 40pf, 47pf, 50pf, 75pf, 80pf, 100pf, 115pf, 160pf, 300pf, 430pf, 440pf, 1,050pf, 2,300pf, .001mfd., .0016 mfd., .0002 mfd., .00025 mfd., .001 mfd., .002 mfd., .005 mfd., 5d each, or 3/6 per dozen 1 type.

**24 v. BLOWER MOTORS.** Only 12/6.

**CRYSTALS.** British Standard 2-pin 500 kc/s. 15/-.

Miniature 200 kc/s. and 465 kc/s. 10/- each.

**SPEAKERS.** P.M., 6in. less trans., 19/6; 8in. less trans., 16/6; 10in. with trans., 27/6 (postage 2/- ea.).

**CHOKES.** 10H 60 mA., 4/-, 5H 200 mA., 7/6, 10H 120 mA., 10/6 (post 1/- ea.).

F.S.D.	METERS	SIZE AND TYPE	PRICE
5 milliamp.	D.C.	2in. Flush square .....	7/6
100 "	D.C.	2 1/2in. Flush circular .....	12/6
150 "	D.C.	2in. Flush square .....	7/6
500 "	thermo	2in. Flush square .....	5/-
500 "	thermo	2in. Proj. circular .....	5/-
20 amps.	D.C.	2in. Proj. circular .....	7/6
40 amps.	D.C.	2in. Proj. circular .....	7/6
30-0-30 amp.	D.C.	Car type moving iron .....	5/-
15 volts	A.C.	2 1/2in. Flush, circ., mov. iron .....	8/6

All meters Brand New in Maker's Cartons.

Cash with order please, and print name and address clearly.

## 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 min. from High Holborn (Chancery Lane Station) and 5 min. by bus from King's Cross).

## COMPLETELY BUILT SIGNAL GENERATOR

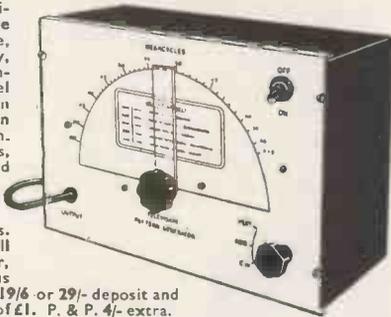


Coverage 120 Kc/s-320 Kc/s., 300 Kc/s.-900 Kc/s., 900 Kc/s.-2.75 Mc/s., 2.75 Mc/s.-8.5 Mc/s., 8 Mc/s.-28 Mc/s., 16 Mc/s.-56 Mc/s., 24 Mc/s.-84 Mc/s. Metal case 10 x 6 1/2 x 4 1/2 in. Size of scale 6 1/2 x 3 1/2 in. 2 valves and rectifier. A.C. mains 230-250 v. Internal modulation of 400 c.p.s. to a depth of 30 per cent., modulated or unmodulated, R.F. output con-

tinuously variable 100 millivolts. C.W. and mod. switch, variable A.F. output and moving coil output meter. Black crackle finished case and white panel. Accuracy plus or minus 2%. £4/19/6 or 34/- deposit and 3 monthly payments 25/-. P. & P. 4/- extra.

## PATTERN GENERATOR

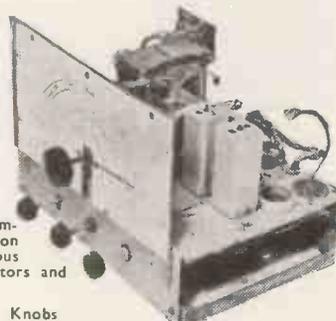
40-70 Mc/s. direct calibration, checks frame and line time base, frequency and linearity, vision channel alignment, sound channel and sound rejection circuits and vision channel band width. Silver plated coils, black crackle finished case 10 x 6 1/2 x 4 1/2 in. and white front panel. A.C. mains 200/250 volts. This instrument will align any T.V. receiver, accuracy plus or minus 1%. Cash price £3/19/6 or 29/- deposit and 3 monthly payments of £1. P. & P. 4/- extra.



**EXPORT & TRADE ENQUIRIES INVITED**  
(N.B. Post and packing charges stated apply to British Isles only.)  
★ Both generators guaranteed for 12 months ★

## USED A.C. MAINS 5 VALVE, 3 WAVE-BAND SUPERHET CHASSIS

Size 1 1/2 x 8 1/2 x 3 in., complete with 3 wave-band stage, size 10 1/2 x 5 1/2 in., pair of 465 Kc/s I.F.s, tuning condenser, mains transformer, volume control with switch, tone control. 3 wave-band coil pack (this is a completely detachable coil pack on separate small chassis) various small condensers and resistors and biasing condensers.



**19/6** Post & Packing 3/6 Knobs 1/6 extra.

As above, two wave-band. **15/-** Post & Packing 3/6 Knobs 1/6 extra.

## USED TELEVISION TUBES WITH HEATER GATHODE SHORT

**GUARANTEED FOR THREE MONTHS**

6 volt heater, duodecal base: all with bent gun construction. 12in. £3/17/6. Post & Packing 7/6 extra. 9in. £1/17/6. Post & Packing 7/6 extra. Maximum E.H.T. 10 Kv.

Any of the above complete with line and E.H.T. Trans., Ferrocart core, line and width control scan coils and frame. Output Transformer, 35/- extra.

## SPECIAL NOTE: NO GOODS SENT WHERE CUSTOMS DECLARATION IS APPLICABLE

Terms of Business: Cash with order. Despatch of goods within 3 days from receipt of order. Where post and packing charge is not stated please add 1/6 up to 10/-, 2/- up to £1, and 2/6 up to £2. All enquiries S.A.E., lists 5d. each.

**MAINS TRANSFORMERS**

Primary, 200-250 v. P. & P. 2/.

300-0-300, 100 mA., 6 v. 3 amp. 5 v. 2 amp., 22/6.

Semi-Shrouded, drop-through 380-0-380 v., 120 mA., 6.3 v. 4 amp., 5 v., 2.5 amp., 22/6.

Drop thro' 350-0-350 v. 70 mA., 6 v. 2.5 amp., 5 v. 2 amp., 14/6.

Drop thro' 250-0-250 v. 80 mA., 6 v. 3 amp., 5 v. 2 amp., 14/6.

280-0-280, drop through, 80 mA. 6 v. 3 amp., 5 v. 2 amp., 14/6.

250-0-250 80 mA., 6 v. 4 amp., 14/.

Drop thro' 270-0-270, 80 mA., 6 v. 3 amp., 4 v. 1.5 amp., 13/6.

Drop thro' 270-0-270, 60 mA., 6 v. 3 amp., 11/6.

250 v. 350 mA., 6.3 v. 4 a., twice 2 v. 2 a., 19/6.

Auto-trans. Output 200/250 H.T. 500 v. 250 mA., 6 v. 4 a., twice, 2 v. 2 a., 19/6.

200-0-250, 60 mA., 6.3 v. 1.5 a. 0-5-6.3 v. 1.5 a., 10/6.

Auto Trans. Input 200/250. H.T. 350 v. 350 mA. Separate L.T. 6.3 v. 7 a., 6.3 v. 1 1/2 amp., 5 v. 3 amp., 25/-. P. & P. 3/.

Primary, 230 v., fully shrouded, screened primary, 13 v. 1 amp., 7/6

Fri 200 v. Sec. 500-0-500 and 500-0-500 250 mA. both windings. 4 v. 3 amp. 4 v. 3 amp., 39/6. P. & P. 5/.

Mains Transformer, fully impregnated, input 210, 220, 230 and 240. Sec. 600-0-600, 275 mA., and 200 v. at 30 mA., complete with separate heater transformer. Input 210, 220, 230, 240. Sec., 6.3 v. 2 amp. three times, 0, 4, 6.3 v. at 3 amp. and 5 v. 3 amp., 45/-. P. & P. 5/.

Mains Transformer, fully impregnated, Input 210, 220, 230, 240. Sec. 350-0-350 100 mA., with separate heater transformer. Pri. 210, 220, 230, 240. Sec. 6.3 v. 2 amp., 6.3 v. 3 amp., 4 v. 6 amp. and 5 v. 2 amp., 30/-. P. & P. 5/.

**MAINS TRANSFORMERS, chassis mounting, feet and voltage panel. Primaries 200/220.**

350-0-350 75 mA. 6.3 v. 3 a. tap 4 v. 6.3 v. 1 a., 13/6.

500-0-500 125 mA. 4 v. C.T. 4 a., 4 v. C.T. 4 a., 4 v. C.T. 2.5 a., 27/6.

500-0-500 250 mA. 4 v. C.T. 5 a., 4 v. C.T. 5 a., 4 v. C.T. 4 a., 39/6.

9in. T.V. Cabinet, front in contrasting walnut veneers, size 16 1/2in. long, 1 1/2in. high, by 12 1/2in. wide. Complete with two pieces expanded aluminium in gold 12x9in. and 5in. speaker baffle and chassis, 20/-, post paid.

6 1/2in. M.E. Speaker, 1,000 ohm. field, 15/-.

R. & A. T.V. energized 6 1/2in. speaker with O.P. trans., field coil, 175 ohms 9/6. P. & P. 2/6.

R. & A. 6 1/2in. M.E. speaker, with O.P. trans., field 440 ohms, 10/6. P. & P. 2/6.

Volume Controls. Long spindles less switch, 50K, 500K, 1 meg., 2/6 each. P. & P. 3d. each.

Volume Controls. Long spindle and switch, 1, 1 and 2 meg., 4/- each. 10K and 50K, 3/6 each. 1 and 1 meg., long spindle double pole switch, miniature, 5/-. P. & P. 3d. each.

Trimmers, 6-40 pf., 5d. 10-110, 10-250, 10-450 pf., 10d.

Twin-Gang .0005 Tuning Condenser, 5/-. With trimmer, 7/6.

Twin Gang, .0005, with feet, size 3 1/2 x 1 1/2in., 6/6.

3-gang .0005, with feet, size 4 1/2 x 3 1/2in., 7/6.

T.V. Coils, moulded former, iron-cored wound for re-winding purposes only. All-cad 1 1/2in., 1/- each, 2 iron-cored. All-cad 2 1/2in., 1/6 each.

Used Metal Rectifier, 250 v. 150 mA., 6/6.

Metal Rectifier, 230 v. 45 mA., 6/-. Metal Rectifier, RM2, 125 v. 100 mA., 3/6.



6 1/2in. deep, 4in. high, 9in. blank-scale. Width including scale-overlap 14in. Mains, permeability tuned. Complete with 3 valves. Post and Pkg. 3/-. £2/19/6.

**T.V. CONVERTER** for the new commercial stations complete with 2 valves. Frequency—can be set to any channel within the 180-198 Mc/s. band. I.F.s.—will work into any existing T.V. receiver designed to work between 42-88 Mc/s. Sensitivity—10 Mu/v. with any normal T.V. set. Input—arranged for 300 ohm feeder, 80 ohm feeder can be used with slight reduction in R.F. gain. Circuit EF80 as local oscillator, EOC81 as R.F. amplifier and mixer. The gain of the first stage, R.F. AMPLIFIER 10 db. Required power supply of 200 v. D.C. at 25 mA., 6.3 v. A.C. at 0.6 amp. Input filter ensuring complete freedom from unwanted signals. 2 simple adjustments only. £2/10/- P. & P. 2/6.

USED 12in. TUBE, aluminumized, heater cathode-short, 10KV max. 2 v. heater complete with HUE and E.H.T. transformer 9 KV with ferrocart core, line and width control, EY81 rec. winding frame O.P. scan coils and 12in. Perspex enclosure. £6/17/6. P. & P. 7/6.

As above but with 12in. non-aluminumized tube 8KV max. £5/17/6. P. & P. 7/6.

**GENERAL PURPOSE 3-IN-1 MAINS TRANSFORMER.** Input 200/250. Sec. 200 v. 350 mA. 6.3 v. 4 amp. twice, 2 v. 2 amp. 500 v. 350 mA., 6.3 v. 4 amp. twice, 2 v. 2 amp. Auto-transformer, 110, 250 v., 250 watt, 19/6. P. & P. 3/6.

**HIGH-IMPEDANCE PLASTIC RECORDING TAPE**, by famous manufacturer. 600ft. on aluminium spool, 8/-. 1,200ft. on aluminium spool, 17/6, post paid.

**PLASTIC CABINET**, as illustrated, 1 1/2 x 6 1/2 x 6 1/2in. In Walnut, Cream and Green, and in polished Walnut complete with T.R.F. chassis, 2 waveband scale, station names, new wave-band, back-plate, drum, pointer, spring, drive spindle, 3 knobs and back, 22/6. P. & P. 3/6.

AS ABOVE, with superhet chassis, 23/6. P. & P. 3/6.

Used metal rectifier, 230 v. 50 mA., 3/6. gang with trimmers, 6/6; M. & L. T.R.F. coils, 5/-; 3 obsolete ex-Govt. valves 3 v/4 and circuit, 4/6; heater trans., 6/-; volume control with switch, 3/6; bias condenser switch, 2/-; 32 x 32 mfd., 4/-; bias condenser, 1/-; resistor kit, 2/-; condenser kit, 4/-.

Cydon 5 channel T.V. Tuner, uses EF80 and 12AT7 less valves, 12/6, post paid.

Radiogram Chassis, 5 valve A.C./D.C. 3 wave-band superhet 195-255 v., 19-49, 200-550 and 1,000-2,000 metres, I.F. 470 Kc. size of chassis 13 x 6 1/2 x 2 1/2in., size of scale 7 1/2 x 3 1/2in. Valve line-up 10C1, 10F9, 10L1D1, U404 and 10P14. Twin mains filter input, 2 dial lights and 8in. P.M., 25/17/6. P. & P. 5/.

**CR100 Coil packs in first-class condition less oscillator section, complete with 4-gang tuning condenser, 19/6. P. & P. 3/6.**

**CR100 465 Kc. I.F.s., types 3, 4 and 5 and F.B.O., new condition, 7/6 each. 465 Kc. Xtal for CR100, 12/6.**

**4-gang tuning condenser for CR100, 9/6.**

**CONSTRUCTOR'S PARCEL**, medium and long wave A.C. mains 230/250 2-valve plus metal rectifier, comprising chassis 19 1/2 x 4 1/2 x 1 1/2in., 2 wave-band scale, tuning condenser, wave-change switch, volume control, heater trans., metal rectifier, 2 valves and w/holders, smoothing and bias condensers, resistors and small condensers, and medium and long wave coil, litz wound, 22/6. P. & P. 2/6 extra. Circuit and point-to-point, 1/3.

**CONSTRUCTOR'S PARCEL** comprising chassis 12 1/2 x 8 x 2 1/2in., cad. plated, 16 gauge. 7/4, I.F. and trans. cut-outs, back-plate, 2 supporting brackets, 3 wave-band scale, new wavelength stations names. Size of scale 1 1/2 x 4 1/2in. drive, sp., drum, 2 pulleys, pointer, 2 bulb holders, 5 pax. I.O. v/4., 4 knobs and pair of 465 L.F.s. twin gang, 16 x 16 mfd. 350 wkg., mains trans. 250-0-250 80 mA., 6.3 v., 2 amp., 5 v. 2 amp. and 6 1/2in. M.E. speaker with O.P. trans. 39/6. P. & P. 3/6.

**Battery charger, input 230/250 v. output 6 and 12 volt 1 amp. Black crackle finished case size 10 x 6 x 4in. Incorporating metal rectifier, main on-off switch, and output switch, 21/- P. & P. 3/-. OUTPUT TRANSFORMERS.** Standard type 5,000 ohms, 1/4; 42-1 with extra feed-back windings, 4/3. Miniature 42-1, 3/3. Multi-ratio 3,500, 7,000 and 14,000, 5/6. 10-watt push-pull, 6V6 matching, 7/-. 90-1 3 ohm speech coil, 6/6.

**PUSH-BACK CONNECTING WIRE.** Doz. yds., 1/6. Post paid.

**STANDARD WAVE-CHANGE SWITCHES** 4-pole 3-way, 1/6; 5-pole, 3-way, 1/9; 3-pole, 3-way 1/9; 9-pole 3-way, 3/6; Miniature type, long spindle 3-pole 4-way, 4-pole 3-way and 4-pole 2-way, 2/6 each. 2-pole 11-way twin water 5/-; 1-pole 12-way single water 5/- P. & P. 3d.

**POTATO AND VEGETABLE PEELER.** Used pump. All aluminium construction, white stove-enamelled finish. Originally intended for adaptation on an electric food-mixer, can be easily converted for hand operation. 39/6. P. & P. 3/-. Mains Droppers. 0.3 amps., 460 ohms, tapped 250 and 410, 1/6; 0.2 amp., 717 ohms, tapped at 100 ohms, vitreous, 1/6; 0.3 amps. 950 ohms, tapped 700 and 825, 2/6; 0.2 amp., 1,000 ohms, vitreous, tapped 2/6; vitreous, 0.3 amp., 700 tapped 650, 640, 900, 3/6. P. & P. on each 3d.

T.V. Width Controls, 3/6.

**PERSONAL SHOPPERS ONLY.** 9in. Enlarger, 17/6; 12in., 27/6.

Germanium Crystal Diode, 1/6, post paid.

Used 9in. Tube with ion burn, 17/6, post paid.

Line O.P. Transformer in aluminium case mounted in rubber, 12/6.

**PERMEABILITY TUNED T.V. UNIT**

Input 300 ohm balanced line, coverage 54 Mc/s—89 Mc/s and 174 Mc/s—217 Mc/s. Vision I.F.—45 Mc/s, sound 60.5 Mc/s. Uses 6AK5 RF valve, 6AK5 as mixer, and 6C4 oscillator. Provision for auto-gain control. Dimensions 8in. wide, 14in. high. Four stages

Crystal Set, medium and long wave. in plastic cabinet, 16/-.

Headphones, per pair, 8/-. Speaker Matching Unit on aluminium chassis, 3-15 ohms reversible, 12/6.

Line and E.H.T. Transformer, 14 Kv., using ferrocart core, complete with line and width control and corona shields U37 rectifier winding, 35/-.

Line and E.H.T. Transformer, 9 Kv., using ferrocart core, complete with built-in line and width control. Mounted on small all-chassis. Overall size 4 1/2 x 1 1/2in. EV81 rec. winding, 27/6.

Scan coils, low line low impedance frame, complete with frame transformer, to match above, 27/6. P. & P. 2/-. Line and E.H.T. Transformer, 9 Kv. ferrocart core, EV81, heater winding, complete with scan coils and frame output transformer, and line and width control, £2/5/-. P. & P. 3/-. As above, but complete with line and frame blocking transformers, 5 Henry 250 mA. choke, 100 mfd. and 150 mfd. 250 wkg. 350 mA. A.C. ripple. £2/19/6 P. & P. 3/-. Valve Holders, moulded cetal Mazda and local, 4d. each. Paxolin, cetal Mazda and local, 4d. each. Moulded B7G, B8A and B9A, 7d. each. B7G moulded and B9A with screening can 1/6 each.

32 mfd., 350 wkg. .... 2/-

16 x 24, 500 wkg. .... 4/-

40 mfd., 200 wkg. .... 3/3

40 mfd., 400 wkg. .... 3/6

16 x 8 mfd., 500 wkg. .... 4/6

16 x 16 mfd., 500 wkg. .... 5/9

16 x 16 mfd., 450 wkg. .... 3/9

32 x 32 mfd., 350 wkg. .... 4/-

32 x 32 mfd., 350 wkg., and 25 mfd., 25 wkg. .... 6/6

25 mfd., 25 wkg. .... 11d.

250 mfd., 12 v. wkg. .... 1/-

16 mfd., 500 wkg., wire ends .... 3/3

8 mfd., 500 v. wkg., wire ends .... 2/6

8 mfd., 350 v. wkg., tag ends .... 1/6

50 mfd., 25 v. wkg., wire ends .... 1/9

100 mfd., 350 wkg. .... 4/-

100 mfd., 450 v. wkg., 280 mA., A.C. ripple .... 3/11

150 mfd., 350 v. wkg., 280 mA., A.C. ripple .... 4/6

100+200 mfd., 350 wkg. .... 9/6

16+16 mfd., 350 wkg. .... 3/3

50 mfd., 180 wkg. .... 1/9

65 mfd., 220 wkg. .... 1/6

65 mfd., 150 wkg. .... 1/6

60+100 mfd., 280 wkg. .... 7/6

50 mfd., 12 wkg. .... 11d.

32+32 mfd. min. 275 wkg. .... 4/-

50 mfd., 50 wkg. .... 1/9

Miniature wire ends moulded, 100 pf., 500 pf., and .001, each, 7d.

T.V. Filter, in lightly tinted Perspex, size 13 1/2 x 11 x 3 1/2in., 4/6.

Combined 12in. mask and esutheon, in lightly tinted Perspex. New aspect edged in brown. Fits on front of cabinet, 12/6. As above for 15in. tube, 17/6.

Frame Oscillator Blocking Trans., 4/6. Line Osc. Blocking Trans., 4/6.

Tube Mounting Bracket, size 9 1/2 x 4 1/2in. 12in. tube clamps, 2/-.

**CHOKES:** 2-20 Hen. 150 mA., 15/- P. & P. 3/-. 6 Hen., 275 mA., 15/- P. & P. 3/-. 100 Hen., 40 mA., 15/- P. & P. 3/-. 2 Henry 150 mA., 3/6; 250 mA., 10 Henry, 10/6; 5 Henry 250 mA., 60 ohms, 5/6.

P.M. Focus Unit for any 9 or 12in. tube except Mazda 12in. with Vernier adjustment, 15/-.

P.M. Focus Unit for Mazda, 12in., less Vernier adjustment, 15/-.

Wide Angle P.M. Focus Units, Vernier adj. state tube, 25/-.

Energised Focus Coil, low resistance mounting bracket, 17/6.

Ion Traps for Mullard or English Electric tubes, 5/-, post paid.

Standard 465 Kc. Iron-cored I.F.s. 4 x 1 1/2 x 1 1/2in., per pr., 7/6. Wearite standard, iron-cored, 465 Kc. I.F.s. 3 1/2 x 1 1/2 x 1 1/2in., per pr., 9/6.

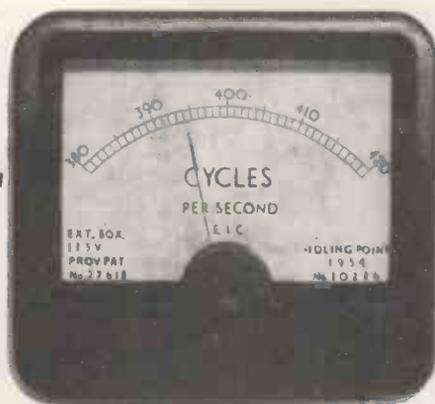
Iron-Cored 465 Kc. Whistle Filter, 2/6. 465 Kc. MIDGET L.F.s. Q.120 size 1 1/2in. long, lin. dim. deep by very famous manufacturer. Pre-aligned adjustable iron-dust cores, per pair, 12/6.

**RADIO & T.V. COMPONENTS (Acton) LTD.**

(Late D. COHEN)

**23 HIGH STREET (Uxbridge Road) ACTON, W.3. Telephone: ACOrrn 5901**

Hours of Business: Saturday 9-5 p.m. Wednesday 9-1 p.m. Other days 9-4.30 p.m.



## FREQUENCY METERS

2½-8" up to 10,000 cycles

## DIFFERENTIAL A.C. CURRENT METERS

COMPARING THE MAGNITUDE OF TWO CURRENTS.

A full range of switchboard and portable instruments, including four types of Millirange Meters.

## THE ELECTRICAL INSTRUMENT CO. (HILLINGTON), LTD.

Boswell Square Industrial Estate, Hillington, Glasgow, S.W.2. Halfway 1166 and 2194

## The Manning-Garr P.53G MINIATURE POLARISED RELAY

Now in dust-proof heavy gauge anodised aluminium can and with miniature 5 or 9-pin base for plugging in.

(Original version still available.)

BOTH TYPES FITTED WITH PLATINUM POINTS IF SPECIFIED



Actual Size

**Data**—A Sensitivity of 25 milli-watts and capable of handling mains voltage on the contacts with alternating currents up to 0.25 amps. Being polarised it has the advantage that the Armature contact can be biased to lock in either direction by suitable adjustment of the contact screws which provides a useful facility where pulse operation is required. Speed of operation is high and the Relay will follow frequencies appreciably higher than 50 c.p.s. Resistance up to 7,000 ohms which is acceptable for Anode circuits. Alternatives to specification if required Sole Concessionnaires.

## POST OFFICE TYPES

**3,000 & 600 RELAYS  
TO SPECIFICATION**

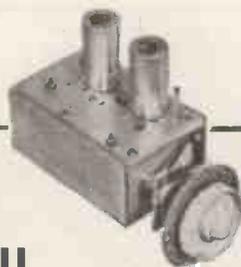
Tropicalising, impregnating and Services jungle finish if required, Delivery 3-4 weeks.

Manufacturers to H.M. Govt., Depts. and leading Contractors

**L. E. SIMMONDS LTD.**

5 BYRON ROAD, HARROW, MIDD.X.

Telephone: Harrow 2524 - 0315



## TUNERS for BAND III COMMERCIAL TELEVISION

Specially developed for incorporating into new T.V. receivers, or for tuning standard receivers for reception of Band III. Price £6.

ABOUT 2½ MILLION T.V. SETS WILL PROBABLY BE TUNED FOR BAND III RECEPTION. MAKE SURE THAT YOU ARE UP TO DATE. WRITE TO US TODAY FOR FULLEST DETAILS

**Valradio LIMITED**

New Chapel Rd., High St., Feltham, Middx. Phone: Feltham 4242

## MIDLAND INSTRUMENT CO.

**POWER SUPPLY UNITS** No. 5, complete except for the 6-v. accumulator, consists of the 6-v. 5-amp. hand generator, with cut-out, 6-v. input vibrator pack, provides all L.T. and H.T. outputs for the 18 and 38 sets, spare Mallory vibrator, bakelite accumulator box, etc., etc., in metal back carrying case, complete with belt and shoulder webbing, new in sealed cartons, 40/-, carriage 6/-; Scot. 7/6; N.I. 10/-.

**ELECTROLYTIC CONDENSERS**, 32-mfd. 450-v. D.C., by Zenith, Micamold, etc., new and guaranteed, cartons of 12 condensers, 10/-, post paid.

**PROJECTION UNITS**, consists of an optical mount, fitted with a bloomed f/2.2 Achromatic lens, 3½in. focal length, at one end, also a convex/concave ground glass at the other, attached to an enclosed lamphouse, fitted with a 24-v. 15-watt lamp, and polished reflector, fraction of original cost, 10/-, post 1/-.

**SELSYN TRANSMITTERS** (Marslips), 3½in. type, pure synchro x-y-1-2-3, suitable as master or slave, 50-v. 50-cycle single phase A.C. operated. When two or more of these are wired up, the rotation by hand (or other means) of one, will result in a 100 per cent. follow in the other(s), both clockwise or anti-clockwise, supplied brand new with test report, in tropicalised sealed cartons. Value, £8 each, our price 25/-, post 2/-, 2 for 50/-, post paid with wiring diagram.

**TELEPHONE SETS**, consists of 2 combined receivers and microphones, connected by 20ft. twin flexible, provides perfect 2-way communication (up to 1 mile with extra flex), self-energised, no battery required, complete ready for use, new, boxed, 12/6, post 1/-.

**"NELCO" ROTARY TRANSFORMERS** (matched), brand new latest manufacture, receiver type, 6½in. long, 2½in. dia., input 6-v., output 170-v. at 60-m/A., 15/-, post 1/6, ditto transmitter type, 7½in. long, 2½in. dia., input 6-v., output 350-v. at 170-m/A., 20/-, post 1/10.

**G.E.C. POWER UNITS**, intended for 100-watt R.F. amplifiers, input A.C. 200/220/240-v. plus 10-v. 45/120-c.p.s., output 550-v. at 300-m/A. D.C., and 6.3-v. r.m.s., consists of eight U52 rectifiers, separate heater and H.T. transformers, 2 Dubilier nitrogol 8-mid. 1,200-v. capacitors, 2 heavy smoothing chokes, resistors, fuses, switches, etc., etc., for 19in. rack mounting, weight 104½lb., new and unused, £7/10/-, carriage and crate, 15/-; Scot. 20/- extra.

**WIRE STRIPPERS**, strips the insulation from flexes and cables up to ½in. dia., micro-meter adjustment, brand new boxed, usual toolshop price 15/-, our price 3/6, post 6d., 3 for 10/-, post paid.

**ARROW SWITCHES**, 250-v. 25-amp. rotary 4-position, 3-heat and off, series parallel, panel mounting, complete with pointer knob, brand new, 2/6, post 1/3, ditto smaller Diamond H., 250-v. 15-amp., 2/6, post 9d.

**VENNER 24-VOLT TIME DELAY SWITCHES**, consists of high-grade clockwork motor with external press wind, 2 electro-magnets, 5-pole cam-operated contacts, in smart metal cases fitted 4-way terminal block, new boxed, 7/6, post 1/-.

**G.E.C. MINIATURE RELAYS**, 40-ohm., 4-pole changeover platinum contacts, brand new boxed, 8/-, post 6d., 90/- doz., post paid.

**ELECTRO-MAGNETIC COUNTERS**, G.P.O. subscribers pattern, 3-ohm. coil, 0-9999 repeating, size 4½ x 1½ x 1½in., 5/-, post 1/-.

**ELECTRIC BELLS**, 12-v. D.C., single dome 3½in. dia., 1½in. high, very superior, worth 30/-, our price, brand new boxed, 3/6, post 9d.

Many other bargains; send 3d. with S.A.E. for current lists.

**MIDLAND INSTRUMENT CO., MOORPOOL CIRCLE, BIRMINGHAM, 17**  
Tel.: HAR 1308

### C.R.T. ISOLATION TRANSFORMERS

Designed to cover practically every demand for Transformers for Cathode Ray Tubes having Heater/Cathode short circuit or 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	With Tag
4 volt	10/6 each	Panel and
6.3 volt	10/6 each	Solder Tags
10.8 volt	10/6 each	
15.3 volt	10/6 each	

Type B. Mains Input 220/240 volts. Multi Output 0-2-4-6-3-7-10 and 13 volts. Input has two taps which increase output volts by 25% and 50% respectively. This transformer is suitable for most Cathode Ray Tubes. The MOST versatile Low Capacity C.R. Transformer with Universal Output. With Tag Panel and Solder Tags. 21/- each.

Type C. A most useful low capacity wound transformer for use with 2 volt Tubes with falling emission. Input 220/240 volts. Output 2-2 1/2-2 1/2-3 volts at 2 amps. With Tag Panel and Solder Tags 17/6 each. All Isolation Transformers are individually boxed, labelled and clearly marked with relevant data.

### Volume Controls

Midget type. Long spindles. Guaranteed 1 year. All values 10,000 ohms to 2 Meg-ohms. No 8w. S.P.Sw. D.P.Sw. 3/- 4/- 4/9

COAXIAL PLUGS 1/2  
SOCKETS 1/-  
LINE CONNECTOR 1/2  
OUTLET BOXES 4/6

### 80 ohm COAXIAL

STANDARD 1/4 in. diam. Coaxial GRADE 8d. yd. "A"

SPECIAL Semi-air spaced Polythene insulated. 1/4 in. diameter. Stranded core. 9d. yd. Losses cut 50%.

BALANCED TWIN FEEDER per yd. 6d. TWIN SCREENED BALANCED FEEDER 1/- yd. 80 ohms 5 OHM COAXIAL CABLE, 8d. per yd. 1/4 in. dia. TRIMMERS, Ceramic, 30, 50, 70 pf., 9d. 100 pf., 150 pf., 1/3; 250 pf., 1/6; 600 pf., 750 pf., 1/9.

RESISTORS.—All values: 10 ohms to 10 meg., 1/2 w., 4d.; 1/4 w., 6d.; 1 w., 8d.; 2 w., 1/-.

HIGH STABILITY, 1/2 w. 1% 2/-. Preferred values 100 ohms to 10 Meg.

WIRE-WOUND RESISTORS.—Best Makes Miniature Ceramic Type—5 w., 15 ohm to 4 K., 1/9; 10 w., 20 ohm to 6 K., 2/3; 15 w., 30 ohms to 10 K., 2/9; 5 w. Vitreous, 12 K. to 25 K., 3/-.

WIRE-WOUND POTS, 3 WATT LAB. COLVERN, ETC. Pre-Set Min. TV Type Standard Size Pots, 2 1/2 in. Knurled Slotted Knob. Spindle High Grade. All All values 25 ohms to 30 K., 3/- each. 50 K., 4/6; 100 K., 6/6; 200 K., 9/6. DIAL Carbon Track 50 K. W/100 EXT. SPEAKER to 2 meg., 3/-.

OP TRANSFORMERS.—Heavy Duty 70 mA., 4/6. Ditto tapped primary, 4/9. Multiratio, QPP, push pull 6/6. Tapped small pentode, 3/9.

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. MAINS TRANS. 300-350, 80 mA., 6.3 v., 4 a., 5 v., 2 ditto 250-0-250, 21/-.

AMPLIFIER TRANS. 250-0-250 v. 50 mA. 6.3 v. 2 a., 17/6. MAINS HEATER TRANS. 6.3 v. 1 1/2 a., 7/6; 6.3 v. 3 a., 10/6.

ELECTRODYNAMIC MIKE INSERT.—U.S.A. make. Precision engineered. Size only 1/4 in. diam. by 1/2 in. Bargain Price 3/9. Matching Trans. 3/9.

SPEAKER FRET.—Expanded anodised metal, 12 in. x 12 in., 4/-.

EXT. L.S.—Switched Socket, on-off and parallel switching, complete with plug, 2/-. COPPER PLATED AERIAL RODS, 2 1/2 in. x 12 in. push fitting, 2/6 doz., p. & p. 9d.

MAINS LEAD—3 yds. Twin Twisted Maroon Flex. 1/-.

2 pf. Non-kink Appliance Leads, 1/3.

TYANA.—Midget Soldering Iron. 200/220 v. or 230/250 v. 14/11. TYANA TRIPLE THREE.—Complete with detachable bench stand, 19/8. 200/220 v. or 230/250 v.

NEW SOLON MIDGET IRON.—25 w., 19/6. IDEAL FOR RADIO CONSTRUCTION. 200/220 v. or 230/250 v.

MIKE TRANS.—Ratio 50:1. 3/9 ea., new and boxed.

VHOLDERS.—Fax: Int. Oct. 4d.; EF50, EA50, 6d.; B12A CRT, 1/3. Moulded: Int. Oct. 6d.; BYG, 9d., with screening can, 1/6; B8A, B9G, B9A, 1/-; VCR97, 2/6. Ceramic: EF50, B7G, 1/-. Faxolin ENG. and AMER. 5, 7- and 9-pin, etc., 1/-.

Nuts, Bolts and Washers, 12 of ea. 1/- packets, 2 4 or 6 B.A TAG STRIPS.—2- or 3-way, 2d.; 4- or 6-way, 3d.; 5-way, 4d.; 10- or 10-way, 6d. etc.

TOGGLE SWITCHES EX-GOV'T.—"On-Off," 9d. Ersin M-core solder 60/40, 16 g. or 15 g., 5/6; 1 lb., 4d. T.C. Tubes.—18 to 22 s.w.g., 2/-; 1 lb. P.V.C. Connecting wire, 3 colours. Single or Stranded, 2d. yd. 2 K. 5 w. H.D. w/w Pots, 4/6, 10 K., 25 K., Colvern w/w Pot. 1/4 in. spindle, 3/6. SCREENED GRID CAPS 1. Oct. or Mazda, 6d. ea.

BULGIN HIGH VOLTAGE VALVE CAPS, 1 Oct., 1/-.

USSES.—1 1/4 in. all values 60 mA. to 10 a., 6d.

ADDIN FORMERS and cores, 1/4 in., 8d.; 1/2 in., 10d.

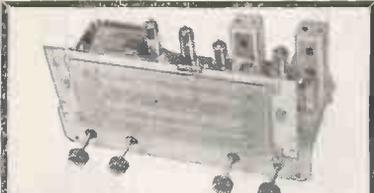
SLOW MOTION DRIVES.—Epicyclic ratio 6:1 2/3.

INT. OCTAL CABLE PLUG (8-pin), with cover, 1/3.

200-250 Volt SELECTOR SOCKET (2in. x 1 1/2 in.) with Plug 1/-. PILOT LAMPS.—6.3 v. 3 a., 8d.

MAINS DROPPERS. 5in. x 1 1/2 in. Adj. Sliders, 3 amp. 750 ohms, 4/3, 2 amp., 1,000 ohms, 4/3.

LINE COORD.—3 amp., 60 ohms per foot, 2 amp., 100 ohms per foot, 2 way, 1/6 a yard; 3 way, 1/8 a yard.



### ALL WAVE RADIOGRAM CHASSIS

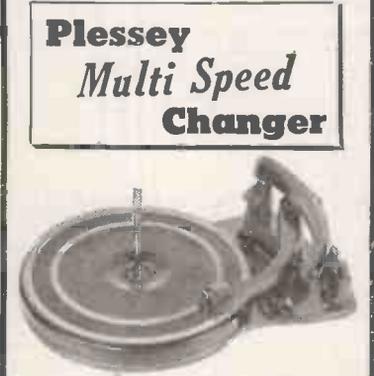
THREE WAVEBANDS FIVE VALVES  
S.W. 16 m.—56 m. LATEST MULLARD  
M.W. 200 m.—550 m. ECH 42, EF41  
L.W. 800 m.—2,000 m. EBC 41, EL 41, EZ40

Brand New and Guaranteed, with 10in. P.M. Speaker, A.C. 200/250 v. Four position Wavechange Switch. Short-Medium-Long-Gram. Slow Motion Tuning. Speaker and Pick-up connections. High Q Iron-dust core coils, 465 kc/s I.F. Latest circuit technique delayed. A.V.C. and Negative feedback. Output 4.2 watts. 3 ohms output transformer on chassis. Chassis size 3 1/2 x 5 1/2 x 2 1/2 in., Glass Dial—10in. x 4 1/2 in. horizontal or vertical type available, 1/6 by 2 Pilot Lamps. Colour Black Station names, L.W. Green, M.W. Red, S.W. White. Four Knobs supplied. Walnut or Ivory to choice, aligned and calibrated. Chassis isolated from mains. PRICE £10/15/-.

Carriage and Insurance, 4/6. (Without 10in. Speaker, £9/15/-.

Carr. & Ins., 4/6. A.C.-D.C. 10/- extra.

RECOMMENDED FOR ABOVE CHASSIS



PRICE Carriage Paid £9.19.6

### GREAT REDUCTION

Brand New Plessey 3-speed Autochanger Mixer Unit for 7, 10 and 12in. Records. Twin Hi-Fi Xtal Head with Duopoint sapphire stylus. Plays 4,000 records sprung mounting. Superb Quality. Bargain offer. This Changer will play:—

- 8 mixed 78 r.p.m. 10" and 12" records.
- 8 45 r.p.m. 7" records
- 10 33 1/3 r.p.m. 7" records.
- 10 33 1/3 r.p.m. mixed 10" & 12" records
- Baseboard required 15 1/2 x 12 1/2 in.
- Height required 5 1/2 in.
- Depth required 2 1/2 in.

### \* MIXER TYPE MECHANISM \* DUAL POINT TURNOVER HEAD

Similar model 3 speed single record unit with Aceo 37 turnover head, each sapphire stylus will play 2,000 records. Starting switch automatically places pick-up on records. 7in., 10in. or 12in. auto-stop. Baseplate size 12 x 8 1/2 in. Height required 2 1/2 in. depth 1 1/2 in.

Price carriage paid **£7.15.6**

### EXCLUSIVE BARGAIN

### RECORDING TAPE

1,200 ft. on standard fitting 7" reels. Brand new boxed High tensile strength, sensitivity and coercivity.

ONLY 17/6 REEL

Covered by our usual money back guarantee.

T/V PRE-AMP.—Channel 1. Easily modified for other Channels or Converter use. Midget Chassis, 4 1/2 x 2 1/2 x 1 1/2. Complete with EF42 valve, coaxial lead and plug. Ready for use. Brand new Mfrs. Surplus. Listed £2/15/-.

Special Clearance Price, 21/- Buy Yours Now.

PYE Aerial Plug and Socket, 1/6 pr.

5in. RADIO SCREWDRIVERS.—Sheffield made blade 2 1/2 in. x 1/4 in. Ins. handle 0,000 v. 4 1/2 each.

CONDENSERS.—New Stock .001 mfd. 8 kv. T.C.C., 5/6. Ditto, 12.5 kv., 9/6; 2 pf. to 500 pf. Mica, 6d.; .001. Mica or Tub. 500 v. 01 Sprague 500 v., .02 500 v., .1 mfd. 350 v. Tub., 9d.; Hunts Moidseal 500 v., .005, 9d.; .05 mfd. and .1 mfd., 1/-; .25 mfd., 1/6. 1.1 mfd., 600 v., 1/3; Tubular .5 mfd. 500 v., 1/9.

SILVER MICA CONDENSERS.—10%.

5 pf. to 500 pf., 1/-; 600 pf. to 3,000 pf., 1/3.

DITTO 1/1 (ex. stock).

1.5 pf. to 500 pf., 1/9. 515 pf. to 1,000 pf., 2/-.

ELECTROLYTICS ALL TYPES NEW STOCK.			
Tubular Wire Ends	Can Types	OHMs	3d. ea.
16+16/500 v.	6/-	32+32/350 v.	4/6
1/275 v.	2/6	32+32/275 v.	4/6
2/450 v.	2/3	32+32/450 v.	3/6
4/350 v.	1/8	32/350 v.	4/6
4/500 v.	2/-	60/350 v.	6/6
8/450 v.	2/3	250/350 v.	8/6
8/500 v.	2/6	8+16/450 v.	5/-
10/500 v.	2/6	8+16/500 v.	5/6
16/500 v.	2/6	16+16/450 v.	6/6
8+8/500 v.	4/6	16+16/500 v.	6/-
32/500 v.	5/6	32+32/450 v.	6/6
32+32/350 v.	5/6	60+100/350 v.	11/6
32/275 v.	7/6	100+200/275 v.	12/6
50/25 v.	1/9		
50/25 v.	1/9		
50/50 v.	2/-		

SPECIALS. Can Types. 500 mfd. 12 v., 3/-; 1,000 mfd. + 1,000 mfd., 6 v., 6/6; 1,500 mfd. 6 v., 4/6; 1 mfd. 1.5 kv. T.C.C. 3/6. Type 512 screw base, 8 mfd. 500 v., 3/-; 16 mfd. 600 v., 4/6.

SENTREX RECTIFIERS. E.H.T. Type FLY-BACK VOLTAGES. K3/25 2 kv., 4/3; K3/40 3.2 kv., 6/-; K3/45, 3.6 kv., 6/6; K3/50 4 kv., 7/3; K3/100 8 kv., 12/8; K3/100 14 kv., 18/-; MAINS TYPE.—RM1, 125 v., 60 mA 4/-; RM2, 100 mA., 4/9; RM3, 120 mA., 5/-; RM4 250 v. 2/5 mta. 16/-.

TV. AERIALS. Aerialite, all channels in stock. Indoor 20 type Inv. T., 13/6.

KNOB, GOLD ENGRAVED.—Walnut or Ivory, 1 1/4 in. diam., 1/6 each. "Focus," "Contrast," "Brilliance," "Brilliance—On-Off," "On-Off," "Volume," "Vol.—On-Off," "Tone," "Tuning," "Tretle," "Bass," "Wavechange," "Radio-Gram," "S.S., M. L. Gram," "Record-Play," "Brightness." Ditto not engraved, 1/- each. Size "B" lin. engraved, 1/2, plain 8d.

POINTER KNOBS.—Brown with white marking line, small 9d., large 1/-.

COILS.—"P" type, 2/6 each. Midget "Q" Type adj. dust core, 3/6 each. All ranges in stock.

REACTION. COND.—.0001, .0003, .0005 mfd. 3/6 ea.

ALUMINUM CHASSIS.—18 s.w.g. Plain, un drilled, folded 4 sides and riveted corners lattice fixing holes. Strong and soundly constructed with 2in. sides. 7in. x 4in., 4/6; 11in. x 7in., 6/9; 13in. x 8in., 8/8; 14in. x 11in., 10/6; 6 in. x 16in. x 3in., 16/6

FULL WAVE BRIDGE SELENIUM RECTIFIERS.—2/6 or 12 v. 1 1/2 amp. 8/9; 2 a. 11/3; 4 a., 17/6 F.W. only 6 v., 1 a. (9 v.-0-9 v. A.C.), 6/5.

CHARGER TRANSFORMERS. Tapped input 200/250 v. for charging at 2, 6 or 12 v., 1 1/2 amp., 13/6, 4 amp., 21/-.

ACID HYDROMETER.—New ex-Gov't. Unbreakable. Packed in metal case, 7in. x 1 1/2 in. dia., 4/6.

EX. F. MIDGET GHOOKS.—14 M.H., 2/6 each.

BRIMSTONS.—CZ1 for 3 a. heater chassis, 3/6. CZ2 for 15 a., or 2 a., 2/6. CZ3, 1/6.

COPPER ENAMEL WIRE.—1 lb. 15 to 20 s.w.g., 2/-; 2 to 28 s.w.g., 2/6; 30 to 40 s.w.g., 3/6.

SWITCH CLEANER Fluid, squirt spout, 3/9 tin.

TWIN GANG TUNING CONDENSERS.—.0005 mfd. midget with trimmers, 9/6; 376 pf. midget less trimmers, 6/6; .0005 Standard size with trimmers and feet, 9/-; less trimmers, 8/-; ditto, soiled, 2/6.

SLIDING.—Various colours, 1, 2 mm., 2d.; 3, 4 mm., 3d.; 4, 6 mm., 5d. yd.

LOUDSPEAKERS F.M. 3 OHM. 5in. 18/6, 6in., 17/6. 8in., 19/6. 10in., 25/-.

6in. Goodman with trans., 21/-.

Famous make 10 in., 10 watt heavy duty speakers, 3 ohm. Aluminium voice coil., 39/6

CRYSTAL DIODE.—Very Sensitive. G.E.C. 3/6.

H.B. PHONES.—(Hi-grade Amer.), 15/6 pr.

S. G. BROWN'S. 4,000 ohms, 15/6 pr.

VCR97 £2

TESTED FULL PICTURE

I. F. TRANSFORMERS

WEARITE TYPE 500. 465 Kc/s., adjustable 450-470 Kc/s., size 3 1/2 x 1 1/2 x 1 1/2. Q value 110. BRAND NEW.

HALF PRICE. 10/6 PAIR

We have no connection with any other firm. Please address all correspondence correctly as below.

# RADIO COMPONENT SPECIALISTS

307 WHITEHORSE RD., WEST CROYDON

OPEN ALL DAY SATURDAY

P. & P., 6d. £1 orders post free. C.O.D. Service 1/6. Lists S.A.E.

'Phone THO 1665, after 6 p.m. 4198. Buses 133 or 68 pass door. 48-hour postal service.

## TWO WONDERFUL BARGAINS

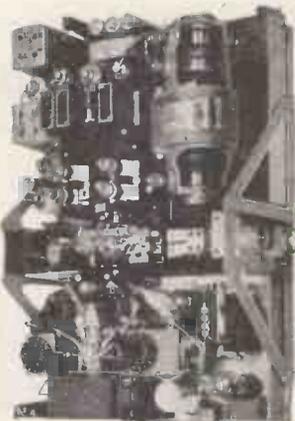


Illustration is with covers removed.



### ELECTRO-VOICE MOVING COIL MICROPHONES

No. 600.C. With built-in matching transformer for direct connection to grid of amplifier valve. These mikes are the famous BC.610 Transmitter and give perfect speech quality, they are all brand new with 9ft. screen lead and 3 pin plug, packed in original carton. Price £2, plus 1/6 postage and packing.

LARGE QUANTITIES OF OUR UN-USED COMPONENT BARGAINS STILL AVAILABLE AT PRICES BELOW MANUFACTURING COSTS.

Ceramic Variable Condensers split stator 15/15 Pf., 2/6 each. Ceramic Trimmers 22 Pf., 5/- per doz. Variable Condensers 100 Pf. ceramic insulation, 2/- each. Variable Condensers in screening case 50 Pf., 1/- each. Permanoid Sleeving coils of approx. 1 gross yds. 1 mm. and 1.5 mm., 8/6 per coil. Wave Change Switches 2 wafer 6 pole 3-way standard 1/3 spindles, 1/3 each. Porcelain Stand-offs, insulators only, miniature lin., 2/- doz. Pots 100 K and 1 meg. 1/2 spindle and 3-gang each 70 K all at 1/- each. Humdinger Pots 100 ohm. miniature wire wound, 2/- each. Colvern do, 200 ohm. w/wound 5w, 2/- each. 100 K Miniature Pots 1/2 in. long spindle, 1/- each. Erie Resistors 47K 2 watt boxed in 50's. and 5's. Erie Resistors 1,200 ohm, 1/2 w. boxed in 50's 2 watt 150 K 1 watt, 22 K 1 Watt, 70 K 1 watt; price, 2 watt 3d., 1 watt 2d.; 1/2 watt 1d. Paxolin Resistor Panels (size 4in. x 3in.) with fixing brackets contains 1-10 w. 5 K, 2-5 w. 120 K. 1-47 K, 1-56 K, 5 w. Brand new each, 1/9. Wire Wound Vitreous 10 watt wire ends 500 Ω each, 9d. Ferranti m/amp Meters Flush Square 2 in. 0-150, 7/6 each, do. 0-5 m/a. 9/- each.

INCLUDE SUFFICIENT FOR POSTAGE

We are offering **AS NEW, COMPLETE TR.1196 TRANSCEIVERS**, as illustrated. Outfit comprises, 6 valve Superhet, 3 Valve Transmitter, Power Unit and Relay Unit. All complete on Chassis. Present range 4-6.5 mc/s. and output 2 watts. Can be easily converted to cover 1.5 mc/s - 7 mc/s and power output up to 8 watts. It has a most versatile Receiver which can be easily adapted to cover any band of frequencies from medium broadcast to 30 mc/s. The Transmitter range can also be easily extended and by simply adding 200 pf. condenser to tank circuit will cover 1.5 mc/s. Circuit and conversion details included with each unit. Each outfit is despatched in transit case at the amazingly low price of £3/- plus carriage 10/-. If despatched without Transit Case, £2/10/- plus carriage 8/6.

## WOOLLEYS RADIO & ELECTRICAL SUPPLIES LTD.

615, BORDESLEY GREEN, BIRMINGHAM, 9. Phone: VIC 2078

### BRADMATIC LTD.

#### HIGH QUALITY TAPE RECORDING EQUIPMENT

**THE MODEL 5D TAPE DESK** (to take 10 1/2 in. NAB Reels)  
 Programme Time: 62 minutes at 7 1/2 i.p.s.  
 124 minutes at 3 3/4 i.p.s.

Panel size: 20 in. x 14 1/2 in.  
 Two speeds, 3 3/4 and 7 1/2 i.p.s. Double track heads. Push button control. Fast wind and rewind. Three heavy duty motors. Three separately shielded heads. Complete with NAB reel adaptors.  
**PRICE: (fitted with 6RP heads) £50/-.**

#### ALSO AVAILABLE

**MODEL 5C TAPE DESK** (to take 9 in. Reels)  
 Programme Time: 55 minutes at 7 1/2 i.p.s.  
 110 minutes at 3 3/4 i.p.s.  
**PRICE: (fitted with 6RP heads)**  
 Large Panel (20 in. x 14 1/2 in.) £47/10/-  
 Small Panel (13 1/2 in. x 15 1/2 in.) £45/10/-

**MODEL 5B TAPE DESK** (to take 9 in. Reels)  
 Programme Time: 31 minutes at 7 1/2 i.p.s.  
 62 minutes at 3 3/4 i.p.s.  
**PRICE: (fitted with 6RP heads)**  
 Panel size (13 1/2 in. x 15 1/2 in.) £42/-.

#### PORTABLE RECORDERS

In rexine covered case, fitted with model 5B tape desk, type D.2. C.J.R. amplifier with monitoring. Provision for external loud-speaker.  
**PRICE: £117/- (without microphone)**

High fidelity sound heads. Type 5RP (Record/Play) £3/5/- Type 6RP (super fidelity), £3/15/- Type 5E (Erase), £3/5/- Mumetal Screening cans, 8/6. Amplifiers, microphones. All types and sizes of magnetic tape.

Trade supplied.

Send for lists.

**BRADMATIC LIMITED**  
 STATION ROAD · ASTON · BIRMINGHAM 6

Telephone: East 2881-2

Grams: Bradmatic, Birmingham

## ASK ARTHURS FIRST

### ★ NEW VALVES

Send your enquiries for all Radio and Electrical goods, especially those in short supply.

We have probably the largest variety of valves in the country. Let us know your requirements.

#### AVO METERS IN STOCK

Avo Model 7 .....	£19 10 0
Avo Model 8 .....	£23 10 0
Signal Generator, Mains and Battery	
Models .....	£30 0 0
Electronic Test Meter .....	£40 0 0
Valve Characteristics Meter .....	£60 0 0

Also full range **TAYLOR METERS.** List on request.

#### VALVE MANUALS

Mullard .....	5 0
Osram .....	5 0
Osram, Part 2 .....	10 0
Brimar, No. 5 .....	5 0
Mazda, Part 2 .....	2 0
Mullard Valve Replacement Guide .....	2 6
Art and Science in Sound Reproduction by F. H. Brittain, D.F.H. 2 6	
Postage 6d. each extra.	

Leak TL/10 Amplifier and "Point One" Preamplifier complete .....	£28 7 0
Chapman Tuning Units .....	£16 0 0
Leak Tuning Unit .....	£35 6 3

Terms: C.O.D. or Cash with order. Goods offered subject to being unsold and to price alteration.

**NOW EXHIBITING AND DEMONSTRATING — HIGH FIDELITY SOUND REPRODUCTION**

*Arthur's*  
 PROPS: ARTHUR GRAY, LTD.

EST. 1919

GRAY HOUSE, 150-152 CHARING CROSS ROAD, LONDON, W.C.2  
 Temple Bar 5833/4 and 4765 Cables: TELEGRAY, LONDON



5 Harrow Road, Paddington, W.2

PADddington 1008/9 and 0401

OPEN MONDAY to Sat. 9-6. THURS. 1 o'clock.

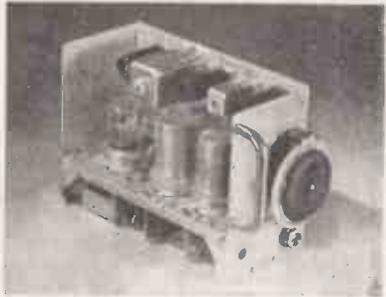
SEND STAMPS FOR NEW 1955 28-PAGE CATALOGUE

**"R.F. 26" F.M. CONVERTOR UNIT—88/100 Mc/s.**

We can now offer this self-contained Unit comprising 6 Valves—2-6BA6, EB91, VR137, EF54, EF54. Two I.F. stages and separate local oscillator, also Multithread graduated vernier drive assuring easy tuning.

**COMPONENTS OFFERED TO COMPLETE F.M. UNIT**

- New RF26 Unit with 3 valves VR137, EF54, EF54, £1/15/-.
  - Complete set of all components for conversion including 2 6BA6 and EB91, tuning condenser, I.F.T.'s Osc. and coils. Resistors and fixed condensers, plus wire and tag strips, £4/12/6.
  - Instruction Book with technical circuit and complete lay-out diagrams, 2/-.
  - Voltage required 250 v. 50 mA. 6.3 2 amps.
  - Special offer of all above items and RF26, including circuit, £6/5/-, postage 3/-.
- ALL ITEMS SOLD SEPARATELY**
- Charge for alignment when completed..... 7 8
  - Assembled, aligned and ready for use..... £8 10 0
- Call for demonstration.



**RADIO-GRAM CHASSIS**  
3 Wave-band Superhet. Med., long and short.  
5 Latest Type MULLARD Valves.  
4 Position Switching Gram., med., long, and short.  
Provision for Extension Speaker. A.C. Mains. 110/250 volts.  
Chassis 1 1/2 in. x 7 in. x 2 1/2 in. Scale Bin. Square. Or Chassis 1 3/4 in. x 6 1/2 in. x 2 1/2 in. Dial 10 in. x 5 1/2 in. PRICE £10/5/-.  
BRAND NEW AND GUARANTEED.  
CARR. PACKING AND INS. 10/-.

**14 WATT HIGH FIDELITY F.M. AND RECORD AMPLIFIER**  
200/250 volt A.C. First Quality Components only. Stewart Transformers and Chokes. Partridge Output Transformer. Bass and Treble Controls (Boost and Cut). Supply Socket for Tuner Unit. Ideal for Denco F.M. Feeder. 5 valves—6SN7, 6SL7, 6L6, 6L6, 5Z4. Complete ready for use.  
**BARGAIN PRICE £17/10/-.**

**MORSE PRACTICE KIT**  
Complete with buzzer, morse tapper and battery compartment on baseboard, 6/-, post paid.

**DENCO F.M. FEEDER UNIT**  
Finest Audio available. Complete kit of parts, including drilled chassis. 5 valves: types 6AM6, 12AH8, EB91 and 28A86. Also complete circuit and wiring diagram. £8/7/6. Or assembled and aligned, £8/10/-, Alignment only 10/-.

**G.E.C. RECORDING TAPE**  
600ft. Reels ..... 10/-

T.C.R. 1 mfd. £7,000 v. wkg., type CP58QO, Bakelite case, 7/6 each. B.I. 1.2,500 v. wkg., 4/-.

**TUNING CONDENSERS**  
.0005 Midget 24 x 1 1/2 x 1 1/2 in. .... 5/-  
.0005 Midget 24 x 1 1/2 x 1 1/2 in. with trimmers .. 6/6  
.0005 Standard Size, with trimmers ..... 7/6  
.0005 with 4-way push-button assembly ..... 7/6

**EF50 (VR91A)**  
The selected EF50, Red Sylvania, original boxes 10/- each, 90/- for ten.

**COMMUNICATION RECEIVER TYPE P.C.R.3**  
Brand new, in original cartons: 6 valves. EF39, R.F. stage. X61, Freq. Changer. EF39, 1st I.F. stage. EF39, 2nd I.F. stage. EBC33, Det. and L.F. amp. 8V8G, Output. Ranges: 12-41 metres; 41-120 metres; 200-560 metres. Aerial Trimmer control. Volume control and tone control.  
\*Power Supply Unit for 12 volt operation £2/15/-  
\*Power Supply Parts to convert to A.C. mains £1/17/6  
Limited quantity. £10/10/- P. & P. 7/6.

**NEON INDICATOR LAMP**  
Siemens type V1132. Diameter 1 1/2 x 1/2 in. Striking volts 80 v. S.P.B.C. 2/6 post free.

**PYE 45 Mc/s STRIP TYPE 3583 UNITS**  
Size 1 1/2 in. x 8 in. x 2 in. Complete with 45 Mc/s. Pye Strip, 12 valves 10 EF50, EB34 and EA50, volume controls, and hosts of Resistors and Condensers. Sound and vision can be incorporated on this chassis with minimum space. New condition. Modification data supplied. Price £5. Carriage paid.

**TR1196 RECEIVER**  
Receiver 27/73. This is a six-valve superhet receiver with 465 kc/s I.F.s. Complete with all valves: 2 EF39, 1 EK32, 2 EF36, 1 EBC33. In brand new condition with full conversion data. SPECIAL OFFER, 27/6, plus 2/6 carriage.

**INDICATOR UNIT TYPE 182A**  
Unit contains VCR517 Cathode Ray 6 in. tube complete with Mu-metal screen, 3 EF50, 4 8P61 and 1 5U4G valves, 9 wire-wound volume controls and quantity of resistors and condensers. Suitable either for basis of television (full picture guaranteed) or Oscilloscope. Offered BRAND NEW (less relay) in original packing cases at 67/6. Plus 7/6 carr. "Radio-Constructor" scope circuit included.

**3 SPEED RECORD CHANGER**  
Plays mixed records. Well-known manufacturer (list price £16/10/-). £9/19/6. carr. 5/-.

**R.F. UNITS**  
R.F.24 20/30 Mc/s ..... 15/-  
R.F.25 40/50 Mc/s ..... 19/6  
R.F.26 50/65 Mc/s ..... 35/-  
R.F.27 60/80 Mc/s ..... 35/-  
Brand new, carr. free.



(CASE REMOVED FOR ILLUSTRATION)

**TRANSMITTER/RECEIVER "38" WALKIE TALKIE SETS**

We have purchased large quantity of the above "38" Sets, and can now offer same complete in case with 5 valves 4-VP23 and ATP4, Throat Microphone, Headphones, Junction Box and Collapsible Aerial in absolutely new condition and guaranteed Air Tested. Freq. range 7.4 to 9 Mc/s. Range approx. 5 miles. Voltage 150 v. and 3 v. L.T. Set of batteries, leads and canvas carrying bag 25/-.

59/6 CARR. 5/-.

**CRYSTALS**  
200 kc/s, 2 pin, U.S.A. .... 10/-  
465 kc/s, 2 pin, U.S.A. .... 10/-  
500 kc/s, 2-pin British ..... 15/-  
Holders for U.S.A. Types 1/6.

**T/V. PRE-AMPLIFIER FOR LONDON AND BIRMINGHAM**  
45 meg. pre-amp unit complete with 2-VR91 (slight modification necessary) 17/6, p.p. 2/6.



**U.S.A. PACKARD-BELL PRE-AMPLIFIER**

Complete with 6L7GT-28D7GT, relay, plugs, condensers, etc. Instruction booklet. Brand new 12/6, p.p. 2/-.

**STROBE UNITS**  
Brand new in sealed cartons, these contain 6 EF50's, 5 EA50's, 1 8P61, a host of condensers, resistors, transformers, chokes, relays, switches, 7 pots and 5 smoothing condensers. Size 18 x 8 1/2 x 7 1/2 in. Only 58/6, carriage free.

**CRYSTAL MICROPHONE INSERTS**

8/6 POST FREE  8/6 POST FREE

Ideal for tape recording and amplifiers. No matching transformer required.

**CATHODE RAY TUBES**

VCR139A. 2 1/2 in. C/R Tube. Brand new in original cartons (carr. free) .....	£1 15 0
VCR97. Guaranteed full T/V picture (carr. 2/-) .....	£2 0 0
VCR517C. Guaranteed full T/V picture .....	£1 15 0
MU-METAL SCREENS for VCR97 or 517. P.P. 1/6 .....	10 0
6 in. ENLARGER for VCR97 or 517. P.P. 1/6 .....	17 6
VCR97. Brand new and crated—slight cut-off—Ideal for "Scopes. Limited quantity. Carr. 2/- .....	15 0

**RCA 931A PHOTO-ELECTRIC CELL AND MULTIPLIER**  
For facsimile transmission, flying spot telecine transmission and research involving low light-levels, 9-stage multiplier. Brand new and guaranteed, only £2/10/- Special 11-pin base, 2/-, Data sheets supplied. Replacements for Mazda 27M1 and 27M2.

**PHOTO CELLS G.S.18.** Brand new, 25/-

PLEASE ADD POSTAGE. ARTICLES UP TO 10/-, 1/-, £1, 1/6, £2, 2/-.

# GEE RADIO LTD.

**SCR-720 RADAR EQUIPMENT EX-U.S.A. CONSISTING OF THE FOLLOWING ITEMS:**  
**RADIO MODULATOR B.C. 1142A. RADIO FREQUENCY UNIT B.C. 1091AM. CONTROL BOX B.C.1150V. RECTIFIER RA-88-A. RECTIFIER RA-90-A AND POWER EQUIPMENT P.E.158B.**

**ALL THE ABOVE ITEMS ARE SOUND AND CLEAN AND FORM THE MAJOR PART OF THE COMPLETE SCR-720 SET AND OFFERED AT A FRACTION OF THE ORIGINAL COST. LIMITED QUANTITY AVAILABLE ONLY. PLEASE WRITE FOR FURTHER DETAILS, ETC.**

**50 WATT AMPLIFIER EX-GOVT.** With 4-KT66s in parallel push-pull Standard 200-250 v. mains input, A.C. Output impedance 600 ohms line. High imp., gram, and microphone input. Bass boost control fitted. This excellent quality amplifier is housed in a strong metal case and is ready for use. Our price £25, carriage paid.

**ELECTRIC LIGHT SLOT METERS.** 200-250 v. at 5-10 amps. 1/- in slot at 6d. per unit, by Measurement Ltd. All bakelite case, in very good condition. 50/-, p.p. 2/6.

**TELEPHONE L/SPEAKER No. 2 (By Vitavox).** Semi-re-entrant all-metal. H/Duty 6in. P.M. 15 ohms S/Coil, with 600 ohm built-in line transformer, housed in a strong wooden case. £1/5/-, carriage 5/-.  
**VITAVOX PRESSURE UNITS.** Heavy duty, P.M. 20 watts. Brand new. £4/9/6, carriage 5/-.

**ROTARY CONVERTERS.** 12 v. D.C. input, 230 v. A.C. 50 cycles output at 100 watts. Brand new. £4/17/6. Ditto 24 v., same price, carriage 7/6.

**RA-88 RECTIFIER UNIT (PART OF SCR.720) EQUIPMENT.** Containing the following valve line-up: 3-6L6 metal valves, 3-5T4 metal valves. 2-6SL7gts, 2-VR150/30s, etc., etc. Bargain value at £4/19/6, carriage 5/-.

**A.C./D.C. SUPPLY UNIT.** (S.T.C. Selenium rectifier). Complete with mains isolation transformer, fixed and housed in strong metal cabinet. 250 v. A.C. at 200-220 v. D.C. at 3-4 amps. Ready to use for £8/10/- only, carriage 10/-.

**R.1155 COMMUNICATION RECEIVERS.** Individually tested and despatched in good working order. Cases slightly soiled, £8/19/6, brand new, £10/19/6.

**RECEIVER TYPE 109.** In good condition. Freq. range 1.8-3.9 mc/s and 3.9-8.5 mc/s continuous. Designed to operate on 6 v. battery. Limited quantity only, £4/7/6, plus 10/- carriage.

**CATHODE RAY TUBES.** Type 3BP1, 3in. new and unused with base and screen, 42/6, p.p. 2/- Type VCR138 (ECR35), 3½in. with screen and base, in new and unused condition, 42/6, p.p. 2/- Type VCR97, 6in., ex-equip., in good order, 20/-, p.p. 3/6. VCR131, lin. C.R.T. new and in perfect condition. Miniscope replacement tube, etc., 35/-, p.p. 1/- Type CV1526, 2½in., 4 v. filament, 3,000 v. anode. Complete with base and mu-metal screen, 20/-, p.p. 2/6.

**PHOTO ELECTRIC MULTIPLIER CELLS. TYPE 931A, £2/10/-, p.p. 1/-.** Also 931A complete on chassis with multiplier network and 2-832 valveholders, etc., £3/10/-, p.p. 2/-.

**PAINTON PLUGS AND SOCKETS (MIN. JONES).** All types available. Delivery ex stock. Please let us quote you.

**L.M.S. SMALL COIL PACK.** Size 2½in. x 2½in. x 1½in. Very good quality, with circuit diagram. 19/6 each only. Every one guaranteed.

**CERAMIC WAVE-CHANGE SWITCH (WEARITE).** One-pole 12 position 2 bank, 7/6, p.p. 1/-.

**813 CERAMIC VALVE HOLDERS.** 9/6 each, p.p. 6d. Also 4-pin large "Jumbo" ceramic valve holders, 6/6 each, p.p. 6d.

**B.C.614A SPEECH AMPLIFIER (Part of V.C.610 Equipment).** As new, £25.

**EVERSHED AND VIGNOLES (EX-G.P.O.) HIGH-RANGE CONSTANT PRESSURE MEGGER.** 5 meg-1,000 meg-infinity. In good working condition. Housed in wooden case, £7/10/-, carriage 10/-.

**EVERSHED AND VIGNOLES 250 v. LOW RANGE BRIDGE MEGGER.** 5,000 ohms-20 megs.-infinity. Finished as above, £7/10/-, carriage 10/-.

**CRYSTAL CALIBRATOR-MARCONI (EX-GOVT.)** Freq. range: 170-240 Mc/s. Perfect condition, complete with instruction book and spare valves. Standard input, 200-250 v. A.C. at 50 cycles. £6/19/6. Carriage extra.

**AN/APA-1 CATHODE RAY INDICATOR AMPLIFIER UNIT.** Complete, comprising 3BP1 C.R.T., 7-6SN7gts., 1-6H6, 1-6G6, 1-2X2. 1-6X5, valves. Bargain value, £4/19/6, plus 10/- carriage.

**TELESCOPIC AERIALS.** Min. length 12in., max. length 48in., suitable for car radio aerials. 8/6 each, p.p. 9d.

**HALF MILE OF TWIN DON "8" TELEPHONE WIRE** Brand new, on wooden drums, £2/12/6, per drum, carriage 10/- extra, England only.

**TRANSMITTER-RECEIVER 1142A or 1430.** Complete Unit (less crystals and power supply). In very good condition. This transmitter, which until recently was extensively used by the R.A.F. has a very wide frequency range and is offered at the ridiculously low price of £9/19/6, carriage 10/-.

**TIME SWITCHES (NEWBRIDGE).** 250 v. A.C. Synchronous 5 amp. Used but good working order, 39/6, p.p. 2/6.

**CRYSTAL CALIBRATOR BY MARCONI INSTRUMENTS.** Brand new and unused, complete with spare set of 5 valves and operating manual. Frequency range: 170-240 mc/s. Accuracy: 1 part in 10,000. Our price £7/9/6, carriage 10/-.

**AMERICAN HIGH FREQUENCY SIGNAL GENERATORS.** Type 122A, input: 110 v. A.C. Frequency range 8-150 mc/s. and 50-230 mc/s. New and unused £30, carriage 10/-.

**MANY OTHER LINES IN STOCK. YOUR ENQUIRIES INVITED. TRADE SUPPLIED.**

**15 LITTLE NEWPORT ST., LONDON, W.C.2.**

GERrard 6794/1453

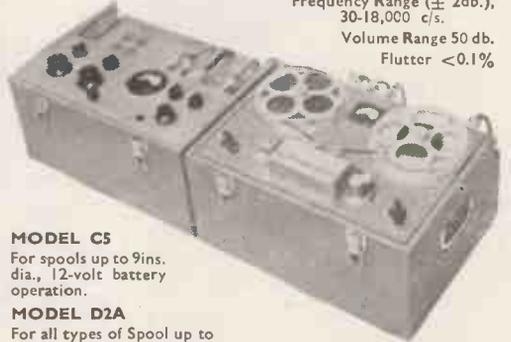
## LEEVERS RICH

HEAVY DUTY

# MAGNETIC TAPE RECORDER

for Industrial and Professional Use

Frequency Range ( $\pm 2$  db.),  
30-18,000 c/s.  
Volume Range 50 db.  
Flutter <0.1%



### MODEL C5

For spools up to 9ins. dia., 12-volt battery operation.

### MODEL D2A

For all types of Spool up to 11½ins. dia. A.C. operation

### MODEL D2B

For all types of Spool up to 11½ins. dia., 12-volt battery operation

Prices from £365 complete

All of these models may also be supplied with  
**SYNCRULSE (prov. pat.) INTERLOCK SYSTEM**

**LEEVERS-RICH EQUIPMENT Ltd.**

Please note new address :

**78, Hampstead Rd., London, N.W.1. EUSton 1481**

## Transformers

## Transformers

## Transformers

## QUALITY-RELIABILITY

For the Mullard Amplifier.  
 For the Osram 912 Amplifier.  
 For the Williamson Amplifier.  
 C. R. Tube Isolation Transformers.  
 Instrument Transformers,  
 and all popular types.

FROM

## Ellison Transformers

LIMITED

62, BRIDGE ST. NORTHAMPTON  
 AND ALL LEADING COMPONENT DEALERS

**PROOPS BROS. LTD.**  
now offer you

*The Walk-around Shop*

**A MULTIRANGE AC/DC TESTMETER** of well known American manufacture

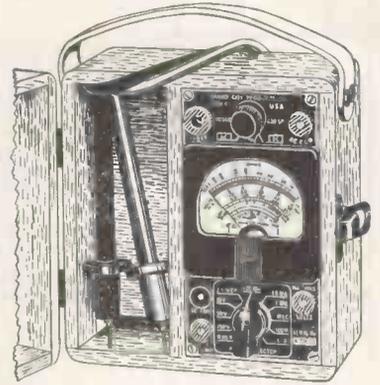
This testmeter has a basic movement of 400 microamps and is calibrated for use on the following ranges :—

A.C. and D.C. Volts 0 to 5,000 V. in 6 switched ranges.  
D.C. Current ranges 0-1mA, 1-10mA, 10-100mA and 100mA-1 Amp.  
Use as an OHMMETER (Resistance Measurements) .1 ohm to 1 megohm.

Decibels from -10db to +15db. For line load impedances from 5 to 1,000 ohms (directly calibrated for 500 ohm line).

This instrument is contained in a well finished polished wood case with leather carrying handle. Leads and test probes are housed in the case which measures 6½in. x 6½in. x 4½in.

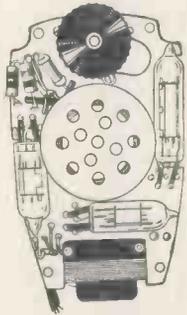
All meters fully tested before despatch. Supplied complete with moulded test probes, full operating instructions and circuit diagram.



**£4.19.0**  
(Packing & postage 3/-)

**Miniature POCKET RADIO**

incorporating high "Q" technique using the New Ferrite rod. Made possible by simple conversion of the "Medresco" Deaf Aid.



RADIO MINDED AMATEURS will at once grasp the interesting possibilities of this unique unit. Good reception (without using a trailing aerial) of broadcast programmes in home, office, cycling or hiking, etc.

FOR DEAF PEOPLE. The "Medresco" Deaf Aid in perfect working order is also available with miniature earphone and moulded ear insert for ONLY 35/9, post 1/-. Batteries 5/- extra. See details opposite.

THE COMPLETE KIT OF PARTS includes a Type OL10 Deaf Aid (with Crystal Microphone) in perfect working order and miniature earphone with moulded ear insert attached; Ferrite rod 4in. x 5/16in. dia., germanium diode, components. Conversion details, circuit diagram and full instructions free with every Kit.

**£2.6.0** Post Paid

Batteries extra:  
1.5v. L.T. (Type D 18) 8d.  
30 v. H.T. (Type B 119) 4/3.



3½" x 2½" x 1"

For technical Information, see whole page advertisement in MAY issue.

**24-VOLT D.C. MOTORS.** 0.4 A. Size 2in. x 2in. x 2½in. 5/32in. spindle extending ½in. 4-pole field. Brushes at 90°. External connections to field and armature. Will run on A.C., 6/6, plus 1/6 postage.

**AMPLIFIER UNIT Ex-TR1143A.**—A 3-stage transformer coupled amplifier. Push pull VT52s output to modulate push pull VT501s. Circuit diagram free. Price, less valves, 4/6 post paid.

**TRANSMITTER UNIT Ex-TR1143A.** Suitable for conversion to 2 metres. Circuit diagram and coil conversion details supplied free. Price, less valves, 5/-, post paid.

**RECEIVER UNIT Ex-TR1143A.**



Suitable for conversion to 2 metres and F.M. Wrotham. Circuit diagram free.

Price—less valves, 9/-, post paid.

**70 cm. UNIT.** Brand New consisting of pair of tuned lines. 2 acorn valve holders, coarse and fine tuning. Suitable for mixer or oscillator unit. Size 5in. x 3½in. x ½in. 6/6 post paid.

**CONDENSERS.** U.S.A. Manufacture. 10 mfd. 600 v. wkg. (Solar) size 5in. x 4in. x 1½in. with Stand-off Insulators 8/6. 4 mfd. 1,000 v. wkg. (Cornell Dubilier) 2½in. x 4½in. x 1in. Stand-off Insulators 5/6. 1 mfd. 1,000 v. wkg. (Aerovox) 2in. x 2in. x 1in. 2/6. 1 mfd. 600 v. wkg. (Cornell Dubilier) 1½in. x 1½in. x ½in. 2/-, 8 x 8 mfd. 475 v. wkg. (Sprague) electrolytic 1½in. tubular 3/-, NOTE: Prices include postage.

**SPECIAL PURPOSE VALVES:** 713A VHF triode (Door knob type) 9/-, GL446A Disc Sealed triode (Lighthouse Tube) 25/-, 6SN7 6/9, 6SL7 6/9, 6SQ7 7/-, 807 (American) 6/6, VT 52. (EL32) 7/-, TT.11 (VT 501) 5/-, NOTE: Prices include postage.

**AMERICAN CAMERA DRIVE MECHANISM.** with 24 volt D.C. motor 5in. x 3in. dia. Shaft 1½in. x ½in. dia., metal box 5½in. x 4in. x 2in. containing a number of useful gears. 24 v. solenoid, overload trip, micro switch, etc. 15/- post paid.

**BATTERY HYDROMETER.** Ball type No. 1. 1/6 post paid.

**TEST SET 87** Made by famous instrument maker. Available complete including:—  
**POWER PACK.** 200/250 v. 50 cycle Power Pack. Fully smoothed, 250 v. 50 mA., with 6.3 v. 4½ A., L.T.

**R.F. OSCILLATOR.** RL18 oscillator 150-300 Mc/s; easily altered to TV or FM Bands with the use of 4 inches of tinned copper wire.

**MODULATOR AMPLIFIER.** Two-valve Modulator/Amplifier for RL18.

**PULSE AMPLIFIER.** Six-valve Pulse Amplifier using VR65s.

**TEST SET 87** can easily be altered to TV **PATTERN GENERATOR** or to **WIDE RANGE RC AUDIO OSCILLATOR** as fully described in M. G. Scroggie's articles in "Wireless World" issues dated August and September 1949. Circuit diagrams available at 2/6 each.

**TEST SET 87** is housed in a robust steel cabinet 23in. x 8½in. x 10in. high, copper plated and stove enamelled; fitted with chrome handles.

**An exceptionally fine bargain.**  
**PRICE, Complete with 10 valves (5Z4G, RL18 and 8 VR65s)** Carriage 10/-

**VHF AERIALS** (Sword type). Mounted on Bakelite Base 3in. dia. Ref. 110BB/879. 2ft. overall length, 7/6 post paid.

NOTE: Orders and Enquiries to Dept. 'W.'

Shop hours: 9 a.m. to 6 p.m.

Thursday: 9 a.m. to 1 p.m.

OPEN ALL DAY SATURDAY

**PROOPS BROS. LTD.**

*The Walk-around Shop*

52 TOTTENHAM COURT ROAD · LONDON · W.1

Telephone: LANgham 0141

# MODERN ELECTRICS LTD.

164 Charing Cross Road, London, W.C.2.

Tel.: TEMple Bar 7587.

Cables: Modcharex, London.

Prompt attention to post orders.

Export enquiries welcomed.

Immediate delivery from stock.

**TAPE RECORDERS**

GRUNDIG TK12	£73	10	0
GRUNDIG TK819	£99	15	0
GRUNDIG TK9	£68	5	0
FERROGRAPH 2A/N	£79	16	0
VORTEXION 2A	£84	0	0
VORTEXION 2B	£99	0	0
SUPER EDITOR	£57	15	0
ACE (Battery)	£52	0	0

**RECORDING TAPES**

GRUNDIG			
L.G.S. 1,200ft.	£2	0	0
850ft.	£1	14	0
600ft.	£1	5	0

**FERROVOICE**

1,200ft.	£1	2	6
Spare Spools		4	6
E.M.I. type 88, 1,200ft.	£1	15	0
E.M.I. type 88, 600ft.	£1	1	0

**GEVAERT**

1,200ft.	£1	15	0
----------	----	----	---

**SCOTCH BOY**

1,200ft.	£1	15	0
600ft.	£1	1	0
Spare Spools 1,200ft.		4	3
Spare Spools 600ft.		3	6

**FERROGRAPH**

1,200ft.	£2	5	0
1,750ft.	£3	3	0
8 1/2 in. Spools		9	6

**AGFA**

1,200ft.	£1	17	6
600ft.	£1	2	6
Lead on tape 150ft.		8	0

**RECORD REPRODUCING EQUIPMENT**

**COLLARO TRANSCRIPTION**

Model 2000	£13	9	6
Model 2010	£18	3	6

**GARRARD UNITS**

RC80M AC	£17	9	6
RC80M AC/DC	£26	3	5
301 Transcrip	£25	3	6
Type TA/AC	£10	16	0
Type TA/D w th Decca heads	£14	0	11

**CONNOISSEUR**

Variable 3 speed	£25	15	5
------------------	-----	----	---

**SPEAKERS**

**W.B. STENTORIAN**

HF.610	£2	10	6
HF.810	£3	0	6
HF.912	£3	9	6
HF.1012 tapped coil, 3, 7.5 or 15 ohms...	£3	17	6

**GOODMANS**

Axiom 150 Mk. II	£10	5	6
Axiom 102	£9	18	2
Axiom 101	£6	12	1

**WHARFEDALE**

W15 CS	£17	10	0
Super 12 CS/AL	£17	10	0
W12 CS	£9	15	0
Golden 10 CSB	£8	6	7
Super 5 and 8 CS/AL	£6	13	3
Bronze 10in.	£4	12	9
Bronze 8in.	£3	4	0
W.B. Crossover Unit	£1	10	0
W.B. Tweeter Unit	£4	4	0

**TEST EQUIPMENT**

**AVO**

Model 8	£23	10	0
Model 7 (latest)	£19	10	0
Unimirror Mk. II	£10	10	0
Electronic Meter	£40	0	0
Wide Band Sig/Gen	£30	0	0
Valve Characteristic Meter (new type)	£60	0	0
D.C. Minor	£5	5	0
10KV Multiplier for Model 8	£3	5	0
Carrying Cases for Models 7, 8 and 40	£3	0	0

**ADVANCE**

H.1 (Sig/Gen)	£25	0	0
E.2 (Sig/Gen)	£28	0	0
P.1	£19	19	0

**COSSOR**

Oscilloscope 1035	£120	0	0
Oscilloscope 1052	£104	0	0
Volt: Calibrator 1433	£18	5	0

**TAYLOR**  
All new Taylor Test Gear in stock.

**PICK-UPS**

**ACOS Hi G 20** ..... £3 8 4

**DECCA**  
X.M.S. Magnetic ... £6 9 5

**CONNOISSEUR**  
Super L/weight ..... £9 9 11  
Spare Heads ..... £3 7 10

**COLLARO STUDIO**  
Type O or P ..... £3 14 8

**LEAK**  
2 Heads with Diamond Stylus ..... £20 19 9

**MICROPHONES**

**ACOS**

Mic 22 (Crystal)	£2	2	0
Mic inserts for above	£1	0	0
Mic 16 (Crystal)	£12	12	0
Mic 35-1 (Crystal)	£1	5	0

**LUSTRAPHONE**  
M/C High Imp. .... £5 15 6

**RESLO**

URA Ribbon	£7	5	0
RVA Ribbon	£9	0	0
VMC (low imp.)	£6	0	0

**FILM INDUSTRIES**  
Ribbon ..... £10 0 0

**MICROPHONE STANDS**

Floor, 3 extensions	£3	12	6
Table Stand	£1	5	0

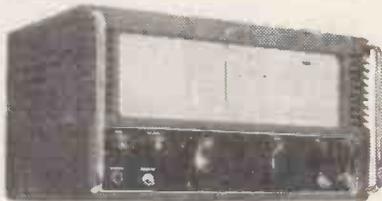
**LEAK AMPLIFIERS**

TL.10 complete	£28	7	0
Point 1, TL.12	£28	7	0
Point 2, TL.25	£34	7	0

**QUAD, Mk. II** ..... £42 0 0

**SOLOIN, New Instrument Iron 200-250 v. 25 w.** ..... 19 8

**ALL GARRARD, CONNOISSEUR, DECCA and COLLARO HEADS, SAPPHIRE and DIAMOND STYLII for the above HEADS NOW AVAILABLE**



**EDDYSTONE COMMUNICATION RECEIVERS**

Now available on attractive Hire Purchase Terms.

Model	Cash Price	Deposit	Monthly
740	£42 15 0	£8 11 0	£3 2 10
840A	£49 0 0	£9 0 0	£3 13 4
750	£68 0 0	£13 12 0	£5 0 0
680	£106 0 0	£21 4 0	£7 15 6

Installments are for 12 months.

The model illustrated is the new 840A. All models are for A.C. operation except the 840A which is A.C./D.C. 110/250 v. making it especially suitable for universal use. Descriptive literature of all models gladly forwarded.

Latest Eddystone Component Catalogue 1/-.

**The**  
**Eddystone**  
**Specialists**

**RADIO SERVICES LTD.,**

55 COUNTY ROAD, LIVERPOOL, 4  
Telephone: AINTREE 1445 ESTAB. 1935  
Branch Address: MARKET CROSS, ORMSKIRK

## MAGNETIC RELAYS

### The P.O. 3000 TYPE

remains the most popular and widely used relay of all.

#### THOROUGHLY RELIABLE AND BUILT TO SPECIFICATION

*Tropical or jungle finish if required*

Prototypes at short notice and reasonable deliveries on quantities.

Stocks also held of A/C relays, high-speed, sealed and open.

#### ★ LARGE STOCKS OF KEY SWITCHES ★

#### ELECTRO MAGNETIC COUNTERS

P.O. MAJOR TYPE

Any D/C resistance 17/6 each

## JACK DAVIS (RELAYS) LTD.

PERCY STREET · LONDON · W.1

MUSEUM 7960

LANGHAM 4821

# Best Buy at Britain's

**COMMUNICATIONS RECEIVER ADMIRALTY TYPE B.28 (MARCONI CR.100).** Valve line up 2 RF, F.C. separate local Osc., 3 I.F.s, 2nd Det., Output, B.F.O. and rectifier. Self contained power supply 200/250 volts A.C. 50 c/s. Variable selectivity (crystal filter). 6,000, 3,000, 1,200, 300 and 100 cycles. Frequency coverage 60 kc/s to 30 Mc/s in six ranges, continuous except for gap between 420 to 500 kc/s. Size 16in. x 13½in. x 12in. Weight 82 lb. The set for the serious operator. Thoroughly overhauled in superb condition, complete with new valves and air tested prior to despatch. A real bargain at only £30 plus £1 carriage.

**TRANSMITTER TYPE I2** Frequency coverage 1.2 to 17.5 Mc/s in four bands. M.O., Buffer, P.A., 2 stage Modulator, built-in stabilised A.C. mains power pack, P.A. Anode current meter M.C.W., C.W., and R.T. operation. V.F.O. or crystal controlled. Super "Table Topper" size 24in. x 12½in. x 17½in. Weight 134lb. Complete with all valves ready for operation. In first-class condition and tested before despatch, with circuit and full instructions. Only £20 plus £1 carriage. Can be demonstrated to callers.

**COMMUNICATIONS RECEIVER R155 BRAND NEW "MINT" condition, in ORIGINAL MAKERS' TRANSIT CASES.** R155A, £11/19/6 R155B with super slow-motion drive, £12/10/- R155A, shop soiled models, as new, £9/19/6 Used models £7/19/6 "L" and "N" MODELS. Cover trowler and shipping bands. Excellent condition £17/19/6 Carriage on all models 10/6 extra. All receivers supplied with FREE BOOKLET giving circuit data and details of the power pack required for A.C. mains. Full re-aligned and aerial-tested before despatch and gladly demonstrated to callers. Send S.A.E. for full details of power packs and receivers or 1/3 for booklet, D/F. Loops and Visual Indicator Meters available.

**A.C. MAINS POWER PACKS AND OUTPUT STAGE.** Enable the R.155 to be used to operate speaker from 200/250 volts A.C. without ANY MODIFICATION WHATSOEVER. All our power packs have heavy duty transformers, are complete with leads and Jones plugs and are guaranteed for 6 months. **Type A** In smart black metal case, size 8½in. x 4½in. x 6½in. less speaker, price £4/10/- plus 3/6 carriage. **Type B** With built-in 5in. speaker in black metal case size 13½in. x 5½in. x 7½in. Price £5/5/- plus 3/6 carriage. **Type C** With an 8in. speaker in specially designed beautiful black crackle cabinet speaker to match receiver, size 11½in. x 10½in. x 6in. A de Luxe job. Price £6/10/- plus 3/6 carriage. **NOTE: 10% REDUCTION WHEN PURCHASING ANY OF THE ABOVE POWER PACKS WITH RECEIVER.**

**ERIE HI-K CERAMICONS.** 1,000 pfd. 4 B.A. chassis mtg. Particularly suitable for V.H.F. decoupling, etc. Price 10/6 dozen.

**SYLVANIA STANDARD OSCILLOSCOPES** Type 112. For 115 or 230 v. 50 or 60 c/s. A.C. Mains. Controls:—Focus, Brilliance, X and Y Shift, X and Y Amp. Gain. Sync Selector, Sync Phase, Time Base Coarse and Vernier, 15 c/s. to 30 Kc/s., X and Y. plates direct or attenuated. Push-pull deflection 5in. green trace C.R.T. Stabilised H.T. supplies, no electrolytic capacitors. Contained in handsome black crackled case, size 15½ x 10 x 19½in. In first class working order and condition. Price £30

**COSSOR GANGING OSCILLATORS.** A.M./F.M. Sig. Gen. covering 70 Kc/s. to 20 Mc/s. in five ranges. Standard A.C. mains input. In good condition. For callers, (only few available). Price £4/19/6

**U.H.F. SIGNAL GENERATORS by R.C.A. TYPE 710A.** Cover 370 to 560 Mc/s. Large directly calibrated dial. Carrier level and 400 c/s. modulation monitored by large 200 micro-amp. meter. Precision piston attenuator. For A.C. mains operation 117 volts 50/60 c/s. Complete with instruction manual. BRAND NEW. £35.

**OSCILLATOR BEAT FREQUENCY No. 5** manufactured by Furzhill for the Admiralty. Range 0-10,000 cycles. Complete with seven valves—push-pull 6V6 output giving 2 watts into 600 or 10 ohms. The output is monitored by moving coil meter. For operation on A.C. mains 100-250 volts. Contained in handsome metal instrument case, size 17½in. x 9in. x 11in. With circuit diagram and operating instructions. In perfect condition and tested prior to despatch. A laboratory instrument for ONLY £12/10/-, plus 10/- carriage.

**E.M.I. OUTPUT METER.** Desk type Incorporating a 2½in. 1 mA. meter together with instrument rectifier, etc. 2 ranges 0-500 milliwatts and 0-5 watts and decibel scale. Brand new in original manufacturers' boxes with instructions. Price 35/-, post 1/6.

**METER BARGAINS, ALL BRAND NEW**  
 15 v. (50~) mov. iron 2½in. pnl. mtg. ... 8/6  
 3,500 volts moving coil 3½in. projection 10/-  
 150 milli-amp. 2in. sq. pnl. mtg. .... 7/6  
 5 milli-amp. moving coil 2in. sq. pnl. mtg. 7/6  
 20 amp. moving coil 2½in. dia. .... 7/6  
 1 mA. 2½in. barrel flush pnl. mtg. .... 22/6  
 1 milli-amp. 2½in. barrel desk type .... 25/-  
 100 micro-amps. barrel pnl. mtg. scaled 0-1,500 in 15 clear divisions. Only ..... 42/6  
 500 mA. Thermo Couple 2in. sq. pnl. mtg. 5/-

**METER RECTIFIERS.** 1 mA. Salord Instruments, 8/9 5 mA. Salford Instruments, 6/9 2 mA., S.T.C. as used in E.M.I. Output Meter, 5/6 All are full wave bridge and brand new.

**HOUR METERS.** 200-250 volts 50 c/s. 4½in. diam. Direct reading 1/10 to 10,000 hours in five scales. Indicates the time any A.C. mains operated apparatus has been in use. Ideal for life testing, process timing, etc. BRAND NEW and BOXED, 39/6 each.

**VALVE VOLTMETERS.** EX-R.A.F. Operate from standard A.C. mains, stabilised H.T. supply. Three ranges: 50/200/500 volts D.C. Meter employed 2½in. 1 mA. F.S.D. Contained in handsome wooden instrument case size 14in. x 8½in. x 9in. Complete with all valves and tested prior to despatch. In brand new condition and a real bargain at only 79/6 plus 5/6 carriage.

**HEAVY DUTY L.T. TRANSFORMERS.** Standard tapped primary. Type A, 30 v. 36 Amp. or Type B, 50 v. 16 amp. Size 6in. x 5½in. x 8in. high. Weight 24lb. BRAND NEW, not ex-Govt. Suitable for soil heating, rectifiers, chargers, etc., special offer, 55/- each, plus 5/- carriage.

**EX-ADMIRALTY.** Primary 250 v. 50 c/s. Secondary 5-0-5 v., 5-0-5 v., and 5-0-5 v., all at 5 amps. each winding. This means, in effect, that you can have 5, 10, 15, 20, 25, 30 v. at 5 amps. or other possible combinations. Size 4½in. x 4½in. x 6in. high. Weight 12lb. BRAND NEW. A very useful transformer at only 39/6.

**EX-ADMIRALTY.** Primary 230 v. 50 c/s. Secondary 620-550-375-0-375-550-620 v. (620 v. at 200 mA., 550 v. at 250 mA.). Two rectifier windings at 5 v. 3 amps. each. Total rating 278 vA. Upright mtg. weight 24lb BRAND NEW, 42/6.

**E.H.T. TRANSFORMERS.** For VCR97, etc. Mains input. Output 2,500 v., 4 v., 2 a. and 2-0-2 v. at 2 a. Fully guaranteed at 35/- plus 2/- postage. SPECIAL SURPLUS SNIP, 230 v. 50 c/s. input. 2 kV. R.M.S. output (2.8 kV. when rectified). Size 2½in. x 2in. x 3½in. high. Upright mtg. ONLY 15/- plus 2/- postage.

**EX-MANUFACTURERS' SURPLUS.** Drop through type. Pri. 200-250 v. 50 c/s. Secondary 310-0-310 v. 70 mA., 6.3 v. at 3 a., 4 v. at 2 a. Can be used with either 4 or 6.3 volt rectifier. Only 9/6 plus 1/6 postage. A similar type, 325-0-325 v. 100 mA., 6.3 v. 4 a., 4 v. 2 a., supplied to callers only, 12/6 each.

**BLOCK CONDENSERS.** 8 mfd. 600 v. D.C. wkg. at 71° C. size 4 x 2 x 4½in. high. Very suitable for all good quality amplifiers, etc. Brand new. Price 5/- each.

**RF UNITS. ALL BRAND NEW and BOXED.** RF24, 20-30 Mc/s, 12/6. RF25, 40-50 Mc/s, 17/6. RF26, 50-65 Mc/s, 29/6 and RF27, 65-85 Mc/s., 32/6.

**X'TALS**  
 465 kc/s. S.T.C. ½in. pins suitable for crystal gates, IF checking, etc. Brand new, boxed 10/- each.  
 200 kc/s American G.E.C. ½in. pins suitable for crystal calibrators, etc. Brand new, boxed, 10/- each.  
 100 kc/s ½in. pin spacing. British ex-new units, 15/- each

**RACKS** 6ft. "U" channel P.O. type for 19in. panels, heavy angle base. Price 79/6, plus carriage at cost.

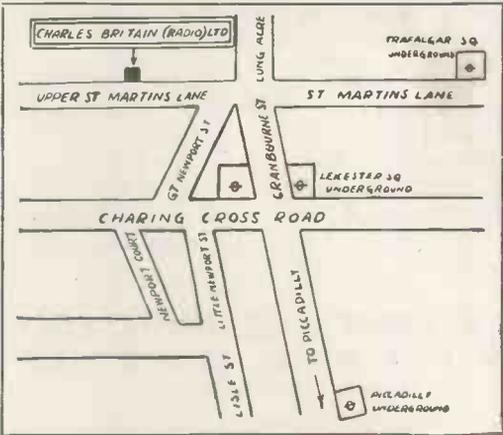
**H.R. HEADPHONES.** Consist of two high resistance earpieces with adjustable metal headbands. Price, less cord, 6/6.

**HEAVY DUTY POTENTIOMETERS** Wire-wound on porcelain former, 2½in. diam. 20 W. 1,200 ohms, 6/6 each. Colvern-type wire-wound 5,000 ohms, 2½in. diam. 7/6 each.

**U.S.A. CHOKES.** Upright mtg. Black crackled, 4½ x 3 x 4in. high. 10 H. 200 mA. 100 ohms. 12/6 each.

**METAL RECTIFIERS.** Heavy duty, funnel cooled. Two units required for bridge. Size 12 x 12 x 4½in. Input 36 v. R.M.S. Output 50 amps. £7/10/- per pair, plus 5/- carriage. BRAND NEW. Ex-Govt. Selenium, 300 v. 100 mA., 7/6 each. 60 mA. ditto, 5/6 each. 12 V. 1 amp. full wave bridge, 7/6 each, 100 v. 1 mA., K/34 S.T.C. 6 for 7/6 (minimum).

**BARGAINS, BARGAINS, BARGAINS. HUGE STOCKS OF COMPONENTS, RECEIVERS, VALVES, AT SPECIAL REDUCED PRICES FOR CALLERS.**



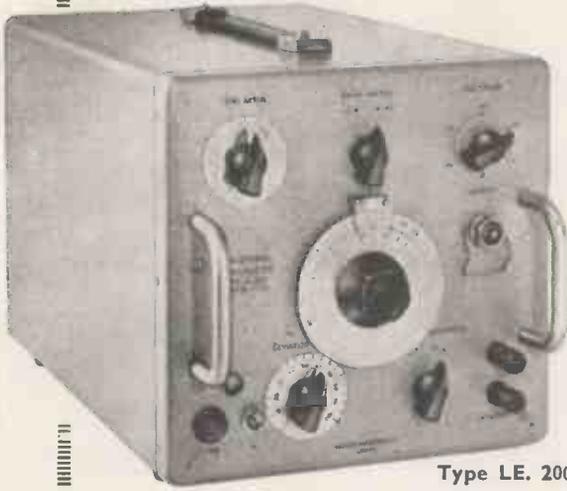
## CHARLES BRITAIN (Radio) Ltd.

11 UPPER SAINT MARTIN'S LANE LONDON, W.C.2. TEMple Bar 0545

One Minute from Leicester Sq. Station (up Cranbourn St.) Shop Hours: 9-6 p.m. (9-1 p.m. Thursday) Open all day Saturday



# a new F.M. SIGNAL GENERATOR



Type LE. 200

**NOTE:** A suitable Crystal Controlled Marker Generator will be available shortly which provides very precise alignment of F.M. Receivers.

★ **Two Frequency Ranges**—I.F. 2-20 Mc/s.  
R.F. 80-104 Mc/s.

★ **Modulation:**

Sinewave—Frequency 500 c.p.s.  
Deviation variable  $\pm$  0-100 kc/s.  
Sawtooth—Frequency 100 c.p.s.  
Deviation fixed 450 kc/s (peak-to-peak).  
Amplitude modulation less than 1%.  
The deviation is substantially linear.

★ **R.F. Output**—Variable from  $1\mu$ V-100 mV.  
Output impedance 75 ohms.

★ **Mains Operated.**

This F.M. Signal Generator is primarily designed for production testing and servicing of the new F.M. Receivers operating at the frequencies used by the B.B.C. The 100 cycle sawtooth waveform of fixed amplitude gives a peak-to-peak excursion of 450 Kc/s. An output of 160 volts at the "X" Plates Sockets on the Signal Generator gives sufficient "X" deflection for most Oscilloscopes. Visual alignment of the selectivity curves and discriminator characteristics can easily be obtained with this Signal Generator.

OUR ONLY ADDRESS

**HATFIELD INSTRUMENTS LTD.** 175, UXBRIDGE ROAD, HANWELL, LONDON, W.7

Telephone: EALing 0779 & 9857



**STL**

*Hermetically  
sealed  
transformers  
for  
tropical  
conditions*

## STL TRANSFORMERS

incorporate sound design and are manufactured to the highest standards called for in the electronic and communication fields. Consult us for your next transformer requirements.

**STEWART TRANSFORMERS Ltd.**

75 KILBURN LANE, LONDON, W.10 · LADbroke 2296/7



## TELEPHONE EQUIPMENT

Brand new and boxed American Desk telephones with built in ringer complete with handsets as shown. 59/6.

Ditto:— of English manufacture, complete with distributor boards. 49/6 each.

Telephone Secrecy Equipment:— Army No. GAC-YBO2700. Complete frequency scrambler units for secret telephone conversations which cannot be tapped or overheard, for operation from 230 v. A.C. or 12 volt D.C. Offered in brand new condition at a fraction of their original cost. £5 each. Limited number only available.

**G. W. SMITH & CO. (RADIO) LTD.**  
3-34, LISLE STREET, LONDON, W.C.2

Telephone: Gerrard 8204/9155.

# G.W. SMITH & CO (RADIO) LIMITED

Phone: GERRARD 8204/9155  
3-34, LISLE ST., LONDON, W.C.2.

**TRADE ENQUIRIES  
INVITED**

**FOR ALL RADIO BARGAINS**

**WE PURCHASE ALL TYPES OF  
RECEIVERS AND TEST GEAR**



**RI155 COMMUNICATION RECEIVERS.** Individually aerial tested. Brand new in original transit cases, £11/19/6 each. Brand new but shop soiled, £9/19/6 each. A combined power pack and audio output stage for A.C. mains, can be supplied with a receiver for an extra cost of 7/6.

**DEAF-AID VALVES.** Brand new "Raytheon" CK505AX equivalent to DF70, 2/6 each. Holders 6d each.

**METER SWITCHES.** Standard "Yaxley" type, 8 bank, single pole, 9, 11 or 12 way, 7/6 each.

**AMERICAN POWER RHEOSTATS.** Brand new and boxed. 8 ohm, 3.3 amp., 8/6 each; 8 ohm, 2.5 amp, 7/6 each; 60 ohm, 1.3 amp, 7/6 each; 90 ohm, 0.74 amp, 7/6 each; 200 ohm, 0.3 amp, 5/6 each. Ideal for train, model or charging control.

**METERS.** All brand new and boxed. 0-50 m/a. 2in. square, F/M., M/Coil, 7/6. 0-100 m/a., 2½in. round, F/M., M/Coil, 9/6; 0-150 m/a., 2in. square, F/M., M/Coil, 7/6; 0-200 m/a., 2in. square, F/M., M/Coil, 7/6; 0-200 m/a., 2½in. round, F/M., M/Coil, 9/6; 0-20 volts, 2in. square, F/M., M/Coil, 7/6.

**AMMETERS.** 0-1 amp., 2½in. projecting, R.F., 7/6; 0-5 amp., 2½in. round, F/M., R.F., 7/6; 20/20 amp., 2in. round, F/M., M/L., 6/6; 0-30 amp., 2in. square, F/M., M/Coil, 7/6.

**A.C. VOLT METERS, 50 CYCLE.** 0-15 volts, 2½in. round, F/M.; M/L., 8/6; 0-20 volts, 2½in. round, F/M., M/L., 10/-; 0-300 volts, 2½in. round, F/M., M/L., 25/-; 0-300 volts, 5in. projection, M/L., 50/-.

**HOOR RECORDERS.** A time recorder for operation on 200-250 volts A.C. Range from 1/10-10,000 hours on five separate scales. Supplied brand new and boxed, 39/6 each.

**RELAYS.** Siemens midget high-speed relays, twin 1,000 ohm coils, 12/6. Polarised twin 600 ohm coils, 8/6 each. We stock all types of relays, 600 and 3,000 types, heavy and light contacts, including platinum, send us your enquiries, we are the cheapest in the trade.

**SOUND POWERED MICROPHONES AND RECEIVERS.** No batteries required, just connect wires to speak or listen, 3/6 each.

**HEADPHONES.** Brand new and boxed, res. 150 ohms, adjustable headband, 8/6 each.

**MULTIWAY TOGGLE SWITCH BOXES.** Fitted with 16 goggle type switches. Ideal for train or model control, brand new and boxed, 4/- each.

**PYE 45 MEG. I.F. STRIPS.** Complete television I.F. strip with 6 EF50 valves. Finest strip ever produced, brand new and complete, 69/6 each.

**DEAF AIDS.** An exceptional offer of deaf aid units complete with three miniature valves, crystal mike, etc., but less outside Bakelite case, only 19/6 each. Miniature earpieces, 3/6, or with lead and plugs, 4/3 each.

**P.O. UNISELECTOR SWITCHES.** 4 bank, double wipers, 25 position, brand new, 32/6 each. Ditto 8 bank, 45/- each.

**CRYSTAL MICROPHONE INSERTS.** A sensitive high impedance crystal mike, ideal for tape recorders, amplifiers, etc., 7/6 each.

**TRANSFORMER TYPE 1.** Primary 230 volts 50 cycles. Secondary 620-0-620 volts, 250 m/a. tapped 550-0-550, and 375-0-375 volts. Two 5 volt 3 amp windings. Ample space for 6.3 volt windings, supplied brand new, 39/6 each.

**AMERICAN INSTRUMENT POTENTIOMETERS.** Brand new and boxed. 10,000 ohms, 5½in. diameter. Ideal for bridge, etc, 22/6 each.

**TRANSFORMER TYPE 2.** Primary 230 volts 50 cycles. Secondary 5-0-5 V., 5-0-5 V., and 5-0-5 V., all at 5 amps. This will give any voltage between 5 and 30 volts in 5 volt steps, at 5 amps. Supplied brand new, 39/6 each.

**SPECIAL OFFER. PACKARD BELL AMPLIFIERS.** These brand new American amplifiers are complete with a 6SL7 and 28D7 valves, condensers, resistors, midget relay, pot and 8 way midget plug and socket. 12/6 each with circuit.

**TRANSFORMER TYPE 3.** Ex-Admiralty. 230 volt 50 cycle input. Secondary 2,000 volts, 5m/a. Ideal for 'scope, etc., 14/6 each.

**100 MICROAMP METERS.** A 2½in. flush mounting meter, scaled 0-1,500 yards, first-grade instruments, brand new and boxed, 42/6 each.

**TRANSFORMER TYPE 4.** Ex-Admiralty. 200/250 volts 50 cycles input. Secondary 4 volts 14 amps., and 6.3 volts, C.T., 1½ amps., only 10/6 each.

**TEST SET TYPE 74A.** "The ideal basis for an oscilloscope." These units contain a VCRI39 3in. CRT and 11 other valves. A complete A.C. 230 volt power pack giving E.H.T., H.T. and L.T., fully smoothed, paper condensers throughout. Supplied tube tested, £4/19/6 each.

**TRANSFORMERS, TYPE 5.** Ex-Admiralty 230 volt, 50 cycle input, secondary 500 x 500 volts, 250 m/a., 4 volt 3 a C.T., 3,000 volt insulation, 22/6 each.

**WAVEMETER TYPE WO102.** An absorption wavemeter covering 180/220 Mc/s. Complete with 230 volt A.C. mains power pack, supplied brand new, 52/6 each.

**CERAMIC SWITCHES.** 12 pole, 4 way, 4 bank, 10/6 each; 12 pole, 3 way, 3 bank, 6/6 each; 7 pole, 2 way, 3 bank, 5/6 each. Large transmitting type, 2 pole, 6 way, 2 bank, 6/6 each; 1 pole, 4 way, 1 bank, 4/6 each.

**"S" PHONES. A MINIATURE UHF TRANSMITTER RECEIVER.** Complete with all valves, vibrator power pack, headphones and microphones, aerial and canvas satchels for attaching to the body, £4/10/- each complete.

**FILAMENT TRANSFORMERS.** 220/240 volt input, 6.3 volt 1.5 amp., 5/9 each; 6.3 volt 3 amp., 9/6 each.

**GERMANIUM DIODES.** Ideal for crystal sets, 1/6 each.



**"RECORD AMPLIFIERS."** A push-pull amplifier giving 8 watts output. For operation on 200-250 volts A.C. input. Standard gram input, output matched to 3 or 15 ohms. Tone and volume controls. Complete valve line up, 6SN7, 6V6, 6V6, 5Z4. Supplied in an attractive desk type cabinet, £6/10/- each.

**P.40 POWER PACKS.** Input 200-250 volts A.C. 50 cycle. Output 175 volts 60 m/a., and 12 volts 2.5 amp. Fully smoothed, 5Z4 rectifier, 32/6 each.

**P.O. KEY SWITCHES.** Double pole change-over. Complete with knob, brand new, 2/9 each.

**MIDGET REVERSIBLE MOTORS.** For operation on 4, 6, 12 or 24 volts D.C. Size 2in. x 1½in., spindle length ½in. x ¼in. Ideal for model makers, Locomotives, boats, etc., 10/6 each.

**WESTERN ELECTRIC HANDSETS.** Standard P.O. type, 12/6 each.

**MUIRHEAD PRECISION BUILT KEY SWITCHES** with heavy contacts. 8 pole, 2 way, brand new, 4/6 each.

**APN4 RECEIVERS.** Brand new and complete with valves type 1 of 6SL7, 1 of 6SN7, 1 of 6H6, 1 of 6SA7, 1 of 5U4G, 1 of 6SJ7, 1 of VR 105/30, 2 of 2X2, 3 of 6B4, 4 of 6SK7, £5/19/6 each.

**METER RECTIFIERS.** Brand new valve bridged, 2 ma., S.T.C., 5/6 each.

**TELEPRINTER EQUIPMENT. APPARATUS TELEGRAPH TWO TONE MARK II.** Complete with all valves and send-receive relays, £7/10/- each.

**SMOOTHING CHOKES.** Admiralty type 9 henry 100 ma., 7/6; American shrouded type, 10 henry 60 ma., 5/-; American potted types, 10 henry 80 ma., 7/6, and 8 henry 100 ma., 8/6.

**AMERICAN "SPRAGUE" CONDENSERS.** Oil and paper filled, 4 mfd., 600 volt, 10/6; 2 mfd., 1,000 volt, 5/6; .25 mfd., 3,000 volt, 3/6; .15 x .15 mfd., 8,000 volt, 7/6; .05 mfd., 16,000 volt, 10/6; 6 mfd., 50 volt, 4/6; complete smoothing units: 8 x 8 x 4 mfd., 650 volts, 12/6 each; 4 x 4 x 4 x 2 x 1 mfd., 600 volts, 12/6 each.

**EX-W.D. POWER PACKS.** 230 volts A.C. input. Output 150 volts 60 m/a., 6.3 volt 1½ amps. Fully smoothed, metal rectifiers, 29/6 each.

**EX-A.M. SWITCH BOXES.** Fitted with 3 independent 5 amp. switches, size 3½ x 2 x 2in. Ideal for models, etc., 1/9 each.

**H.R.O. 6 VOLT VIBRATOR SUPPLY UNITS.** Output 165 volts 80 ma., 6.3 volts 3 amp. 6 x 5 rectifier, choke and condenser smoothed, cabinet size 7 x 7 x 6in. Supplied with clips and leads, 29/6 each.

**SUB-STANDARD VOLT METERS.** A portable precision instrument complete with leather carrying case measuring 0-300 volts D.C. on 6 ranges. A 6in. mirror scale, £4/10/6 each.

**HOURS OF BUSINESS:** 9 a.m.-6 p.m. Thursday 1 p.m. Open all day Saturday.

**PLEASE PRINT YOUR NAME AND ADDRESS CLEARLY, ALSO INCLUDE POSTAGE OR CARRIAGE ON ALL ITEMS.**

## SHORT BROTHERS & HARLAND LIMITED

wish to engage Senior Engineers, Engineers and Technical Assistants for the Electro-Mechanical Section of their Research Department for work on Automatic Controls, Navigational Systems, and other interesting military and commercial projects. Applicants should have had some experience of instruments, small electro-magnetic devices, gyroscopes, or systems employing such components.

Qualifications required are: Senior Engineers: Honours Degree plus at least five years' good engineering development experience, and the ability to control a development team. Engineers: University Degree, or equivalent, with several years' experience of development work. Technical Assistants: H.N.C. or equivalent, with good practical experience in appropriate field.

These are permanent positions in an expanding organisation with new and well-equipped laboratories. Good salaries and prospects for men with initiative; pension scheme; assistance with removal and housing.

Interviews can be arranged either in London or Belfast.

Applications will be treated as strictly confidential.

*Send full particulars of age, qualifications, experience with salary required to—*

**Staff Appointments Officer, Short Brothers & Harland Limited,  
P.O. Box No. 241, Belfast, quoting Ref. No. S.A. 32**

## GOODSELL



### Type PFA Pre-amplifiers

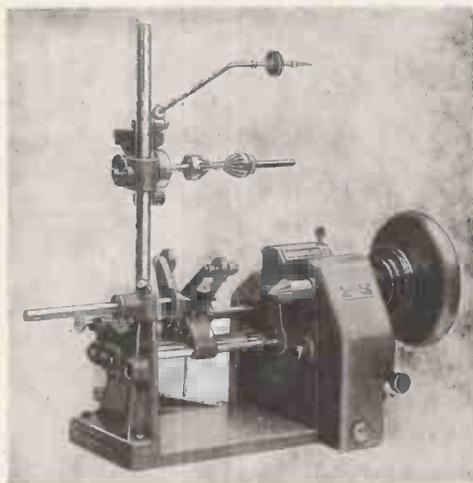
The latest PFA unit is built especially for use with our range of Williamson Amplifiers. Separate bass and treble control in equaliser section. Low noise—high gain, 5 mv. input, 6 valves. Price £20.

Write for  
details of  
F.M. Units.

★ Demonstrations of all these units at B.K. Partners Ltd., 229 Regent St., London, W.1, and Classic Electric Co. Ltd., Croydon.

## GOODSELL LTD.

40 Gardner Street · Brighton 1 · Sussex  
Tel. : Brighton 26735



Model 'Q'

MANUFACTURERS OF  
**AUTOMATIC & HAND  
COIL WINDING  
MACHINES**

## ETA TOOL CO.

(LEICESTER) LTD.

29A WELFORD ROAD, LEICESTER

Phone 5386



# ALPHA COMPARE THIS PRICE

### ALPHA OFFER A SELECTION OF GOVERNMENT SURPLUS VALVES ALL TESTED BEFORE DESPATCH

Full list available 2½d. stamp. Complete catalogue 6d.

OZ4	6/-	6J6	8/-	12S17	8/6
1A5GT	6/6	6I7G	6/6	12S7	6/6
1A7	11/6	6K6GT	6/6	12S7L	9/-
1CSGT	8/-	6K7G	6/-	12SQ7	8/6
IHS	10/-	6K7GT	6/6	12SR7	7/6
1L4	7/6	6K7M	6/9	25A6G	10/6
1NS	10/-	6K8G	8/-	25L6GT	8/6
1R5	7/6	6K8GT	9/6	25Y5G	9/-
1S4	7/6	6L6G	9/-	25Z4G	9/-
1S5	7/6	6L7M	7/6	35L6GT	8/9
174	7/6	6N7	7/6	35Z4GT	8/6
1U5	8/-	6Q7G	9/-	50L6GT	8/6
220VSG	6/9	6R7G	8/-	AC6/PEN	5/6
2A3	6/9	6SA7GT	8/-	ATP4	6/6
2X2	5/-	6S7G	7/6	E1148	2/-
3A4	8/-	6SH7	6/-	FW4/500	10/-
3Q4	9/-	6S7GT	8/-	H30	5/-
3Q5	10/-	6SK7	6/3	HL23DD	7/6
3D6	5/-	6SL7	8/-	KT2	5/-
354	8/6	6SN7GT	9/-	MS/PEN	5/-
3V4	8/-	6SQ7	9/-	PEN25	8/-
4D1	3/-	6SS7	8/-	PEN46	8/6
42	8/-	6ST7	7/6	PEN220A	4/-
5U4	8/6	6U5G	8/6	PM12M	10/-
5Y3GT	8/6	6U7G	9/-	PX251	15/-
5Z3	8/6	6V6G	7/6	QP21	7/6
5Z4G	8/6	6V6GT	7/6	S130	8/6
6A7	10/-	6X5GT	7/9	VR53(EF39)	6/6
6A8G	9/6	7B7	8/6	VR54(EB34)	2/-
6AC7	6/6	7C5	8/6	VR55(EBC33)	7/6
6AG5	7/6	7C6	8/6	VR56(EF36)	6/-
6AJ5	9/-	7H7	8/-	VR57(EK32)	8/-
6AK5	9/-	7Q7	8/-	VR65(SP61)	3/9
6AL5	7/-	7R7	8/6	VR65A(SP41)	3/6
6AM5	7/6	7S7	8/6	VR66(P61)	3/9
6AM6	7/6	7Y4	8/6	VR91(EF50)	6/-
6AQ5	8/6	80	8/6	VR91(EF50Syl)	8/-
6AT6	8/-	807	7/6	VR92(EA50)	2/-
6B4	6/-	8D2	2/9	VR105/30(OC3)	9/-
6B8G	4/-	9001	5/6	VR116(V872)	4/-
6BA6	8/-	9002	5/6	VR119(DDL4)	4/-
6BE6	8/-	9003	5/6	VR123(EF8)	6/6
6BR7	9/6	9004	5/6	VR136(EF54)	7/-
6BV6	8/6	9006	6/-	VR137(EC52)	6/3
6C4	8/-	954	2/-	VC150/30(OD3)	9/-
6C5GT	7/6	955	4/9	VP23	8/-
6C6	6/6	956	3/6	VT52(EL32)	8/-
6D3	7/6	12A6	6/9	VT501(TT11)	6/-
6D6	7/6	12A7	9/-	VU39(MU12/14)	8/6
6F6G	7/6	12AU7	9/-	VU64(U12)	3/6
6F6M	8/6	12AX7	10/-	VU111(V1907)	8/6
6F8G	7/-	12C8	8/-	XU120A	3/-
6G6G	6/6	12H6	5/-	X65	10/-
6H6	3/6	12J5	6/-	X66	11/6
6J5G	5/-	12K7	9/-	Y63	9/-
6J5GT	5/6	12K8GT	9/-	Barret	9/-
6J5M	5/6	12Q7GT	9/-	Atlas 150A	4/6

## THE "EKE" QUALITY 3 WATT AMPLIFIER



This is not a kit of parts but a well-built unit—read this specification.

- 3 valves—6B8G, 6X5GT, 6V8GT.
  - Components 100%, only recently manufactured condensers used.
  - Strong chassis, sockets for all input and output leads.
  - Output 3Ω secondary.
  - Tone and volume controls.
  - Input for crystal or Hi-Fi magnetic pickups.
  - A.C. mains fully isolated.
  - Negative feed back.
- Price 79/6. Packing & Post 2/6.

## WE INVITE YOU TO BUILD THIS PORTABLE FOR ONLY

### £6 · 16 · 6



Full details, circuit diagram, point to point wiring instructions, and complete list of components. Available 2/6 each. Case can be supplied separately. Available in the following attractive colours:

- Lizard Grey
- Blue
- Maroon

All components can be supplied separately.

**PERSPEX IMPLOSION GUARDS**  
Incorporating esoucheon and filter. 12in. type, 11/8 ea.; 16in. type, 14/8 ea.

**NYLON DRIVE CORD**  
25 yard reel nylon drive cord on wooden reel, 2/9 ea.

**CRYSTAL DIODES**  
Plastic case, wire ends, 2 for 2/1.

**TERMS:** Cash with order or C.O.D. Postage and Packing charges extra, as follows: Orders value 10/- add 9d.; 20/- add 1/-; 40/- add 1/6; £5 add 2/- unless otherwise stated. Minimum C.O.D. fee and postage 2/3.

## MAIL ORDER ONLY

### PENCIL RECTIFIERS

K3/25, 5/8; K3/40, 7/8; K3/45, 8/2; K3/30, 8/8; K3/60, 9/8; K3/100, 14/8.

### CONDENSERS

each	each		
8 x 8 mfd. 450 v. ....	4/-	32 x 32 mfd. 450 v. ....	0/11
8 x 16 mfd. 450 v. ....	4/-	32 x 32 x 8 mfd. 350 v. ....	5/6
8 x 24 mfd. 350 v. ....	3/-	32 x 32 mfd. 350 v. 25	
8 x 32 mfd. 475 v. ....	3/9	25 mfd. 25 v. ....	5/9
12 x 4 mfd. 450 v. ....	2/-	60 mfd. 450 v. ....	2/9
16 mfd. 450 v. ....	3/-	64 mfd. 350 v. ....	2/-
16 x 8 mfd. 350 v. ....	4/-	Dublier (B.R. Range):	
16 x 16 mfd. 350 v. ....	3/3	BR 850. 8 mfd. 500 v. ....	2/9
16 x 15 x 8 mfd. 350 v. ....	3/6	BR. 1650. 16 mfd. 500 v. ....	3/3
20 x 20 mfd. 500 v. ....	4/9	BR. 2050. 20 mfd. 500 v. ....	3/6
24 mfd. 450 v. ....	2/9	8 x 8 mfd. 500 v. ....	4/-
24 x 16 mfd. 350 v. ....	3/6	BR. 501. 50 mfd. 12 v. ....	1/9
32 mfd. 450 v. ....	3/-	16 x 16 mfd. 500 v. ....	5/9
32 x 8 mfd. 350 v. ....	3/6	16 x 8 mfd. 500 v. ....	4/9
32 x 16 mfd. 350 v. ....	4/6		

### OSMOR COIL PACKS

Type H.O., 48/- each. Type L.M., 40/- each. Type T.B., 50/- each. Type TRF, 40/- each.

### SPRAGUE CONDENSERS

.05 mfd., 500 v.; .01 mfd., 1,000 v.; .1 mfd., 350 v.; .02 mfd., 750 v. All 9/- doz.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

### LOUDSPEAKER CABINETS

- ★ This attractive walnut finished cabinet is available for 6in. or 8in. speaker units. Metal speaker fret, complete with back and rubber feet.
- ★ 6in. type: Measures 8in. x 8in. x 4in. at base. Price 16/6 each.
- ★ 8in. type: Measures 10in. x 10in. x 6in. at base. Price 20/6 each.

★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★ ★

### LOUDSPEAKER UNITS

Bola 5in. Speaker with transformer	16/- ea.
Plessey 6in. lightweight unit	16/6 ea.
Rola 6in. standard type	17/6 ea.
Lectrona 6in. with transformer	18/- ea.
Truvox 6in. water type	20/- ea.
8in. lightweight unit	21/- ea.
Mains energised 8in. unit, 1,000Ω	17/6 ea.
Mains energised 8in. unit, 600Ω	17/6 ea.
R & A 10in. unit	25/6 ea.

### MAINS TRANSFORMERS

#### 3-WAY MOUNTING TYPE

- MT1 Primary: 200-220-240 v. Secondary: 275-0-275 v. 80 mA. 0-6.3 v. 4 amp. 0-5 v. 2 amp. Both tapped at 4 v. 17/6 ea.
- MT2 Primary: 200-220-240 v. Secondary: 350-0-350 v. 80 mA. 0-6.3 v. 4 amp. 0-5 v. 2 amp. Both tapped at 4 v. 17/6 ea.

### CONTROL KNOBS IN MODERN STYLING

Tastefully and clearly engraved in gold.  
Size A. Diameter 1 1/2in. Depth 1/2in.  
Size B. Diameter 1 1/2in. Depth 1/2in.  
These Mouldings are available in two colours: Walnut and Ivory.  
They are suitable for use with 1in. spindles and are simply and firmly held by means of a grub screw and locking nut.  
Price:  
Type "A" — 1/6 each.  
Type "B" — 1/2 each.  
Plain Knobs can be supplied in either size or colour: Price 1/- each and 6d. each respectively. Inscriptions available:—  
"RADIO"; "Volume"; "V1/On-Off"; "Wave-change"; "Tuning"; "S.M.L. Gram"; "Radio-Gram"; "Tone"; "On-Off"; "TELEVISION"; "Contrast"; "Brilliance"; "Brilliance/On-Off"; "Focus"; "Brightness".  
AMPLIFIER: "Treble"; "Bass" (plus any of those shown above) TAPE RECORDER: "Record-Play".

### EX GOVERNMENT AND SURPLUS CONTROLS

This popular range is suitable for all Television constructors, etc. Keep your costs down when building the "Argus" or "Simplex" receivers. Available: 500Ω, 600Ω, 1,500Ω double type, 2 KΩ, 5 KΩ, 10 KΩ, 20 KΩ, 25 KΩ, 50 KΩ, 200 KΩ, 100 KΩ. ½ meg. Ω, ¼ meg. Ω, 1 meg. Ω, 2 meg. Ω, 50 KΩ double type. All 1/8 each.

**TRANSFORMERS FOR BATTERY CHARGERS**  
230 v. Input Tapped 6-12 v. 1 amp. 13/8 ea.  
230 v. Input Tapped 6-12 v. 3 amp. 18/- ea.  
Both with tap on Primary for 2.5 v. Pilot light.

**HEATER TRANSFORMERS**  
230 v. Input 2 volt .8 amp. 4/8  
230 v. Input 3 volt 3.0 amp. 7/9  
230 v. Input 4 volt 1.5 amp. 5/-  
230 v. Input 4 volt 3.0 amp. 10/-  
230 v. Input 5 volt 2.0 amp. 10/-  
230 v. Input 6.3 volt .8 amp. 5/-  
230 v. Input 6.3 volt 1.5 amp. 6/-  
230 v. Input 6.3 volt 3.0 amp. 9/-  
230 v. Input 12 volt .75 amp. 5/-

**SEXTERCEL RECTIFIERS**  
RM1, 3/9 ea.; RM2, 4/2 ea.; RM3 5/- ea.; RM4, 16/- ea.

**METAL RECTIFIERS**  
12 v. ½ amp., 1/6 ea.; 12 v. 1 amp. 4/6 ea.; 2 v. 1 amp. 3/- ea.; 250 v. 45 mA., 6/3 ea.; 250 v. 75 mA., 7/6 ea.; 300 v. 80 mA., 7/6 ea.

**GOLDRING PICK-UP HEADS.** Pick-up head type No. 112 (2,000 ohms), complete with lead. Price 17/6 each.

**IRON ELEMENTS**  
Standard adaptable type, 230 v. 460 w. 1/8 ea. Morphy-Richards, replacement type, 3/9 ea. H.M.V. replacement type, 3/- ea.

**PLIERS.** with side cutters. 4/3 pair.

### MIDGET RADIO CABINETS



This well-known cabinet of which thousands have been sold is ideal for every constructor. Complete with chassis, dial, backplate, cord drive, pointer and dial drum. Price 27/6 each.

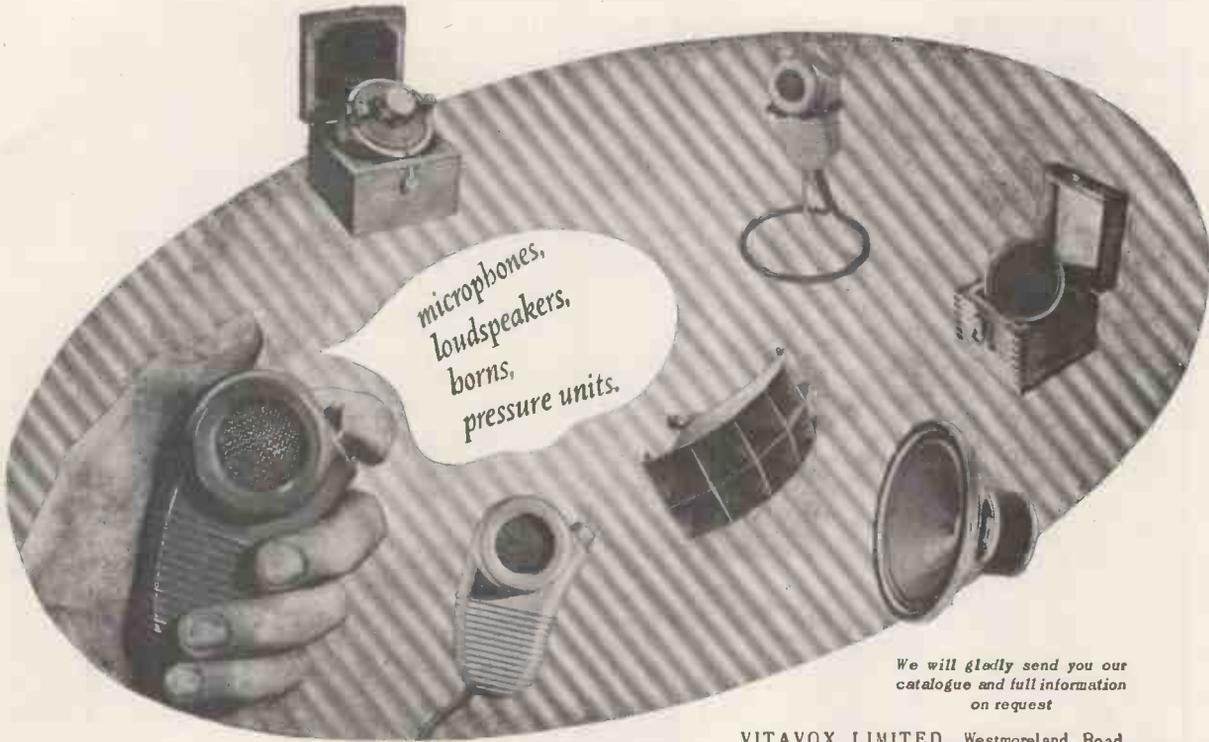
### POCKET TEST METER

Ex-Govt., volt meter two ranges 0-15 v.; 0-250 v. D.C. Complete in case, 17/6 each.

# ALPHA RADIO SUPPLY CO.

## 5/6 VINCES CHAMBERS, VICTORIA SQUARE, LEEDS 1.

WHEN ORDERING PLEASE QUOTE "DEPT. W.W."



microphones,  
loudspeakers,  
horns,  
pressure units.

We will gladly send you our catalogue and full information on request

VITAVOX LIMITED, Westmoreland Road, London, N. W. 9. Telephone: COLindale 8671

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 and pages 8, 25, 57.

Numerous other types of head fittings available

Engineers, Pat.tees and Sole Manufacturers  
**AUTOSET (PRODUCTION) LTD.**  
DEPT. "H," STOUR STREET, BIRMINGHAM, 18  
EDG. 1143 (3 lines). Estd. over 35 years.  
Please mention "Wireless World"

**TRANSFORMERS**

**COILS  
CHOKES**

LARGE OR SMALL QUANTITIES  
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

**CABINETS!!**

The "OCTAGONAL" Speaker Cabinet

This new cabinet, which works on the loaded port principle, is constructed in laminated soft woods. It was originally designed for the G.E.C. Metal Cone Speaker, but is equally suitable for any 8in. speaker unit. The model is available in polished veneered oak or walnut.

Retail Price £12/10/- Liberal Trade Discount.

Send for our current trade price list on the Osram 912 Amplifier Components together with our monthly bulletin and Special Cabinet List.



Trade only supplied.



**V.E.S. WHOLESALE SERVICES Ltd**  
Dept. (W.W.), 11, Gunnersbury Lane, Acton, W.3. Tel.: 400rn 5027

## THE HAM'S SHOP

CHEAPEST TELEVISION & ELECTRICAL SHOP  
IN GT. BRITAIN.

45, WINETAVERN ST., BELFAST, NORTHERN IRELAND.

(Phone : BELFAST 31849).

RECEIVER TR1198, complete with valves, £1/15/-; 1135, £2.  
TRANSMITTER, TR1196, £1, without valves, 10/-.  
REC. TRANSMITTER, Type 38, 35/-.  
AMPLIFIER, With valves, £2. POWER PAK, 12 v., £1.  
NEW ZEALAND TRANSMITTER REC. Mark 1, £6/10/-.  
UNITS, R.F. Type 24 and 25, with valves, 14/-, Type 6, £2/15/-, Type 62, £2/10/-.  
HORN LOUD SPEAKERS, Tannoy for P.A. complete with units, £2/10/-.  
LOUD HAILERS, Complete with valves, £5. (Cannot be repeated).  
MORSE KEYS, 3/6. SPEAKERS, 6in., 12/6.  
METERS, 5 M/amp., 8/6. 50 m/amp., 8/6. 1 amp., 8/6. 3.5 KV 12/6. (Cannot be repeated).  
VCR CHASSIS, With valves, £1. DIALS, 1191, 4/6. DOOR BELLS. (Work off mains), 3/-. LARGE BRASS TERMINALS, 7id. each, 7/- per doz.  
CUT-OUTS, 12 v. and 24 v., 8/6. MINIATURE MOTORS, Work off 12 v. or 24 v. A.C. 8/6 each.  
TUBES, 5CP1, £1; VR97, 30/- (no cut-offs), 807, 8/-.  
METAL BOXES, 2/-, CHASSIS WITH COMPONENTS, 5/- (worth £1 each).  
TRANSFORMERS, 350/350, 80 m/amp. 4 v. 4 amp. and 4 v. 3 amp., 14/- each. 350-0-350, 250 m/amp., 4 v., 7 amp., 6.3 at 4 amp. 5 v. at 3 amp., 27/6 (heavy duty).  
RIVETS ALUMINIUM, 2/6 per box.  
RESISTORS, All sizes from 6d.  
CO-AXIAL CABLE, 8d. per yd. TUB UNITS, 7/6 each.  
BATTERY CHASSIS, With valves 12/6. SUPERHET CHASSIS, With Valves, 25/-.  
REV. COUNTERS, 1/6 each. TWIN FLEX, 50 yds., 22/6.  
CONDENSERS, 6 mfd. High Voltage, 5/- each.  
POWER PAKS, 200 m/a. 250-0-250 6.3 v. at 5 amp., £2.  
PUSH BUTTON UNITS, With knobs, 2/6. CONTROL UNITS, 2/6 each.  
PULLEY WHEELS, 6d. each (Bakelite). CRYSTALS, 2/6 each.  
TELEVISION VIEWING BINOCULARS, 10/-, RELAYS, 2,000 or 5,000 ohms. 7/6 each; 820 ohms, 3/6. BELL TRANSFORMERS, 5/6 each. FILAMENT TRANSFORMERS, 3.5 and 6 v. lamp, 5/6 each. CROKES, 200 m/amp. 10 H., 3/6. BULBS, 10 v. 1/3 amp., 6d. each. ALL SIZES OF VOLUME CONTROLS, 2/6 each with switch, 3/6. VALVE HOLDERS, All types, from 6d. ALADDIN FORMERS AND CORES, 6d. HYDROMETERS, 3-Ball type, 1/6. PUMPS, £1. SOUND PROJECTORS, (2) with Speaker (price on application). VALVE TESTER AND UNIVERSAL METER COMBINED, AMERICAN, £8/10/-. BELL WIRE, 100 yd. coils, suitable for wiring up, 4/6. AERIAL WIRE, 50ft., 1/-, MIC TRANSFORMERS, 2/6. POLISHED EBONITE RODS, 9d. COIL FORMERS, 6 x 1 and 6 x 1, 6d. each. MORSE KEY AND BUZZER SETS, 5/-. RESISTORS WITH SLIDER ADJUSTMENT, 300 ohms, 50 watt, 1/6. VHF AERIALS, 2/6. ANGLEPOISE LAMPS, 25/-, ROD AERIAL BASES, 2/6. NOISE LIMITERS, 2/6. FILTERS, 10/-, RECORDING SPOOLS, 2/-, MEGGERS (Bridge type), £3/10/- (cost £65). T.V. CABINETS FOR 6in. or 9in. TUBES, 25/-, CRYSTAL MIC. INSERTS, 5/6. CARBON INSERTS, 1/6. E.T. BATTERIES, 60 v. 3/6 (or 47 v.). INSUL. TESTERS, £1.  
PACKING AND CARRIAGE EXTRA. PLEASE ENCLOSE S.A.E. WITH ENQUIRIES.  
DELIVERIES WITHIN 14 DAYS. ALWAYS AT YOUR CHOICE

## Repeats All It Hears

Be careful what you do in front of a Celsonic tape recorder. Remember it is not merely an imitator. It is a repeating machine that reproduces all it hears with exactitude.

It may be a single voice or a massed choir, a solo instrument or a full orchestra, sound effects for a film or the lisping voice of a child receiving speech therapy.

The Celsonic recorder covers nothing up with 'tone,' 'resonance,' 'boomph' or any other inherent noise. It gives you the naked truth, from 50 to 14,000 cps.

That is why, time after time, it is placed first for absolute fidelity when compared with other machines. It will record 3,250ft. of tape at one session and give an hour and twenty-five minutes play-back without break at 7 1/2 in. per second.

The "Celsonic" has two other outstanding advantages. Firstly, a superimposing device is part of its standard equipment. This device makes it possible to record words over music. This is of particular interest to cine enthusiasts who wish to add commentary and suitable music to their films.

Secondly, the "Celsonic" can be supplied with a synchronising unit which permits the conversion of silent films to "talkies." This unit marries the speed of the tape to that of the film and makes it possible to synchronise the dialogue with the features of the film.

The "Celsonic" has everything needed by the professional recordist at a price the amateur can afford.

Write for descriptive leaflet to Excel Sound Services Ltd., Celsonic Works, Garfield Avenue, Bradford, 8.

## SHORT BROTHERS & HARLAND LIMITED

wish to engage Senior Engineers, Engineers and Technical Assistants for the Electronics Section of their Research Department, to work on Guided Missiles, Computing Systems, Navigational Equipment, and other interesting projects. Applicants should preferably have experience of servo-mechanisms, precision electronic or radio circuits, instruments or test gear.

Qualifications required are: **SENIOR ENGINEERS**—Honours Degree with at least five years' good engineering experience, and the ability to control a development team.

**ENGINEERS**—University Degree, or equivalent, with several years' experience of development work.

**TECHNICAL ASSISTANTS**: H.N.C. or equivalent, with good practical experience in appropriate field.

These are permanent positions in an expanding organisation with new and well equipped Laboratories. Good salaries and prospects for men with initiative; pension scheme; assistance with removal and housing. Interviews can be arranged either in London or Belfast. Applications will be treated as strictly confidential.

Send full particulars of age, qualifications, experience, with salary required to—

Staff Appointments Officer, Short Brothers & Harland Limited,  
P.O. Box No. 241, Belfast, quoting Ref. No. S.A./31

## 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.

**BIET**

## THE MODERN BOOK CO.

BRITAIN'S LARGEST STOCKISTS OF  
BRITISH AND AMERICAN  
TECHNICAL BOOKS

The Radio Amateur's Handbook: 1955 by "A.R.R.L." 30s. Postage 1s.  
Radio Designer's Handbook by F. Langford-Smith. 42s. Postage 1s.  
Electronic Musical Instruments by R. H. Dorf. 55s. Postage 1s.  
Practical FM Circuits for the Home Constructor by R. Deschepper. 5s. Postage 3d.  
Radio Engineering by F. E. Terman. 50s. Postage 1s.  
Television for Radiomen by E. M. Noll. 52s. 6d. Postage 1s.  
Television Receiver Servicing: Vol. I—Time-Base Circuits by E. A. W. Spreadbury. 21s. Postage 9d.  
The Oscilloscope at Work by A. Haas and R. W. Hallows. 15s. Postage 9d.  
Telecommunications by A. T. Starr. 35s. Postage 9d.  
Sonics by T. F. Hueter and R. H. Bolt. 80s. Postage free.  
Valves for A.F. Amplifiers by E. Rodenhuls. 10s. 6d. Postage 6d.  
Practical TV Aerial Manual for Bands I and III by R. Laidlaw. 4s. 6d. Postage 3d.  
Radio Valve Data compiled by "Wireless World." 3s. 6d. Postage 3d.

Please write or call for our catalogue

19-23 PRAED STREET

(Dept. W.6)

LONDON, W.2

'Phone: PADdington 4185

Open 6 days from 9-6 p.m.

## THE INSTRUMENT MODEL

Specially designed for soldering operations in the compact assemblies used in present day radio, television and electronic industries. Weight 3½ oz. excluding flexible. Length 9 in. 25 Watts—200/220 volts, LIST No. 624 220/240 volts, LIST No. 625

19/8d



Interesting features

1. Bit ¼" diameter, simple to replace.
2. Steel cased element, also replaceable.
3. Detachable hook for suspending iron when not in use.
4. Moulded two part handle, remains cool in use.
5. Six ft. Henley 3-core Flexible.

**HENLEY SOLON**  
ELECTRIC SOLDERING IRONS

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD.  
51/53, Hatton Garden, London, E.C.1

## A. C. SOLENOID TYPE SA.



Continuous ¾ lb. at ¾"  
Instantaneous to 6 lbs.

100% PRODUCTION INSPECTION

Larger and Smaller Sizes Available. Also Transformers to 6kVA 3 Phase.

## R. A. WEBBER LTD.

18, FOREST ROAD, KINGSWOOD, BRISTOL. Phone: 74065

## STAR METAL

Riverside 6673/4

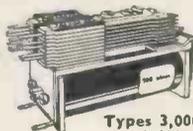
for  
**PRESSED METAL COMPONENTS**  
— FINISHED TO SPECIFICATION —



• MANY STANDARD TOOLS AVAILABLE IN STOCK •  
**STAR METAL PLATE WORKS,**  
74-76 CHURCH ROAD, BARNES, S.W.13

## MAGNETIC RELAYS

BUILT TO SPECIFICATION.



Types 3,000 and 600.

Coil Winding and Tropicalizing.

Spring Sets and Coils supplied separately if required.

Send for Price List or quotation.

■ KAYE ELECTRICAL MANUFACTURING CO. ■

Havelock Works, Havelock Place,  
Harrow, Middlesex.

HAR. 1432

## THE VESPA TAPE DECK



2 speed 3½ in. and 7 in.

Twin Track.

Model 521 Compact Deck, 7½ in. x 11 in., 5 in. reels, kit. £7/10/-

Model 721 Standard Deck, 10½ in. x 11 in., 7 in. reels, kit. £8/10/-

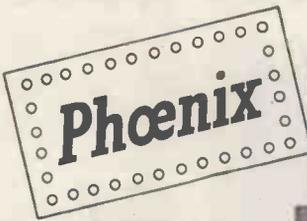
Easy to assemble precision machined parts, latest high fidelity heads,

first class motors, full assembly instructions.

Either model fully built and tested 27/6 extra.

Send stamp for full details.

E.W.A., 266 WARBRECK DRIVE, BLACKPOOL



**EYELETTING  
and light  
PUNCHING  
MACHINES**

**Autophœnix No. 6**

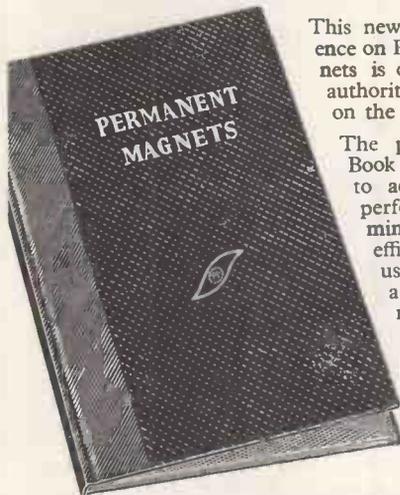
A new and improved treadle operated machine for the automatic insertion and closing of eyelets in either flat or formed work in metals, plastics, fabrics, etc. The deep throat, high vertical gap and projecting base make this machine adaptable for eyeletting radio chassis, cylindrical shells, spinnings, mouldings etc.

We manufacture a very full range of hand and automatic Eyeletting and Piercing Machines. Write for illustrated brochure to:

**HUNTON LIMITED,**

Phoenix Works, 114-116, Euston Road, London, N.W.1  
Tel.: EUSTON 1477 (3 lines). Grams: Untonexh, London.

**Keep up-to-date with  
the aid of this  
NEW BOOK**



This new work of reference on Permanent Magnets is one of the most authoritative available on the subject.

The purpose of the Book is to help YOU to achieve required performances at minimum cost, by efficient design and use of the most appropriate materials.

**PRICE 10/-**

**PERMANENT  
MAGNET ASSOCIATION**

301 GLOSSOP ROAD, SHEFFIELD 10

- RHEOSTATS. 12 v. 1 a. 2/6. 12 v. 5a. 10/6.
- NEW AC/DC MOTORS. 24v. 2a. 6" x 2 1/2". Spindle 1" x 1/2", 18/6.
- NEW FREQUENCY CRYSTALS. 9100 kc. 10/6. 4250 kc. 6/6.
- Also Type FT243 from 5675-8650 kc. in 25 kc. intervals. 10/6 each.
- NEW ROTARY TRANSFORMERS. Inputs 6 or 12 volts, output 250 v. 80 mA., 17/6.
- NEW VR65, SP61 VALVES, 5/6, 4 for 1/-.
- CYLDON 5-CHANNEL PRE-TUNER. Gives 26 D.B. gain. Fit one of these to your T.V. for better pictures. I.F. Output 9.5-14 Mc/s., 15.5-22 Mc/s. With valves EF80, ECC81, 52/6. Less valves, 15/-.
- MAINS TRANSFORMERS. Input 200/240 v. Output 350-0-350 or 250-0-250 volts 80 mA. and 4 and 6.3 v. 4 a. and 4 and 5 v. 2 a. Price 21/6. Input 200/240 v. Output tapped 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30 volts, 2 amp., 21/6. Output 17-11.5 volts 5 amp., 22/6. Output 17-11.5 v. 1 1/2 a., 16/6. 6.3 v. 2 1/2 a., 8/6. All with one year's guarantee.
- D.P.D.T. RELAYS. Operate at 200/300 volts D.C., 8/6. We can supply any type of voltage and contacts at varying prices.
- NEW SELENIUM RECTIFIERS. F.W. 12/6 volts 3 amps., 14/6; 4 amp., 22/6; 6 amp., 30/-; 1 amp., 8/6; 12 v. 100 mA., 3/-; 24 v. 2 amp., 30/-; H.W., 250 v. 100 mA., 9/-; 250 v. 275 mA., 17/6; 250 v. 60 mA., 6/6.
- GERMANIUM or SILICON CRYSTAL DIODES, 3/9.
- M/C MICROPHONES with matched Trans., 15/6.
- FL5 FILTER UNITS, 8/6. Same as FL8 but less switch.
- TR1196 TRANSMITTER SECTION. New and complete but less valves. 4.6-6.8 Mc/s. Easily converted, 15/- With valves TT11, EL32, EF50, 62.
- L.R. ARMY HEADPHONES, 9/6.
- TIME DELAY RELAYS. We specialise in units giving varying time constants. Pleased send us your requirements or problems.
- FISHING ROD AERIALS, RUBBER BASES, 3/6.
- P.O. FEEDER COUNTERS 0-9999, 24/50 volts D.C., 15/6.
- POCKET VOLTMETER. 12in. M.C., 0-20-200, 11/6.
- U.H.F. AERIALS. Complete with base, 180-200 Mc/s., 6/6.
- NEW BROWNS M/C HEADPHONES. With earpads and 6ft. lead and plug, list price £5/5/- . Our price 18/6.
- VCR97 TUBES. Brand new, in original crates, picture tested, 45/-.
- SPECIAL OFFER—SELENIUM RECTIFIERS, 12 v. 16 amp., full wave, 50/-.
- CARBON TWIST DRILLS. Set of 9, 1/16 to 3/16, in plastic case, 3/6. All Carriage Paid in the U.K. from Dept. W.W.
- EX-R.A.F. BATTERY RECEIVER. R1224 1-9 Mc/s., £7. R1116A, 142 kc/s.—20 Mc/s., £10. Signal Generator L/1270, 18-131 Mc/s. Less Crystals, £10. Wavemeters, W1432. 160/220 Mc/s., £3/10/-.
- NO. 19 POWER UNITS. Mk. III, with 2 rotary transformers, HT31 and HT32, £3/10/-.

Carriage on above items extra.

**THE RADIO AND ELECTRICAL MART**  
253B PORTOBELLO ROAD, LONDON, W.11.  
Phone: PARK 6026.

**SPECIAL OPPORTUNITY:—**

- TRANSMITTERS/RECEIVERS TR-50XM.  
Use: Marine or Fixed Stations.  
Output: 50 W. Frequency: 1.5-12 mc/s.  
Built-in VFO & 5 crystal positions.  
Brand New—Special prices for quantities.
- TRIPLE DIVERSITY RECEIVERS.  
Type 171-66A. Range 1250 Kc/s to 40 mc.  
Write for details.
- 250-WATT AM BROADCAST TRANSMITTERS.  
Type BR5—Short Waves.  
Type BRM—Medium Waves.  
Features: Small size—low power consumption—high fidelity—low distortion.  
Quick delivery—write for full technical details
- COMMUNICATIONS TRANSMITTERS.  
By leading American manufacturers (R.C.A. Hallicrafters, Technrad and Westinghouse). 5 types available for immediate delivery: 250 w., 400 w., 1 kW., 2 1/2 kW., and 5 kW.—New Equipment.  
Full technical details will be gladly sent on request.
- We can supply large quantities of MASTER OSCILLATORS M1-19467-A. Also a full range of spares for:  
R.C.A. TRANSMITTERS ET-4331, 4332, 4336 and AVT-22.
- TEST EQUIPMENT—A large range of laboratory test equipment of American manufacture (including BC-221).
- RADAR EQUIPMENT (Airborne, Ground and Naval).  
Our Radar Dept. will welcome your specific enquiries.

**BRITISH SAROZAL LIMITED**  
ELECTRONIC WORKS

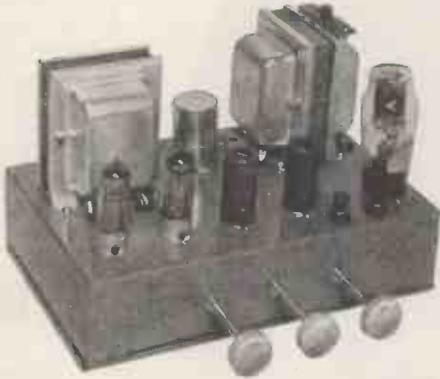
1-3 Marylebone Passage, Margaret St., London, W.1  
Cables: Sarozal, London. Telephone: LAngham 9351 (3 lines)

A.I.D. and A.R.B. approved.

## NOT JUST ANOTHER HIGH FIDELITY AMPLIFIER

The STANLEY Model HF125 is a scientifically designed instrument which will provide perfection of sound reproduction. Read the Brief Specification:—

Frequency response 10-20,000 c/s within less than 1db. Total harmonic distortion 0.2% at 400 c/s., 0.1% at 5,000 c/s. Hum and noise —74 db. Power output 12 watts, bass and treble controls providing 10 db. lift and cut. Input impedance 1M ohm. Power supply 110/250v. 40/100 c/s. A.C. Provision for connection of tuner unit.



Our technical department is at your service. Send for details of this brilliant instrument to-day.

**LIST 18 GNS. PRICE**

**STANLEY SOUND & VISION PRODUCTS LTD.**  
Stanley Works, Lower Street, Haslemere, Surrey  
Phone: 1426

## INSTRUMENT CASE



All welded construction. Louvred back and sides. 17" x 10" x 9". Finish, silver hammer.

PRICE

**50/-**

Fittings extra  
Send for List 42

**SUTTON COLDFIELD ELECTRICAL ENGINEERS**  
Clifton Street, Sutton Coldfield. Phone SUT. 5666

## Television · Radio · Record CABINETS MADE TO ORDER

*ANY SIZE OR FINISH*

CALL OR SEND DRAWINGS FOR QUOTATION

**B. KOSKIE** (DEPT. E.)  
72-76 Leather Lane, Holborn, E.C.1  
Phone: CHAncery 6791/2

## Sound Reading!

### SOUND REPRODUCTION by G. A. Briggs

Third edition, second impression, 368 pages, 315 illustrations. Chapters on Resonances, Cabinets, Room acoustics, Response curves with oscillograms, Crossover networks, Recording systems, Records, Pickups, etc. Total sales exceed 35,000. 17/6. (18s. 6d. post free).



### LOUDSPEAKERS The Why and How of Good Reproduction by G. A. Briggs

New 4th Edition. 92 pages. 45 illustrations. Standard reference work on loudspeakers. Detailed information, easy-to-follow diagrams, description of Electrostatic speaker and demonstrations in Royal Festival Hall. Total sales exceed 40,000 7/6. (7/9 post free).

### PIANOS, PIANISTS AND SONICS by G. A. Briggs

Invaluable to students, teachers, etc. Chapters on: History, Construction, Harmonic Analysis, Room Acoustics, Touch, Tone and Tuning. 192 pages, 162 illustrations. 10/6. (11/- post free).

Wharfedale Wireless Works Ltd.  
Bradford Rd, Idle, Bradford, Yorks

## NELSON RESEARCH LABORATORIES ENGLISH ELECTRIC CO. LIMITED, STAFFORD

have vacancies for ASSISTANTS in interesting work on the PHYSICS, development and applications of magnetic and electrical insulating materials and devices.

Graduates with or without industrial experience and people with National Certificates in Electrical Engineering or Physics are required.

Reply to Dept. C.P.S.,  
336/7, Strand, W.C.2., quoting ref. no. 312A.

# hallicrafters & NATIONAL

Sole Concessionaire U.K.:

**McELROY ADAMS MFG. GROUP LTD.**

Phone: FUL 1138/9

## COMMUNICATION RECEIVERS and TRANSMITTERS and RAYTHEON MARINE RADIO DEVICES

*Again becoming available*

328 LILLIE ROAD, LONDON, S.W.6

Cables: Hallicraft, London

**SAMSON'S**

**SURPLUS STORES**

**SPECIAL OFFER A.M. H.T. TRANSFORMERS.** Pri. 200-240 v. Sec. 525-0-525 v. 150 mA. 5 v. 3 a., 6.3 v. 1.5 a., 55 v. 50 mA., 32/6, P.P. 2/6.  
**BRAND NEW METERS BY FAMOUS MAKERS.** 4in. Round flush M1 Ammeters. 0-10 amps. 500 c/s., 37/6, P.P. 2/-. 3 1/2in. round flush MC 0-400 mA., 30/-. P.P. 2/-.  
 \* 2 1/2in. round flush MC 0-500 mA., 15/-. P.P. 1/6.  
**EXIDE ACCUMULATOR** 10 volt 5 AH. Glass accumulators, size 7in. x 2 1/2in. x 5in. suitable for H.T. unit construction and models, etc., 7/6, P.P. 1/6. **MINIATURE ACCUMULATORS** made by Willard Co. 36 volt 0.2 AH. Note size and weight. 3 1/2in. x 1 1/2in. x 1/2in. weight 5 1/2 oz., 5/-. P.P. 6d., or set of three 36 v. and one 6 v. same size but weight 4 1/2 oz. In sealed metal container, 21, P.P. 1/3. Easily filled with hypodermic syringe.  
**EX-ARMY MEDICAL HYPODERMIC SYRINGES.** Brand new. 1 c.c. with needle. 4/6, P.P. 6d. 10 c.c., with needle, 7/6, P.P. 6d. Extra needles, tin of 5, 2/-. P.P. 6d.  
**AMERICAN 6 VOLT 90 AH. 15 PLATE CAR BATTERIES.** Size 9in. x 9in. x 7 1/2in. Brand new in maker's cases, 22/19/6, carr. 7/6.  
**PRICHTT AND GOLD STORAGE BATTERIES.** 12 volt 75 AH. Built in teak cases. Brand new, 24/15/-. carr. 7/6.  
**AMERICAN AIRCRAFT BATTERIES.** 24 volt 11 Ah., by Willard. Size 8in. x 7 1/2in. x 7 1/2in., 50/-. carr. 7/6.  
**AMERICAN C.R. TUBES.** 5 CPL Brand new, 29/6, carr. 2/6. CRT Type NC13 7in., packed in crates, 35/-. carr. 4/-. R.F. UNITS, Type 24, 20-30 Mc/s., complete with valves, brand new, 15/-. P.P. 2/-.  
**INSTRUMENTS, ADMIRALTY INTEGRATORS, TYPE A 891.** Incorporating very fine Galvo movement, coil 40 ohms. Centre zero to F.S.D. 1 microamp. Small mirror one metre radius. A very useful laboratory instrument, 65/-. carr. 2/6.  
**METRO-VICKERS MASTER VOLTMETERS, 0-20 volts A.C. 50 cy. M.1 6in. mirrored scale, 25/-. P.P. 1/6. A.M. 2 1/2in. panel mounting 500-0-500 microameters, blank scale, brand new, 25/-. P.P. 1/6.  
 Howard Butler 0-150 volts D.C. MC. Built in 6in. square Bakelite case, 29/6, P.P. 1/6.  
**HEAVY DUTY A.M. L.T. TRANSFORMERS.** Pri. 440 v. Sec. 220 v., in steps of 25 v. conservatively rated at 2.2 kW., weight approx. 90 lb. Half the above secondary can be obtained from 220 v. input, 29/10/-. plus carr. Pri. 230 v. Sec. 50 v. 20 amps., completely enclosed, 26/10/-. plus carr. Pri. 230 v. Sec. 13, 13.5, 14, 15 v., very conservatively rated at 60 amps., 26/5/-. plus carr. Pri. 115 v. Sec. 17 v. 15 amps. and 2.2 v. 13 amps., 35/-. carr. 4/-. Pri. 230 v. Sec. 8.2 C.T., very conservatively rated at 10 amps., 25/-. carr. 2/6. Pri. 200-250 v. Sec. 115 v. 8.7 amps., 25/15/-. carr. 5/-.  
**A.M. H.T. TRANSFORMERS.** Pri. 230 v. Sec. 1,500 v. 1.6 kVA. 65/-. carr. 7/6.  
**1134 TX H.T. TRANSFORMERS.** Pri. 200-250 v. Sec. 1250-1300 v. 350 mA., 35/-. carr. 4/-.  
**ADMIRALTY SOUND POWERED HAND SETS,** no batteries required, 17/6, P.P. 1/6.**

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.

**ELECTRONIC ENGINEERS**

An exceptional opportunity exists for Research Development and Design Engineers wishing to work in a rural area of South West England. Posts are permanent, pensionable, and carry top-rate salaries.

Assistance can be given in finding suitable accommodation.

The working conditions are ideal, the laboratories being housed in a new building designed for the purpose, close to a well-known country town in the heart of one of the most attractive districts.

The work offers a maximum amount of interest, being concerned with a new super-priority Government Project.

There are vacancies for:

- (1) **PHYSICISTS**  
—with a good mathematical background.
- (2) **RESEARCH AND DEVELOPMENT ENGINEERS**  
—of all levels.
- (3) **DESIGN ENGINEERS**  
—with practical experience of miniature circuitry.

Applications should be made in strict confidence, with full details of experience and academic background, to:

PERSONNEL OFFICER,  
**E.M.I. ENGINEERING DEVELOPMENT LIMITED,**  
 WELLS DIVISION,  
 PENLEIGH WORKS, WELLS, SOMERSET.

**THE ENGLISH ELECTRIC CO., LTD.,**

LUTON

require

SENIOR ENGINEERS or SCIENTISTS

for

THREE SPECIAL VACANCIES

in

GUIDED WEAPONS SYSTEMS DESIGN

CONCERNED WITH

ELECTRONICS AND RADAR

SERVO MECHANISMS

BALLISTICS

These are permanent posts of unusual interest and applications should be addressed to Dept. C.P.S., 336/7, Strand, W.C.2,

quoting Ref. 1260C.

**ELECTRONIC ENGINEERS**

with suitable backgrounds interested in entering the rapidly expanding field of

**DIGITAL COMPUTORS**

are offered the opportunity of acquiring these new techniques at the new ENGLISH ELECTRIC establishment at Kidsgrove. Previous Computer experience is not necessary as the Company provides special conversion courses in conjunction with MARCONI COLLEGE. Full salary will be paid during such courses. Apply to Dept. C.P.S., 336/7, Strand, W.C.2, quoting ref. no. 1353C.

# G2AK *This Month's Bargains* G2AK

**THE IDEAL POWER TRANSFORMER FOR THE TABLE TOP RIG.**

This Parmeko-made transformer has the following conservative ratings: Primary, 230 V. 50 c/s. Secondary, 620/550/375/0/375/550/620 V. Rated at 275 vA. It will give 620 or 550 volts at 200 mA. simultaneously with 375 V. at 250 mA. All the H.T. you require for R.F. and Modulator. Also 2-5 V. 3 A. windings for suitable rectifiers such as 5R4GY, 5Z3, 83, 5U4, etc. Weight 24½lb. Size 6½ x 6½ x 5½in. high. Worth at least £7. Our price £3 only, Carr. Paid. C.V.O. only, no C.O.D.

We regret that we cannot accept orders for these from EIRE or abroad.

**METERS:** 2½in. Scale Flush Mounting. 0-10 mA. Ditto 0-30 mA., ditto 0-100 mA., 12/6 each. 2in. Scale Square Flush Mounting 0-50mA., ditto 0-150 mA., ditto 0-3 Amp. Thermo., ditto 0-20 V. d.c., ditto 20/0/20 Amp. d.c., 7/6 each. 2½in. Scale Projecting Type 0-15 Amp. Thermo., 7/6. 2in. Scale Round Flush 0-1 Amp. R.F., ditto 0-350 mA. Thermo., 7/6.

**SPECIAL OFFER.**  
Genuine American 807 Valves, 6/- each or 4 for £1.

**PI. CIRCUIT OUTPUT TUNING CONDENSERS.**  
Made by E. F. Johnson Co., U.S.A. Max. cap. 500 pf. 1,500 V. rating. Ceramic insulation, size 5in. long x 2½in. wide x 2½in. high, excluding spindle projection. Our price only 15/-, post free.

**VIBRATOR POWER UNITS.** 12 V. d.c. input, 300 V. 100 mA. output. Fully smoothed and filtered. In black crackle case. Only 39/6, p. & p. 1/6.

**HEADPHONES:** L.R. Type CLR No. 3, 9/6, DLR No. 2, 13/6, H.R. Type CHR Mk. 2, 17/6, DHR 5b (very sensitive), 18/6, p. & p. 1/-.  
**CONDENSERS:** 8µF 600 V. Trop. 750 V normal condensers. New ex-W.D. stock, 5/6, p. & p. 1/6.

Carriage paid on all orders over £1 except where stated. Please include small amount for orders under £1.

Please print your name and address All Mail Orders to:—

**CHAS. H. YOUNG, G2AK**

Dept 'W' 102 HOLLOWAY HEAD, BIRMINGHAM 1

'Phone: MIDLAND 3254

All callers to 110 DALE END, BIRMINGHAM 4

'Phone: CENTRAL 1635

## THE VALVE SPECIALISTS

**THE BENTLEY ACOUSTIC CORP. LTD.**  
38, CHALCOT ROAD, N.W.1. PRIMROSE 9090

Obsolete and current types and Government surplus.

0Z4	6/-	6J7	5/-	25L8	8/8	ECC82	10/8
1A5	6/-	6K6	7/-	30	7/6	ECC83	10/8
1E7	6/6	6K7	5/-	35L8	8/-	ECC91	7/6
1G6	6/6	6K8	8/-	35Z4	8/8	ECH42	10/-
1L4	6/-	6L7	7/6	35Z5	8/8	EE37A	10/8
1LD5	7/6	6M7	7/6	50C5	9/8	EE39	6/8
1LN5	6/-	6Q7	8/8	50L8	8/-	EF41	9/-
1R5	7/-	6SA7	8/-	72	4/8	EF50(E)	5/-
1S5	7/-	6SC7	10/-	75	8/8	EF54	5/-
1T4	7/-	6SG7	6/8	76	7/-	EF55	12/6
2C28	4/-	6SE7	6/-	77	7/-	EE81	6/8
2D13C	4/-	6S7	9/-	78	8/8	EL41	10/8
2D21	8/6	6SK7	6/-	83	8/-	EL91	6/6
2X2	4/6	6SL7	8/-	84/8Z4	9/8	EM34	10/-
3Q5	9/6	6SN7	8/8	85A2	10/8	EVS1	11/-
3S4	7/-	6SS7	7/6	210LF	2/8	EZ40	9/-
5U4G	8/6	6ST7	8/-	215G	4/-	H30	5/-
5X4G	8/8	6US(UX)	7/-	807	7/8	HL2	5/-
5Y3	7/8	6US(10)	7/8	868	15/-	HL13C	7/8
5Z4	8/6	6V6	7/-	856	3/8	HVR2A	7/8
6AB7	6/-	6X4	7/6	5763	9/-	KT44	7/-
6AC7	6/8	6X5	6/8	7193	2/8	KTZ41	6/8
6AG5	6/8	6Z4	8/8	9092	5/8	KW262	5/-
6AG7	12/8	7C5	8/-	9003	5/8	MH4	5/8
6AK5	7/8	7D8	6/-	ARP3 (A)	5/-	ML4	6/8
6AL5	6/-	7E7	7/6	ATP4	3/-	Pen 46	7/-
6AM5	6/8	7V7	8/8	BL63	7/8	Q8150/15	10/8
6AM6	6/8	8D2	2/6	D77	6/-	RM4	12/6
6AG5	8/8	12A6	6/8	DAF91	7/-	RL37	6/-
6AT6	8/-	12AH7	12/6	DF91	7/-	SP4(7)	8/8
6BA6	7/6	12AT7	9/-	DF92	6/-	TP22	8/8
6B8	4/-	12AU7	9/-	DR77	8/-	UL41	9/-
6BE8	7/6	12BE8	6/8	DL510	10/8	UJ9	9/-
6BW6	7/6	12C1	7/-	DL72	7/-	Y6	12/6
6C4	7/6	12H6	3/-	EAS0	2/-	U31	6/8
6C8	8/-	12J5	6/-	EAC91	9/-	U50	7/8
6C8E	6/6	12K8	8/-	EL148	2/-	VP4(7)	8/8
6FM	8/-	12SC7	7/-	EB34	2/-	VR105/30	9/8
6F8	7/-	12SG7	5/6	EB91	6/-	VR150/30	8/8
6F12	6/8	12S7	6/8	EB33	7/6	W61	6/-
6F32	6/8	12SK7	6/-	EB41	10/-	XH(1.5)	4/8
6F33	9/8	12SQ7	8/6	EC91	7/-	XSG1.5	6/8
6G6	6/8	12SR7	7/8	ECC33	9/-	X88	6/8
6H6	2/8	12U5G	7/-	ECC35	9/-	Y63	12/6
6J6	7/8	18	8/-	ECC81	9/-	Z77	6/8

All boxed and guaranteed. Post 6d each. Immediate delivery. Full list S.A.E. Shop hours 8.30 to 5.30. Sats. 1 p.m. Why not phone or wire that urgent order for same day despatch C.O.D.?

## POLYTHENE INSULATORS, END CAPS, PLUGS, ETC.

# for T.V. AERIALS

Standard Articles or Special Mouldings

### AMPLEX APPLIANCES (KENT) LTD.

19 DARTMOUTH ROAD, HAYES, BROMLEY, KENT

(RAVensbourne 5531)

All export enquiries to

ANTEX LTD., 3 TOWER HILL, LONDON, E.C.3

## The H.E. Ltd. BULK ERASER NOW SUITABLE FOR

# GRUNDIG STENOIRETTE SPOOLS

LIST PRICE £7.10.0

Model 102 200-250v 50/60 c.p.s.

Model 103 100-130v 50/60 c.p.s.



Send for pamphlet and full details from:—

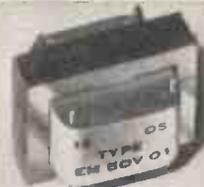
**HARVEY ELECTRONICS LTD.**

FARNBOROUGH, HANTS.

Tel.: Farnborough 1120

LONDON OFFICE:—

59 Union Street, S.E.1. Phone: HOP. 4567



## BELCLERE

MINIATURE

INPUT, OUTPUT  
AND INTERSTAGE

## TRANSFORMERS

We specialise in the manufacture of coupling transformers to customers' requirements. An illustrated brochure describing the range of transformers we manufacture will gladly be sent on request.

Illustrated above is a standard input transformer type "E" size 1in. x ½in. x ½in. overall, available with varnish dip finish, encapsulated block form, or in mu-metal screening can

Quick delivery—low prices—maximum efficiency.

**JOHN BELL & CRYDEN, 117 HIGH STREET, OXFORD**

Telephone: 47072.

Cables: Belclere, Oxford.

## LYONS RADIO Ltd.

**RECEIVERS TYPE R.1155 "B"** These are an improved version of the well-known R.1155 "A." Frequency range 18-7.5 Mc/s., 7.5-3 Mc/s., 1.5 Mc/s.-600 Kc/s., 500-200 Kc/s., and 200-75 Kc/s. Fitted with 10 valves (3-VR99, 3-VR100, 2-VR101 and one each VR102 and V103). These receivers are fitted with a superior type of slow-motion drive which is a considerable improvement on the type fitted to the models of earlier design. In good, new condition and aerial tested before despatch to ensure in first-class working order. PRICE £11/11/-, carriage 7/6.

**POWER PACK/OUTPUT-STAGE UNITS.** Specially designed to operate the R.1155 receivers from A.C. mains and to provide for loudspeaker output. Fitted with 3Z4 rectifier and 6V6 output valves and connector which plugs direct into receiver for immediate use. Housed in neat metal cases approx. 9x7x4½in. PRICE £4/4/- or £4 with R.1155. Carriage 3/6.

**MICROPHONES.** A superior carbon type, candlestick pattern, fitted to extension arm with stand for bench mounting and single carpiece fitted with double wire head. Extension arm allows mike to be moved from mounting between 8 to 25in. American made by the famous Western Electric Co. In brand new condition. PRICE 32/6, post 2/6.

**SLYDOK FUSE HOLDERS.** 5 amp. size 3 for 6/8, 6 for 11/9. Trade enquiries for bulk quantities invited.

**F.M. for the HOME CONSTRUCTOR.** Basic theory and practical circuits. PRICE 5/6 post paid.

**3 GOLDHAWK ROAD (Dept. M.W.), SHEPHERD'S BUSH, LONDON, W.12** Telephone: Shepherd's Bush 1729

# WE PAY TOP PRICES

FOR  
AMERICAN SURPLUS  
ELECTRONIC EQUIPMENT  
LOOK AT THESE EXAMPLES  
For equipment in good condition

Receiver RS4/APR4 complete .....	£200
Test Sets, TS13 .....	£100
Frequency Meter TS175/U .....	£80
Frequency Meter BC221 .....	£20
Receiver BC348R .....	£25

We pay similar remarkable prices for many other U.S.A. units not listed above. We particularly require American test equipment. If you have anything to offer, telephone Central 7834.

**TO HAMS WHO CONVERTED BC348, BC342, BC312**  
Post to us the dynamotors and power units which you removed  
We pay top prices for these items i.e., DM28, DM21, RA20.

### TO OVERSEAS BUYERS

We have the largest stock in Europe of American Government surplus electronic equipment and we would be pleased to quote by return of post against your enquiries. The following are a few examples only of the equipment which we can supply from stock.

BC221 Frequency Meter.
BC348 Receiver.
SCR522 Transmitter/Receiver.
ET4336 Transmitter.
SCR720C Search Radar complete, also separate units and spare parts.

Please write for our list.

Deal with the firm that has been established for twenty-five years.

## ALTHAM RADIO CO.

JERSEY HOUSE, JERSEY STREET  
MANCHESTER 4

Telephone: Central 7834/5/6

## THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY

has vacancies for the following skilled craftsmen to serve as Research and Experimental Mechanics at Windscale Works, Sellafield, Cumberland.

- ★ **INSTRUMENT MECHANICS**  
for interesting work in connection with electronics and precision instruments.
- ★ **MAINTENANCE FITTERS**
- ★ **MAINTENANCE ELECTRICIANS**

All applicants must have served a recognised apprenticeship as appropriate.

Rates of Pay for a 44 hour, 5 day week, 171/1d. on entry, with early assessment for merit pay, and opportunities for advancement to 197/1d. with a maximum of 213/1d. for a specialised few in the case of Instruments Mechanics. Successful married applicants will be considered for housing within a reasonable period of appointment and Hostel accommodation is available for single men.

For application forms, or further details, apply to  
The Senior Labour Manager,  
UNITED KINGDOM ATOMIC ENERGY AUTHORITY,  
Windscale Works, Sellafield, Cumberland.

## MARCONI INSTRUMENTS LTD LONGACRES HATFIELD ROAD ST. ALBANS

**TECHNICAL WRITER** required for Technical Literature (telecommunications) section. The applicant should have electrical engineering qualifications and/or experience in the design, or, development of electronic equipment.

The firm produces light current communication, measuring and test apparatus for a wide field of requirements. Excellent opportunity for experienced man to broaden experience.

Offices are pleasantly situated near City centre and all amenities and within easy reach of London.

Holiday arrangements can be maintained.

## MARCONI INSTRUMENTS LTD LONGACRES HATFIELD ROAD ST. ALBANS

Technical Assistants, or, Testers required.

We have vacancies for men of City and Guilds Final Certificate telecommunications standard, or, compensating experience in U.H.F. and V.H.F.

The firm produces light current measuring, test and communication instruments for a wide range of requirements also X-ray diagnostic and therapeutic and electro-medical apparatus. Suitable applicants can be considered for training in X-ray technique. Other posts entail some travelling and liaison with customers.

Works are pleasantly situated near City centre and all amenities and within easy reach of London.

## Z & I AERO SERVICES LTD.,

OFFER THE FOLLOWING EQUIPMENT:

**BONDING TESTERS**, A.M. Ref. No. 5G/2126, complete with matched leads..... £6 15 0

**RECTIFIERS RA-62**—A.C. operated power supply units for ground operation of SCR-522 Radio Sets. Input: 110/220V, 40-60 c/s. Rated output: H.T.—300V, 260 mA. L.T.—13.0V, 3.9 mA. G.B.—150V, 10 mA. PRICE, overhauled, in perfect operating condition, ex our warehouse..... £50 0 0

### ACCESSORIES

Headsets HS-38, low impedance, consisting of two earpieces ANB-H1, Cord and plug PL-354..... £0 12 6

**R.A.F. Type Receiver Headgear Assembly**, consisting of two low or high impedance earpieces 10A/13466 or 10A/12401, headband 10A/12160 with earpads, cord 10H/4887 and electromagnetic microphone 10A/14381..... £1 5 0

Headsets Cords CD-605, consisting of low-to-high impedance transformer C-410, cable and plug PL-55, for using low impedance Headsets HS-30 with high impedance equipment..... £0 10 0

Extension Cords CD-307, consisting of socket JK-26, plug PL-55 and cable..... £0 10 0

### ALSO STILL AVAILABLE

Marconi Signal Generators TF-390G, range 16-150 M/c and TF-390G/7, range 4-100 M/c., completely overhauled and guaranteed. PRICE, ex our warehouse £25 0 0

Please write for full Catalogue of Aircraft, Radio and Test Equipment to:—

## Z & I AERO SERVICES LTD.,

19, Buckingham St., London, W.C.2

Telephone: TRAfalgar 2371/2

We always buy American Radio Equipment and Test Equipment of any description.



## E.M.I. ENGINEERING DEVELOPMENT LTD.

is the active and steadily expanding Development Company of the E.M.I. group, makers of H.M.V., Columbia and Emitron products. The company has a limited number of highly attractive vacancies at its laboratories at Hayes and Feltham (Middlesex), and at Wells (Somerset).

### VACANCIES

Senior Engineers and Physicists, qualified and with experience, are needed for teams engaged on a variety of problems of electronics development.

Engineers and Physicists, also qualified and preferably with some experience, but this is not essential, to back up our senior men.

Senior Designers and Draughtsmen, the former to design the mechanical equipment associated with the company's work, the latter to work either on the circuit or mechanical side.

Technical Writers, with sound engineering background and, preferably, knowledge of Radar and TV techniques, who must be able to write clear, concise, factual descriptions of intricate electronic-mechanical proto-type equipment.

Technical Assistants, with O.N.C. and some experience either in industry or with the services.

School Leavers, with G.C.E. ordinary or advanced level to join our trainee courses run in conjunction with E.M.I. Institutes.

All posts are pensionable. Salaries are commensurate with ability, experience and the responsibility to be undertaken. Prospects in the company are excellent.

Please reply in the first instance, with full details of experience, to

Personnel Dept. (ED/EE)

E.M.I. Engineering Development Ltd.,  
Hayes, Middlesex.

ED9

## PARKER'S SHEET METAL FOLDING MACHINE



Heavy Vice Model. Capacity 18 gauge M.S. x 2ft. wide. Loose Attachments for Radio Chassis Making Weight 22 lb. Price 50/-. Attachments 1/6 per ft. Carriage 4/-. with attachments 5/6. Also Parker's Square Type Drill Vice. Machined table 7in. x 6in. x 1in. Jaws of Bright Steel. Admits stock of 4in. Complete with stand. Heavily constructed. Wt. 13 1/2 lb. Price 37/6. Carriage 2/6

Machines guaranteed. Send for details.

**A. B. PARKER** WHEATCROFT WORKS, WELLINGTON STREET, BATLEY, YORKSHIRE. Tel.: Batley 428

## INSULATING SLEEVINGS . . .

P.V.C. AND POLYTHENE SLEEVINGS INSULATED WIRES AND FLEXIBLES

An aircraft's performance . . . your car's reliability . . . tonight's Television and Radio's sound may depend upon efficient electrical insulation.

A.I.D. Approved

**PLASTICABLE LIMITED**  
HAWLEY LANE, FARNBOROUGH, HANTS

Phone: Farnborough, Hants 85

## The NEW ACRU SEALING IRON

Gives the right heat in the right spot and makes perfect joints. Suitable for most plastics.



Ask for leaflet

**THE ACRU ELECTRIC TOOL MFG. CO.,**  
CHAPEL STREET, LEVENSHULME, MANCHESTER, 19.

Tel.: Rusholme 4613

## **MAGNETIC AMPLIFIERS**

### **SHORT BROTHERS & HARLAND LIMITED**

have a vacancy in the Research Department for a

### **DEVELOPMENT ENGINEER**

to work on magnetic amplifiers for computing systems and automatic pilots.

**Qualifications:** University Degree and some years' engineering development experience with the capacity to accept full responsibility for the theoretical design and practical development of such components. Salaries are good, Pension Scheme, assistance with housing in Northern Ireland and with expenses of removal thereto.

Applications are treated in the strictest confidence.

Interviews either in London or Belfast.

Applications to Staff Appointments Officer, P.O. Box 241, Belfast, quoting S.A.51.

### **MARCONI INSTRUMENTS LTD LONGACRES HATFIELD ROAD ST. ALBANS**

---

**ELECTRONIC ENGINEERS** required. Excellent opportunity for men of degree standard and with suitable experience to broaden experience and avoid restrictive specialization by joining the staff of Marconi Instruments who produce light current communication, measuring and test apparatus for a wide range of requirements.

Holiday arrangements made can be maintained.

The posts are well remunerated and pensionable.

Laboratories are pleasantly situated near City centre and all amenities and within easy reach London.

### **MARCONI INSTRUMENTS LTD LONGACRES HATFIELD ROAD ST. ALBANS**

---

**DRAUGHTSMEN** required. Senior and Juniors. Men of at least O.N.C. standard and experience in radio. Excellent opportunity to broaden experience with well-known, well-established progressive firm producing light current measuring, communication, and test equipment for a wide field of application.

Holiday arrangements can be maintained.

On well-served transport routes. Saturday interview if required.

## SERVO-MECHANISMS

**SHORT BROTHERS & HARLAND LIMITED**

require a

### DEVELOPMENT ENGINEER

in the Research Department for interesting work on

## SMALL SERVO-MECHANISMS

involving electronic or magnetic amplifiers coupled to electric or hydraulic mechanisms.

Qualifications: University Degree. Development experience and ability to undertake theoretical analysis of feedback systems and engineering development of the components involved.

Salaries and conditions are good, pension scheme, assistance with housing in Northern Ireland and with expenses of removal thereto.

Applications are treated in strictest confidence.

Interviews in London or Belfast.

Applications to Staff Appointments Officer, P.O. Box 241, Belfast, quoting S.A.50.

THE  
**BRITISH NATIONAL  
RADIO SCHOOL**

ESTD. 1940

NOW IN OUR FIFTEENTH YEAR  
AND STILL

**NO B.N.R.S. STUDENT  
HAS EVER FAILED**

to pass his examination(s) after completing  
our appropriate study course.

If you have the **WILL**  
We can show you the  
**WAY**

A.M.Brit.I.R.E. and CITY and GUILDS Radio and  
Telecommunications Exams., etc., etc.

PRINCIPAL, M.I.E.E., M.Brit.I.R.E.  
**BRITISH NATIONAL RADIO SCHOOL**  
2, CANYNGE ROAD, CLIFTON, BRISTOL, 8  
Tel. BRISTOL 34755

## **ELECTRONIC DIGITAL COMPUTORS**

### **MEN ABOUT TO LEAVE THE ARMED FORCES**

with experience of Radar maintenance are invited to apply for posts now vacant, due to expansion, on this new and interesting type of engineering.

Previous experience on this equipment is not essential since training on **FULL SALARY** will be provided at

### **MARCONI COLLEGE**

to those people who lack the necessary "know how" but possess the interest and enthusiasm for this type of work.

Please apply in writing to

**Dept. C.P.S.**

**336/7, Strand, W.C.2**

**quoting ref. no. 1353D**

# 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 1955 issue, Thursday, June 2nd. 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

**C.J.R. ELECTRICAL & ELECTRONIC DEVELOPMENT, Ltd.**, Bickford Rd., Witton, Birmingham, 6. Tel. East 0822. SPECIALIZE in the manufacture of High Fidelity Sound Reproducing equipment, including: **WILLIAMSON Amplifiers**, Tone Control Stages with variable Steep Cut Filters, Cross-over Units, High Fidelity Portable Tape Recording equipments ideally suitable for replaying the new EMI pre-recorded tapes. **Professional Recording Amplifiers**, Microphone Mixing Units, etc. Send for details and leaflets. [0105]

**SHIRLEY Laboratories, Ltd.**, 125, Tarring Road, Worthing, Sussex, the precision high fidelity specialists; amplifier type SB/1-15E, 15 watts output, response 15 to 60,000 c/s, bass lift 18 db, cut 18db, treble lift 14 db, cut 20 db. B.V.A. valves, complete with engraved panel, 18gns; with 3 position switched input filter 19gns; also the Jupiter reproducers at 34gns, the WB/U 6 watt amplifier, 12gns; tape amplifiers to suit most decks; specialized amplifiers to order for the musical and scientific industries. Tel. Worthing 513, 3571. [0095]

### RECEIVERS, AMPLIFIERS—SURPLUS AND SECONDHAND

**EDDYSTONE 680X**, practically unused and as new, with speaker: £70.—Box 3191. [4600]

**CAPEHART** radiogram, bass/treble amplifiers, separate speakers, superb cabinet: £80.—Box 3232. [4605]

**Lyte** pre-amplifier type PF91A, unused; offers to Snelgrove, 316, Canford Lane, Westbury-on-Trym, Bristol, Tel. 8240. [4671]

**G.E.C. B.R.T. 400** comm. rec., maker's check-over, new valves Nov. '54, condition as new; Whiteley Hi-Fi speaker; offers.—Box 3141. [4585]

**VORTEXION 15-watt A/C and 12-watt 20 watt A/C and 12-watt 15 watt A/C**, 4 inputs; the lot £40.—130, Fairlawn Park, Sydenham, S.E.26. Syd. 5934. [4606]

**ZENITH** super trans-oceanic portable, 7 bands 2-4, 4-9, 9-12, 12-19, 19-25m, 19m, 36m, 550-1600 kc/s, a.c./d.c./battery, very good condition; £45.—Box 3388. [4626]

**R.F. units**, new in original cartons, types 26-27 27/6, 25 11/6, 24 11/-, post 2/6.—E.W.S. Co., 69, Church Rd., Moseley, Birmingham. [4365 ham.]

**HRO Rx's** and coils in stock, also AR88, BC348R, CR100, etc.—Requirements please to R. T. & I. Service, 254, Grove Green Rd., London, E.11. Ley. 4986. [0053]

**WIRELESS WORLD 2R.F.** 3-valve quality tuner, M.W. and L.W., complete with fully smoothed power supply unit, unused, ideal for use with all high fidelity amplifiers; £7, including 4 valves, approx. half original price; limited number bargain.—Box 2974, [4516]

### LOUDSPEAKERS—SURPLUS AND SECONDHAND

**GOODMANS 12in** with recommended corner cabinet; £8.—Hunt, "Casterbridge," Brooklands Park, S.E.3. [4642]

**WHARFEDALE W15/GS**, £11; Broadcast and Acoustic 12in, 75/-; 2 high quality P.P. output transformers, 25/- each; all perfect.—65, Woodbourne Ave., S.W.16. Str. 1123. [4660]

### TRANSMITTING EQUIPMENT

**AVAILABLE:** ET4532B, BC375 with T.U., T1131, TR1430, TR1464, W.S.38.—E.W.S. Co., 69, Church Rd., Moseley, Birmingham. [4366]

## Specify PARTRIDGE

### TRANSFORMERS

**Because** each is backed by 21 years design and manufacture experience in this field.

**Because** each has been designed and manufactured to all relevant B.S. Specifications.

**Because** each has been individually tested and manufactured with the same care as one would to meet a rigid Government specification.

**Because** each carries a 12 months' guarantee which covers free replacement if failure is due to faulty workmanship or materials.

**Because** if you are building one of the many published circuits you will find that Partridge are specified whenever high fidelity is essential. Full literature is now available on request for the transformers and chokes specified in the Osram 912 and Mullard 10-watt High Quality Amplifier circuits.

**Because** if you require to take advantage of the C core technique in audio transformers, only Partridge offer a standard range.

## A new edition of the PARTRIDGE CATALOGUE

is now available

Contains up-to-date prices and specifications for a comprehensive range of transformers, chokes, etc.

WRITE FOR

YOUR COPY NOW

**PARTRIDGE TRANSFORMERS LTD TOLWORTH SURREY**

Phone: ELMbridge 6737/8

### NEW TEST EQUIPMENT

**T.V.** signal intensity meter (S.I.M.) for aerial checks and installation, etc; send for full details.—Radio-Aids, Ltd., 29, Market St., Watford. Tel. Watford 5988. [4653]

### TEST EQUIPMENT—SURPLUS AND SECONDHAND

**VARIACS**, type 80C In: 200-240v, 50c. Out: 220v, 7½amps, £5/10; type 500L-2G, In: 180v, 500c; out: 0-180v, 7-7amps, £14. **BRIDGE-MEGGERS**, 250v, series 2, complete in leather case, used, tested; £12/15. **SPEEDIVAC** pumps, Edwards, type 1, with 8in v-pulley, £15; motorised 230v, A.C., £21. **ADVANCE** constant voltage transformers, In: 204-275c; Out: 240v, 500w, £10. **VOLTAGE** regulators, Ferranti 230v motor-driven moving coil, 480va, £18; 1440va, £28. **MICROAMMETERS**, 2½in M.C., flush, round, centre zero, 250-0-250µA, 22/6 p.f. **P. B. CRAWSHAY**, 94, Pixmore Way, Letchworth, Herts. Tel. Letchworth 1851. [0097]

**AVO** valve characteristic meter; £30.—Apply, The House of Toomer Ltd., Newbury, Berks. Tel. Newbury 814. [4656]

**MULLARD** TV optical unit, complete with C.R. tube, in excellent condition, £11; Avo wide-range signal generator, £20.—Cosmic Radio, 129, Oxton Rd., Birkenhead. [4661]

**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. [0056]

**10** Cossor double beam oscilloscopes, model 3339; all in working order; £275 or £30 each plus carriage and insurance.—Cox Radio, 39, West St., Bognor Regis. [4581]

### NEW DYNAMOS, MOTORS, ETC.

**1500** cycles alternators 2KVA, 80v.—E.W.S. Co. 69, Church Rd., Moseley, Birmingham. [4601]

**SPECIAL** television rotary converters, guaranteed interference free, fitted radio and television filters, wt. 60lb, d.c. input 12v 200va, out, 24v, 32v, 110v, 230v, d.o., to 230v out, 250va £28/10 del., also converters for radiogram and general use, inputs, outputs and price as above; the above also supplied without smoothing, £25 del. immediate despatch; trade supplied.

AT a purchaser's home 60 mls. S.W. of Sutton Coldfield a 24v. TELEVISION converter was tested on Ekco television 12in tube, stated consumption 135 watts d.c. current from battery only 9½ amps, picture and sound were perfect and completely free of interference or flutter.

THE above is the latest product of British manufacture, and is guaranteed for one year. J.A.P. No. 2A 1.2hp petrol engine, air-cooled, 4-stroke, starting rope, tools; £17/10 delivered. T. W. PEARCE, 66, Great Percy St., W.C.1 (near Angel). [0013]

**DYNAMOS, MOTORS, ETC.—SURPLUS AND SECOND-HAND**

**2,000c/s** motor-alternator sets, input 220v d.c., output 80v, 1ph, 2,000c/s 6.25amps, 500VA, complete with starter, fuses, control panel and voltmeter, all mounted in ventilated steel cabinet 14in×26in×49in high, new in original cases; £16, carr. extra. **P. B. CRAWSHAY**, 94, Pixmore Way, Letchworth, Herts, Tel. 1851. [0096]

### NEW GRAMOPHONE AND SOUND EQUIPMENT

**NEW** portable tape recorder, Truvox deck Mk. 3; £40.—Box 3328. [4620]

**M.S.S. LED3** disc recorder, 3-speed; £76.—J. Bryant, West St., Cromer. [4658]

**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., Braunton, N. Devon, Tel. Braunton 224. Callers by appointment only. [0209]

Contains up-to-date prices and specifications for a comprehensive range of transformers, chokes, etc.

WRITE FOR YOUR COPY NOW

**PARTRIDGE TRANSFORMERS LTD TOLWORTH SURREY**

Phone: ELMbridge 6737/8

FOR SALE AND WANTED ADVERTISEMENT FORM

TURN TO PAGE NO. 171

**"AUTOMAT" CHARGERS and POWER PACKS**

as supplied to Ministries, Airline 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. 6 amps., using S.T.C. selenium rectifier, damp-proof, ultra reliable, wt. 16lb., for 215/245 v. A.C. 265/51 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, 45/-, p.p. 1/10. Handmade steel case, ready punched, louvered, enamelled, 12/6. No. 1A 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., 45 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. Minar 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. 150 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/-, case 4/-.

**SELENIUM RECTIFIERS, new stock not surplus, 6 v. 1 a., 4/-, 2 a., 7/6, 4 a., 15/6, 12 v. 0.5 a., 5/-, 1 a., 7/6, 2 a., 9/6, all p.p. 6d. 12 v. 1/4 v. 3 a. to 8 a., 15/6, 5 a., 27/-, Large finned 1 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/-, 3 a., 47/-, 230 v. 1 a., 97/-, p.p. 1/6. H.T. rectifiers, 130 v. 80 ma., R.M.2, 5/4, 135 v. 30 ma. elim., 5/6, 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

**EASY PAYMENTS ON 'SOUNDMASTER' COMPONENTS**

**W.B.201** Amplifier chassis, grommets, valve holders, etc., 35/- cash or 4/4 deposit and 8 monthly payments of 4/4.  
**W.B.202** POWER UNIT CHASSIS and Accessories, 31/6 cash or 3/11 deposit and 8 x 3/11.  
**W.B.204.** MAINS TRANSFORMERS, 67/6 cash or 8/3 deposit and 8 x 8/3.  
**"COLLAR" MOTORS.** Set of 3, 25/15/- cash or 14/2 deposit and 8 x 14/2.  
**BRENELL COMPONENTS.** £13/13/- cash or 33/5 deposit and 8 x 33/5.  
**BULGIN COMPONENTS, 23/10/-** cash or 8/6 deposit and 8 x 8/6.  
**LAB COMPONENTS, 48/6** cash or 6/- deposit and 8 x 6/-.  
**T.O.O. COMPONENTS, 24/3/-** cash or 10/3 deposit and 8 x 10/3.  
**WEARITE COMPONENTS, Red Seal Heads, 27** cash or 17/3 deposit and 8 x 17/1.  
**WEARITE COMPONENTS, Gold Seal Heads, 21/3/-** cash or 24/10 deposit and 8 x 24/10  
**LUSTRAPHONE MIKE, Specified C512, 25/15/6** cash or 14/3 deposit and 8 x 14/3.  
**TRUVOX TAPE DECK, E23/2/-** cash or 56/6 deposit and 8 x 56/6.  
**RADIO JACK (Standard) 23/8/4** cash or 8/4 and 8 x 8/4.  
**RADIO JACK (Senior) 24/4/11** cash or 11/8 and 8 x 11/8.  
**LANE TAPE TABLE, Mark VI, 2-speed, £18/10/-** cash or 45/3 deposit and 8 x 45/3.  
**GRUNDIG ACCESSORIES.** Let us know your requirements, we will be pleased to quote you.

Send your Remittance to Desk 169.

**"LAFCO"**

3, CORBETTS PASSAGE, ROTHERHITHE NEW ROAD, BERMONDSEY, S.E.16  
BERmondsey 4341 (Ext. 1)

**NEW GRAMOPHONE AND SOUND EQUIPMENT**

**T/R** amps 18gns and pre-amps £5/15 for 3-headed decks, inc. p. pack. and meter level ind.  
**GRUNDIG, Philips T/R** promptly supplied: Rectograph decks £31, for Lodestar; T/R amps for Wearite, Truvox, etc.. U/L output. TEL. Gla. 1770.  
**HARDING ELECTRONICS, 120a, Mora Rd., Cricklewood, London, N.W.2.** [0032]

**TAPE** recorders for sale, exchange, or hire in Greater London, good quality tape recorders wanted for cash, all types of repairs, mechanical and electronic, carried out by specialists, all accessories available, we deal exclusively in magnetic recording equipment.  
**THE MAGNEGRAPH RECORDING Co., Ltd., 1, Hanway Place, London, W.1. Tel. Langham 2156.** [3596]

**GRAMOPHONE AND SOUND EQUIPMENT SURPLUS AND SECOND-HAND**

**GRUNDIG 700C** Consul recorder with mlke, as new; quick sale, £58.—Box 5590. [4646]

**LOWTHER DT4** tuner, perfect: £22.—18, Hawkhurst Way, West Wickham, Spring Park 3398. [4672]

**TREX T41** Home Music amplifier, as new, unwanted gift; £10/10.—Hay, 3, Primley Gdns., Moortown, Leeds. [4644]

**VORTEXION 30-watt** gramophone reproducer, as new, cost £30, sell £22/10. 130 Fairlaw Park, Sydenham E.S.26. Syd. 5934. [4606]

**UNUSED Decca** ffr pick-up, 30/-; Wharfedale 3,000 c/s crossover 7/16 ohms 3/-; Whitlark 10, Rochester Drive, West Timperley, Cheshire. [4523]

**H.M.V.** disc recorder 2300 complete, all latest modifications, checked by E.M.I. last month; £130.—J. Bryant, West St., Cromer. [4659]

**FOR sale, Minlon** pocket size wire recorder, perfect condition, with all accessories, nine hours' recording wire; £130 value for £70.—Call Ful. 0389. London. [4582]

**GRUNDIG TK9**, as new, Golden mike, £55; Truvox Mk. III deck, £15; Truvox amp, unused, new, £13.—Taylor, 191, Ashton Rd., Denton, M/c. Den. 5182. [4387]

**NEW COMPONENTS**

**F.M.** new W.W. design; collists, kits, available now: BEL, FM and transistor pioneers.—Marlborough Yard, London Archway, N.15. Arc. 5078. [0185]

**NEW** mains transformers, fully shrouded, 250-230-250v, primaries 350-0-350, 150ma. secondarys, 6.3v 4ct, 6.3v 2a, 5v 3a fly leads, 42/6; 400-0-400 200ma 6.3v 4ct, 6.3v 3act, 5v 3a, 63/-.—C. S. F. Steward, 6, Broughton Rd., Hadleigh, Essex. [3585]

**COMPONENTS—SURPLUS AND SECOND-HAND**

**RADIO CLEARANCE, Ltd., 27, Tottenham Court Rd., London, W.1. Tel. Museum 9188.**  
**ELECTROLYTICS,** capacity, voltage, size, type of mounting, price post paid: 400, 6v, 1x2in, lug, 1/9; 250+250, 6v, 20x2in, lug, 2/-, 40, 150v, 1x2, clip, 2/6; 20+20, 275v, 1x2, lug, 3/3; 15+32, 275v, 1/2, lug, 3/3, 16+16, 275v, 1x2, clip, 3/3; 100, 275, 350v, 1 1/4x3, clip, 3/8; 32+12, 350v, 1 1/4x2, clip, 4/-; 16, 350v, 3/4x2, lug, 1/9; 10, 450v, 3/4x2, lug, 1/6; 16, 450v, 3/4x2, tag, 2/9; 32, 450/525v, 3/4x2, clip, 3/9; 15+15, 450v+20m, 25v, 1 1/4x3, lug, 4/-; 200, 6v 5x1 1/2, clip, 1/6; 100, 12v, 5x1 1/2, clip, 1/9; 8, 450v, 1x2, clip, 2/-; 150, 25v, 3/4x1 1/2, clip, 2/-; 250, 12v, 3/4x1 1/2, wire, 2/3; 40+40, 275v, 1 1/4x2, clip, 3/3; 24+24+16, 350/425v, 1 1/4x2, clip, 4/3; 4, 150v, 5/8x1 1/2, clip, 1/7; 500, 12v, 1 1/2x2, clip, 2/-; 8, 350v, 3x2, clip, 1/9; 32+32, 350/425v, 1 1/4x2, clip, 5/-; 2, 450/525v, 3/4x1 1/2, tag, 1/6; 8, 450v, 3/4x2, clip, 1/9; 64+120, 275v, 1 1/4x4 1/2, clip, 5/6; all all cans, some with sleeves, all voltages, WKG, surge where marked, new stock guaranteed.  
5mA meters, moving coil, bakelite case, 2in square, flush mounting new, boxed; 7/- post paid; 50mA, 8/6.  
MAINS TRANS., 250-0-250v, 80ma, 6.3v, 2.5A, 6.3v, 0.6A, Pri. 0-210-230-250v 12/- post paid.  
TELEVISION chassis, 13 valve, plated, new, size 14x13x2 1/2in, complete with 13 valve holders (9-B9A Pax, 1-B9A Cer, 2-B7G Cer, 1-Int. Oct. amp.), 20 various tag strips, cut away for metal rect., line trans., etc.; 9/11 each, post paid.  
FRONT and rear tube mounts to fit above chassis, 3/- pair, post paid.  
P.M. focus rings, wide angle, tetrode tube, fully adjustable, 12/- post paid.  
**RADIO CLEARANCE, Ltd., 27, Tottenham Court Rd., London, W.1. Tel. Museum 9188.** [0015]

**VARIAC 0-270V 2K.V.A.** type 100L; £12.—Taylor, 29, Mulhouse Ave., Edinburgh. 4. [4604]

**SOUTHERN RADIO SUPPLY, Ltd., 11, Little Newport Street, London, W.C.2.** See our displayed advertisement, page 158. [0016]

**METAL-GLASS** seals; single-way, hermetically sealed terminals for soldered connections and leads; mostly 1kv and 2kv sizes, new (surplus), 65/- per 1,000 assorted.—P. B. Crawshaw, 94, Pixmore Way, Letchworth, Herts, Tel. 1851. [0087]

**BENSON'S BETTER BARGAINS**

**BRAND NEW. ORIGINAL CARTONS. R.F. UNITS. TYPES 26 or 27, 27/6; 24, 15/-.**

Postage 2/6. RF25, Sotted, 12/6. High Stability, Close-tolerance Resistors, mainly 1/4 and 1 watt, from 10Ω to 5.1MΩ in pref. values; 1/- each. DYAMOTORS, D.C. (approx. 250 v. 80 ma., at 6 v.), 8/8, 12 v. input; 250 v. 60 ma. and 6.3 v. outputs, P.M. field, 7/8. Filters for these, 2/6. I.F. T's, new, canned 10/13 Mc/s, 1/6. POWER UNIT 285, 230 v. 50 c. input. Output D.C. 2 kv. 5 ma., 350 v. 150 ma. A.C. 6.3 v. 15 a., 3 valves. New 75/-, cart. paid inland. TRANSFORMERS, new, std. mains input; 6.3 v. 3 a., (twice), tapped 4 v. and 5 v. 9/8; 230 v. to 6.3 v. 5 a. and 10 a., 17/8; 2 kv. 5 ma., 2 v. 2 a., 20/-; 350-0-350 v. 150 ma., 5 v. 3 a., 25/-; 55 v. 30 ma. (twice), 6.3 v. 3.2 a., 9/-; 230-0-220 v. 33 ma., 71 v. 8 a., 8.4 v. 10 a., 5 v. 3 a. each C.T., 15/6; 740-0-740 v. 165 v.A., 470-0-470 v. 220 v.A., 4 v. 8 a., C.T. (twice), 30/- (cart. 6/-); 350-0-350 v. 120 ma., 6.3 v. 4 a., 4 v. 2 a., 16/- (post 2/- each). METAL RECS. 600 v. 30 ma., 6/-, H.W. 400 v. 1 a., 22/8. 240 v. 230 ma., 10/-, FW 24 v. 2 a., 12/6. MOTORS, thy 24 v. driving aerial switch, 8/6. R1165, coilpacks, new, 12/6, used, 9/6; twin knob drives, 7/8; I.F. Filters, 2/8; Condensers, tubular, 3 x 1 mfd., 1/-, RX 78, two band 8/W. Tuner, I.F. 560 kc/s, with 100 kc/s crystal, less valves, 22/6. Dipole Insulators, Perspex, flat, for 1' rods, 5/6. WAFER SWITCHES: 1P4W2B, 2P3W3B, 4P4W1B, 3P3W1B, 2P5W2B, 3P4W1B, 1P10W1B, 4P2W1B, 9P2W1B, each 1/6. Toggles SPST, new, metal, 1/6. R1261, valves 2E/PG4, 1E/C52, 1C/V66, VHF, with rotary coil selector, 17/6.

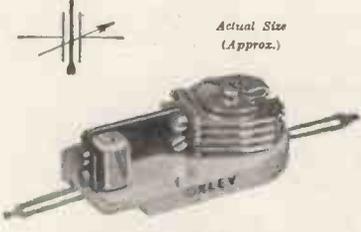
**METERS—BRAND NEW—BOXED**

FSD	Scale	Size	Type	Fit	Price
500uA		3 1/2in.	MC	Fl.Rd.	25/-
1mA		3 1/2in.	MC	Fl.Rd.	18/6
2mA		2in.	MC	Pr.Rd.	10/6
10mA		3 1/2in.	MC	Fl.Rd.	7/-
10mA		4 1/2in.	MC	Fl.Rd.	20/-
20mA	200A	3 1/2in.	MC	Fl.Rd.	7/-
30mA	50A	3 1/2in.	MC	Pr.Rd.	6/6
40 x 120 mA		2in.	MC	Fl.Sq.	7/8
100mA	300mA	2in.	MC	Fl.Sq.	5/-
100mA		3 1/2in.	MC	Fl.Rd.	7/-
200mA		2in.	TC	Fl.Sq.	6/6
200mA		3 1/2in.	MC	Fl.Rd.	7/-
250 mA		3 1/2in.	MC	Fl.Rd.	7/-

List and enquiries. S.A.E. please! Terms: Cash with order. Postage extra. Immediate despatch. Callers and Post Office Order (W.W.) 308 Rathbone Rd., Liverpool 13. ST0 1604. Callers: S U P E R A D I O (W) Chapel LTD., 110 Whitechapel, Liverpool 1. ROY 1130.

*Excellence in design..*

Specialists in Subminiature Telecommunication Components



**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

EXCELLENT  
REPRODUCTION

with the

**LOCKWOOD**

Standard Loudspeaker Cabinet



This new Lockwood model has been designed to give reproduction of a very high order and can be "tuned" to suit any make of loudspeaker unit.

We especially recommend the "TANNOY" 15in. and 12in. DUAL CONCENTRIC units, and we can supply complete with either of these models.

★ The LOCKWOOD STANDARD LOUDSPEAKER CABINET has been developed from the Monitoring Loudspeaker Cabinet used by the B.B.C. (B.B.C. Patent 696,671).

★ "Wireless World," November and December, 1950.

Two versions are available:—

Major Model **£35**

Minor Model **£25**

A brochure, free on request, fully explains these new models and why they are supplied ready to assemble.

Export & Tropical Models available.

Trade enquiries invited.

Demonstrations by appointment only.

**LOCKWOOD**

Acoustically Designed Cabinets

**LOCKWOOD & COMPANY**

LOWLANDS ROAD, HARROW, MIDDX.

BYRon 3704

**COMPONENTS—SURPLUS AND SECOND-HAND**

**SUPREME RADIO, 746b**, Romford Road, Manor Park, London, E.12. Tel. III. 1260 Est. 12 years.  
**BROWN** 800hm co-axial cable, 8d per yard or 7/6 doz yards; W/Wound 10K ohm knob-type pre-set v/controls, 2/6 ea.  
**EARTH** Rods, copper tube type; 1/8 ea.  
**ELECTROLYTIC** Cond., 8mfd, 450v wkg., sleeved tubular w/end; our price, 1/11 ea.  
**METALPACK** 0.1mfd 350v condensers; 8d ea., or 7/6 doz.  
**SPRAGUE**, 0.1mfd 350v condensers, w/end; 6d ea., or 5/6 doz.  
**STILL** a popular buy, Mains Trans, shrouded, upright, mounting with base connections, 290-0-290v 60m/a, 6.3v 1.5amp, and 4v 2amp, with screen, primary tapped on v./panel, 0-200v, 220v, 240v, size H 3 3/4in, W 3 3/4in, D 2 3/4in; 12/6 ea. and 1/- pack/post.  
**STEEL** Chassis, ready punched for s/het layout, 14in X 6in X 3in; 2/6 ea.  
**R.M.I.** Metal Recs, 3/11 ea.; R.M.2 type, 4/3 ea.; R.M.3 type, 5/11 ea.; R.M.4 type, 18/- ea.; 14A86 metal recs, 16/6 ea.; 14A100, 19/6 ea.  
**2-POLE** 2-way w/c switches; 1/- ea.  
**MICRO-PACK**, 25mfd, 25v, bias cond—small; 1/4 ea.  
**ALL** parts in stock for Denco F.M. unit, manual; 1/6 ea.  
**MULLARD** 5/10 Amplifier parts always in stock, manual; 2/6 ea.  
**TRY** us for Radio and Television component parts at the right price; your enquiries welcomed.  
**TERMS:** C.W.O.; no C.O.D.  
**SEND** 9d extra for postage orders under £5.  
**2 1/2d** S.A.E. all enquiries and list. [0021]

**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**, tuning units, TN17, TN18, TN19, for R54/APR4; £50 each offered.—Box 4963. [0261]

**£12** offered for Avo 8.—D. Stewart, Chalfont St. Peter, Bucks. Gerrards Cross 2683. [4602]

**WANTED**, set manufacturers' or ex-Government radio equipment, large or small quantities of valves, electrolytics, speakers, meters, also components.

**LOWE BROS.**, 9a Diana Place, Euston Rd., N.W.1. Eus. 1636/7. [4485]

**WANTED**, HRO coils, Rx's, etc., A.R.88s, BS348s, S27 etc.—Details to R.T. & I. Service, 254, Grove Green Rd., London, E.11. Ley. 4986. [0163]

**WANTED**, B.C.610 Hallicrafters, E.T.4336 transmitters and spare parts for same; best prices.—P.C.A. Radio, Beaver Lane, Hammersmith, W.6. [0079]

**WANTED**—Antique apparatus: Marconi magnetic detector, early Marconi hand keys, Marconi coherers and decoherers; exchange letters with other collectors of early wireless gear.  
**LOUIS RIZOLI**, 100, Bay View Ave., Salem, Massachusetts, U.S.A. [4670]

**WANTED**, signal generators types TF144G, WF517F, TF762A, frequency meters type BC221, TS174, TS175; also receivers types R1359 and R1294.—Send price and details to Hatfield Instruments, Ltd., 175, Uxbridge Rd., Hanwell, W.7. Tel. Ealing 0779/9857. [0037]

**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, S.27CA, U.S.A.; APR4 and tuning units TN18, 17, 18 and 19, RCA AB8D-LF Hallicrafters SX28; valves 707A-707B, 2K28, 2K39, 2K33, 2K41; highest offers given by return.—Ger. 8410 and 4447. Universal Electronics, 22, Lisie St., Leicester Sq., London, W.C.2. [0229]

**VALVES WANTED**

**ALL** types of valves required for cash; state quantity and condition.—Radio Facilities, Ltd., 38, Chalcot Rd., N.W.1. Primrose 9090. [4074]

**VALVES** purchased for cash; large or small quantities; why not make a parcel of your unwanted valves and send us full details with your price required in your first letter?—Walton's Wireless Stores, 48, Stafford St., Wolverhampton. [0061]

**CABINETS**

**LEWIS RADIO** have the best selection and finest finish.—See page 156. [0824]

**WALNUT** radiogram and television cabinets, soundly constructed; stamp for details.—R. Shaw, 69, Friarip Rd., Leytonstone, E.11. [4330]

**METERS WANTED**

**WE** urgently require meters of all types, meter components, test equipment, etc.; any quantity, large or small; prompt cash.  
**ANDERS ELECTRONICS, Ltd.**, 91, Hampstead Rd., London, N.W.1. Euston 1639. [4663]

**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. 47898. [0115]

**Armstrong**

Specialists for over 20 years in the manufacture of

**HIGHEST QUALITY CHASSIS**

Hand made by Craftsmen

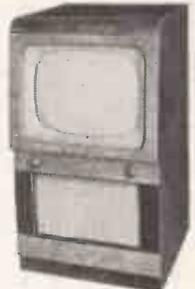


Price **£23.18.0** (inc. tax)

**F.C.48 RADIOGRAM CHASSIS** with provision for F.M. Tuner.

- 8 VALVES including 2 double triodes.
- 8 WATTS output from push-pull tetrodes.
- **NEGATIVE FEED BACK**—20 dB, resulting in negligible distortion and high damping factor.
- **BASS** and **TREBLE** controls independent and continuously variable, **LIFT** as well as cut. Unique Thermometer Visual Indicator ensures positive setting of these controls.
- **MAGIC EYE** Tuning Indicator.
- 4 WAVE BANDS: 16-50, 49-120, 190-550, 900-2000 metres.
- Large 4 colour illuminated dial.
- Overall size 12 1/2in. x 9in. x 9 1/2in. high.

**T.V.5 14" and 17" CONSOLE TELEVISION**



Giving the true black and white picture.

The same high standard of design and manufacture for which our radio chassis have been renowned for many years, has been maintained in the T.V.5 range. Aluminised rectangular Cathode Ray tubes are used, which together with tinted filters, pinpoint focussing, full bandwidth and accurate interlacing, ensure **BRILLIANT DAYLIGHT VIEWING**.

The cabinet is finished in beautiful walnut veneer and makes an elegant addition to any well furnished room. Silent running castors are fitted for easy movement.

The Prices (including Purchase Tax) are:—  
 17in. CONSOLE ..... £82 19 0  
 14in. CONSOLE ..... £72 9 0  
 The chassis may be purchased separately as follows:  
 17in. CHASSIS ..... £64 15 11  
 14in. CHASSIS ..... £54 0 3

\* Provision is made for a tuner which will enable you to receive alternative programmes as soon as it becomes possible to receive them in your area.

**ARMSTRONG WIRELESS & CO. LTD.** TELEVISION  
 WARTLERS ROAD, HOLLOWAY, LONDON, N.7  
 Telephone: NORth 3213/4

# Fidelia

**HAND BUILT  
QUALITY  
UNITS**



**MAJOR  
10 VALVE  
RADIOGRAM  
CHASSIS £32/8/4.**

Music Critic Fred, of world renown 'tis said,  
New to the Fidelia creation, sends us his commenda-  
tion,  
"The opera ('tis said) was very bad, the reproduction  
a sensation."

Fidelia F.M. Tuner	£13 10 0
Fidelia Standard 7-valve model	£21 12 0
Fidelia de Luxe 9-valve model with 7 watt triode push-pull output	£25 5 0
Fidelia 10 watt amplifier	£27 10 0

Are you ready to receive the new V.H.F. Frequency  
Modulated transmissions. Helpful details about  
these and particulars of suitable equipment in-  
cluding a fringe area tuner on request.



**ELECTRO  
Acoustic  
DEVELOPMENTS**

2 AMHURST ROAD,  
TELSCOMBE CLIFFS,  
Nr. Brighton,  
SUSSEX  
Tel: Peacehaven 3156

**REPAIRS AND SERVICE**  
**L** OUDSPEAKERS repaired promptly.—Model  
Loudspeaker Service, Bullingdon Rd.,  
Oxford. [4627]

**M** AINS transformers, E.H.T.s, chokes, field  
coils, etc., promptly and efficiently re-  
wound or manufactured to any specification.  
LADBROKE REWIND SERVICE, Ltd., 820a,  
Harrow Rd., London, N.W.10. [0222]

**S** ERVICE sheets for hire or sale, over 2,000  
models, radio and television, list 1/- s.a.e.  
enquiries.—W. Gilbert, 24, Fritchville Gardens,  
London, W.12. Tel. She. 3052. [4296]

**T** RANSFORMER rewind service, mains,  
E.H.T. transformers and chokes, prompt  
delivery, range of replacement types ex-stock  
or manufactured to your specification  
METROPOLITAN RADIO SERVICE Co., 75,  
Kilburn Lane, London, W.10. Ladbroke 2296.  
[0200]

**N** OTICE that Melton Electronics, Ltd., 387,  
Ashley Rd, Parkstone, Poole, Dorset, manu-  
facture transformers, chokes, line and frame  
outputs, R.F. and E.H.T. coils, and a complete  
range of "C" core types.  
**Y** OUR enquiries for rewinding all Commercial  
Types will receive immediate attention. [4669]

**E** LECTRICAL test instruments repaired and  
recalibrated, all makes, ammeters, voltm-  
eters, multi-range test meters; meters suppl-  
ied or converted to any range.—Electrical  
Instrument Repair Service, 329, Kilburn Lane,  
W.9. Ladbroke 4168. [4016]

**24-HOUR** service, 6 months' guarantee, any  
i.f.c. transformer; rewind, mains outputs and  
i.f.c. etc.; all types of microphones; trans-  
mitted to specification; business heading or ser-  
vice card for trade prices.—Majestic Winding  
Co. 180, Windham Rd., Bournemouth. [4268]

**R** EWINDS and conversions to mains and out-  
put trans., pick-ups, fields, clock coils,  
etc., from 4/6; P.P. equipment a speciality; all  
work guaranteed.—N. L. Rewinds, 173, High  
Rd., Willesden Green, N.W.10. Tel. Words-  
worth 7791. [4657]

**D. C. BOULTON** for repairs to any loud-  
speaker, specialists on heavy and P.A.  
types; cone assemblies, field coils, repair acces-  
sories, pressure units, microphones; trans-  
formers rewound and to specification; motor  
rewinds.—Lumby St., Manchester Rd., Brad-  
ford. Tel. 22838. [0171]

**A** RMATURE rewinding service to the trade,  
vacuums, drills, grinders, hood dryers,  
dental motors, vacuum cleaner armatures re-  
placed from stock; 24 hours' service; every job  
guaranteed we also specialize in complete over-  
hauls and rebuilds of vacuum cleaners; all  
vacuum cleaner parts, boxes, bearings, fans,  
brushes for any make in stock.—Regam Elec-  
tric, 95, Park Lane, Leeds, 1. [0028]

**PAINTS, CELLULOSE, ETC.**  
**P** AINT spraying handbook 3/6 post free,  
cellulose and synthetic paints and all spray-  
ing requisites supplied; catalogues free.—Leo-  
nard Brooks, 53, Harold Wood, Romford. 0207

**BUSINESS AND PROPERTY**  
**P** ROSPEROUS Black Country town main road  
lock-up shop, garage, self-contained flat  
and 2-storey workshop, all 600 sq. ft. work-  
shop 1,000 sq. ft, garage 650 sq. ft; suitable con-  
tractor/retailer/distributor; freehold and vacant  
possession, £3,000.—Box 3390. [4624]

**WORK WANTED**  
**C** AN we help Your development or produc-  
tion; assembly and wiring service at your  
disposal.—R.A.E. Mfg. Co., 135a, Kentish Town  
Rd., N.W.1. Gul. 7011. [0219]

**C** APACITY available for small plastic moulds  
and stamping tools; highest limits, clean  
work, reasonable prices; speciality: hearing  
aids and electronic components.—Toolmaker,  
23b, St. Stephens Ave., London, W.12. [0084]

**CAPACITY AVAILABLE**  
**T** RACING, electrical and mechanical, elec-  
tronic equipment, to IDP 13 specifications.  
—Everson & Co., 72, Station Rd., Hampton,  
Midxx. Tel. Molesey 2131. [4655]

**V** ACUUM impregnation capacity available.  
Hadfields Solventless to RCS214 Specifica-  
tion.—Enquiries to, Avis & Baggs, Ltd., Gos-  
brook Rd., Caversham, Reading. Tel. 71765. [0094]

**MISCELLANEOUS**  
**T** O manufacturers, technical institutes,  
research depts., etc.  
**H** IGH voltage oil-filled condensers, 5+ 5 mfd,  
2,200 volts; normal price 56/- each; limited  
stock to clear at 12/6 each.—Box 3086. [4538]

**M** ETALWORK, all types cabinets, chassis,  
racks, etc., to your own specification;  
capacity available for small milling and cap-  
stan work up to 1in bar.  
**P** HILPOTT'S METAL WORKS, Ltd., (G4B1),  
Chapman St., Loughborough. [0206]

**F** ERROGRAPH recorders for dependability.  
We have several years' experience using,  
supplying these fine instruments. Microphones,  
tapes, splicers (8/9 post free). Disks from  
your tapes, L.P. and 7/8. Hear our recording  
Royal Fireworks Music Paxton Records pr.  
648. Intending callers please telephone first.—  
Erica Recording Studio (1949). 31, Peel  
St., Eccles, Manchester. Eccles 1624. [0121]

**NEW G.E.C., S.T.C. AND "WESTALITE" SELENIUM RECTIFIERS.**  
Largest L.T. range in Great Britain.  
Latest Current Products. NOT Surplus.

## CURRENT PRICE LIST

**DEDUCT 15% FROM S.T. & C. PRICES.**  
S.T. & C. E.H.T. K3/15, 4/5; K3/45, 8/2;  
K3/50, 8/8; K3/100, 14/8; all post 4d. extra.

**BRIDGE CONNECTED FULL WAVE.**  
17 v. 1.2 a., 16/4; 1.6 a., 26/-; 2.5 a., 29/-;  
3 a., 30/-; 4 a., 34/6; 5 a., 37/6; all post 6d.  
33 v. 0.7 a., 24/3; 1 a., 28/-; 1.5 a., 45/-;  
2 a., 51/-; 3 a., 52/-; 4 a., 62/-; 5 a., 67/-;  
all post 1/- 54 v., 1 a., 38/6; 1.5 a., 62/-;  
2 a., 69/-; 3 a., 70/-; 5 a., 93/-; 72 v., 1 a., 49/-;  
1.5 a., 78/-; 2 a., 81/-; 3 a., 92/-; 5 a., 122/-;  
100 v. 1 a., 70/-; 1.5 a., 112/-; 2 a., 128/-;  
5 a., 174/-; all post 1/4.

**BRIDGE CONNECTED HEAVY DUTY**  
7 1/2 in. SQUARE COOLING FINS. 17 v.  
6 a., 49/6; 10 a., 56/-; post 1/10.

**BRIDGE CONNECTED HEAVY DUTY**  
Funnel Cooled, also  
7 1/2 in. SQUARE COOLING FINS. Re-  
vised price, same both types. 17 v. 12 a.,  
102/-; 20 a., 118/-; 30 a., 164/-; 50 a.,  
£12/15/-; 33av. 6 a., 91/-; 10 a., 104/-; 12 a.,  
168/-; 20 a., 188/-; 54 v. 6 a., 120/-; 10 a.,  
142/-; 72 v. 6 a., 154/-; 10 a., 178/-; 100 v. 6 a.,  
£11/10 a., £12/15/-; all post 2/-.

**"WESTALITE" (BRIDGE), 12-15 v.**  
D.C., 1.2 a., 15/10; 2.5 a., 27/8; 5 a., 31/9;  
10 a., 54/6; 20 a., 99/6; 30 a., 144/10; 50 a.,  
257/-; 24 v. 1.2 a., 15/10; 2.5 a., 27/8; 5 a.,  
51/-; 10 a., 92/8; 20 a., 176/2; 36 v. 1.2 a.,  
27/8; 2.5 a., 51/-; 5 a., 69/10; 10 a., 130/9;  
E.H.T. RECTS., 14D, 134, 22/-; 36 E.H.T. 60,  
31/10, all post extra.

Wholesale and Retail  
Special Price for Export and Quantity.

## T. W. PEARCE

66 GREAT PERCY STREET, LONDON, W.C.1  
Off Pentonville Rd. Between King's Cross and Angel

*"Easco"*  
**INTER-COM &  
SOUND Advisors**



BRIGHTON TERRACE, LONDON, S.W.9  
Phone BRixton 4961  
(3 lines)

EASCO ELECTRICAL  
(HOLDINGS) LTD.

# TANNOY

SOUND EQUIPMENT

Tells you what's going on clearly

WEST NORWOOD · S.E.27  
Telephone: GIPsy Hill 1131 (7 lines)

**This UNIQUE BENDER**



*Quickly and Accurately Forms*  
Angles, Channels, Sections, Boxes, Lids,  
Trays, Tanks, Chassis Brackets, Clamps,  
Clips, Shrouds.  
Chemical, Electronic and Electro Medical  
apparatus. Used by leading Radio Manufac-  
turers. Invaluable to Servicing Engineers,  
Hospitals, Universities and Research Workers.

For 6 page Folder write to:—  
**A.A. TOOLS (W)**  
197a Whiteacre Rd., Ashton-u-Lyne  
Every genuine A.A. tool bears this mark.

Introducing the:—  
**TYANA TRIPLE THREE**



Reg. Design,  
No. 867884

**MAKE SOLDERING A PLEASURE  
SMALL SOLDERING IRON**

Complete with detachable BENCH 19/6  
STAND

The smallest high-power soldering iron.  
Length only 8 1/2 in.; adjustable long bit dia.  
3/16; mains voltages 100/110, 200/220,  
230/250.

## The "STANDARD"

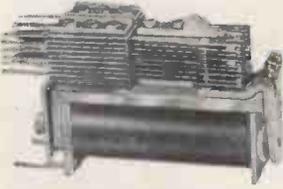
Popular Soldering Iron



now reduced to 14/11  
Replacement Elements and Bits for both types  
always available.

**KENROY LIMITED**  
152/297 UPPER ST., ISLINGTON,  
LONDON, N.1.  
Telephone: Canonbury 4905-4663

**RELAYS TYPE 3000**



**BUILT TO YOUR SPECIFICATION—EARLY DELIVERY—QUOTATION BY RETURN—PLEASE STATE RESISTANCE OF COIL REQUIRED AND CONTACT BUILD UP.**

**GENALEX EXTRACTION FANS.** 230/250 volt, 50 cy. Induction motor 1,350 r.p.m., 85 watts, 9in. blades, silent running. **£8/15/-**. Carriage 7/6.  
**CELL TESTING VOLTMETERS.** 3-0.3 volts. In leather case with leads. **25/-**. Post 2/-.  
**RATIO ARM UNITS** by H. W. Sullivan. Brand new. 600 ohms-600 ohms. **50/-**. Post 2/-.  
**WHEATSTONE RESISTANCE BRIDGE.** Manganin. 1 to 10,000 ohms. **25/-**.  
**GALVANOMETER.** Mirror type, 5 Microamps F8D. Table model in case 8x5 1/2 x 5 1/2 in., scaled 0/5, 0/25, 0/125 microamps. **£10/-**.  
**MICROPHONE.** A most attractive professional mike for studio use, etc., with a beautiful friction slide, adjustable heavy floor stand, complete with 12ft. screened cable. **£8/6/-**. Post 2/6.

**MICROAMMETERS**

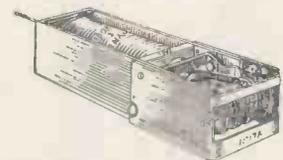
250 F.S.D. 3 1/2 in. FLUSH MODEL S37  
 Specially scaled for test meters. Knife edge pointers, magnetic shield. Brand new. **55/-**  
**BLOWER MOTORS.** Dual voltage 12-24 volts. Recommended for car cooling or heating. **25/-**. Post 2/-.

**RECEIVER RI155**

**BRAND NEW. AERIAL TESTED**  
 In maker's original transit case. Now is the chance to get one from the best delivery we have had from the Ministry. Carr. **£11-19-6**  
 10/6. Send S.A.E. for further details or 1/3 for publication giving circuit diagrams, etc. Others available from **£9/10/-** according to condition.  
**45 Mc/s PVE IFF STRIP.** These vision units are brand new and complete with 6 EF50 valves and EA50. Our price only **65/-**. Post 2/6.

**TELEPHONE SETS**

**FOR PERFECT COMMUNICATION BETWEEN 2 OR MORE POSITIONS**  
**WALL TYPE.** One, pair of units, **25/-**. Batteries 5/8. Twin wire 5d. yd. Post 2/6.  
**DESK TYPE** now available, latest modern style. Two complete units with battery, ready for use. **£8/17/6**. 3 core flex required at 5d. per yard.  
**RACKS P.O. STANDARD** for 19in. panels. Steel channel sides, correctly drilled. Heavy angle base. Height, 4ft. 10in. or 6ft. **22/6**. Post 2/-.  
**VACUUM PUMPS or Rotary Blowers.** Ex-R.A.F. Brand new, 7 cu. ft. per min. 10 lb. per sq. in. at 1,200 r.p.m. Ideal for a brazing torch, etc. Size 6in. x 4in., shaft 2 x 1/4 in., 22/6. Post 2/-.  
**LOW MOTION DIALS.** 6in. Scaled 0-100, reduction 200 to 10 direct, ideal for wavemeters, signal generators, etc. Our price, while they last, 5/6 each. Post 1/6.  
**VOLTMETERS.** 0/300 v. A.C. 50 cy. 5in. projection type moving iron, 60/-.  
**VOLTMETERS.** 0/300 2in. flush D.C. moving coil, 10/6; 0/40, 10/6; 0/20, 10/6. Post 1/-.  
**AMMETERS.** 2in. Flush 0/20, 10/6 each. 20-0-20, 12/6 each. Moving Coil D.C.  
**MOVING COIL METER** with 1 mA. movement, 21in. type rectifier type scaled 0/100 volts A.C., resistance, 100 k. ohms. A very useful basic meter. **30/-**.



**ELECTRO MAGNETIC COUNTERS.** Post Office type 11A, counting up to 9,999, 2 to 6 volts D.C., 3 ohm coil, 12/6 each. Post 1/- Many other types in stock, lists sent with order or send S.A.E.  
**HEADPHONES. HIGH RESISTANCE.** 4,000 ohms. Type CHR. New. 12/8 pair. Post 1/6.  
**ACFIL PUMPS.** These pumps enable you to fill all accumulators on the bench with the carboy at floor level. Brand new, only 30/-, post 2/-.  
**ROTARY CONVERTERS.** Input 12 volts D.C., output 230 volts A.C. 50 cycles, 100 watts, 92/8 each. Also available with 24 volt input, carr. 7/8.  
**LISTS AVAILABLE.** Rotors, Motors, Telephones, Rectifiers, Relays, Potentiometers, Resistances. All types including High Stability Carbon and Wire wound. Send S.A.E.

**L. WILKINSON**  
 (CROYDON) LTD. DEPT. W.W.  
 19, LANSDOWNE ROAD, CROYDON

**MISCELLANEOUS**  
 YOUR own tape recording transferred to disc.—Write, call or 'phone Queensway Private Recording Studios, 123, Queensway, W.2. Tel. Bay. 4992. Studio recordings, tape recording service. [4662]

**BUILD your own TV and learn about its operation, maintenance and servicing; qualified engineer-tutor available whilst you are learning and building.—Free brochure from E.M.I. Institutes, Dept. WW.58, London, W.4. (Associated with H.M.V.) [0130]**

**COPPER wires enamelled, tinned, Litz, cotton, silk covered, all gauges; B.A. screws, nuts, washers, soldering tags, eyelets, ebonite and laminated bakelite panels, tubes, coil formers; Tufnol rod, headphones, flexes, etc.; latest radio publications, full range available; list, s.a.e.; trade supplied.—Post Radio Supplies, 33, Bourne Gardens, London, E.4. [0138]**

**NOTICES**

**BRITISH SOUND RECORDING ASSOCIATION.** Details of membership. Open to the professional and recording engineer and all others interested in recording 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]

**PUBLIC ANNOUNCEMENTS**  
**NATIONAL College of Horology and Instrument Technology.**  
 THE Minister of Education, in consultation with the Board of Governors, proposes to fill a vacancy, as from September 1st, 1955, for a Head of the National College of Horology and Instrument Technology.  
 THE College is accommodated at the Northampton Polytechnic, St. John Street, London, E.C.1. The College provides for technical education and research to the highest levels in connection with the horological and the instrument making industries. The curriculum includes a three-year Diploma Course in Horology. Advanced courses in Instrument Technology are projected for next session.  
**CANDIDATES** for the post must have good academic qualifications and industrial experience.  
**SALARY** scale £1,265 by increments of £50 a year to £1,415 p.a.  
 THE post is recognised for pension purposes under the Teachers' Superannuation Acts.  
 A LETTER of application to include particulars of age, academic qualifications, industrial experience, and the names of three persons to whom reference may be made, should be sent to the Secretary, National College of Horology and Instrument Technology, Northampton Polytechnic, St. John St., London, E.C.1. [4596]

**AGENCIES WANTED**  
**WE** intend sending one of our sales managers to Pakistan, India, Ceylon, Burma, Thailand, Malay, Indonesia, etc., during the latter part of this year; manufacturers of radios, parts and electrical equipment seeking new outlets and distributors, and prepared to enter into provisional agency agreements, are invited to communicate with us—B. Ashworth & Co. (Overseas), Ltd., King's House, 36/7, King St., London, E.C.2. [4629]

**SITUATIONS VACANT**  
 The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is exempted from the provisions of The Notification of Vacancies Order, 1952.  
**CITY** of Liverpool  
**EDUCATION** Committee.  
**RIVERSDALE** Technical College.  
**PRINCIPAL:** A. B. Kinsman, B.Sc. (Eng.), A.M.I.E.E., A.M.I.Mech.E.  
**APPLICATIONS** are invited from suitably qualified persons for the undermentioned appnts. (full-time)  
**GRADE B** Assistant Teacher for Radio and Electrical Engineering; industrial experience desirable.  
**GRADE A** Assistant Teacher to assist in full-time P.M.G. Certificate and part-time Radio Servicing Courses; industrial and/or marine experience an advantage.  
**SALARIES** in accordance with the Burnham Technical Scale, 1954.  
**FURTHER** particulars and form of application (returnable as soon as possible) may be obtained from H. S. Magnay, M.A., Director of Education, 14, Sir Thomas St., Liverpool, 1.  
**THOMAS** Alker,  
 TOWN Clerk and Clerk to the Local Education Authority. (JA.3890.) [4645]

**MAINTENANCE** of multi-channel demonstration links.  
**TWO** engineers, with suitable radio experience, required for the maintenance of the above—Apply to the Personnel Manager, Pye Telecommunications, Ltd., Ditton Works, Cambridge. [4525]  
**COMPETENT** TV and radio engineer, able to drive; excellent salary and prospects; S.W.3 district.—Box 3140. [4588]  
**SENIOR** TV engineers required; must drive. S salary from £650 p.a.—Apply E. Coyne, 120, Ladbroke Grove, W.10. Bay. 1947. [0052]

**GILSON TRANSFORMERS**

**FOR THE ELECTRONIC ENGINEER**  
**FOR THE OSRAM 912 AMPLIFIER**



The Gilson output transformer, Ref. WO 710, has been tested and approved by the General Electric Co. Ltd. for use in the Osram 912 Amplifier.  
**LIST PRICE £2. 12. 6**

**FOR THE MULLARD 5-10 AMPLIFIER**

Extract from Mullard letter:  
 "We have much pleasure in informing you that the two sample transformers—Ref. Nos. WO 696A and 696B—for the Mullard 5 valve 10 watt amplifier which you exhibited to us for approval have been tested in our laboratory and have been found to meet all the specifications laid down."  
**LIST PRICE £2. 7. 6**  
 Or less panel, tags on coil **£2. 3. 6**

**MAINS TRANSFORMERS FOR THE 912 AND 5-10 AMPLIFIERS**

205-225-245 volts 50 c/s. 300-0-300 V, 150 mA., 5 V. 2 A. or 6.3 V. 1 A., 6.3 V. 5 A. C.T. Ref. WO 695. List price £3, or less panel, tags on coil, £2/15. Choke 10H-150MA. List Price £1/15/-.

**R. F. GILSON LTD**

**11a ST. GEORGE'S ROAD, WIMBLEDON, S.W.19**  
 Phone: WIMbledon 5695

**MAKERS OF NEON SIGN TRANSFORMERS**  
 Specialists in the design and manufacture of transformers for power and audio frequency  
 Contractors to Admiralty, etc., A.I.D. A

**CABINETS**



We can supply any Cabinet to YOUR OWN SPECIFICATION. The one illustrated can be obtained in walnut, oak or mahogany for £19.15.0, or as a COMPLETE RADIOGRAM incorporating:

- 5-VALVE SUPERHET, 3-speed Plessey Autochanger and 10in. W.B. Speaker **£48.0.3**
- 8-VALVE ARMSTRONG F.C.48, 3-speed Collaro Autochanger and 10in. W.B. Speaker **£60.14.8**
- 14-VALVE ARMSTRONG EXP 125/c, 3-speed Garrard Autochanger and 12in. Goodman speaker. **£95.5.11**

(H.P. terms can be arranged.)

Send 1/- for complete Catalogue of Cabinets, Chassis, Autochangers and Speakers (refunded on receipt of order).

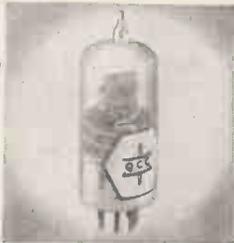
**LEWIS RADIO CO.**

120, GREEN LANES, PALMERS GREEN, LONDON, N.13. BOWes Park 6064.

**OUR NEW GOVERNMENT SURPLUS CATALOGUE No. 12**

containing over 400 items price 1/6d. post free. 2/6d. overseas seamount. **ARTHUR T. SALLIS (w.w.)** 93 NORTH ROAD, BRIGHTON, SUSSEX. Tel.: BRIGHTON 25806

**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 NEWMALDEN

**SITUATIONS VACANT**

SENIOR draughtsmen.

DUE to expansion of the Electronics Division of the Plessey Company, Ltd., there are several vacancies for experienced men in the following fields:

1. DESIGN of a wide range of electronic equipment, including work to Service requirements.
2. MECHANICAL design of precision mechanisms for quantity production.

THESE vacancies carry attractive salaries and long-term prospects in reward for hard work and offer good staff conditions including superannuation and insurance schemes.—Applications, which will be treated in confidence, should be addressed to:

THE Plessey Company, Ltd., Vicarage Lane, Ilford, Essex. [4474]

THE PLESSEY Co., Ltd.

VACANCIES exist in new well equipped and expanding laboratories of the Chemical and Metallurgical Division, for junior and senior metallurgists, chemists and ceramists with progressive ideas; experience in any of the following an advantage.

- SEMICONDUCTORS.
- ELECTROLYTIC capacitors.
- MAGNETIC materials.
- ELECTRICAL ceramics.

POSITIONS offered are permanent and pensionable and offer considerable scope for advancement; salaries will be generous and commensurate with qualifications and experience.—Write in confidence to the Technical Manager, The Plessey Co., Ltd., Towcester, Northants. [4407]

**ELECTRONIC apprenticeships.**

THE Ministry of Supply invites applications for electronic apprenticeships (tenable for five years at the Radar Research Establishment, Malvern, Worcestershire).

APPLICANTS should be 16 and under 17 years of age on 1st September, 1955; they should be in possession of, or expect to obtain, the General Certificate of Education at Ordinary level, with passes in four subjects, including mathematics and physics (or other science subject), or be of equivalent educational standard; technical school boys are eligible to apply provided they have exemption from S.1 Stage of the Ordinary National Certificate.

FORMS of application and further particulars may be obtained from Ministry of Supply, D.T.O. (Industrial), 66-72, Gower St., London, W.C.1. The closing date for receipt of applications is 1st June, 1955. [4530]

**ELECTRICAL/electronic/radio engineers.**

A number of vacancies exist in the design organisation of Vickers-Armstrongs, Ltd., Hursley Park, nr. Winchester.

THE work will include development, design and testing of latest specialised installations in aircraft; applicants with varying qualifications up to Degree standard are invited to apply; salary commensurate with experience and ability; recommendation may be made for housing after qualifying period.

APPLY: Personnel Department, Vickers-Armstrongs, Ltd., Hursley Park, nr. Winchester. [4607]

**COLLEGE OF TECHNOLOGY, Birmingham.**

DEPARTMENT of Physics and Mathematics.

THERE is a vacancy for a research assistant in the department of physics and mathematics for taking part in a major electronic project; candidates should have a good honours degree, preferably of London University or of a university which awards higher degrees for external research; experience in the design of electronic circuits is essential; the successful candidate will be expected to do some teaching, but ample time will be available for research.

SALARY will be in accordance with the Burnham (Further Education) Scale for Grade "A" Assistants; basic salary (men) £510 with increments for approved training and industrial or teaching experience.

FURTHER particulars and form of application may be obtained from the Registrar, College of Technology, Suffolk Street, Birmingham, 1, on receipt of a stamped addressed foolscap envelope; completed forms should be returned not later than two weeks after the appearance of this advertisement.

K. R. FILLING, Clerk to the Governing Body. [4598]

**PYE TELECOMMUNICATIONS, Ltd., Ditton Works, Cambridge, offer:—**

EXCELLENT opportunities for junior and senior development engineers in the electronics and communications field.

DUTIES include development work on H.F., V.H.F., microwave and recording equipment. APPLICATIONS from persons possessing B.Sc., Higher National or Ordinary National Certificates especially welcomed.

GOOD facilities available, however, to keen young men wishing to train and study in these fields.

PLEASANT working conditions in modern factory; single accommodation available.

WRITE, giving fullest details to Personnel Manager. [4622]

A. H. HUNT (CAPACITORS), Ltd., require engineers for design and development of paper, mica and ceramic capacitors.

APPLICANTS should have previous training in electrical engineering at least to intermediate B.Sc. standard.—Apply to Personnel Manager, A. H. Hunt (Capacitors), Ltd., Bendon Valley, Garratt Lane, Wandswoth, S.W.18. [10057]

**RADIO/RADIOGRAM CHASSIS**

BUILT TO HIGHEST TECHNICAL STANDARDS FOR THE CONNOISSEUR OF QUALITY MUSIC REPRODUCTION

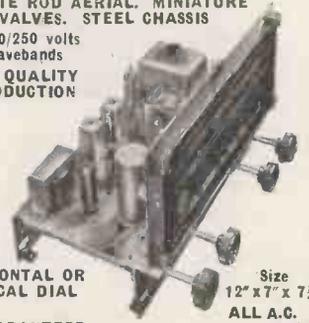
New Range of Models with Latest Features

FERRITE ROD AERIAL, MINIATURE (BVA) VALVES, STEEL CHASSIS

A/C 200/250 volts

3 wavebands

HIGH QUALITY REPRODUCTION



HORIZONTAL OR VERTICAL DIAL

FULLY GUARANTEED

ASSEMBLED AND READY FOR USE.

5 VALVES chassis, 4 watt output, wide range of tone control. **£13.18.3**

7 VALVES PUSH/PULL chassis, 6 watt output, separate bass and treble controls **£17.17.9**

Negative feedback applied from output transformer secondary.

Gram switching on wavechange switch. Plug-in connections for pickup, speaker, gram motor.

Choice of horizontal or vertical dial. Also magic eye fitment, dial escutcheon, matched 8in. and 10in. speakers.

FULL TRADE FACILITIES DETAILED LIST AND DIMENSIONS, DIRECT FROM THE MANUFACTURER

**THE DULCI CO. LTD.**

97 VILLIERS ROAD, LONDON, N.W.2. Telephone: WILLESDEN 6678.

**MALVYN ENGINEERING WORKS**

Precision Engineers

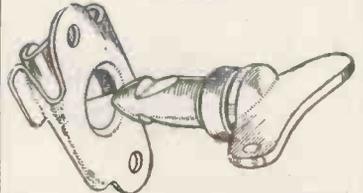
Manufacturers of: Chassis, Small Pressings, Machined Components, Wiring and Mechanical Assemblies, to specification.

Single and Production Quantities. Enquiries Invited 100 PARK ROAD, WARE, HERTS.

Telephone: Ware 465

**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.

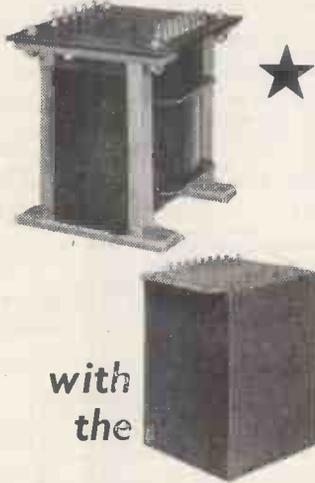
DEPT "W.W"

Oddie, Bradbury & Cull Ltd., Southampton

Tel.: 55883 Cables: Fasteners, Southampton

# ENSURE THE BEST RESULTS

from your  
**ULTRA - LINEAR  
AMPLIFIER**



with  
the

# SAVAGE

OUTPUT

# TRANSFORMER

3S95

The Savage Masscore output transformer type 3S95 is designed to the same standard as the 3C67A, which so many enthusiastic friends incorporated in the Williamson circuit. The specification is as follows:—

- ★ Primary D.C. resistance 100Ω + 100Ω Inductance taken at 5 v. 50~ 80 hys minimum.
- Primary impedance 7,000Ω tapped at 43% symmetrically about the centre tap.
- Leakage reactance tested at 1 v. 800~:—
- Whole primary to secondary: 8 m/Hys.
- Half primary to secondary: 4 m/Hys.
- Half primary to the other half primary: 8 m/Hys.
- Secondary impedances: 0.45Ω, 1.8Ω, 4Ω, 7Ω, 11Ω, 16Ω, 22Ω, and 30Ω.



**NURSTEED ROAD,  
DEVIZES : WILTS.**

Telephone: DEVIZES 932.

### SITUATIONS VACANT

**ULTRA ELECTRIC Ltd.,** Western Avenue, Acton, London, W.3  
ANNOUNCE the following vacancies for **ENGINEERING Staff:—**

- (1) **TELEVISION Development.**  
(a) **SENIOR ENGINEERS** required for TV receiver design; applicants should have good academic qualifications and experience of the design of radio frequency amplifiers, preferably up to frequencies of the order of 200 Mc/s.  
(b) **SENIOR ENGINEERS** for time base development; applicants should have good academic qualifications and previous experience in the design of TV scanning circuits.  
(c) **JUNIOR ENGINEERS** with academic qualifications or experience in TV receiver development.
  - (2) **RADIO DEVELOPMENT**  
(a) **SENIOR ENGINEERS** required for development of radio receivers embodying the most recent AM/FM techniques, knowledge of FM receiver design desirable.  
(b) **JUNIOR ENGINEERS** required for receiver design; experience desirable but not essential if possessing Hr. N.C. or C. & G. (Telecoms.) Final Cert.
  - (3) **ELECTRONICS.**  
(a) **SENIOR ELECTRONICS ENGINEER** with some experience of circuit design for work in one of the following:
    - (i) Pulse techniques and general waveform circuitry.
    - (ii) Radar display.
    - (iii) Feedback techniques at video frequencies.
    - (iv) Simple servo devices.
- SUCCESSFUL** applicants will have opportunities of studying recent American techniques and they should be capable of accurate recording of experimental and design data and the preparation of technical servicing information.
- (b) **ELECTRONIC ENGINEERS** for work on one of more of the above subject-matter.
  - (4) **TEST EQUIPMENT DEVELOPMENT.**  
(a) **TEST EQUIPMENT DEVELOPMENT ENGINEER** for design and development of production test equipment for TV, radio or contract work; applicants should have Hr. N.C. or equivalent and good experience.  
(b) **JUNIOR T.E. ENGINEER** with some qualifications or preferably some experience.
  - (c) **MEASUREMENTS SECTION LABORATORY ASSISTANT (m. or f.)** with some technical knowledge and experience of calibration and certification of electron equipment.
- APPLICANTS** are requested to write to the Personnel Manager, stating which of the post(s) desired and giving full details (in strict confidence) including age, experience and salary expected; Saturday morning interviews can be arranged if desired. [4590]

**ELLIOTT BROTHERS (LONDON), Ltd.,** have the following openings in the Electronic section of their Process Control Division:—

- (1) **SENIOR ELECTRONIC ENGINEER** to study present and future requirements in the field of Automatic Process Control and to act as a technical consultant on overall system design. **APPLICANTS** must have the facility of providing original solutions to new problems and be in a position to advise on the use and application of new techniques. The section has its own staff of qualified Development Engineers and Physicists, and the services of divisions engaged in the fields of Computing, Servos, Radar and Nuclear, etc., are available. THE situation is particularly applicable to engineers who have had wide and responsible experience in the detail design of industrial electronic equipment and who desire to concentrate on the overall concept of system research and design. Candidates must possess a good engineering degree or equivalent.
  - (2) **JUNIOR ELECTRONIC ENGINEER** to assist with the work of system study and design. **APPLICANTS** who may be required to organize or carry out experiments, where necessary, to their study must have had several years' experience in the design of electronic equipment and have an aptitude for System Analysis. Experience in the field of Industrial Instrumentation and Control will be of particular interest.
- THIS position provides a valuable opportunity for entry into the rapidly expanding field of Automatic Process Control with a Company already widely experienced in these matters and having active Divisions in all branches of modern electronics. Candidates must have a good engineering degree or equivalent.
- APPLICANTS** for the above positions, which will be treated in strictest confidence, giving age, qualifications and experience to Personnel Officer, Elliott Brothers (London), Ltd., Century Works, Lewisham, S.E.13. [4529]

**PYE TELECOMMUNICATIONS, Ltd.,** Ditton Works, Cambridge, invite applications for the following posts.

**MARINE** sales engineer to promote the selling of marine communication and associated equipment.

**SALES** engineer to promote the sale of communication equipment; training given to suitable applicants lacking experience.

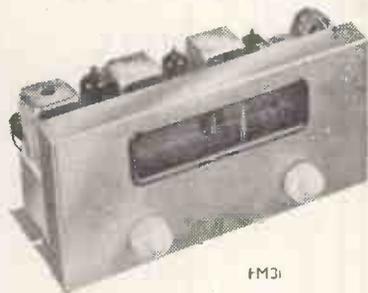
**APPLY**, giving fullest details to Personnel Manager. [4623]

**SENIOR Technical Sales Representative** with British Communications Corporation, Ltd., Exhibitions Grounds, Wembley.

A NEW appointment to meet expanding commercial activities; applicants should have sound general knowledge of V.H.F. communications equipment and have sales experience in this field; some administrative skill also desirable.—Write giving full details of personal history to the Sales Manager [4639]

# TUNERS

AM and FM



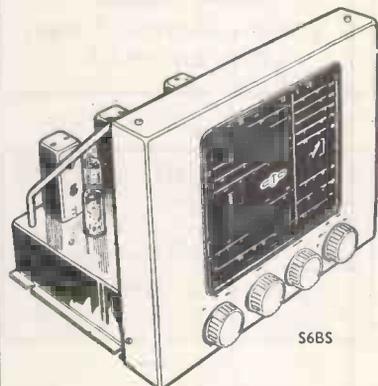
Our FM tuners provide excellent reproduction with absence of background noise and are tuneable between 87.5 Mc/s-100 Mc/s and will receive the proposed National B.B.C. Frequency Modulated V.H.F. transmissions as and when installed within approximately 60 miles of the transmitter.

Using the latest valves and techniques they are available in three forms:

**FM81** illustrated above, £21 tax paid.

**FM82** with pre-set station selection, output 1-2 volts, self-powered 200-250 volts, £24 tax paid.

**S5/FM** all waves AM and FM tuner, £32/10/- tax paid.



**S6BS** 9 Band (6 Electrical band spread) with R.F. F.C. 2 I.F. Delayed Amplified A.V.C. Variable selectivity. Fly Wheel Tuning. Tropicalised. Suitable for use with any High Quality Amplifier. £44. Tax paid.

**S6** A new model similar to the well-known S6BS but only 3 Wave Bands; 16m-50m 195m-550m, 800m-2,000m. £30. Tax paid.

**S6E** As S6 but 4 Wave Bands: 12.5m-37m, 35m-100m, 90m-250m, 190m-550m. £30. Tax paid.

**S5** 3 Wave Bands. 16m-2,000m, R.F. pre-Amplifier, variable selectivity I.F. Delayed Amplified A.V.C. very low distortion. £21/6/8. Tax paid.

**S5E** As S5 but 12.5m-550m. £21/6/8. Tax paid.

**S4** The Standard high-quality Feeder Unit Specification as S5 but without R.F. amplifier. £16. Tax paid.

A modified version of all models is available for use with Leak, Acoustical and other High Quality Amplifiers.

**C. T. CHAPMAN (Reproducers) LTD.**  
RILEY WKS., RILEY ST., CHELSEA, S.W.10

FLAxman 4577/8

Export Enquiries Invited

# RADIOS, RADIOGRAMS, CABINETS, RECORD-CHANGERS, CHASSIS, and TAPE-RECORDERS

at manufacturers' prices  
Direct to consumers

**HIRE-PURCHASE AVAILABLE**  
Send for lists  
**DOMESTIC DIRECT SALES LTD.**  
**DUDLEY HOUSE**  
36, SOUTHAMPTON STREET,  
LONDON, W.C.2

## A.R.I. 5206 (STR 16/17) EQUIPMENTS

150-505 Kc/s C.W., 14 watts.  
2.4-13 Mc/s C.W., 25 watts.  
MCW. R/T., 6 watts.  
Built in 100 Kc/s X-tal calibrator.  
Complete T/R installations or separate units.  
Send your enquiries to:

### AVIONICS LIMITED

Croydon Airport, Surrey. Tel. Croydon 5791, 4383, 7744.  
Grams: Aeradio Croydon.

## THE "LODESTAR" HIGH FIDELITY TAPE RECORDER

can now be heard at



Component Specialists since Broadcasting started  
Priced parts list available, also Booklet containing full constructional details, price 3/6, from

**H. L. SMITH & CO. LTD.**  
287/289 EDGWARE ROAD, LONDON, W.2  
Telephone: Paddington 5891

Hours 9 till 6 (Thursday 1 o'clock)

Near Edgware Rd. Stations, Metropolitan & Bakerloo

**SITUATIONS VACANT**  
**"THE TELEGRAPH CONSTRUCTION & MAINTENANCE Co., Ltd.,** cable manufacturers, wish to appoint:—  
(1) **TECHNICAL ASSISTANT** to be concerned primarily with the design of all types of cables. Candidates should preferably have some experience of manufacture of cables and must have a knowledge of electrical engineering to a standard of at least Inter-B.Sc. or O.N.C.  
(2) **TECHNICAL ASSISTANT (Senior)** to take charge of Power Cable Test Room. Comprehensive experience in electrical testing and examination of low- and high-tension cables for voltages up to 33kV or higher. Education to H.N.C. desirable.  
**PENSION Scheme,** five-day week and all welfare facilities. Salaries in accordance with qualifications and experience.—Write details to Personnel Manager, Telcon Works, Greenwich, S.E.10. [4678]

**GYRO development engineers** required with first-hand knowledge of development work in small gyroscopes; these vacancies fall into two categories:—  
(1) **Mechanical development engineer** used to handling precision bearings, balancing machines, etc.  
(2) **Electro-mechanical engineers** with knowledge of A.C. and D.C. torque motors, voltage pick-offs and gyro motors.  
WRITE in detail or send postcard for form of application, quoting Ref. 143 (i) or (ii), to the Personnel Officer (Technical Employment), de Havilland Propellers, Ltd., Hatfield, Herts. [4532]

**THE UNITED KINGDOM ATOMIC ENERGY AUTHORITY, A.W.R.E.,** Woolwich Common, requires Technicians, Grade I, II and III, for the following duties:—  
**TECHNICIAN I (620/WGE/45).**  
TO supervise and control several workshops engaged in the manufacture of electronic equipment and to assist a professional engineer in the investigation of new manufacturing processes and the development of prototype electronic equipment. Applicants must be familiar with modern light machine shop practice, including sheet metal work as applicable to radio and the assembly, wiring and testing of electronic equipment.  
**TECHNICIAN I (624/WGE/45).**  
TO control a department engaged in the inspection of mechanical details and assemblies and in the inspection and testing of electronic equipment. Duties will also involve the design of electronic test equipment for use on a production line. Applicants should be familiar with the testing and inspection of electronic equipment and have a good knowledge of light engineering workshop practice.  
**TECHNICIAN II (621/WGE/45).**  
TO supervise and control a small group engaged on engineering of prototype electronic equipment for small scale production. Applicants should be familiar with modern electronic components and be conversant with basic electronic design. They should have had some experience of electronic equipment manufacture and of drawing office practice.  
**TECHNICIAN II (622/WGE/45).**  
TO control a team engaged on the planning for production of electronic equipment and to liaise with sub-contractors on technical difficulties experienced during manufacture. Applicants should have had previous experience in similar duties. They should be familiar with modern electronic components and manufacturing processes. A knowledge of inspection and contracts procedure would be an advantage.  
**TECHNICIAN II (625/WGE/45).**  
TO control skilled staff engaged in the final testing of electronic equipment. To design test equipment for use on final inspection and production lines and to contribute to the production of prototype electronic equipment. Applicants should have had previous experience of similar duties. They should also be familiar with modern electronic components and manufacturing techniques.  
**TECHNICIAN III (623/WGE/45).**  
TO assist in engineering of prototype electronic equipment and to carry out planning of small scale production. Applicants should be fully conversant with modern electronic components and be familiar with basic electronic design. They should have had some experience of electronic equipment manufacture and of drawing office practice.  
**TECHNICIAN III (626/WGE/45).**  
TO control skilled staff engaged in the making of a wide range of models, formers, moulds, etc., in wood. To advise on the purchase of timber and to design instrument cases and special packing cases for shipment of apparatus. To control a paint and spray shop. Applicants should have had previous experience of the type of duties detailed.  
**APPLICANTS** for all posts should have served a recognized engineering apprenticeship and possession of H.N.C. or O.N.C. or equivalent qualification is desirable.

**SALARY:**  
**TECHNICIAN I,** £830-£1,015 (Male).  
**TECHNICIAN II,** £710 (linked to age 30)-£830 p.a. (Male).  
**TECHNICIAN III,** £575 (linked to age 26)-£715 p.a. (Male).  
IN addition a London allowance will be payable.  
**THE successful applicants** will be required to join the Authority's superannuation scheme. **REQUESTS** for application forms by **POST CARD** to Senior Recruitment Officer, A.W.R.E., Aldermaston, Berks, quoting the appropriate reference number. [4667]

## SOUTHERN RADIO'S WIRELESS BARGAINS

**TRANSCEIVERS.** Type "38" Mark II (Walkie-Talkie). With 5 valves and ready for use. Metal carrying case, 30/- per set.  
**THROAT MICROPHONES,** with long lead and plug, 4/6. **JUNCTION BOX,** 2/6. **HEADPHONES** 15/6 per pair. **AERIALS,** 2/6. **ALL OF THESE ITEMS ARE FOR USE WITH THE "38" Walkie-Talkie.**  
**TRANSCEIVERS.** Type "18" Mark III. Comprising Superhet Receiver and Transmitter. Two units contained in metal carrying case. Complete with 6 valves, £4/10/- per set.  
**RECEIVERS.** Type "109." Built-in speaker, 8 Valves with **VIBRATOR PACK** for 6 volts. Contained in metal case. Perfect, £5 each.  
**CRYSTAL MONITORS,** Type 2. New in transit cases. Less valves, 8/-.  
**AERIAL FILTER UNITS, MARCONI,** P.O. specifications, 4/- each. Interference suppressors, 5/- each.  
**BOMBIGHT COMPUTERS, BRAND NEW,** ex-R.A.F. Contains gyro, motors, rev. counters, gear wheels, etc., etc. Ideal for model makers, experimenters, etc. £3/5/- each, plus 10/- carr.  
**LUFBRA HOLE CUTTERS,** Adjustable 2 to 3in. For metal, wood, plastic, etc., 6/6.  
**RESISTANCES,** 100 Assorted, all useful values, etc. Wire end, 12/6 per 100.  
**CONDENSERS,** 100 Assorted. Mica, Metal, Tub, etc., 15/- per 100.  
**PLASTIC CASES,** 14in. by 10 1/2in. Transparent. Ideal for maps, display, etc., 5/6.  
**STAR IDENTIFIERS,** Type 1 A-N. Covers both Hemispheres, in case, 5/6.  
**CONTACTOR TIME SWITCHES.** In sound-proof case, 2 impulses per second. Thermostatic control. Clockwork movement, 11/6 each.  
**REMOTE CONTACTORS** for use with above, 7/6 each.  
**METERS,** 12 Instruments. May need adjustment or with broken cases, 35/- for 12.  
**MORSE PRACTICE (WITH BUZZER) SET.** Mounted, 6/9. Full List of Radio Books, 24d.  
*Postage and carriage extra.*  
**SOUTHERN RADIO SUPPLY LTD.**  
11 LITTLE NEWPORT STREET,  
LONDON, W.C.2. Gerrard 6653.

## CABLE CHEAPER IN SMALL COILS

All coils 20-49 yds. in length, unless requested shorter. All prices per 100 yd. lot, less supplied, add 5%. Full 100 yd. coils are available add 5% to any price.  
**TWIN FLAT**  
1/044 3/029 3/029 7/029  
Rubber or Plastic ..... 50/- 64/6 78/6 135/-  
Single V.L.R. .... 23/- 28/6 — 48/6  
**EARTH WIRE** 7/029 tinned copper 10/- a 100-ft. lot. Send for lists of other cables, hoses, wiring accessories and surplus switch and fuse gear. (We buy surplus electronic items, send details). Add part carriage to small orders please.  
**BRITISH DISTRIBUTING Co. (Desk W),** 591, Green Lanes, London N.8.

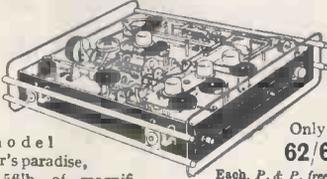
## COPPER WIRE

S.W.G.	COTTON-COVERED		SILK-COVERED	
	2 ozs.	4 ozs.	2 ozs.	4 ozs.
16	1/6	2/3	1/6	2/3
18	1/6	2/5	1/6	2/5
20	1/8	2/7	1/9	2/11
22	1/8	2/9	1/11	3/3
24	1/9	2/11	2/-	3/5
26	1/11	3/2	2/2	3/9
28	2/-	3/5	2/4	4/1
30	2/3	3/9	2/6	4/5
32	2/3	3/11	2/9	4/11
34	2/9	4/5	3/1	5/7
36	2/9	4/11	3/5	6/3
38	3/6	6/5	3/9	6/11
40	4/8	8/3	4/3	7/11

**WIRES TO 48 S.W.G. AVAILABLE**  
**COPPER INSTRUMENT WIRE** ENAMELLED, TINNED, LITZ, COTTON AND SILK COVERED.  
**RESISTANCE WIRES**  
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

**SSC Bargains from SHERMAN'S**

**MONEY BACK GUARANTEE  
BOMB SIGHT COMPUTOR**



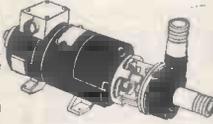
A model maker's paradise, over 56lb. of magnificently made gears, driving shafts, bearings, miniature motor, repeater motor, gyroscopes, etc. All supplied in a strong wooden transit case 24in. x 22in. x 11in. high which itself is ideal as a tool box.

**PRECISION DRILL CHUCK**

3in. capacity, self-centring by H. D. Murray. Complete with 3/16in. parallel shank. At third list price. *Postage and Packing 1/-.* **10/-**

**STUART TURNER Water Pump**

Motorised 250 v. A.C. bronze pump, 440 g.p.h. Lifts 3ft., head 6ft., 1in. inlet and outlet. *Postage and Packing free.* Brand new. **£7.10.0**

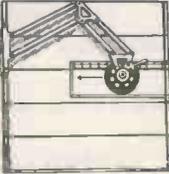


**PICADOR RIGHT-ANGLE DRIVE**

This is a must for every owner of an electric drill. Gives 2 ratios of speed, 1:2 and 2:1. Complete with adaptors to fit Black & Decker, Wolf Cub and Bridges 3/16in. cap. elec. drills. *Postage and Packing 1/-.* **21/-**

**CHART BOARD**

Ideal as drawing board. 17in. sq. Complete with pantograph arm, protractor head and Perspex scale. Each **30/-**



**THERMOSTAT**

Complete with fitting for insertion in hot water tank. Variable between 70 deg. F. and 100 deg. F. 250 v. mains. Suitable for immersion heater, greenhouse, etc. Brand new. *Postage and Packing 1/-.* **25/-**



**NYLON PARACHUTE**

18in. diameter, spring loaded in metal frame. Complete with nylon cord. *Postage and Packing free.* **3/11**

**NEW CATALOGUE**

Send 1/- for latest edition packed with Bargains. Refunded on first purchase.

TERMS—CASH WITH ORDER. C.O.D. 1/- EXTRA. Phone Orders Accepted. (Dept. W15), 359, KILBURN HIGH ROAD, N.W.8. 479, HARROW ROAD, LONDON, W.10. ELGar 8857. HIGH STREET, HARLESSEN, N.W.10.

**SITUATIONS VACANT**

**TELEVISION** engineers able to drive required by leading and progressive dealers; good salary, conditions and prospects.—Singer's, 350, Edgware Road, W.2. Pad. 7915. [4213]

**DEVELOPMENT** Engineer required for laboratory of well-known television and radiogram manufacturer.—Write, giving experience and qualifications, to Box 3615. [4650]

**PARTRIDGE** Transformers, Ltd., have a vacancy for an engineer experienced in transformer testing and development; to take charge of transformer testing department. WRITTEN applications giving details of past experience, qualifications and age to the Chief Engineer, Partridge Transformers, Ltd., Tottworth, Surrey. [4475]

**ELECTRICIANS** required by The Steel Company of Wales, Ltd. (Steel Division), Port Talbot, for work on industrial electronic equipment. CANDIDATES should have previous experience and/or technical background as basis for period of training.

THOSE wishing to apply should write stating age, experience, etc., to the Personnel Superintendent, The Steel Company of Wales, Ltd. (Steel Division), Abbey Works, Port Talbot, Glam. [4422]

**THE Chemical and Metallurgical Division of the Plessey Co., Ltd.,** is engaged in the development of interesting new products for the electronics, radio and T.V. industries.

**ENGINEERS, metallurgists and chemists** are required for development work on semiconductors, electrical ceramics, magnetic materials and electrolytic capacitors. ATTRACTIVE posts are available for junior and senior grades in new, well equipped and expanding laboratories.

POSITIONS offered are permanent and pensionable; salaries will be generous and commensurate with qualifications and experience.—Write in confidence to the Technical Manager, The Plessey Co., Ltd., Towcester, Northants. [4406]

**R. B. PULLIN & Co., Ltd.,** invite applications for the following vacancies in their recently formed and expanding electronic development division:—

(a) **SENIOR** development engineer: applicants should possess an Honours Degree or equivalent qualifications and should have had several years experience of the development of electronic circuits, preferably including work on electronic servos and magnetic amplifiers.

(b) **JUNIOR** development engineer: qualifications to O.N.C. or H.N.C. standard together with some previous experience of valve circuit design.

The positions are of a permanent nature; they offer excellent prospects and the opportunity to work in a newly equipped laboratory on a variety of projects requiring considerable individual technical responsibility and initiative.

A commensurate salary will be paid; contributory pension scheme, canteen and recreational facilities.—Applications will be treated as confidential and should be made to the Superintendent Electronic Development Division, R. B. Pullin & Co., Ltd., Phoenix Works, Great West Rd., Brentford, Middlesex. [4611]

**RADIO** and/or television engineer required for bench and outside repairs, driver; references, age, experience, salary expected.—Field's Radio, Ltd., 52, Hall Gate, Doncaster. [3592]

**TECHNICAL** writers, with experience, are required by a reputable N. London electronics company, these well-paid positions are interesting and require initiative.—Write Box 3653. [4673]

**G9AED** experimental television transmitter, South Norwood. A full-time operator is required, capable of locating and rectifying circuit and component faults, academic qualifications not essential; training period given. APPLICANTS should be mobile and prepared to move to the Midlands for a short period if necessary, after a few months.

ON closing down the transmitter the operator will be transferred to the company's permanent technical staff.

**APPLICATIONS** (in confidence), giving full details of qualifications and experience, with some indication of salary required, to The Secretary, Belling & Lee, Ltd., Great Cambridge Rd., Enfield, Middlesex. [4651]

**RESEARCH** Engineers, preferably of degree standard, and with a sound knowledge of communications and, particularly, electronics, are required for experimental work relating to underwater sound apparatus.

APPLICATIONS, giving past experience, technical qualifications, age and salary required, should be addressed to the Personnel Manager, Kelvin & Hughes, Ltd., New North Rd., Barkingside, Ilford, Essex. [4390]

**RADIO** service mechanics required by Smiths (Radlmobile), Ltd., for many parts of the country.—Write details of experience and qualifications to Personnel Officer, Goodwood Works, North Circular Rd., London, N.W.2. [0342]

**TWO** draughtsmen required for work on interesting electronic development for small progressive company near Southampton.—Reply stating age, qualification, experience and salary expected to Box 3234. [4613]

**CHIEF** mechanical designer for research dept. of large manufacturers of electronic equipment; prev. exp. in electronic industry essential; salary up to £1,500 p.a.; North London area.—Write Box 3419. [4632]

**—TELE-RADIO (1943) LTD**

**STEEL METER CASES WITH ALUMINIUM PANEL, SLOPING FRONT**

4in. x 4in. x 4in.	6/8
6in. x 5in. x 8in.	10/8
6in. x 6in. x 12in.	18/-

**SMALL STEEL TEST METER CASES WITH ALUMINIUM PANEL**

4in. x 4in. x 2 1/2in.	5/6
6in. x 4in. x 3in.	7/-
8in. x 6in. x 3in.	8/6
10in. x 6in. x 2 1/2in.	10/6

**STANDARD STEEL CASES WITH ALUMINIUM PANEL**

10in. x 7in. x 7in.	18/8	16in. x 9in. x 8in.	39/8
12in. x 7in. x 7in.	23/8	16in. x 11in. x 8in.	46/-
14in. x 7in. x 7in.	27/6		
14in. x 9in. x 8in.	36/-	19in. x 11in. x 10in.	52/-

**18 S.W.G. ALUMINIUM CHASSIS**

8in. x 6in. x 2 1/2in.	7/6	14in. x 5in. x 2 1/2in.	9/8
10in. x 6in. x 2 1/2in.	8/3	14in. x 8in. x 2 1/2in.	10/8
12in. x 6in. x 2 1/2in.	8/6	14in. x 10in. x 2 1/2in.	11/-
12in. x 8in. x 2 1/2in.	9/6	17in. x 10in. x 2 1/2in.	12/6

**18 S.W.G. STEEL CHASSIS**

14in. x 8in. x 2 1/2in.	9/8	17in. x 10in. x 2in.	11/3
14in. x 10in. x 2 1/2in.	10/3	17in. x 10in. x 3in.	12/6

**FULLY DRILLED CHASSIS FOR WILLIAMSON AMPLIFIER** ..... 27/8

**G.E.C. OSRAM 912 AMPLIFIER DRILLED CHASSIS** ..... 21/-

**G.E.C. OSRAM 912 FRONT PANEL** ..... 14/8

**"PAUL" CRACKLE PAINT, BLACK, GREEN OR BROWN, 3/- per tin.**

**SUNDRIES**

- 0-15 v. A.C. Meter ..... 10/6
- 0-30 M.A. Meter ..... 7/6
- Crystal Headphones ..... 7/6
- London Channel T.V. Pre-amplifier ..... 21/-
- (1 valve EF42 or equivalent)
- 813 Valve Bases (new) ..... 10/-
- 280 v. 80 mA. Half-wave Metal Rectifier ..... 7/6
- 40 H. 50 mA. Wooden Chokes ..... 12/6
- 5-pin P/S. Belling Lee ..... 6 for 10/-
- 7-pin P/S. Belling Lee ..... 6 for 10/-
- E.M.I. Variable Selectivity I.F.T.s, pair 4K Colvern Preset Wire-wound Potentiometers ..... 6 for 9/-
- 6K Colvern Preset Wire-wound Potentiometers ..... 6 for 9/-
- 2K Colvern 15-watt Precision Potentiometers ..... 8/6
- E.M.I. 100-1 Microphone Transformer, heavy screen ..... 7/6
- OZ4, Govt. surplus. New and boxed ... 3/6
- PEN46. New and boxed ..... 8/6
- 866A. New and boxed ..... 10/-
- HVR2A. New and boxed ..... 8/6
- Mains Transformer, drop through, 350-0-350 v. 60 mA., 6.3 v. 2.5 a., 5 v. 2 a., Standard Primary ..... 14/6

**SOLO INSTRUMENT IRONS**

624 200-220v. ....	19/8	625 220-240v. ....	19/8
--------------------	------	--------------------	------

**ADCOLA INSTRUMENT IRONS**

1" Bit 230/250v. ...	30/-	1 1/2" Detachable Bit 230-250v. ....	33/6
----------------------	------	--------------------------------------	------

**Q-MAX CHASSIS CUTTERS**

1in. and 1 1/2in.	11/8 ea.	2-3/32in.	30/-
1in. and 1 1/2in.	12/8 ea.	1in. sq. hole	23/-
1 1/2in. and 1 3/4in.	14/8 ea.	Small keys	10s.
1 3/4in. and 1 7/8in.	16/8 ea.	Medium keys	11s.
1 7/8in.	18/8	Large keys	1/9

*Postage & Packing extra. C.W.O. or C.O.D.*

**TELE-RADIO**

(1943) LTD

**189 EDGWARE ROAD, LONDON, W.2.**

Phone: PAD. 4455/6.

Shop hours: Mon-Sat. 9 a.m.-6 p.m. Thursday 9 a.m.-1 p.m.

**SHERMAN'S SUPPLY COMPANY**





The Technical Editor of the "Wireless & Electrical Trader" in the March 5 issue on page 582 says:—

"We have had several models in constant use in our laboratory. One with an  $\frac{1}{2}$  in. bit was left on continuously day and night for three weeks and then for another month all day only, and was in constant use during the day, without failure of the element."

**LIFE TEST**

The three  $\frac{1}{2}$  in. models connected to a 240-volt mains day and night since March 6, 1954, are all still functioning satisfactorily—now over 10,000 hours.

Details of full range in folder No. S.P. 5 sent on request.

Sole Manufacturers and Distributors:

**LIGHT SOLDERING DEVELOPMENTS LTD.,**  
106, GEORGE STREET, CROYDON, SURREY.  
Tel. CROYdon 8589

**PRECISION SHEET METALWORK**

We specialise in manufacturing of Chassis in all metals, large or small quantities to your own specifications.

**V. W. BEAMISH**

Shardloes Garage, Shardloes Rd., New Cross London, S.E.14.

Telephone: TIDeway 4795

**SITUATIONS VACANT**

**CHEMISTS**, metallurgists and ceramists are required for the Chemical and Metallurgical Division of the Plessey Co., Ltd.; attractive posts are available for junior and senior grades.

**APPLICANTS** should be interested in the development of semiconductors, electrical ceramics, magnetic materials and electrolytic capacitors and experience in any of these fields would be an advantage

**POSITIONS** offered are permanent and pensionable and offer considerable scope for advancement; salaries will be generous and commensurate with qualifications and experience.—Write in confidence to the Technical Manager, The Plessey Co., Ltd., Towcester, Northants. 14405

**ROYAL AIRCRAFT ESTABLISHMENT** requires radio and electronic mechanics and aircraft electrical fitters to serve as research and experimental mechanics or research and experimental mechanics (special).

**RATE** of pay on entry 158/10d or 158/10d+26/-, according to experience, for 44-hour 5-day week, with prospects of reassessment of rate within one to three months; any increase back-dated to date of entry.

**PROSPECTS** of advancement to higher rates of pay.

**APPLICATION** to Director, Royal Aircraft Establishment, Farnborough, Hants, giving full details of apprenticeship training (including Forces training), qualifications and experience. 14616

**RADAR Scanner Mechanics**, ex-Forces tradesmen required for maintenance and repair of scanner mechanisms.—Apply stating age, experience and wages required to Personnel Manager (Ref. W.), Box 3013. 14524

**WORKS MANAGER** for electronic equipment factory, to take full charge of design, production and factory management; high salary and real prospects for capable and experienced man.—Write fully Box 3161. 14592

**EXPERIENCED** contact setters required with full knowledge of P.C. type relays; good wages and overtime, pleasant working conditions.—Apply Keyswitch Co., 126, Kensal Rd., London, W.10. Lad. 0666/4640. 14640

**GENERAL** manager to take control of electronic equipment factory, experienced and capable person is offered a high salary and excellent prospects.—Please write fully to Box 3329. 14621

**TELEVISION Service Engineer** required by A. E. Parsons, Ltd., Stephenson Place, Chesterfield; state experience and present salary, etc.; a house for living accommodation will be provided. 14631

**TV** and radio engineer, fully experienced; £12 p.w. to right man, and normal shop hours, able to drive.—Radio & Electrical Services, 35, Westbury Ave., Wood Green, N.22. Box 2068. 14421

**THE Edison Swan Electric Company, Ltd.**, have vacancies in their Special Products Development Laboratory for Engineers for development work on a wide range of electronic instruments and apparatus for Medical, Industrial and Government use.

**PLEASE** write, stating experience, age and salary required, to 155, Charing Cross Road, London, W.C.2, reference SP/LAB. 10063

**TECHNICAL** Assistants required for development of electro-mechanical and electronic instruments (marine). Work involves initial experiments, sea-going trials, pre-production models and factory liaison. Occasional visits overseas are arranged

**QUALIFICATIONS**—Practical: 5 years' workshop or drawing office experience. Academic: City & Guilds Telecommunications Final Group Certificate, or equivalent.

**APPLICATIONS**, stating salary required, should be addressed to the Personnel Manager, Kelvin & Hughes, Ltd., New North Rd., Barkingside, Essex. 14508

**EXPERIENCED** radio testers and inspectors required for production of communication and radio apparatus, also instrument makers, wipers and assemblers, for factory test apparatus.—Apply Personnel Manager, E. K. Cole, Ltd., Ekco Works, Malmesbury, Wilts. 10238

**TECHNICAL** sales manager with sound knowledge of television; give full details education, technical qualifications, sales experience, knowledge of overseas countries and languages spoken.—Reply Ferguson Radio Corp., Export Division, 105, Judd St., W.C.1. 14614

**ELECTRONIC** engineer, degree or equivalent, previous design experience of V.H.F. F.M. mobile equipment essential; small but rapidly expanding organization on south coast (near Southampton).—Write full details, age, experience and salary expected to Box 3453. 14634

**DEVELOPMENT ENGINEERS** to help design electronic instruments; permanent posts, salary range £550-£750 p.a. according to experience.—Taylor Electrical Instruments, Ltd., Montrose Avenue Slough. Tel. Slough 21381. Write or 'phone for appointment. 14591

**MOTOR** vehicle distributors require capable car radio fitter with substantial installation experience; excellent rates of pay, pension scheme, etc.—Apply Service Manager, Lamb's, Ltd., Standard House, Southend Road, Woodford, Wanstead 6666. 14594



The "MINNETTE MINOR"

New style suitcase Recorder

**42 Gns.**

Complete with mtc.

The very latest home and office recorder in two tone leather-cloth. Two speeds, two tracks. Electrical braking and speed change. Perfection in performance, modest in price. H.P. Terms 27/12/- deposit, 12 or 18 months.

**THE MINNETTE LUXURY MODEL** Price 46 gns. The new Minnette (illustrated above) has every possible refinement, full specification includes internal speaker monitoring, bass and treble lift and cut controls.

**PULSE-PULL OUTPUT RECORDERS.** We have a range of high power recorders for schools, colleges, industry, etc. Price, 10 watt output, 65 gns.

For details write or 'phone:

**MODERN SOUND EQUIPMENTS**  
16 Pattison Road, London, S.E.18 (WOO 0387)  
or, 19 City Road, London, E.C.1. (M.O.N. 6508)

**TELECRAFT**

**TV AERIALS ARE CHEAPER AND BETTER**  
Send for Lists  
**TELECRAFT LTD.**  
Quadrant Works, Wortley Rd. West Croydon, Surrey  
THOrnton Heath 1191-2-3

**THE OSRAM NINE-ONE-TWO**  
**AMPLIFIER INSTRUCTION BOOK**  
and  
**HIGHEST QUALITY COMPONENTS**  
Available from  
**COVENTRY RADIO**  
189, DUNSTABLE ROAD, LUTON.  
'Phone: 2677.  
Price 3/6, plus 3d. postage also  
**Our 1954-5 Component Catalogue at 1/-**

**'Radiospares' Quality Parts**

**THE SERVICE ENGINEER'S FIRST CHOICE**

**BASS REFLEX CABINETS**

Walnut, Mahogany or Oak, veneered, 30-in. high. For 8-in. Speakers, 10-in. Speakers, 12-in. Speakers. £9-0-0d. £9-10-0d. £10-0-0d. carriage paid.

**FOR BUYERS ABROAD**

We now have a collapsible Tropic Proof Model of our Standard Bass Reflex Cabinet. (Patent Pending)

**GOODMANS & G.E.C.**

Full range of cabinets for these speakers. You can see your cabinet being made in our cabinet-making workshop.

Cabinets made to order. Armstrong Chassis and Amplifiers. The Leak TL10 Amplifier. LOUDSPEAKERS.

Open till 5.30 Saturdays

**A. DAVIES & CO. (Cabinet Makers)**  
3 Parkhill Place, off Parkhill Road, London, N.W.3.  
GULLIVER 5775.

**METER REPAIR SERVICE**

ALL TYPES AND MAKES Single and Multi-Range METERS SUPPLIED FROM STOCK OR CONVERTED TO ANY RANGE

Phone for immediate service  
**THE ELECTRICAL INSTRUMENT REPAIR SERVICE**  
329 Kilburn Lane, London, W.9  
Tel.: LADbroke 4168

## GUIDED WEAPONS— DRAUGHTSMEN

(Mechanical and Radio)

The Bristol Aeroplane Company Limited is expanding its design activities in its London Design Office still further. Guided Weapons Design Teams are to be recruited. The following staff are urgently required:—

1. Design, Senior and Intermediate Draughtsmen for work on Ground Equipment in connection with Guided Weapons Development. Experience of the design of Ordnance Equipment is desirable, but mechanical engineering knowledge is essential.

2(a) Senior and Intermediate Draughtsmen for design and layout of Rack Mounting Laboratory Equipment, Electronic and Electrical Instruments. Previous experience in the Radio Industry is desirable.

(b) Senior and Intermediate Draughtsmen for design of Wiring Layouts. Knowledge of components used in the Radio Industry is essential.

The London Design Office is located in Haymarket, London, S.W.1, a convenient centre for travel. The salaries offered are appropriate to experience and qualifications. A luncheon voucher scheme has been introduced.

Applications, giving details of experience, qualifications, experience and present salary, quoting L.D.O.5, should be addressed to the Personnel Manager, The Bristol Aeroplane Company Limited, Aircraft Division, Filton House, Bristol.

## The LESDIX latest model Crystal Set

Black or brown Bakelite case, fitted litz wound tapped aerial coil, germanium diode detector, var. condensers, A.E. and Ph. plugs and sockets. Complete with double headphones with headband and cord, 30/-, post 2/6.



condensers, A.E. and Ph. plugs and sockets. Complete with double headphones with headband and cord, 30/-, post 2/6.

**PEDAL GENERATORS.** Totally enclosed D.C. generator with two outputs 310 volts 85 mA. and 3 volts 5 amps., fitted pedals and on frame with operator's stationary chair, constant power supply for Ranch or Country Transmitters. Light and easily operated. Cheap.

**ROTARY CONVERTERS.** 110 volts D.C. Input 230 volts A.C. 50 cycles 200 watts output, £12/10/-. Starter, 45/- 24 volts D.C. input 230 volts A.C., 50 cycles output, 100 watts, 85/- 24 volts D.C. input 230 volts A.C. output, 50 cycles 75 watts, enclosed in attractive metal case, grey finish, fitted A.C. voltmeter 0-250 input and output on-off switch, input and output slydlock fuses and spares, rotary increase voltage switch. Surplus stock, new and unused, £5/10/-, carriage 10/-.

**NIFE BATTERIES.** 12 volts 45 a.h., comprising ten 1.2 volt 45 a.h. cells in wood crate, uncharged, £12/10, carriage 10/- Single cells 1.2 volts 45 a.h., 30/- each, post 2/-.

**MOTORS, DYNAMOS, TRANSFORMERS, WAVEMETERS, AMMETERS, VOLTMETERS,** etc. Send us your enquiries.

## Leslie Dixon & Co.

Dept. A, 214 Queenstown Road, London, S.W.8

Telephone: MAcaulay 2159

**SITUATIONS VACANT**  
Senior and junior electronic engineers required for high fidelity sound reproduction projects; applicants should give full details of qualifications and experience by letter to Chief Engineer, Pye. Ltd., St. Andrew's Rd., Cambridge. [4487]

**P**ROJECT engineers to control and coordinate electronic and mechanical projects, experience of estimating, planning, time and motion study desirable; a progressive position in expanding firm; high salaries, superannuation scheme.—Box 3088. [4550]

**ELECTRICAL SERVICE (EDGWARE), Ltd.,** 93, Edgware Rd., W.2 require urgently a senior T/V and radio service engineer; able to take complete charge of service dept.; clean licence, good refs., congenial, top salary.—Pad 2342. [4264]

**MICHAEL RADIO, Ltd.,** Slough, Bucks. have vacancies from time to time for electronic engineers to be engaged on Government projects; those wishing to be considered are invited to write fully to the Chief Engineer, Equipment Division. [0198]

**T**RANSFORMER Designer required for development projects involving audio-frequency power transformers, pulse transformers, oil-filled units, etc.—Apply stating age, qualifications and experience to The Personnel Manager (Ref. R.G.), The General Electric Co., Ltd., Brown's Lane, Allesley, Coventry. [0260]

**S**ENIOR Transformer Designer required to take charge of design office dealing with small transformers, power, audio, pulse, etc. Excellent prospects for an engineer with practical experience as well as academic knowledge. London area.—Box 3026. [4528]

**E**XPERIENCED sound engineers required immediately for servicing cinema and sound reproducer equipment in Manchester area.—Write, giving details of experience, to the British Thomson-Houston Co., Ltd., Construction Department, 15, Quay St., Manchester, 3. [4587]

**R**ADIO inspectors required for service depot at London Airport; knowledge of A.R.B. procedure desirable; basic knowledge of radio theory and test equipment essential.—Write in first instance to Mr. D. Smith, Asst. Chief Inspector, Decca Navigator Co., Ltd., 244, Burlington Rd., New Malden. [4633]

**D**ESIGNER-Draughtsmen required for work on audio equipment, to receive manufacturing details from prototype information. Wide variety of work including electro-mechanical devices and casing details.—Apply Chief Engineer, Pye. Ltd., St. Andrew's Rd., Cambridge. [4522]

**E**LECTRONIC engineer required for maintenance and construction of specialised factory equipment; final City & Guilds, Higher National or Inter B.Sc. standard; age preferably under 35; reply stating experience and salary.—Anglo-Celtic Watch Co., Ltd., Ystradgynlais, nr. Swansea. [4603]

**E**NGINEER for long-established West End retailer dealing with high fidelity equipment, preferably sympathetic to classical music; will be required at times to demonstrate, assemble, convert and instal equipment of highest quality.—Write Box No. 8557, c/o Streets, 110, Old Broad St., E.C.2. [4641]

**E**LECTRONICS TECHNICIAN, experienced, for interesting and varied work in teaching and research laboratories, salary £610 by £20 to £390, depending on experience and qualifications.—Apply Department of Electrical Engineering, University of Birmingham, giving particulars of experience. [4589]

**M**ETALLURGICAL factory in Buckinghamshire requires male laboratory assistant with some experience of electronics for operation of direct reading spectrograph, on shifts; training on the instrument will be provided; apply, stating age and experience, to—Box 3410. [4630]

**C**OMMERCIAL bank with large expanding share purchase business requires clerical staff, aged 22-39, pension and bonus scheme, paid holiday for applicants joining before 31.5.55, excellent prospects.—Write, giving full details, to Box W.W.251, c/o 191, Gresham House, E.C.2. [4584]

**T**ELEVISION field and bench service engineers required immediately for modern service department of leading radio retailers in East London; wages up to £14 per week or according to ability; permanent position.—Apply for interview to Leytonia Radio, Ltd. Tel. Leytonstone 1396. [4271]

**T**ECHNICAL LIAISON OFFICER required for Aircraft Division capable of following up material and piece parts, procurement position as placed on sub-contractors; knowledge of A.I.D. and A.R.B. procedure and conditions an advantage; some engineering experience in the design of aircraft components or buying experience in the purchasing department of an aircraft co., also helpful.

**A**PPLICANTS must be free to travel in this country; this is a monthly salaried position; it is progressive and carries entrance to the Company's contributory combined pension and life assurance scheme.—Apply Personnel Manager, Thorn Electrical Industries, Ltd., Great Cambridge Road, Enfield, Middlesex. [4597]

# ODES TO DUODES



### ODE No. 1.

Your 12C arrived safely and was with much excitement fitted into its cabinet and given a thorough test. Needless to say it passed with flying colours and is all you claim it to be. Firstly an audio oscillator was used with the amplifier and the Duode given a frequency run measured by ear from 30 cps. to 16,500 cps. That in itself was amazing, but it was obvious that the response extended well beyond these limits. Using a first class pickup we then played a new RCA-Victor Toscanini record. I have never been so greatly impressed in all my life—here was in my opinion the last word in sound reproduction . . . To say that I am satisfied is a complete understatement.

(Norwich)

### ODE No. 2.

The Duode arrived this week and has been given a thorough tryout. We are delighted with it.

(Hornsea)

### ODE No. 3.

Now you have surpassed yourself! The clarity and depth of Tone are really remarkable. It is a revelation. Blow your Trumpet much louder!

(Birmingham)

### ODE No. 4.

Two years ago we bought two of your units. We were delighted with the results and have yet to hear any which in our opinion are better for quality or power handling.

(York)

### ODE No. 5.

I get more pleased with the DUODE 12C as each day passes and heartily endorse your ideas.

(Bristol)

There are many, many more very pleased DUODE owners who have long-standing proof of our firm claim:

**DUODES ARE THE FINEST LONG TERM SOUND INVESTMENT.**

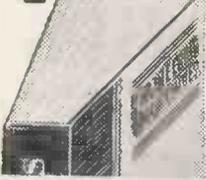
Why not set about proving it for yourself now—write to us today.

**Barker Sound Reproducers**  
3 Newman Yd., London, W.1

# 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

**144 PAGES Free!**



**B.I.E.T.**  
387 College House, 29-31, Wright's Lane, London, W.8

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

## BLACKSMITH — OR EXPERIMENTER ?

Complete unit, 21" x 21" x 2", to mount a valve base and tagged for 12 components. Eliminate the "Blacksmithery" of the bread board stage. Build AF, RF, HT stages, etc., for permanent experimental use.

Price 2/6 each. State valve base.  
**P. SCHOFIELD** 20 Fernende Road  
Herne Hill, London, S.E.24

# THE CHAFFEY CABINET COMPANY

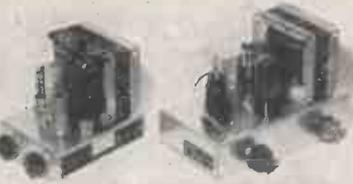
63a, CHELTENHAM RD., LONDON, S.E.13  
TEL: NEW CROSS 4766

## WEBB'S SERVICE DEPARTMENT

for complete renovation of complex communications receivers of any make

Test report issued showing sensitivity, selectivity, signal/noise equal to, or better than, makers' original figures.

**WEBB'S RADIO,**  
14, SOHO STREET, LONDON, W.1



**3-VALVE QUALITY AMPLIFIERS**  
3-4 wt. 16 S.W.G. al. chass.; neg. fdbk.; vol. and tone controls; A.C. 200-250 v.; voltage panel; 2-4Ω spkr socket; new comp. and PLAYING TESTED; 87g 6½ x 5 x 4½in., £42/6.  
INT. OCT. 9 x 6 x 4½in., £3/19/6.  
Carr. 2/6 either model and state type P.U.  
E.K.E., 47, Arksey Lane, Bentley, Doncaster.

**SITUATIONS VACANT**  
HONOURS graduate in physics or electrical engineering is required to work in a laboratory engaged in research and development on frequency control problems relating to communication systems. The position is open to men and women and affords excellent opportunities for detailed study of the theoretical and practical aspects of the subject.  
LIVING accommodation for single or married persons can be made available.  
BOX W., R2421, A.K. Advg., 212a, Shaftesbury Ave., London, W.C.2. [449]

THE G.E.C. Stanmore Laboratories invite applications for the following vacancies:—  
1. CIRCUIT Engineers to fill several vacancies in our engineering development laboratories. The Group is responsible for developing production prototype models of equipment for the services, including items such as: I.F. amplifiers. VIDEO amplifiers. PULSE manipulating circuits. D.C. amplifiers. MAGNETIC amplifiers. POWER packs. (REF. WW/MW.1).  
2. MICROWAVE Engineers for work on transmitter receiver equipment for guided weapons. The vacancies are in laboratory teams engaged on engineering development for production (Ref. WW/MW.2).

ALL the above posts are for experienced engineers. There are, however, a limited number of vacancies for men who are studying for H.N.C. or equivalent qualification.

3. TRIALS Staff for several posts at levels appropriate to H.N.C. and Honours degree standard for work on Radar Type Equipment. In some cases an ability to carry out theoretical assessment would be an advantage. Some interest in the design and development of electronic service qualifications of appropriate standard considered (Ref. WW/JMCP.1).

4. ENGINEERS to fill vacancies in a recently formed Special Development Section working on:

(a) ELECTRONIC equipment design AR/BAT. 1/WW.  
(b) LIGHT electro mechanical and hydraulic servo development. AR/BAT.2/WW.  
(c) GENERAL radar electronic development AR/BAT.3/WW.

APPLICANTS for senior posts should have a sound electrical or mechanical background preferably with academic qualifications in Electrical/Mechanical Engineering or Physics, and those for junior posts should have obtained H.N.C. Electrical Engineering.

5. EXPERIENCED Physicist and/or Electrical Engineer to work on circuitry and servo design aspects of radar equipment (Ref. WW/SM).  
PLEASE apply in writing to the Staff Manager, G.E.C. Stanmore Laboratories, The Grove, Stanmore Common, Stanmore, Middx., quoting the appropriate ref. number. [4668]

**ASSISTANTS (Scientific).** The Civil Service Commissioners invite applications for pensionable posts. Applications may be accepted up to December 31st, 1955, but early application is advised as an earlier closing date may be announced either for the competition as a whole or in one or more subjects. Interview Boards will sit at frequent intervals.  
AGE at least 17½, and under 26 years of age on January 1st, 1955, with extension for regular service in H.M. Forces, but candidates over 26 with specialised experience may be admitted.

CANDIDATES must produce evidence of having reached a prescribed standard of education, particularly in a science or mathematical subject. At least two years' experience in the duties of the class gained by service in a Government Department or other civilian scientific establishment or in technical branches of the Forces essential in one of the following groups of scientific subjects:

- (i) ENGINEERING and physical sciences.
- (ii) CHEMISTRY, bio-chemistry and metallurgy.
- (iii) BIOLOGICAL Sciences.

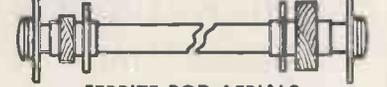
(iv) GENERAL (including geology, meteorology, general work ranging over two or more groups (i) to (iii) and highly skilled work in laboratory crafts such as glass-blowing).  
INCLUSIVE salary scale £262 (at 18) to £545 (men) or £457 (women). Starting pay up to £402 (men) or £357 (women) at 25. Women's pay to be increased under Equal Pay Scheme. Somewhat less in provinces. Opportunities for promotion.

FURTHER particulars from Civil Service Commission, Scientific Branch, 30, Old Burlington Street, London, W.1, quoting No. S 59/55. [4617]

**INSTALLATION Engineer** required by well-known manufacturers of mobile and fixed V.H.F. communications equipment; excellent opportunities for advancement; sound knowledge and experience necessary; write giving full particulars to—Sales Manager, British Communications Corporation, Ltd., Exhibition Grounds, Wembley. [4647]

**SENIOR electronic engineer** wanted to take charge of field project for initial period of 18 months, at group 27, 35, must be single and medically fit and prepared to take complete charge of organisation, administration and technical supervision of team in isolated situation abroad; qualifications required B.Sc. Degree or H.N.C. plus at least three years' experience in electronics or Final Cert. Five Years' Course C. & G.; good prospect of permanency in large and expanding organisation; overseas salary £1,250 to £1,400.—Box 3272. [4618]

## 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.  
● High Q ● Litz wound  
● Dust covered. 3/- ea.  
HAX.L. (L.W.), 3/6 ea.  
Dual wave TRF. coils, matched pairs (as illustrated) 7/- pr. Transistor coils—I.F.T.'s, etc., etc.  
Available from leading stockists.  
Stamp for complete data and circuits.  
**THE TELETRON CO. LTD.**  
266, Nightingale Road, London, N.9. ROW 2527

## THE "Dust Bug" AUTOMATIC GRAMOPHONE RECORD CLEANER

PATENT APPLIED FOR  
From **Cecil E. Watts**  
Consultant and Engineer (Sound Recording and Reproduction)  
Oakleigh Grange, High Cross, nr. Uckfield, Sussex.  
Or your local dealer.  
Price 18/6, plus 6/2 purchase tax

## PRECISION RESISTORS

Wirewound to 1% accuracy, any value between 1 and 1,000 ohms. 2/6d.  
Set of twelve Resistance Box Standards to cover 1 to 1,110 ohms in 1 ohm steps, accuracy 1%, wirewound, 27/- per set.  
**R. MASSEY, 25, DOMINION AVE., LEEDS, 7**

## —CROYDON TRANSFORMERS—

**C.R.T. ISOLATION TRANSFORMERS**  
Type A: Ratio 1-1.25 giving a 25% boost on secondary. 2 volt 7/6; 4 volt 7/6; 6.3 volt 7/6; 10.8 volt 7/6; 13.3 volt 7/6. Low leakage windings.  
Type B: Mains input 200/230 volts. Multi output, 0-2-4-6-3-7-3-10 and 13 volts. Input has two taps which increase output volts by 25% and 50%, 15/- each. Low leakage windings.  
Type C: For use with 2 volt Tubes with falling emission. Input 200/250 volts. Output 2-21-21-21-3 volts at 2 amps., 12/6 each. Low leakage windings.  
Please add postage 1/-.  
**2, Pawsons Rd., W. Croydon**

Vitavox Public Address Multicellular Horns 5/hand complete with new 15 Ohm Pressure Unit, £12. 10.0. Secondhand 8" Speakers in Cabinet 5 Ohm, 21/-. New Fluorescent Quick Start Ballast Units to operate 2 40w. Tubes, state voltage, 19/6 each. 100 yds. coils, Twin Plastic Cable, 35/- coil.  
Please add postage.

**HAROLD MORRIS LTD.**  
423 Green Lanes, London, N.4. LOU. 5241/2



**DECCA RECORD PLAYERS**  
Standard or I.P. List Price £12/1/6  
**OUR PRICE 6 GNS.**  
Packing, carriage, insurance, etc., 10/6

Decca 78 r.p.m. variable speed record players. fitted centre drive Garrard motors, lift plug-in heads, sapphire styl, Rextone case. List price £12/18/6. Our price 28/19/6. Packing, carriage, insurance, etc., 10/6.  
Send stamp for bargain list of record players.  
**RONALD WILSON & CO.**  
12, BRIDGE ST., WORCESTER

## LONDON CENTRAL RADIO STORES

**EVERSHED & VIGOGES SAFETY BRIDGE MEGGER**  
Testing Set. 100 v. Size approx. 14 x 7 x 6 ins.  
Weight about 24 lb. In perfect working order £3/10/-.

**FRACTIONAL AC/DC MOTORS 110-220 v.** Size approx. 4 x 3 in. Weight about 3 lb. 37/6. Carr. & pkg. 2/6.

**TELEPHONE HANDSETS, 9/6.**

**DICTAPHONE CYLINDER TYPE CUTTING HEAD.** Complete with AC/DC Fractional H.P. motor etc. 110-220 v. 50/-.

**GOODMANS P.M. SPEAKERS.** 6in., 9/-; 8in., 11/6; Carr. & pkg. 1/6 each.

**4-VALVE (USED) SUPERHET UTILITY RECEIVERS.** Fully reconditioned. Medium waveband only. 6in. P.M. speaker. Complete in pinewood cabinet. Size 13 1/2 x 12 x 6 1/2. 200-250 v. A.C. mains, £3/18/6.

**PHILCO RADIO SETS.** 3-wave 5-valve. Fully reconditioned and tested. Incorporating 2 speed tuning. In walnut cabinet. A.C. or Universal Mains. Approx. size: 18 x 14 x 9 1/2, £5/10/- Carr. paid.

**23 LISLE ST. (GER. 2969) LONDON, W.C.2**

Closed Thursday 1 p.m. Open all day Saturday

## A NEW TAPE PRE-AMPLIFIER

Designed to professional standards for 3 HEAD DECKS.

- ★ Completely separate recording and replay channels with direct/replay monitor comparison switching.
- ★ Correct pre- and post-equalisation to C.C.I.R. standards.
- ★ Peak-programme metering.
- ★ Good bias and erase supply.
- ★ Designed primarily for WEARITE TYPE 2B TAPE DECK—perfectly suitable for all good 3 head tape decks.

Write to:

**ARIEL SOUND**

57, LANCASTER MEWS, LONDON, W.2  
Telephone: PADdington 5092.

## Rowridge & Norwich



**CONVERTOR TYPE 26.** For conversion from channel 3 to channel 1, complete with self-contained power supply unit and totally enclosed in a handsome, well finished steel case. Price complete, £11/17/-.

Also available in chassis form less HT supply but including mains operated heater supply for inclusion in receivers. Price complete, £8  
**CONVERTOR TYPE AC/4.** For weak signal areas. Price complete, £15/15/-.  
(Leaflets on request.)

**SPENCER - WEST,**  
Quay Works, Gt. Yarmouth.

Telephone: 3009.

Grams, Spencer-West, Gt. Yarmouth.

### SITUATIONS VACANT

**AN Assistant Development Engineer** is required who is accustomed to telephone practice, including simple automatic systems; he should have some knowledge of audio frequency electronics and of acoustics; the salary would be in the range £550-£650 p.a.—Apply to Chief Engineer, Winston Electronics, Ltd., 1, Park Rd, Hampton Hill, Middlesex. [4628]

**ELECTRONIC engineers** are wanted in large Midland engineering plant, the positions are progressive and interesting requiring qualified and experienced electronic engineers, senior and junior for rapidly expanding laboratory engaged upon measurement and control problems.—State age, qualifications and experience fully, in confidence, to Box 3082. [4534]

**WANTED,** car radio mechanic for car distributors specializing in makes car radio; Smiths Radiomobile and Ekco dealerships held; permanent position and good salary for suitable applicant; must be experienced; also boy trainee required.—Apply Sales Promotion Manager, J. Davy, Ltd., 181, Kensington High St., London, W.8. Tel. Wes. 9641. [4595]

**TV MANUFACTURING, Ltd.,** have an opening for a senior TV engineer, for the development of domestic TV receivers, this position has very good possibilities for advancement for the right man.—Applications, stating experience, salary and date of availability should be sent to the Chief Development Engineer, Oulton Works, Lowestoft. [4619]

**ELECTRONIC Engineer** required by London manufacturers of radio components to take charge of measurements laboratory and test gear design; experience of measurement capacitors or telecommunication cables essential; salary £750 p.a.—Write details of qualifications, experience, age and present salary to Box 2259. [4375]

**ELECTRONIC Engineers and Physicists** required for rapidly expanding research dept. Candidates should have experience of electronic instrument development. Experience in pulse circuits or ultrasonics desirable but not essential. B.Sc. or H.N.C. standard.—Write full particulars to Glass Developments, Ltd., Brixton, S.W.2. [4237]

**THE TELEGRAPH CONDENSER Co., Ltd.,** require radio and TV engineer with laboratory experience for work in connection with printed circuits. H.N.C. standard. Superannuation scheme.—Write giving full details of education and experience, age and salary required to Personnel Manager, T.C.C., Ltd., North Acton, W.5. [4311]

**ELECTRONIC engineers.**—Experienced grading techniques required for work on devices employing television technique and also the design of electrical circuits around transistors; commencing salary up to £1,500 p.a. for really competent men; excellent working conditions in new factory in Surrey (1/2 hr. Waterloo).—Apply Box 3087. [4539]

**VACANCIES exist for engineers** in radio and radar field at our various depots; applicants should possess 1st class P.M.G. wireless certificate or Ministry of Transport certificate; applications from long service naval personnel welcome to Reply to: E. N. Smith & Co., Electrical Engineers, Ltd., 68, Grosvenor Street, Manchester, 1. [4648]

**YOUNG men** required for assembly, wiring and testing of electronic apparatus, some experience with scientific instruments an advantage, technical school education, must have completed National Service; pension scheme 5-day week; canteen; Camden Town district; salary according to age and experience.—Please apply, stating age and experience, to Box 3389. [4625]

**HONOURS graduates** in physics or electrical engineering are required for advanced work in a quartz crystal laboratory; the positions offered afford excellent opportunities for young men or women to specialize in the study of piezoelectric materials from both the theoretical and practical viewpoints; an interest in mathematics and electronics would be an advantage for this work.

**LIVING accommodation** can be made available to successful applicants.—Write Box W.3 9363, A. K. ADVG, 212a, Shaftesbury Ave., London, W.C.2. [4460]

**HATFIELD INSTRUMENTS, Ltd.,** who are now expanding their laboratories, required senior and junior electronic engineers with experience in the design and test of high grade radio and industrial laboratory equipment.—Apply in writing, in the first instance, stating age, experience and salary required, to Hatfield Instruments, Ltd., 175, Uxbridge Rd., Hatfield, W.7. [4452]

**MINISTRY OF SUPPLY** requires electronics technician at Burchfield, near Reading, to supervise investigation of faults in radar, H.F. and pulse circuits; qualifications, British of British parents, recognised engineering apprenticeship or equivalent training in appropriate trade, detailed knowledge of radar, H.F. and pulse circuitry essential; experience in fault finding and compiling investigation reports advantageous; H.N.C. or equivalent desirable; salary within £772-£945 p.a.; not established but opportunities to compete for establishment may arise.—Application forms from M.L. & N.S. Technical and Scientific Register (K), 26, King St., London, S.W.1, quoting D150/5A. [4531]

# GALPIN'S

ELECTRICAL STORES

408, HIGH STREET, LEWISHAM, S.E.13

Tel.: Lee Green 0309. Nr. Lewisham Hospital.

TERMS: CASH WITH ORDER. NO C.O.D.

All goods sent on 7 days' approval against cash.

EARLY CLOSING DAY THURSDAY

**HEAVY DUTY SPOT WELDING TRANSFORMERS,** input 200/250 volts. OUTPUT a combination of 2, 4, 6, 8, 10, 12 volts at 120/150 amps. New £6/15/- each, carriage 6/-.

**MEDIUM SPOT WELDING TRANSFORMERS,** input 200/250 volts, OUTPUT a combination of 2, 4, 6, 8, 10, 12 volts at 50/70 amps. New £5/2/6 paid.

**HEAVY DUTY L.T. OUTPUT TRANSFORMERS,** 200/250 volts Input, Output a combination of 6, 12, 18 and 24 volts at 30 amps. £4/2/6 each. C/paid.

Another Input as above, Output 0, 6, 12, 18, 24 volts at 12 amps. 55/- each, post 2/-. Another Input as above, Output 0, 6, 12, 18, 24 volts, 6/8 amps., 4/6/6 each.

**HEAVY DUTY L.T. TRANSFORMERS** suitable for rectifiers, soil heating, etc. Input 200/250 volts. Output a combination of 6, 12, 18, 24, 30, 36 volts at 15 amps., 6/7/6 each, post 2/6. Another Input and Output as above but at 6 amps., 4/7/6, post 2/-. Another input and output as above but at 4 amps., 3/6/6 each.

**EX-RADAR MAINS TRANSFORMERS.** Input 230 volts. Output 4 or 5 Kilo-volts at 30 min., also 3 L.T. windings 4 v. 2 a., 6.3 v. 2 a., 2 v. 2 a., these transformers are capable of a larger output than stated and are immersed in oil. £3/15/- each, carriage 5/-.

**EX-U.S.A. ROTARY CONVERTORS,** 12 volts D.C. input, outputs 500 volts 50 mA. 275 v. 100 mA. Complete with smoothing, 22/6 each, carriage 2/6. As new.

**1,000 WATT AUTO WOUND VOLTAGE CHANGER TRANSFORMER,** tapped 0/110/200/230/250 volts, £5/15/- each, carriage 4/6. 500 watt ditto, £7/15/-, carriage 7/6. 350 watt 55/-, 500 watt 75/-, 200 watt 45/-.

**CHARGING KITS CONSISTING OF RECTIFIER AND TRANSFORMER** for charging 6 or 12 volt batteries at 2 amps. (input 200/250 volts) £2/6 each; ditto for 4 amps., 4/6/6 each.

**EX-R.A.F. DYNAMOTORS** 24/28 volts D.C. input 1200 volts, 17 milliamps 1/2 hour rating, 11/6 each.

**EX-RADAR IMPULSE TRANSFORMERS,** 2 Mu-Metal transformer in oil, Output believed to be 15 kV. at 3 kV. R.F., only 7/6 each.

**ROTARY CONVERTORS,** 24 volts D.C., input 50 or 110 volts 500 cycles 1 phase, Output at 300 watts, £7/10/- each C/forward.

**METAL RECTIFIERS,** large type, 50 volts at 1 amp. D.C. Output (70/75 volts A.C. Input), these can also be broken down for low tension rects., 7/6 each.

**EX-G.P.O. EARPHONE** with separate carbon type Microphone, 40 ohms resistance, 6/6 each.

**AUTO WOUND TRANSFORMERS,** 4 kilowatts 110 to 230 volts or vice versa, £15 each, C/forward; ditto double wound 3 kW., Input 230 volts, Output 55/0/55 or can be used the other way round, £16/10/- each, C/forward.

**MAINS TRANSFORMER.** Input 200/250 volts, Output 25 volts 2 amps., centre tapped, 22/6 each.

**EX-R.A.F. MORSE TAPPING KEYS,** complete with flexible lead with Jack Plug, 3/6 each.

**EX-GOVERNMENT MAINS TRANSFORMERS,** suitable for soil heating, garage lighting, etc. Input 180/250 volts, Output 0/14/17 volts 20 amps., 45/- each, carriage 3/6; another same Input, Output 4 volts 20 amps. twice, 30/- each, C/paid.

**LARGE WIRE WOUND FIXED RESISTANCES,** 350 ohms to carry 1/2 amp., slider easily fitted, 5/- each.

**MAINS TRANSFORMERS,** 200/230 volts. Input 0/9/18 volts 3/4 amps., Output suitable for battery chargers, etc., 22/6 each.

**ELECTROLYTIC CONDENSERS,** 1000 M.F.D. 75 volt working, 6/6 each; 2000 M.F.D. 12 volt working, 5/- each, post 1/-.

**EX-W.D. CONVERTORS,** 18/24 volts D.C., Input 450 volts D.C., Output complete with reduction gear, these can be easily converted to work off A.C. mains, approx. power 1/2 h.p., suitable for grinders, lathes, etc., 20/- each, post 2/6.

Clients in Fire, please allow at least double the carriage stated to allow for customs clearance charges.

## FERRANTI LTD.

(Electronics Dept.)

Manchester, have the following vacancies at their Moston, Chadderton and Wythenshawe factories:—

1. **CHIEF PLANNING ENGINEER** for Cathode Ray Tube production. The essential qualification is previous responsibility and experience in planning and progress, preferably, though not necessarily, in C.R.T. manufacture.
2. **PROCESS CONTROL ENGINEERS** with considerable experience of C.R.T. production and of the technical problems involved.
3. **TECHNICAL MAINTENANCE ENGINEER** with experience of vacuum equipment and automatic and mechanical apparatus of the type used in C.R.T. production. Knowledge of electronic circuitry would be an advantage.
4. **PLANT ENGINEER.** A young mechanical engineer, preferably with some knowledge of vacuum or chemical techniques is required to assist in the design of automatic plant for C.R.T. and valve production.
5. **CIRCUIT ENGINEER** for work with new types of valves including the design of circuitry for use with them. The successful candidate would also assist the Sales Department in establishing these new types.
6. **VALVE DESIGN ENGINEERS** holding good hon. degrees in Physics or Electrical Engineering and preferably with previous experience of Valve design.
7. **CIRCUIT ENGINEER** for Ceramic Valve Laboratory, having experience of R.F. work and preferably of pulse circuitry. He would be required to determine the characteristics of advanced types of valves opening up new and interesting fields.

Salaries would depend on age and experience within the following ranges: Post 1, £800-£1,000 per annum.

Posts 2, 4, 5, 6, and 7, £600-£900 per annum.

Post 3, £500-£700 per annum.

Permanent staff appointments with Pension benefits. Application forms from Mr. T. J. Lunt, Staff Manager, Ferranti Ltd., Hollinwood, Lancs. Please quote reference PDH1, 2, 3, 4, 5, 6 OR 7.

A Leading Radio and Television Manufacturing Company requires the services of a Chief Engineer. Salary up to £3,000 per annum, according to qualifications and experience. Superannuation and Insurance Schemes in operation. Please reply, in strictest confidence, giving full details to Box No. 2694.

### SITUATIONS VACANT

**A SENIOR Engineer** is required for a responsible post on design of Communications Receivers and Low Power V.H.V. R/T Equipment. Applicants should have a good engineering or science degree, or equivalent qualifications and at least five years' experience in these fields in responsible positions.—Applications should be addressed to Personnel Department, S.E., Murphy Radio, Ltd., Welwyn Garden City.

**A SENIOR Communications Engineer** is required for responsible post on design of Carrier Telephony Radio Links. Applicants should have a good engineering or science degree, or equivalent qualifications and at least five years' experience in a similar post.—Applications should be addressed to Personnel Department, S.E., Murphy Radio, Ltd., Welwyn Garden City.

**SIEMENS BROTHERS & Co., Ltd.**, require technicians for their Research Laboratories at Blackheath, S.E.3 engaged in work on electronics and telecommunications; pensionable staff posts with good prospects of advancement.—Apply in writing to Siemens Brothers & Co., Ltd., Ref. 744/12, Woolwich, S.E.18, giving particulars of age, qualifications, experience and salary required. [4462]

**CRAFTSMEN** for Radio and Television Service required at Shrewsbury and Ludlow districts; applicants must be fully experienced in the repair and maintenance of all types of radio and television receivers; rate of pay at present 4/1 per hour; N.J.C. conditions.—Apply, in writing, to Mr. W. Winwood, Sub-Area Manager, Midlands Electricity Board, Spring Gardens, Ditherington, Shrewsbury. [4463]

**EDISON SWAN ELECTRIC Co., Ltd.**, have a vacancy for an engineer to take charge of their Special Products' Development Laboratory. Candidates should have an engineering degree or its equivalent, and should have experience in developing electronic equipment ready for factory production.—Please write full particulars, including age and salary required, to 155, Charing Cross Rd., London, W.C.2. Reference K. S. P. [10086]

**RADIO** technicians required by International Aeradio, Ltd., for overseas service; permanent and pensionable positions, inclusive salary from £894 per annum to £1,575 per annum, tax free, according to marital status; free accommodation; kit allowance; free air fares; generous U.K. leave.—Qualified candidates to whom replies only will be sent please write quoting RT to Personnel Officer, 40, Park St., W.1. [10262]

**DEVELOPMENT Engineers.**—A leading Manufacturer of Radio and Television Receivers has vacancies in its Laboratories for Electronic Engineers with experience in the Design and Development of this type of equipment. Situated in the Midlands. Salaries according to qualifications and experience.—Those interested should write, giving details of career and salary expected to the Personnel Manager (Ref. GLB.) Box 2541. [4427]

**THE LONDON HOSPITAL MEDICAL COLLEGE**, Turner St., London, E.1, requires a technician for the construction, testing and maintenance of electro-medical apparatus; O.N.C. or equivalent qualification desirable but not essential; salary, according to age and experience, on the Whitley Scales for Medical Laboratory Staff.—Applications, stating age, qualifications and experience, to the Secretary within 14 days. [4652]

**APPLICATIONS** invited for Electronics Technician. Duties include construction of equipment for wide range of researches. Previous experience an advantage but suitable applicants having just completed National Service considered. Salary in range £340-£480, plus London Weighting Pension scheme.—Reply Professor A. R. Ubbelohde, Department of Chemical Engineering, Imperial College, S.W.7. [4666]

**UNIQUE opportunity** for the right man; medium-sized engineering company in S.W. London requires enthusiastic electronic engineer to take charge of small development section; academic qualifications necessary, but breadth of interest even more important; products range from aircraft radio equipment and radio components to domestic appliances and tape recorders; substantial salary and assured future for the right man.—Box 3253. [4612]

**ESTIMATOR**, Decca Radar, Ltd., invite applications for a responsible post as estimator in their laboratories; applicants must have a sound knowledge of mechanical and electronic engineering coupled with substantial suitable industrial experience; excellent starting salary with a rising scale; British nationality essential; pension scheme.—Reply, quoting RLA 84, to Decca Radar, Ltd., 2, Tolworth Rise, Surbiton, Surrey. [10193]

**DECCA RADAR LIMITED** invite applications from young men, preferably of H.N.C. standard or above, who would like to become microwave engineers working in the modern wide field of navigational aids; training will be given to suitable applicants to fit them for a progressive career; British nationality essential; there is a pension scheme in operation.—Write, giving full personal particulars and quoting RLA91 to Decca Radar, Ltd., Radar Research Laboratory, 2, Tolworth Rise, Surbiton, Surrey. [10131]

**ENGINEERS AND DRAUGHTSMEN:** Excellent opportunities for keen and enthusiastic engineers and draughtsmen for a wide variety of work associated with Radio and Machine Frequency, Resistance Heating Development, and Application problems. The posts are permanent and pensionable, and every opportunity for advancement is available. Salary will be in accordance with age, experience and qualifications.

**Engineers** for development and design of Radio Frequency Generators. Applicants must have had a full time electrical apprenticeship and experience in high power R.F. equipment. Qualifications—H.N.C. or full time University Degree.

**Engineers** for development and design of Mechanical Handling Equipment associated with Radio and Machine Frequency Heating Applications. Applicants must have had a full electrical or mechanical apprenticeship and experience in the design of Mechanical Handling Equipment, including pneumatics and hydraulics. Qualifications—H.N.C. or full time University Degree.

**Technical Assistants and Junior Engineers** for Experimental Laboratory work on problems related to the application of Radio, Machine Frequencies, and Resistance Heating. Candidates must have had a full time electrical or mechanical apprenticeship and reached at least O.N.C. standard.

**Draughtsmen, Seniors and Juniors** for circuitry layouts, mechanical and electrical equipment associated with Radio, Machine Frequency, and Resistance Heating Applications. Candidates must have had a full electrical or mechanical apprenticeship and have O.N.C. or H.N.C. in mechanical or electrical engineering.

Write for application form to: The Personnel Manager, Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, 17, marking envelope 'R.1.'

### Situations Vacant

HIVAC LIMITED

Manufacturers of specialised thermionic and electronic devices, offer interesting posts for scientists, engineers and technicians in their expanding organisation on research and development projects in valves, cold cathode tubes and transistors. Previous experience in these fields, though an advantage, is not essential, but a sound education and an active and enquiring mind are. Encouragement will be given, wherever possible, to the publication of original work.

The Company is a member of a major communications Group and the posts, which are available for both senior and junior applicants, are pensionable and offer scope for advancement. There is a five-day working week. Applications in writing, which will be treated in strict confidence, stating age, education, qualifications and salary expected, should be addressed to The Engineer-in-Chief, Hivac Limited, Greenhill Crescent, Harrow, Middlesex.

**NEW BOOKS**

**ON RADIO & TELEVISION**

Sound Reproduction, by G. A. Briggs	18/6
Loudspeakers, by G. A. Briggs	8/-
Practical T.V. Aerial Manuals for Bands I and III, by E. Laidlaw	4/9
Fundamentals of Transistor, by L. Krugman	22/-
Radio Control of Model Ships and Aircraft by F. C. Judd	9/-
Radio Amateurs Handbook A.R.R.L. 1955	31/-
An Introduction to Colour Television, by G. G. Gouriet, 72 pages, 12 diagrams, etc.	9/6
Foundation of Wireless, by Scroggie (revised)	13/6
World Radio Handbook, by Lund Johansen	10/-
Practical F.M. circuits for the home construction, by R. Deschepper	5/3
Radio Data Charts by R. T. Beatty, published by Wireless World	8/-
Remote Control by Radio, by A. Bruinsma, Phillips Technical series	9/-

ALL POST FREE. Write for New List of ENGLISH AND AMERICAN BOOKS AND PERIODICALS

**UNIVERSAL BOOK CO.**

12 LITTLE NEWPORT STREET, LONDON, W.C.2 (Adjoining Lisle St.)

**SITUATIONS VACANT**

(1) **PHYSICISTS** and Electronic Engineers are required for the Chemical and Metallurgical Division of the Plessey Co., Ltd. Attractive posts are available for junior and senior grades in new, well-equipped and expanding Physics and Electronics Laboratories. APPLICANTS should be interested in the development and application of semi-conductors, dielectric, piezoelectric or magnetic materials.

POSITIONS are permanent and pensionable and offer considerable scope for creative work; salaries will be generous and commensurate with qualifications and experience.—Write in confidence to the Technical Manager, The Plessey Co., Ltd., Towcester, Northants

(2) **THE Chemical and Metallurgical Division** of the Plessey Co., Ltd., is engaged in the development of interesting new products for the electronic, radio and TV industries.

**PHYSICISTS** and Electronic Engineers are required for development, applications and instrumentation work on semi-conductors, ferro-electric and ferromagnetic materials.

ATTRACTIVE posts are available for junior and senior grades in new, well equipped and expanding Physics and Electronics Laboratories. POSITIONS are permanent and pensionable and offer considerable scope for advancement. Salaries will be generous and commensurate with qualifications and experience.

WRITE in confidence to the Technical Manager, The Plessey Co., Ltd., Towcester, Northants.

(3) **THE Plessey Company, Ltd.**—Vacancies exist in new well-equipped and expanding laboratories of the Chemical and Metallurgical Division for junior and senior Physicists and Electronic Engineers with progressive ideas; experience in any of the following fields an advantage:

Magnetic measurements.

Acoustics.

Piezoelectricity

Design of electronic apparatus.

Radio interference suppression.

Design of electromagnetic devices.

POSITIONS are permanent and pensionable and offer considerable scope for advancement; salaries will be generous and commensurate with qualifications and experience.—Write in confidence to the Technical Manager, The Plessey Co., Ltd., Towcester, Northants. [4260

4260

**MARCONI'S WIRELESS TELEGRAPH Co., Ltd.**, require draughtsmen at their Chelmsford and Acton offices; men experienced in the design of radar, radio or electronic equipment are needed to meet expanding development programmes; 5-day week, super-annuation fund, social and athletic club, modern canteen.—Apply to the Secretary, Marconi's Wireless Telegraph Co., Ltd., New St., Chelmsford, stating age, training and experience. [4608

**SIEMENS BROTHERS & Co., Ltd.**, have vacancies in their laboratories at Woolwich for assistant engineers to carry out experimental work on electronics as applied to long-distance telephony; the work covers multi-channel carrier current telephony and telegraphy over long distance open-wire lines and cables in addition to VHF and UHF radio circuits; field trials for such new equipments afford opportunities for short periods of overseas experience, and young engineers can obtain overseas installation experience.

THE laboratories are also engaged on the development of specialised carrier current terminal equipment for use with submarine cable systems employing submerged repeaters; opportunities are available for dealing with mechanical design, the physical principles of component design and the miniaturisation of equipment.

THERE are vacancies for young engineers who wish to take up sales and project engineering work involving commercial as well as technical requirements; this work necessitates a period of laboratory training before undertaking overseas travel.

APPLICANTS should have Ordinary National Certificate or higher qualification, experience in the maintenance of multi-channel carrier telephone or telegraph equipment an advantage. APPLY Siemens Brothers & Co., Ltd., Ref. 744/11, Woolwich, S.E.18. [4377

A **VACANCY** exists for an electronic instrument development engineer in the Telecommunications Laboratory of British Insulated Callender's Cables, Ltd., at Kirkby, nr. Liverpool; candidates should hold a degree in physics or engineering and have previous experience in the design and development of electronic instruments.—Applications, quoting reference P/60/54, should be addressed to The Staff Officer, B.I.C.C., Ltd., Prescot, Lancs. [4593

**MURPHY RADIO, Ltd.**, have vacancies in the Electronics Division Laboratories for qualified engineers to design and develop the following: 1. V.H.F. and U.H.F. Communications equipment. 2. Airborne and Ground radar equipment. 3. Computing devices and servo systems. 4. Nuclear equipment and measuring instruments. 5. Transistors. The salary range is £600-£1,000 per annum depending upon experience. Further posts are available to engineers of H.N.C. standard of equivalent having less experience, the salary range being £450-£650 per annum. These vacancies are at Welwyn Garden City but one or two vacancies of a similar nature are available at the Ruislip Works.—Applications, giving age, full details of qualifications, experience and salary required, should be forwarded to Personnel Department, Murphy Radio, Ltd., Welwyn Garden City. [4432

# TELENG

## THE EQUIPMENT

FOR

'Communal' Aerial and

Wired T/V Systems

FOR

High Frequency Test, Control and Repeater Purposes.



**WIDE BAND 'CHAIN' AMPLIFIER MARK III**

Gain 20 db  $\pm$  2 db from 40 to 220 mc/s. or  $\pm$  0.5 db over any single T/V channel. 75 ohm unbalanced in and out. Output up to 1.1 v. R.M.S.



**H.F. INDICATOR METER TYPE 1**

20 m/v-2.5 v. in 3 ranges. 5 to 300 mc/s. Small probe. Shunt C at R.F. only 1.5 pf. Stabilised Valve-Bridge Circuit. A sensitive R.F. transfer indicator, for lab. or test bay.

ALSO

**TURRET TUNERS** for T/V receivers with 34.25 mc/s I.F. Models also for conversion of receivers with 13 to 19 mc/s I.F.

**WIDE BAND REPEATERS.** Gain 30 db Band I only and Single Channel Repeaters, with and without A.G.C.

**CO-AXIAL CABLE J.B.'s, COUPLING AND TEE UNITS**

**Telefusion (Engineering) Ltd.**

Teleng Works, Church Road, Harold Wood, Romford, Essex.

Ingrebourne 2901

**L.A.N.E.**

Leads the world in TAPE RECORDING

For details of the world's most advanced Tape Units and Tape Recorders contact

**VERDIK SALES LTD.**

8, RUPERT COURT, WARDOUR ST., LONDON, W.1

Gerrard 8266

**WAFER SWITCHES TO SPECIFICATION**

One or more type "H" switches having any desired contact arrangement or wafer spacing made from parts supplied by A.B. Metal Products Ltd.

Most types despatched within 48 hours.

Send for Price List of 82 "standard" arrangements and switch design chart

Orders and enquiries by post only:

**SPECIALIST SWITCHES**

24 GRANBOURN STREET, LONDON, W.C.2

## GUIDED WEAPONS

Design Engineers—Technicians.

The Guided Weapons Department of the Bristol Aeroplane Company Limited, at Filton, requires to recruit the following:—

1. Design Engineer: To design and develop D.C. and L.F. circuitry for use in computing and other servo applications. A degree in Electrical Engineering or an equivalent professional qualification is desirable.
2. Technical Assistant: To service electronic-servo test equipment. Considerable practical experience, a high standard of education and a sense of responsibility are essential requirements.

Applications, quoting D.O.35, giving details of age, experience, and salary required, should be addressed to the Personnel Manager, Aircraft Division, **BRISTOL AEROPLANE COMPANY LIMITED**, Filton House, BRISTOL.

## ARKAY KITS

WORLD'S FINEST

RADIOS PHONOGRAPHS TV  
TEST EQUIPMENT HI-FI

Write for FREE Brochure

Radio Kits, Inc. • 120 CEDAR STREET  
NEW YORK 6, NEW YORK • U.S.A.

## MORSE CODE Training



COURSES FOR BEGINNERS AND OPERATORS, also a SPECIAL COURSE for passing the G.P.O. Morse Test for securing an AMATEUR'S TRANSMITTING LICENCE.

Send for the Candler BOOK OF FACTS. It gives details of all Courses. Fees are reasonable.

Terms: Cash or Monthly Payments.

**THE CANDLER SYSTEM CO.**

(55W) 52b ABINGDON ROAD, LONDON, W.8

Candler System Co., Denver, Colorado, U.S.A.

## T.V. COMPONENTS SURPLUS & SECONDHAND

T.V. TUBES AS SUPPLIED TO THE TRADE AND INSURANCE COMPANIES, RECONDITIONED AND SURPLUS. GUARANTEED.

## VIDEO ELECTRONICS

16/22 Bacon Street, London, E.1.  
BIS. 0419/0410.



## TRANSFORMERS

of all types up to 25 KVA for Single or Three Phase operation, Phase Conversion, etc.

## MAINS

Output, and Special Purpose Transformers for Radio Equipment; Chokes, etc.

## COILS

for Contactors, E.M. Brakes, Air Valves, etc., and Coil WINDINGS for all purposes.

## SOLENOIDS

for A.C. and D.C. Operation.

**W. F. PARSONAGE & Co., Ltd.**

INDUCTA WORKS • Park Rd • Bloxwich • Walsall  
Telephone: BLOX 66464

## SITUATIONS VACANT

**DESIGNER** (25-55 years) required by old-established firm of electrical component manufacturers in N.W. London. Applicants must possess sound knowledge of radio frequency circuits, pulse forming networks and experience in the electronic, radio and/or television industry would be an advantage. Superannuation scheme.—Write, stating age, experience and salary required, to Personnel Manager, Box 3M S4550, A.K. Adv., 212a, Shaftesbury Ave., W.C.2. [4665]

**DECCA RADAR LIMITED** require the services of a first-class mechanical engineer for work on their microwave link systems; this post is a special appointment and a substantial starting salary is envisaged on a rising scale; British nationality essential; pension scheme in operation. Please write, giving full particulars of qualifications and experience, to the Research Director, Decca Radar, Ltd., Radar Research Laboratory, 2, Tolworth Rise, Surbiton, Surrey. [0130]

**I** grew up in the radio components trade and my 30-year-old business is flagging for want of the right kind of help; I need someone—now—with specialized knowledge and experience like my own, who knows the business inside out, who can compile and maintain a catalogue, and who will justify high pay; technical knowledge alone insufficient, must have experience; write me fully if you think you are the man, but remember I want someone to help me train a passenger to teach.—Box 3454. [4636]

**SENIOR** and junior design draughtsmen required for interesting work in connection with electronic equipment, commercial radio and television and/or light electro-mechanical engineering. London area; the positions vacant offer ample scope and opportunity for future advancement to men of good ability; a high salary will be paid to the selected candidate; all recognised staff privileges available; please reply, giving full details of experience to—Box 2442. [4409]

**TELEPHONE** engineers.—A well-known London company manufacturing Telecommunication equipment have vacancies in their sales section for (a) engineers for preparing tenders, (b) engineers for editing and writing technical publications, (c) engineers for instructing and training customers' engineers; should have good knowledge of carrier telephone and VF telegraph systems; canteen and sports club facilities; pensionable staff post; state age, qualifications and experience.—Box 2287. [4379]

**DECCA RADAR, Ltd.** have vacancies for radar mechanics and wireless in their research organization; these positions carry excellent rates of pay and the possibility of promotion to staff appointments; the work is of a varied and interesting nature, concerned with the development of modern navigational aids; there are good canteen and facilities; nationality is essential.—Reply, quoting ref. RLA 78, to Decca Radar, Ltd., 2, Tolworth Rise, Surbiton, Surrey. [0138]

**DECCA RADAR, Ltd.** invite applications from electrical engineers and physicists of degree standard, having practical experience in microwave components, to work on advanced microwave and millimetric aerial design in a rapidly expanding group and prospects for men of ability are considerable. British nationality essential; a pension scheme is in operation.—Please write to Decca Radar, Ltd., 2, Tolworth Rise, Surbiton, Surrey, quoting reference RLA95. [0192]

**DRAUGHTSMEN**.—An expanding production programme has created a number of vacancies for mechanical designers, senior draughtsmen and detail draughtsmen; situated in the Midlands; the work involves the complete engineering of electronic apparatus for Government contracts and of electronic radio and television equipment.—Applicants interested in this type of work, with or without experience, are invited to apply, giving details of career and salary expected to the Personnel Manager (Ref. GLB.), Box 2458. [4398]

**THE GENERAL ELECTRIC Co., Ltd.**, Brown's Lane, Allesley, Coventry, requires mechanical development engineers, designer draughtsmen and draughtsmen, preferably with experience of radar-type equipments for work on guided weapons and like projects; also required, senior and junior electronic development engineers, particularly in the field of microwave and pulse applications; salary according to age and qualifications and experience.—Apply by letter, stating age and experience, to the Personnel Manager, Ref. R.G. [0259]

**MINISTRY OF SUPPLY** requires Electronics Technicians at Farnborough, Hants (and possibly at Bickley, Kent, later) to supervise, or assist in, scheduling of R.A.F. telecommunication equipment showing breakdown into sub-assemblies and components; preparing lists of spares, connectors for aircraft installations; ensuring completeness of contractors drawings. Qualifications—British or British parents. Recognized engineering apprenticeship or equivalent in electronics. Must have long workshop experience radio/allied equipments, interpret drawings, specifications, circuit diagrams. Knowledge of component standardization and R.A.F. servicing requirements advantageous. O.N.C. or City and Guilds or equivalent desirable. Vacancies in two grades at salaries within £535 (age 26)—£772. Application forms from A.B.1181, London Appointments Office, Ministry of Labour and National Service, 1-6, Tavistock Square, W.C.1. [4674]

## ENGLISH ELECTRIC VALVE CO. LTD.

CHELMSFORD

## JUNIOR ENGINEERS

required for Valve Development Work, especially on the application of microwave valves to circuitry.

Applicants should have a degree and preferably some experience in microwave technique or alternatively with amateur transmitters.

Apply, quoting Ref. 497M, to Dept. C.P.S., 336/7, Strand, W.C.2.



**PULLIN**  
SERIES 100  
TEST METER

AC/DC 10,000 R/V  
21 RANGES  
100µA to 1000 V

COMPLETE IN DIE-CAST CASE WITH TEST LEADS, CLIPS AND PRODS FULLY GUARANTEED

SENT POST FREE FOR £2.10s.  
DEPOSIT AND TEN FURTHER MONTHLY PAYMENTS OF £1. CASH PRICE 11GNS

*Frith* RADIOCRAFT Ltd  
\*PHONE 58927  
69-71 CHURCH GATE LEICESTER

## FERRANTI LTD. (Moston) Manchester

have vacancies for TEST ENGINEERS to undertake work under the following headings:—

1. General testing and fault finding on electronic and servo units.
2. Advanced testing of above units in final form as analogue computers.
3. General testing of electronic testing outfits. (This will mainly involve electrical measurements.)
4. General testing and fault finding on gyroscopic instruments.
5. Design, development and maintenance of test equipment for electronics, servos and gyroscopes. Knowledge of general power supplies would be an advantage.

A standard of approximately H.N.C. is desirable but lesser qualifications would be acceptable if combined with practical ability and experience of this or analogous work (e.g. in H.M. Forces). Permanent Staff appointments with Pension benefits.

Application forms from Mr. T. J. Lunt, Staff Manager, Ferranti Ltd., Hollinwood, Lancs.

Please quote reference HGN.

# NEW

OUR 1955 SUPA-HANDBOOK  
"THE HOME CONSTRUCTOR"\*

20  
CIRCUITS

76  
PAGES

FOR 2/6 ONLY

incorporating these star attractions

\*20 CIRCUITS—Superhets, T.R.F. Sets, Amplifiers, Feeder Units, Tes. Equipment, etc.

\*SUPER HETS—Full constructional details, supra-simplified layout and point-to-point wiring diagrams for building superhets.

\*COIL PACK—Full constructional details for building a superhet coil pack.

\*CAR RADIO—Full constructional details.

\*BATTERY CHARGER, complete details for building a CHEAP CHARGER.

\*RADIO GEN—Pages of information, Resistance Colour Code, Formulae, and "know-how."

\*RADIO CONTROL—General information and list.

\*RADIOGRAM Constructors' list.

\*BOOKS—Comprehensive list of Radio Books.

\*CATALOGUE—Profusely illustrated catalogue and price list of components, receivers, Wolf Cub Tools, Xacto Tools, Soldering Irons, Radio Books, etc.

YOU CAN'T GET BETTER VALUE!  
IT'S TOPS!

\* "The most helpful book in the Trade,"

SEND 2/6 FOR YOUR COPY TODAY!

And, of course, our variable iron-dust cored COILS offer outstanding value at 3/- ea. 10-30, 16-50, 30-75, 75-200, 190-550, 800-2,000 metres. Aerial H.F. or Osc.

**SUPACOILS** (Dept. W.6)

21 Markhouse Road, London, E.17  
Phone KEYSTONE 6896

## SITUATIONS VACANT

**WINSTON ELECTRONICS, Ltd.** have a vacancy for an engineer in their development laboratories. Applicants should have several years' experience on audio frequency circuits, in addition to general electronic circuit knowledge, and would be required to work on loudspeaking telephone equipment. A reliable man is required, who can cope both with development work, and with installation queries.—Apply in writing to Chief Engineer, Winston Electronics, Ltd., 1, Park Rd., Hampton Hill, Middlesex. [4526]

**THE General Post Office** has vacancies for radio operators at its coast radio stations and applications are invited from men between 21 and 35 years of age who hold the Postmaster-General's First Class Certificate of Proficiency in Radiotelegraphy; selected candidates will be considered later for permanent pensionable posts.—Application should be made to The Inspector of Wireless Telegraphy, Radio and Accommodation Department, Wireless Telegraph Section, Union House, St. Martins le Grand, London, E.C.1. [4635]

**RADIO (Meteorological) Technicians** required by Meteorological Office. Qualifications: Basic knowledge of radio and radar and experience in maintenance/operation of radar equipment, including oscilloscopes. Successful applicants serve in United Kingdom and overseas. Commencing London salary £467/10 at age 25 or over, rising annually to £565, subject to deductions for each year below age 25. Provincial salary £220 to £30 lower; overtime, night duty allowance, etc.—Apply at any Employment Exchange, quoting Borough 881. [4467]

**BUSH RADIO Ltd.**, require senior and junior engineers in their laboratories at Chiswick, Kew and Plymouth; applicants should preferably hold a Higher National Certificate, B.Sc. Engineering or Physics, or equivalent qualifications; experience in the following fields of development would be an advantage: Domestic radio or television, electronic equipment for aircraft, communication receivers, pulse circuits and micro-wave techniques.—Write, giving full details and salary required, to the Chief Engineer, Power Rd., Chiswick, W.4. [4395]

**A**n electronic or electrical engineer of degree standard is required to take charge of the engineering department in a factory which is part of a large organisation engaged in the manufacture of all branches of communications equipment. The successful applicant will be responsible for engineering development, design and specification of all new items, as well as routine engineering problems. The wide field of work to be covered offers considerable opportunity for advancement. Living accommodation for single or married persons can be made available. BOX W., R2417, A.K. Advr., 212a, Shaftesbury Ave., London, W.C.2. [4490]

**MANAGER** required for a unit of a well-established engineering company engaged in large-scale production of radio and television; the successful candidate will have a specialised knowledge of this class of work and will be capable of advising and supervising the design laboratories, tool design, planning and machine and assembly departments; this vacancy offers ample scope and opportunity to a man with high administrative ability; salary up to £2,500 per annum; London area.—Please reply in confidence, giving full details, to Box 3083. [4535]

**THE TELEGRAPH CONDENSER Co., Ltd.**, invite applications from engineers fully experienced in radio and television design to assist Chief Development Engineer in development of printed circuits. Qualifications at least to A.M.I.E.E. standard. This position offers scope for the right man who must be capable of initiating and following projects to finality, including contact with customers. Superannuation scheme.—Write giving full details of qualifications and experience, age and salary required, to Personnel Manager, T.O.C., Ltd., North Acton, W.3. [4312]

**DECCA RADAR, Ltd.**, have, due to the continued expansion of their research laboratories, a number of vacancies for circuit design engineers; these cover work in a wide field, embracing high and low power pulse, receiver, A.F.C. radar display, and test equipment design in standard and sub-miniature form; applicants should be of degree standard; experience is desirable but not essential; there is a pension scheme in operation; British nationality.—Please write, quoting RLA 93, to Decca Radar, Ltd., Research Laboratories, 2, Tolworth Rise, Surbiton, Surrey. [0191]

**TECHNICAL sales/service manager** required for British West African branches of large British company distributing domestic radio receivers, V.H.F. radiotelephone equipment, intercommunication telephones, domestic and commercial refrigerators, air conditioners, and office equipment; good technical radio background essential; refrigeration experience desirable; familiarisation course arranged with U.K. manufacturers prior to departure for Africa; first-class passage sea/air, free furnished quarters, full pay on leave after approximately 18-month tours, pension scheme; apply in own handwriting stating age (preferably between 21 and 30), whether married or single, full details education, qualifications, national service and business experience; original references should not be sent.—Apply T. S. D., Box 1134. [4489]

## ELECTRONIC ENGINEERS

are required by the

## ENGLISH ELECTRIC Co. Ltd.

to fill vacancies in the Company's Laboratories at

## LUTON and STEVENAGE

**1. SENIOR MICROWAVE ENGINEER**—applicant should have a good theoretical background to degree standard and experience of design or engineering of microwave equipment. The work includes investigation of new methods of construction with a view to miniaturisation and weight reduction.

**2. SENIOR ENGINEER**—to lead a group of engineers in the development of specialised electronic test gear.

**3. SENIOR ENGINEER**—for work on general circuit development, with sound fundamental knowledge of electronics and the ability to apply it.

**4. SENIOR INSTRUMENTATION ENGINEERS**—with a degree or H.N.C. and experience of the design of equipment for use in the instrumentation field.

**5. SENIOR ENGINEER**—to lead a group concerned with development and field trials of ground radar. Previous experience essential.

**6. SENIOR RADAR AND ELECTRONIC ENGINEERS**—for development and field and flight experiments of radar equipment. Degree or H.N.C. standard preferred but applicants without these qualifications but with wide experience of this work considered.

**7. SENIOR ENGINEER**—for missile telemetry installation planning. Applicants must be familiar with existing telemetry systems and measuring techniques, suitable to a man with trial experience.

**8. JUNIOR ENGINEERS AND LABORATORY ASSISTANTS**—are required to assist in the above work. Vacancies also exist for junior staff with experience of, or an interest in, Microwaves.

Housing assistance may be given in some cases.

All of the above posts are permanent and progressive and pensionable after qualifying period; attractive salaries are offered to the successful applicants. Applications should be sent to Dept. C.P.S. 336/7 Strand, W.C.2, quoting Ref. No. 1260B.

## THE PLESSEY COMPANY LIMITED

needs  
ENGINEERS

for  
RADIO and TELEVISION

Experience in CIRCUIT DESIGN and COMPONENT DESIGN advantageous.

Will interested persons please write, with full details, to Mr. J. Rhys-Jones, The Plessey Company Ltd., Boreham Wood Laboratories, Manor Way, Boreham Wood, Herts.

## A. V. ROE & CO., LTD.

have the following vacancies in their  
**WEAPONS RESEARCH DIVISION**  
 at  
**WOODFORD**

### TECHNICIANS

For design and development work in a guided weapon project. At least 3 years' experience in electronics or H.N.C. is necessary.

### JUNIOR AND SENIOR DRAUGHTSMEN

For design work in precision instrumentation. At least 3 years' experience in design precision engineering or H.N.C. is necessary.

**GOOD SALARIES AND PROSPECTS  
 PENSIONS AND LIFE ASSURANCE SCHEME**

Application giving full particulars of age, qualifications and experience to be addressed to:

**A. V. ROE & CO. LTD.,  
 WEAPONS RESEARCH  
 DIVISION, WOODFORD,  
 CHESHIRE.**

Engineers required for new and expanding Research Laboratory in the Surrey/Hampshire Area. The work consists of fundamental studies in a variety of branches of Electronics. The posts offer scope for initiative, considerable freedom of action and opportunities for advancement. Vacancies exist for the following posts:—

- (1) 1 Senior Engineer to take charge of a group studying initially problems of Microwaves.
- (2) 1 Senior Engineer to take charge of a group engaged initially in a Mathematical and Experimental Study of Modulation.

Applicants, who should be graduates or equivalent, should have had several years' experience in research or development work, although not necessarily in the field indicated above. Commencing salary, according to qualifications and experience, in the range £800 to £1,200.

- (3) 4 Engineers to work in the above groups.

Applicants should preferably possess a degree or H.N.C. and have had some experience in Electronic Development. Commencing salary according to qualifications and experience, in the range of £700 to £900.

- (4) 4 Draughtsmen to work on the above projects.
- (5) 3 Instrument Makers to work on the above projects.

These positions are permanent and facilities are available for Company Insurance and Superannuation. Please reply, in confidence, giving full details of qualifications and experience, to Box No. 3164.

### SITUATIONS VACANT

**TEST** Engineers are required by a Leading Midlands manufacturer for—(1) Testing and Fault-Finding on Radar Units and other Electronic Devices. (2) Construction and maintenance of Test Equipment. (3) Testing and Fault-Finding on domestic Radio and Television Receivers. These progressive positions cover a wide range of activities and selection will be made not only on experience but also on ability to respond to further training. Ex-Service technicians are particularly suitable.—Applicants should write, giving details of career to date and salary expected to the Personnel Manager (Ref. G.L.B.), Box 2540. [4426]

**A**PPPLICATIONS are invited from senior project engineers with a specialised knowledge of the manufacture of electrical and mechanical products; applicants should have a good practical engineering background and a sound technical experience of tool design and planning and be capable of putting new projects on a sound production basis; these vacancies offer excellent opportunities to men seeking permanent and progressive positions; London area.—Applications, which will be treated in confidence, should give full details of experience and salary required, and be addressed to Box 3085. [4537]

**L**ABORATORY Assistants required for vacuum tube development laboratory. Education to standard of School Cert. or equivalent, preferably to Inter. B.Sc. or equivalent. Applicants can be male or female and should be interested in physics and chemistry. Previous experience of vacuum tube work desirable but not essential. Male applicants should have completed National Service, and all applicants must be of British or Commonwealth birth. 5-day week. Pension Scheme. Good canteen.—Write, stating age, experience and salary required to Cinema Electronics, Ltd., Worsley Road, Rd., Lower Sydenham, S.E.26. [4527]

**A**IRCRAFT radio aeriels.—Gloster Aircraft Co., Ltd., Gloucester, have a vacancy for an electronic engineer (H.N.C. or equivalent) to work on the development of suppressed aeriels for aircraft, the work involves theoretical and practical knowledge of measurements from "H.F." to "X" bands and of the properties of different types of suppressed aeriels. A SMALL laboratory is being established for the work; an elementary knowledge of aircraft design and construction would be an advantage.—Applications, stating age, previous employers and experience, etc., should be addressed to the Employment Officer. [4533]

**U**NIVERSITY OF SOUTHAMPTON.—Research assistant with an interest in the development of electronic instruments required in the department of aeronautical engineering; the selected candidate (who should be of degree or H.N.C. standard) will be expected to apply his knowledge to the problems which occur in aerodynamic research and to co-operate directly with aerodynamicists already engaged on such problems.—Applications in writing, giving full details of education, qualifications and experience, together with names of two persons to whom reference may be made, to The Secretary and Registrar, before May 31st. [4610]

**T**HE Mullard Radio Valve Co., Ltd., has a number of vacancies for Electrical Engineers or Physicists to undertake Applied Research Work in the applications of transistors and kindred devices; the field offers opportunities for original work and at times requires considerable ingenuity; further advanced studies and publication of results is encouraged. It is intended that the posts will eventually carry considerable technical responsibility in an expanding organization; for this reason applicants should possess a good honours degree and some previous experience or, alternatively, a real interest in electronics would be an advantage.

COMMENCING salary will be according to individual qualifications and experience and will provide progressive remuneration for increased responsibilities; applications in writing, which will be treated in confidence, should be addressed to—Personnel Officer, The Mullard Radio Valve Co., Ltd., New Rd., Mitcham Junction, Surrey, quoting ref. JFG/H.1. [4638]

**J**UNIOR development engineers are urgently required to assist in the development of precision electronic laboratory instruments; successful applicants will be engaged on interesting long-term projects concerned with the development of a wide range of equipment; the appointments are permanent and carry considerable technical responsibility; applicants should have had previous development experience, preferably in the instrument field; academic qualifications ranging from H.N.C. to degree standard are preferable; salaries are dependent upon age, qualifications and experience.—Apply stating full details to the Personnel Manager, Furrhill Laboratories, Ltd., Boreham Wood, Herts. [4609]

**S**ENIOR methods engineer required by a large and progressive engineering company situated in the London area; applicants are invited from men with good engineering qualifications and experience in the manufacture of radio, television and services equipment; the accepted candidate will have extensive experience of this class of work and will be acquainted with the most up-to-date production methods, including work study and standard costs; for a man with the required knowledge, initiative and drive, this vacancy provides excellent prospects; salary range from £800 to £1,500 per annum.—Please reply in confidence, giving full details of previous experience, to Box 3084. [4536]

First-class Design Draughtsmen required for high production press tools, jigs, fixtures, etc., for valve and cathode ray tube components. Background of practical experience and O.N.C. least qualification, but H.N.C. preferred. Experience in the use of tungsten carbide an advantage. Rates substantially above normal minimum for men of suitable experience. Five-day week, staff pension scheme, modern welfare amenities. Apply Personnel Superintendent,

**The Edison Swan  
 Electric Co., Ltd.,**

Cosmos Works, Brimsdown,  
 Enfield, Middlesex

Test Gear Design Engineers and Maintenance Engineers required with practical experience of this class of work, based on sound knowledge of electronic principles. These vacancies are permanent and progressive. A company pension scheme in operation. London Area. Please write, in confidence, giving full details of qualifications to Box No. 3447.

Special purpose machinery and equipment design draughtsmen required. O.N.C. least qualification, but H.N.C. preferred. Men with imagination and initiative to develop original ideas with minimum direction. Basic applied electrical knowledge an advantage. Rates substantially above normal minimum for men with suitable experience. Five day week, staff pensions scheme, modern welfare amenities. Apply Personnel Superintendent,

**The Edison Swan  
 Electric Co., Ltd.,**

Cosmos Works, Brimsdown,  
 Enfield, Middlesex

**MONEY BACK GUARANTEE**  
**DUKE & CO**  
 621 ROMFORD ROAD, LONDON. E.12  
 CWO or COD • TEL: GRA 6677

**RADIO-GRAM CHASSIS**

29/9. Including Speaker.

5 valve s/het, 3 w/band. A.C. mains, complete, but less valves. All used, tested guaranteed. P. & P. 4/6. Drawings 2/6 or free with order. Knobs, 1/6 set extra. Complete with valves, 97/6.

**RADIO CHASSIS, 7/9.** A.C. or universal, s/het, receivers. Less valves and electrolytics. Otherwise believed to be in working order. Note:—our 8in. M.E. speaker fits some of these sets. We match on request with order. P. & P. 3/6.

**RADIO CHASSIS, 14/9.** As above, with 3-band coil packs. 465 I.F.s. All used bargains. P. & P. 3/6.

**SPEAKERS, 12/9.** 8in., 6½in., 5in., or 3½in. std.; P.M. 3-5 ohms, or with O.P. trans., 14/9. Used, tested guaranteed. Post 1/9.

**SPEAKERS, 2/9.** 8in. M.E. field 1k, 2k-5k ohms. With O.P. trans., 4/9. Post 1/9. Used, tested guaranteed.

**V.H.F. RECEIVER. 1124. 17/6,** with 6 valves, X.W.D. New condition. 6 channel switching. Receives T.V. sound, police, fire and amateurs. 30.5 to 40 Mc/s. I.F. 7 Mc/s. Post 2/6. Drawings and conversion data free with each set.

**V.H.F. 1125 SET. 7/9.** New and boxed. This little set is a V.H.F. receiver. Requires modification to put it into service. Complete with valves. Post 2/-.

**R.F. UNIT 24. 12/6.** New and packed, tuning 20-30 Mc/s. Including 3 valves. Post 2/-.

**£5 T.V. TUBES. 14in. £8.10, 17in. £12.10.** Guaranteed 6 months. Ins., Carriage 15/6. C.W.O. 12in. size, well known make, 6 months' guarantee, other makes 3 months' guarantee.

**(O.P.) TRANSFORMERS. 1/9.** Used, tested, guaranteed. Std. size. Post 9d.

**2 GANG CONDENSERS. 2/9.** Std. size. .0005, used, tested guaranteed. Also 3 gang, 2/9; post 9d.

**T.V. CONDENSERS. 12/6.** Electrolytic. 120 mfd. + 64 mfd. 350 volt. Post 1/-.

**MAINS TRANSFORMERS. 5/9.** 350-0-350 v., 12 v. + 4 v. Primary. 100, 120, 200, 250. Make ideal auto trans. Post 2/-.

**AMPLIFIERS. 57/6.** 3 valve, 4 watt output, A.C. or universal. Post 2/6.

**AMPLIFIERS. 77/6.** 4 valve, 7 watt output, A.C. or universal. Post 3/6.

**AMPLIFIERS. 97/6.** 5 valve, 10 watt output, A.C. only, with extra pre-amp. stage, 3 controls. Post 3/6.  
 2½d. stamp only for complete catalogue.

**SITUATIONS VACANT**

**FERGUSON RADIO CORPORATION, LTD.,** have a vacancy for an engineer with initiative and a sound technical background to take charge of a small, well-equipped test-gear laboratory situated at Spennymoor, Co. Durham; the post is permanent for a man with previous similar experience and also to carry responsibility in a rapidly expanding department and offers exceptional promotion and long-term prospects; the successful applicant will be eligible for the Company's pension and life assurance scheme.—Applications, in writing, giving full particulars as to age, qualifications and experience, to Personnel Manager (Quote -0979), Ferguson Radio Corporation, Ltd., Gt. Cambridge Road, Enfield, Middlesex. [4599]

**MINISTRY of Transport and Civil Aviation.** Radio technicians (men only) required at aerodromes and radio stations in various parts of U.K.; special training courses for keen technicians with basic quals.; interesting work providing and maintaining aeronautical telecommunications and electronic navigational aids; prospects of permanent pensionable posts and advancement; rates of pay (London) from £342/10 at age 19, to £457/10 at 25, rising (subject to qualifying tests) to £2565; rates slightly lower in provinces; shift and night duty allowances from 2/- to 5/- also payable; candidates aged 19 or over with practical experience in maintenance of radio or radar equipment should apply to any Employment Exchange, quoting Westminster 6627. [4649]

**A VACANCY** occurs for a development engineer in a design group concerned with a wide range of small transformers and inductors of types used in radio equipment and electrical appliances. Preference will be given to applicants having experience of this class of work, but young engineers with a sound basic training and limited experience will be considered, and if have the opportunity of gaining practical knowledge of design problems met in fulfilling commercial and military specifications. An attractive salary is offered together with good future prospects. The Company's extensive laboratory and production facilities are situated in London area.—Please reply, giving details of qualifications and experience to Box 2995. [4521]

**D.S.I.R. require (ASSISTANT EXPERIMENTAL OFFICERS)** at Mechanical Engineering Research Laboratory, East Kilbride, near Glasgow, to assist in developing electronic devices including pick-ups, amplifiers and associated equipment for precision measuring apparatus. Candidates must pass 2 passes in C.G.E. at advanced level in mathematics and science, if over 22 would normally be expected to have pass degree, H.N.C. or equivalent in engineering or physics; general knowledge or practical experience of electronics an advantage; include aive annual remuneration or 45½-hour week within range: (men) £297-£659, (women) £297-£570; East Kilbride is a new town with good housing prospects.—Application forms from M.L.N.S., Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting A 135/5A. Closing date June 10th. [4615]

**B.C.C. requires Engineering Staff** (British, minimum age 20) for operations and maintenance duties at transmitter, studio, recording and television centres. Must be willing to serve anywhere in U.K. and have completed or been exempted from National Service. Experience in radio engineering desirable. Essential qualifications include university degree, Higher National Certificate or equivalent in electrical engineering, or success in examination for C.E.T. or full Certificate in Telecommunications, or full Technological Certificate or Graduateship of I.E.E. or Graduateship with maths. of Brit. I.R.E. Promotion prospects. Starting salary £545, rising by 5 annual increments to £755.—Requests for application forms (enclosing addressed envelope and quoting ref. EX.25, W.W.) should reach Engineering Establishment Officer, Broadcasting House, London, W.1, within 7 days [4664]

**WAR** Department requires Technical Adviser to Director of Signals, War Office, London, for advice on all aspects of communication engineering as applied to signal projects world wide and solution of related technical problems; applicants must be British subjects, physically fit and able to travel to any part of the world; they must hold A.M.I.E.E. or University degree in electrical engineering (electronics or light current) and have sound up-to-date theoretical knowledge of radio, particularly H.F., V.H.F. and microwave, and of V.P. and carrier techniques of telegraphy, with sound practical experience of H.F. and microwave radio, including aerial techniques associated with long-distance H.F. communication and microwave radio relay; bias of work is on radio side, and successful applicant will be required to plan and design communication systems; salary according to age, qualifications and experience within range £1,035-£1,355.—Application forms from M.L.N.S., Technical and Scientific Register (K), 26, King St., London, S.W.1, quoting D645/5A. [4637]

**SITUATIONS WANTED**

**CONSCIENTIOUS** man, knowledge of radio, car driver, seeks situation anywhere.—Box 3553. [4643]

**PRINTED** circuits, 12 years' experience, senior electronic engineer seeks position.—Box 3616. [4654]

**DEPENDABLE RADIO SUPPLIES**

12a TOTTENHAM STREET, W.1

TEL.: LANGHAM 7391/7392

1 minute Goudge St. Station

Wireless Sets No. 19, Supply Units No. 1, Mark III, Ref. No. ZA 15208, complete with two rotary transformers.



Price £5/5/-, post and packing extra. Cases, chassis, spares and motors can be supplied separately.

**ROTARY TRANSFORMERS**



**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.

H.T.31, 55/- Post 2/- H.T.32 30/- Postage 2/- Can be supplied for tropical use at a small extra cost.

**SPECIAL OFFER**

American Bulbs, 6-8 v. .25 amp, M.Bc., 6/- per dozen. 12-16 v. .1 amp, M.Bc., 7/6 per dozen. Post free.

Witney Lamps, Red (ex units) at 1/3 each. Wire Wound Pots. 2/3 watts 30 k. NSF, 1in. spindle at 1/9 each. 250Ω Colvern ½in. spindle at 1/6 each.

American Block Condensers. .01 600 v., oil filled 1½ x ½in. at 9d. each. 3 x .1 400 v., oil filled, at 9d. each.

Waxed Tub Condensers. .1 2,000 vac. ± 10%, 2½ x 1in., at 1/3 each.

Large Faradon Micas. .01 2,500 v., test. at 1/6 each. .0001, 2,500 v., Test, at 1/6 each.

Post Office Jacks (brass) at 1/3 each. Belling & Lee panel fusesolders (ex units) 1/6 each. Belling & Lee 7 pin plugs PL182 8d. each.

Ceramic Insulators, ½ x ¼in., at 3/- per doz.

Insulated Hook Eyes, 2½ in., at 6/- per doz.

American Cutler Hammer toggle switches, luminous dolly (new), at 1/6 each.

Please add post for orders under £2. Special Prices for Quantities.



**Heavy Duty Sliding Resistors.** 250 watts to carry 25 amps. Resistance 0.4 ohms. Suitable for charging board, etc. Size 9 x 4 x 6in. high. Brand new. Price 10/6. Post 2/-.

Quantities and Export. Inquiries Invited. Callers also welcome.

Open Monday to Friday 9.30-5.30. Saturday 9.30-1.

TERMS—CASH WITH ORDER  
**DEPENDABLE—ALWAYS DEPENDABLE**

**TECHNICAL TRAINING**

**L**EARN 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. WW.47, London, W.4. [0001]

**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 our 144-page handbook, free and post free. B.I.E.T. (Dept. 388A), 29, Wright's Lane, London, W.8. [0117]

**TUITION**

**N**OTHING succeeds like success! What we have done a thousand times we can do again for you—see the B.N.R.S. advt. page 150. [0172]

**WIRELESS** operating; attendance and postal courses.—Stamp for reply to Manager, The Wireless School, Manor Gdns., London, N.7. [0014]

**FULL-TIME** courses for P.M.G. Certs., C.G.L.I. Telecommunications, Radar Maintenance 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; send 2d stamp for prospectus.—Wireless College, Colwyn Bay. [0018]

**T**HE Institute of Practical Radio Engineers have available home study courses in every phase of radio and television engineering, specialising in the practical training of apprentices in the retail trade; enrolments limited, fees moderate.—The syllabus of Instructional Text may be obtained post free from the Secretary, I.P.R.E., Fairfield House, 20, Fairfield Rd., Crouch End, London, N.8. [0088]

**F**REE!—Brochure giving details of Home Study Training in Radio, Television, and all branches of electronics; courses for the hobby enthusiast, or for those aiming at the A.M.Brit.I.R.E. City and Guilds, R.T.E.B., and other professional examinations; train with the College operated by Britain's largest electronics organisation; moderate fees.—Write to E.M.I. Institutes, Dept. WW.28, London, W.4. [0179]

**WIRELESS** telegraphy.—Merchant Navy offers to youths 16 upwards after qualification, lucrative positions as radio officers.—Apply British School of Telegraphy, 179, Clapham Rd., S.W.9. (Est. 1906). Recognised by Ministry of Education, moderate fees, modern equipment, day and evening tuition; also postal courses in theory of wireless telegraphy or P.M.G. Certs. and Amateur Transmitting Licence. [0124]

**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  
96-100 ALDERSGATE STREET, E.C.1  
(Tel.: MONarch 6822)

**TUITION**

**A.M.I.Mech.E.,** A.M.Brit.I.R.E., City and Guilds, etc., on "No Pass—No Fee" terms; over 95% successes.—or details of Exams and courses in all branches of Engineering, Building, etc., write for 144-page Handbook—Free: B.I.E.T. (Dept. 387B), 29, Wright's Lane, London, W.8. [0118]

**T/V & Radio—A.M.Brit.I.R.E.,** City & Guilds, R.T.E.B. Cert., etc., on "No Pass—No Fee" terms; over 95% successes.—Details of Exams. and Home Training Courses in all branches of Radio and T.V. write for 144-page Handbook—Free: B.I.E.T. (Dept. 387A), 29, Wright's Lane, London, W.8. [0116]

**BOOKS, INSTRUCTIONS, ETC.**

**I.P.R.E.** technical publications, 5,500 Alignment Papers for Superheterodynes, 5/9, post free, data for constructing TV aerial strength meter, 7/6, sample copy "The Practical Radio Engineer" quarterly publication of the Institute 2/- membership and examination data, 1/-.—Sec. I.P.R.E., 20, Fairfield Rd., London, N.8.

**"MICROPHONES,"** By the Engineering Training Dept., B.B.C. Discusses the requirements for microphones in a broadcasting studio, sets out the laws relating to sound waves and their behaviour, and describes the design and characteristics of various types of microphone—with special reference to those used by the B.B.C. 15/- net from all booksellers, 15/5 by post from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1.

**GENERAL PURPOSE CABINET**



GP.2—34" high, 17" wide, 15" deep, 16" x 14" motorboard having a 6" (or less) clearance above and 8 1/2" to shelf below. Flush base or Queen Anne legs. Capacity 125-12". Partitions can be omitted and entire front left plain or cut for loudspeaker and control panel, as required. Supplied in Walnut, Oak or Mahogany. Polished Light, Medium or Dark. Figured veneers. The underside of lid is felt sprayed.

Price £10/15/- or 30/- deposit and 6 payments of 32/4 monthly.

Write for illustrated list of General Purpose Cabinets or for list of Record Cabinets from £5/10/-.

**A. L. STAMFORD (Dept. K.11)**

20 College Parade, Salisbury Rd.,

London, N.W.6

**BOOKS, INSTRUCTIONS, ETC.**

**"THE Williamson Amplifier,"** By D. T. N. Williamson. Gives full details of the basic circuit and ancillary equipment recommended by the designer for high-quality reproduction of records and radio programmes. 2nd Edition, 3/6 net from all booksellers. By post 3/9 from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1.

**"TELEVISION Receiving Equipment,"** By W. T. Cocking, M.I.E.E. An exhaustive description of each stage of the normal television receiver. Other chapters deal with special circuits, faults and their remedies, selectivity, servicing, etc. 3rd Edition, 18/- net from all booksellers. By post 18/8 from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1.

**"RADIO Interference Suppression: As Applied to Radio and Television Reception,"** By G. L. Stephens, A.M.I.E.E. 2nd Ed. An up-to-date guide to the various methods of suppressing radio interference with radio and television reception. Many practical applications are given, particular attention being paid to the problem of interference at television frequencies. Other chapters deal with the design and choice of suppressor components, methods of locating the source of interference, and suppression at the receiver itself. 10/6 net from all booksellers. By post 10/11 from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1.

**"MOTOR Cycle Engines: Famous British Power Units Analysed,"** First Series. In this book sixteen famous engines are examined by experts of "The Motor Cycle" Staff and designers concerned, the mechanism of each engine being specially drawn so that even the most complicated can be readily understood. There are also drawings and facts about nine other engines. 3/5 net from all booksellers. 3/9 by post from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1.

**"A RACING Motorist: His Adventures at the Wheel in Peace and War,"** By S. C. H. Davis of "The Autocar," who has driven racing cars for over thirty years. His victories and crashes, Brooklands, Le Mans, the Isle of Man—all are featured in this great book on a great and exciting sport. 216 pages of speed and thrills—an ideal gift for the enthusiast. 10/6 net, from all booksellers. By post 11/- from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1.

**"BRIGHTER Photography for Beginners,"** By David Charles, F.R.P.S. Describes the whole photographic process without tedious explanation of optics, physics, chemistry or mathematics. This new edition, revised throughout and lavishly illustrated, is the obvious choice for those who want a non-technical explanation of how to succeed with a camera. Fourth Edition. 6/- net, from all booksellers. By post 6/8 from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1.

**"INTRODUCTION to Valves,"** By R. W. Hallows, M.A.Cantab., M.I.E.E., and H. K. Milward, B.Sc.Lond., A.M.I.E.E. Describes the principles, construction, characteristics and uses of most types of radio valve. The approach is simple and, as far as possible, non-mathematical, but the book provides the student with a thorough understanding of valves and how they work. 8/6 net from all booksellers. By post 8/10 from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1.

**"TELEVISION Engineering: Principles and Practice,"** Volume I: Fundamentals. Camera Tubes, Television Optics, Electron Optics. A B.B.C. Engineering Training Manual, by S. W. Amos, B.Sc. (Hons.), A.M.I.E.E., and D. G. Brinkshaw, M.B.E., M.A., M.I.E.E., in collaboration with J. L. Bliss, A.M.I.E.E. This is the first volume of a comprehensive work on the fundamentals of television theory and practice written primarily for the instruction of B.B.C. engineering staff. Covers basic theory of the signal, all types of modern camera tubes, theory of light mirrors and lenses as applied to television, and electron lenses. 30/- net from all booksellers. By post 30/8 from Iliffe & Sons Ltd., Dorset House, Stamford St., London, S.E.1.

**THE WORLD'S GREATEST BOOKSHOP**

**FOYLES**  
★ ★ FOR BOOKS ★ ★  
**NEW AND SECOND-HAND 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 3660 (16 lines) ★ Open 9-6 (Thurs. 9-7)  
Nearest Station: Tottenham Court Road

**ELECTRONIC FITTER WIREMEN**

required by the  
**NELSON RESEARCH LABORATORIES,**  
The English Electric Co. Ltd., Stafford,  
for interesting and varied work on prototype electronic equipment.

Men with industrial or services experience preferred.

Write giving full details of age, qualifications and experience to Dept. C.P.S., 336/7 Strand, W.C.2.

quoting Ref. 944D.

# A MAST PROBLEM?

# WRITE TO Skymasts

BEADON GARAGE BEADON ROAD LONDON W.6 Telephone RIV-rose 1124 & 7878

**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

THE  
**Cape 25**  
 AUDIO AMPLIFIER for the acoustics laboratory  
 or with a  
**CAPE FOUR STAGE PREAMPLIFIER** forming a  
 high fidelity reproducer which sets a new standard  
 of performance.  
**AMPLIFIER £25. PREAMPLIFIERS from £10.**  
*Illustrated leaflets upon request.*  
**CAPE ELECTROPHONICS LTD.**  
 43-45, Shirley High Street, Southampton.  
 Telephone: Southampton 74251.

**RADIO & TELEVISION COMPONENTS**  
 WE OPERATE A PROMPT & EFFICIENT  
 MAIL ORDER SERVICE  
 "VIEWMASTER" & "TELE-KING" specialists  
 Easy terms available. Stamp (only) for lists  
**JAMES H. MARTIN & CO.,**  
 FINSTHWAITE, NEWBY BRIDGE,  
 ULVERSTON, LANCs.

**H. WHITAKER G3SJ.,**  
**10, YORKSHIRE STREET, BURNLEY**  
 Phone: BURNLEY 4924 (A.R.B. APPROVED)

Manufacturers of precision Quartz Crystals in a wide variety of bases covering the complete range 40 Kc. to 18 Mc. in fundamental frequencies. All are made to extremely fine tolerances, and frequency adjustment can be given up to .005%. Plated electrodes of gold, silver or aluminium with wired in spot welded contacts are available. Quotations can be given for any type of cut or mode of oscillation including a complete range for filter circuits with zero temperature co-efficient over a sensibly wide temperature range. Our new works is equipped with up-to-the-minute production technique methods, X-ray orientation ensuring accuracy of all cuts. Artificial aging by etching and plating by evaporation under vacuum ensure long term stability of the final calibration. Early delivery can be given of most types. Our regrind service is still available and in some cases we are prepared to quote for lowering the frequency of your existing crystals.

**SPECIAL OFFER:**

200 kc. DT cut, zero temperature co-efficient over the range—30° centigrade to +55° centigrade. Frequency adjustment .005% or better. Mode: Face shear. Silver-plated electrodes, wire mounted. Basing 1/16 in. pin spaced. Other bases to order, £1 each.

**WICO KIT**  
**VALVE VOLT-OHM METER**

**33 RANGES**  
 7 volts ranges 0.01 v. to 4000 v.  
 D.C. +, D.C.—, A.C., R.M.S. 5  
 ohms ranges 0.5Ω to 500 MΩ, 7  
 Db ranges —20Db to + 61Db.  
**KIT £19.** C.W.O., or C.O.D.  
**WIRED £26.**



Write for further details. Export Enquiries  
 Invited.

**WHARTON INSTRUMENT COMPANY**  
 1081 FINCHLEY ROAD, LONDON. N.W.11. Tel.: MEADWAY 3407

## 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, June 2nd for July issue.

NAME .....

ADDRESS.....


REMITTANCE VALUE.....ENCLOSED

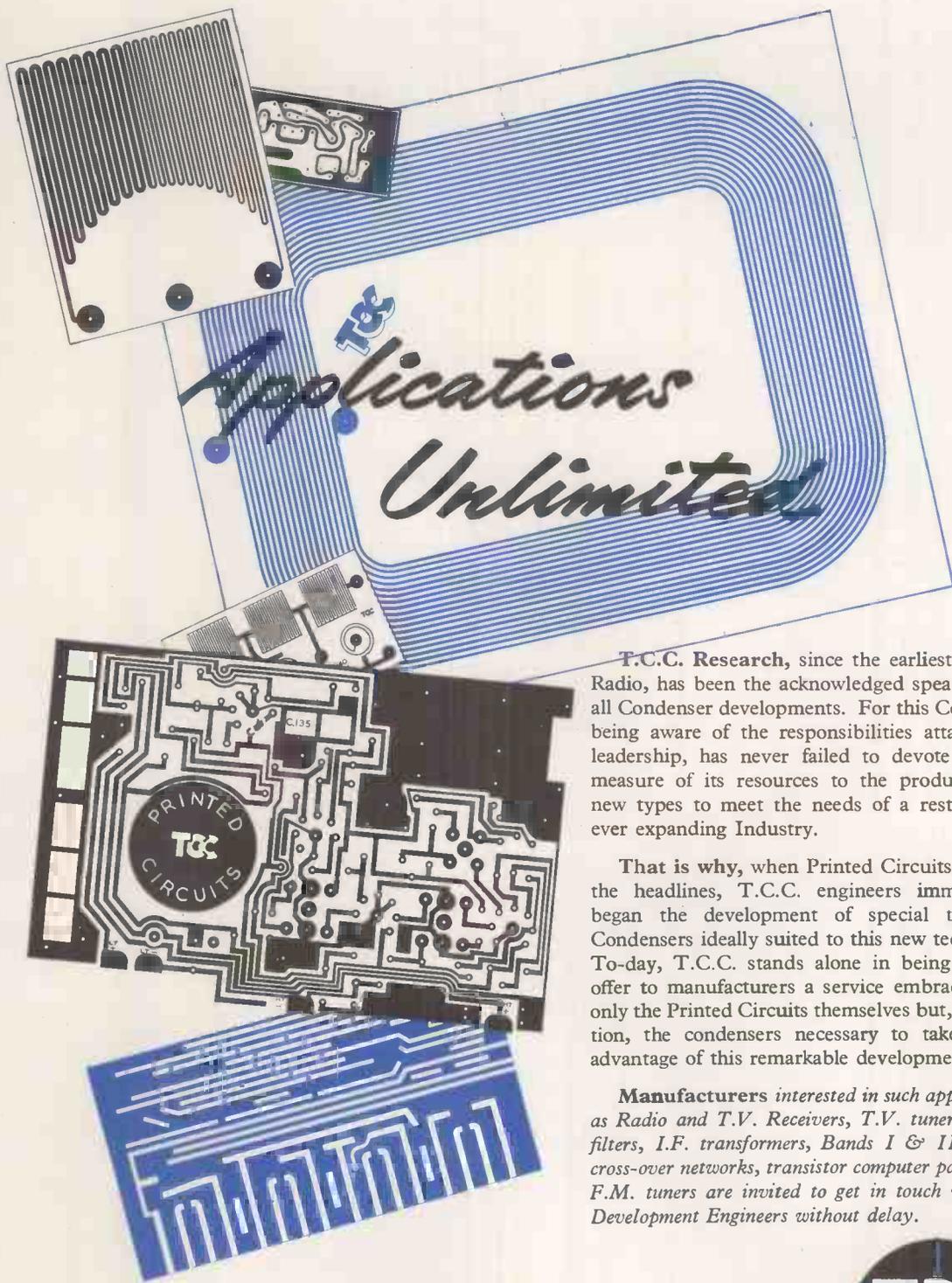
Please write in block letters with ball pen or pencil.

NUMBER OF INSERTIONS.....

# INDEX TO ADVERTISERS

	PAGE		PAGE		PAGE
A.A. Tools	154	Gardners Radio, Ltd.	74	Pye, W. G., Ltd.	69
Acoustical Mfg. Co., Ltd.	6	Garrard Engineering & Mfg. Co., Ltd.	17	Quality Equipment Designers, Ltd.	111
Acru Electric Tool Mfg. Co., Ltd., The	148	Gea Bros., Radio, Ltd.	132	Quartz Crystal Co., Ltd.	156
Adcola Products, Ltd.	28	General Electric Co., Ltd.	37		
A.D.S. Relays, Ltd.	106	Gilson, F. F.	155		
Advance Components, Ltd.	13	Glaser, L., & Co.	170		
Airmec, Ltd.	9	Glover, W. T., & Co., Ltd.	58		
Allen Components, Ltd.	68	Goldring Manufacturing (Gt. Britain), Ltd.	54		
Alpha Radio Supply Co., The	139	Goodmans Industries, Ltd.	19, 34		
Altham Radio Co.	145	Goodsell, Ltd.	138		
Ambassador Radio & Television	113	Gray Arthur, Ltd.	130		
Amplex Appliances (Kent), Ltd.	146	Grasham Transformers, Ltd.	8		
Amper Electronics, Ltd.	106	Grundig (Gt. Britain), Ltd.	70		
Antex	60				
Antiference, Ltd.	20				
Appointments Vacant	144, 145, 147, 149, 150, 164, 166, 168, 169, 170	Hall Electric, Ltd.	34		
		Ham's Shop, The	148		
		Hanney, L. F.	110		
Arcoelectric Switches, Ltd.	26	Hartley, H. A., Co., Ltd.	146		
Ariel Sound	163	Harvey Electronics, Ltd.	148		
Armstrong Wireless & Television Co., Ltd.	76, 153, 32	Hatfield Instruments	136		
		Hatfield Radio	112		
Ashworth, H.	1	Heath Spring & Notion Co., Ltd.	114		
Automatic Coil Winder & Electrical Equipment Co., Ltd., The	140	Henley's, W. T., Telegraph Works Co., Ltd.	142		
Autoset (Production), Ltd.	158		131		
Avionics, Ltd.	158	Henry's	64		
		Hivac, Ltd.	80		
Barker Natural Reproducers	161	Hornelab Instruments, Ltd.	36		
Beamish, V. W.	160	Household Electric, Ltd.	134		
Best Sound Products, Ltd.	103	H.P. Radio Services, Ltd.	40		
Bell, John, & Croymen	146	Hudson Electronic Devices, Ltd.	46		
Belling & Lee, Ltd.	152	Hunt, A. H. (Capactors), Ltd.	143		
Benson, W. A.	146	Hunton, Ltd.	147		
Bentley Acoustic Corporation, Ltd.	80		38		
Berry's (Short Wave), Ltd.	114	Iliffe Books	38		
Birmingham Sound Reproducers, Ltd.	114	Imhof, Alfred, Ltd.	85		
B. K. Partners, Ltd.	48	Industrial Electronics	82		
Bradmatic, Ltd.	110	International Aeradio, Ltd.	64		
Brenell Engineering Co., Ltd.	135	International Correspondence Schools	111		
Brighton Radio Co.	10		142		
Britain, Chas. (Radio), Ltd.	158	Jackson Bros. (London), Ltd.	78		
British Communications Corp., Ltd.	142, 162	Jason Motor & Electronic Co.	154		
British Distributing Co.	150		74		
British Institute of Engineering Technology	143	Kaye Electrical Mfg. Co.	87		
British Insulated Callender's Cables, Ltd.	110	Kempner, S., Ltd.	144		
		Kenroy, Ltd.	103		
		Keyswitch Co., The	132		
British National Radio School	110	Koskile, Ltd.	160		
British Physical Laboratories	80	Koskile, B.	144		
British Saragel, Ltd.	301		54		
Brookes Crystals, Ltd.	102	Labgear (Cambridge), Ltd.	152		
Brown, S. G., Ltd.	166	Lafo Compounds, Ltd.	124, 125		
Bulgin, A. F., & Co., Ltd.	171	Lasky's Radio	103		
Bull, J., & Sons	48	Leak, E., & Co., Ltd.	132		
Bullers, Ltd.	162	Leavers-Rich Equipment, Ltd.	160		
		Lewis Radio Co.	42		
Candler System Co.	157	Light Soldering Developments, Ltd.	153		
Cape Electronics, Ltd.	41	Livingston Laboratories, Ltd.	163		
Cathodeon Crystals, Ltd.	113	Lockwood & Co.	68		
Cementation (Muffelite), Ltd.	122, 123	Lowther Mfg. Co.	112		
Chaftay Cabinet Co.	143	L.R. Supply Co., Ltd.	107		
Champion Products	122, 123	Lustraphone, Ltd.	21		
Chapman, C. T. (Reproducers), Ltd.	143	Lyons, Claude, Ltd.	146		
Cinema Television, Ltd.	92	Lyons Radio, Ltd.	62		
City Sale & Exchange, Ltd.	53	Magnetic Coatings, Ltd.	56		
Classic Electrical Co., Ltd.	160	Magnetic Devices, Ltd.	25		
Clyde Radio, Ltd.	166	Mail Order Supply Co.	158		
Connectors & Electronics, Ltd.	162	Malvyn Eng. Co.	47		
Cosmocord, Ltd.	78	Marconi Instruments, Ltd.	95, 98		
Cossor, A. C., Ltd.	160	Marconi's Wireless Telegraph Co., Ltd.	162		
Covenry Radio	134	Martin, J. H.	144		
Cranston, Alan	30	Massey, R.	66		
Croydon Transformers, Ltd.	167	McElroy Adams Mfg. Group, Ltd.	128		
		McMurdo Instruments Co., Ltd.	142		
Daly (Condensers), Ltd.	114	Midland Instruments Co.	162		
Davies, A., & Co.	161	Modern Book Co.	112		
Davis, Jack (Relays), Ltd.	77	Modern Electrics, Ltd.	162		
Denco (Clacton) Ltd.	169	Modern Sound Equipments	112		
Dependable Radio Supplies	156	Modern Techniques	162		
Direct T.V. Replacements	154	Morris, H.	78		
Dixon, L., & Co., Ltd.	12, 96, 101	M.R. Supplies, Ltd.	5, 7, 59, 72, 75, 90		
Duke & Co., The	32	Mullard, Ltd.	54, Cover 16		
Duid Co., Ltd., The	162	Multicoe Solders, Ltd.	26		
		Multiflex Electric Co., Ltd.	56		
Easco Electrical, (Holdings), Ltd.	162	Murex, Ltd.	26		
Edison Swan Electric Co., Ltd.	154		44, 45		
Egen Electric, Ltd.	154				
E.K.E.	15				
Electrical Instrument Repair Service, The	51, 79				
Electro-Acoustic Developments	140				
Electro-Acoustic Industries, Ltd.	128				
Electro-Methods, Ltd.	104, 105				
Electro-Winds, Ltd.	132				
Electronic Instruments (H'ton), Ltd.	94				
Electronic Precision Equipment	97, 100, 102				
Ellison Transformers, Ltd.	23				
E.M.I. Factories, Ltd.	43				
E.M.I. Institutes	142				
English Electric Valve Co., Ltd.	67				
Enthoven Solders, Ltd.	33				
Fta Tool Co. (Leicester), Ltd.	170				
	166				
Feranti, Ltd.	56				
Fisher Electronics Co., Ltd.	163				
Foyle, W. & G., Ltd.					
Frith Radiocraft, Ltd.					
Furzehill Laboratories, Ltd.					
Galpins					

Printed in Great Britain for the Publishers, ILLIFF & SONS LTD., Dorset House, Stamford St., London, S.E.1, by CORNWALL PRESS LTD., Paris Garden, London, S.E.1. *Wireless World* can be obtained abroad from the following: AUSTRALIA AND NEW ZEALAND: Gordon & Gotch, Ltd., Ixida, A. H. Wheeler & Co., CANADA: The Wm. Dawson Subscription Service Ltd.; GORDON & GOTCH, LTD. SOUTH AFRICA: Central News Agency, Ltd., William Dawson & Sons (S.A.), Ltd. UNITED STATES: The International News Co.



T.C.C. Research, since the earliest days of Radio, has been the acknowledged spearhead of all Condenser developments. For this Company, being aware of the responsibilities attached to leadership, has never failed to devote a large measure of its resources to the production of new types to meet the needs of a restless and ever expanding Industry.

That is why, when Printed Circuits first hit the headlines, T.C.C. engineers immediately began the development of special types of Condensers ideally suited to this new technique. To-day, T.C.C. stands alone in being able to offer to manufacturers a service embracing not only the Printed Circuits themselves but, in addition, the condensers necessary to take fullest advantage of this remarkable development.

*Manufacturers interested in such applications as Radio and T.V. Receivers, T.V. tuners, aerial filters, I.F. transformers, Bands I & III aerial cross-over networks, transistor computer panels and F.M. tuners are invited to get in touch with our Development Engineers without delay.*

**PRINTED CIRCUITS** by



**THE TELEGRAPH CONDENSER CO. LTD**

SPECIAL PRODUCTS DIVISION · North Acton · London W3 · Tel: ACOrn 0061

# Millions

## OF SOUND JOINTS MADE EVERY DAY WITH

# Ersin Multicore Solder

Manufacturers of radio, television and electronic equipment throughout the world protect the quality of their equipment by ensuring that every joint is a reliable one—a sound electrical connection which will not corrode or cause high resistance. They use Ersin Multicore 5-core Solder because it is always efficient and never varies in quality.

### EXTRA-ACTIVE, NON-CORROSIVE FLUX

The highly efficient Ersin flux contained in Ersin Multicore 5-core Solder cleans oxides instantly, and prevents them forming during the soldering process.

### ADVANTAGES OF 5-CORE CONSTRUCTION

Flux continuity is assured by the 5-core construction. The risk that some lengths of solder wire may not contain flux is eliminated. The 5-core construction also ensures rapid liberation of the flux and quicker melting of the solder.

### UNVARYING HIGH QUALITY

To maintain the high quality of Ersin Multicore 5-core Solder, the flux is made strictly to a formula which has A.I.D. approval and an A.I.D. Certificate is also obtained for each batch of alloy used. Thus the precise characteristics of the solder never vary.

Whether you manufacture on a large scale or on a small scale; whether you are a wireless trader with servicing and selling to consider; whether you are a service engineer or an amateur enthusiast, you can depend on Ersin Multicore Solder. Use it always for reliable, trouble-free soldering.

### 7 lb. REELS

Ersin Multicore 5-core Solder is available as standard in 6 alloys and 9 gauges on 7 lb. and 1 lb. reels. Finer gauges, from 24 s.w.g. to 34 s.w.g., are supplied on  $\frac{1}{2}$  lb. reels. Prices on application.



### RADIO & T/V SERVICE ENGINEERS' 1 lb. REEL

Containing approximately 167 ft. of 18 s.w.g. 50/50 alloy Ersin Multicore Solder, these reels provide plenty of solder at an economic price for service engineers and others using a good deal of solder at a time. Cat. Ref. R5018. Price 15/- each (subject).

### Bib WIRE STRIPPER AND CUTTER

These sturdy nickel-plated tools—only 5" long—strip insulation without nicking the wire, cut wires cleanly and split plastic extruded twin flex. Adjustable to most wire thicknesses. Get one for your tool kit. You'll never know how you managed without it. 3/6 each (subject).



### Bib RECORDING TAPE SPLICER

The new Splicer—with easy-lift clamps both on the same side for simple removal of the jointed tape—enables recording tape to be jointed quickly and accurately without breaks or "clicks". Saves hours of time and yards of tape; soon pays for itself. Price 18/6 each (subject).



### PRINTED CIRCUITS

Full details of a complete soldering process developed by the Multicore Laboratories for efficient soldering of printed circuits, are contained in leaflet P.C.101. It also includes details of Multicore Activated Surface Preservative, a protective coating which prevents oxidation during storage.

### SIZE 1 CARTON

The ideal pack for service engineers and radio enthusiasts. The solder is drawn through a hole in the top of the carton.

Available in four specifications.

Catalogue Ref. No.	Alloy Tin/Lead	S.W.G.	Approx. length per carton
C 16014	60/40	14	21 feet
C 16018	60/40	18	55 feet
C 14013	40/60	13	19 feet
C 14016	40/60	16	38 feet

