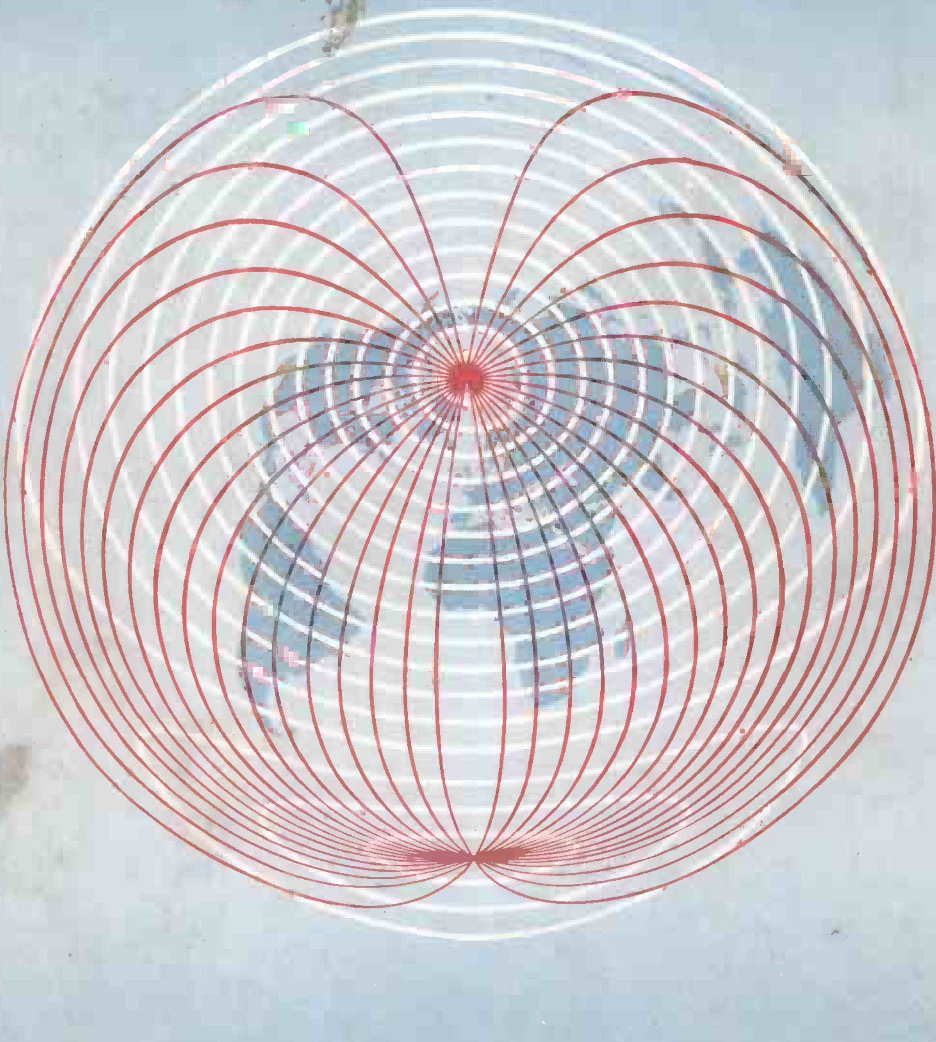
Wireless World

NOVEMBER 1951 TWO SHILLINGS



RADIO, TELEVISION AND ELECTRONICS

Wireless World

RADIO, TELEVISION AND ELECTRONICS

41st YEAR OF PUBLICATION

Managing Editor: HUGH S. POCOCK, M.I.E.E.
Editor: H. F. SMITH

NOVEMBER 1951

In This Issue

PUBLISHED MONTHLY: Price 2/- (last Tuesday of preceeding month) by ILLIFE & 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...and their Applications

INDIRECTLY-HEATED VALVES FOR BROADCAST RECEIVERS

The I.F. Stage

The I.F. stage requires a valve capable of providing a large gain with the desired bandwidth. It must give stable operation under all conditions, and its characteristics must be suitable for the application of A.V.C. A.V.C. must not, however, cause serious variations in the response curve of the stage, and the valve must be capable of handling input and output voltages over a wide range of signal levels without undue distortion.

All these requirements are met by the Mullard EF41 and UF41 medium-slope, high impedance variable-mu pentodes.

The anode-to-control-grid capacitance of these valves is sufficiently small to ensure stable operation with normal I.F. transformers, provided that reasonable care is taken with the wiring layout.

Using critically-coupled I.F. transformers having a single circuit impedence of 0.2 MΩ, gains in the order of 200 are obtainable when the following stage is of high impedance. When, however, as is usual, a single I.F. stage is followed by the detector and A.V.C. diodes, the damping imposed by these diodes limits the gain from the grid of the I.F. valve to the detector input to about 100, assuming a detector load of 0.5 MΩ.

In normal 4-valve receivers where the detector is followed by an A.F. amplifier and high-sensitivity output pentode, the input required at the detector for full output can easily be obtained from the I.F. valve with moderate input signals. In order to reduce the risk of overloading on strong signals where the A.V.C. circuit is supplying a large bias voltage, the A.V.C. characteristics of the EF41 and UF41 are so matched to those of the corresponding frequency changers that, when the same A.V.C. voltage is applied to both stages, the gain of the I.F. valve with sliding screen voltage is reduced more slowly than that of the frequency changer.

The signal voltages on the I.F. valve are therefore not allowed to become excessive, and modulation distortion in this stage is small.

These valves may also be used as R.F. amplifiers before the frequency changer stage. For this application the screen voltage should be obtained via a potentiometer.

R.F. VOLTAGE AMPLIFYING PENTODES

Type EF41 for A.C. Mains and Car Radio Sets

Type UF41 for D.C./A.C. Mains Sets

	EF41	UF41
Heater		
V_h	6.3	12.6 V
I_h	0.2	0.1 A
Characteristics		
V_a	250	170 V
V_{g2}	100	100 V
I_a	6.0	6.0 mA
I_{g2}	1.7	1.7 mA
V_{g1}	—2.5	—2.5 V
g_m	2.2	2.2 mA/V
r_a	1	1 MΩ
μ_{g1-g2}	18	18
R_{eq}	7.4	8.0 KΩ
R_{g2}	90	39 KΩ
V_{g1} (100:1 reduction in g_m)	—39	—28 V
Limiting Values		
$V_{a(b)}$ max.	550	550 V
V_a max.	300	250 V
p_a max.	2	2 W
$V_{g2(b)}$ max.	550	550 V
V_{g2} max. (I_a=6mA)	125	150 V
V_{g2} max. (I_a < 3mA)	300	250 V
p_{g2} max.	0.3	0.3 W
I_k max.	10	10 mA
V_{h-k} max.	50	150 V

THE COMPLETE SERIES

	FREQUENCY CHANGER	R.F. or I.F. AMPLIFIER	DET., A.F. AMPLIFR. & A.V.C. DIODE	OUTPUT PENTODES	RECTIFIERS
6.3V Heater	ECH42	EF41	EBC41	EL41; EL42	EZ40; EZ41
0.1 A Heater	UCH42	UF41	UBC41	UL41	UY41

Reprints of this article together with additional data may be obtained free of charge from the address below.

Wireless World

NOVEMBER 1951 VOL. LVII. No. 11.

Uses of Metre-wave Broadcasting

THIS journal is concerned with the means and not the end of radio communication. To us, the urgent messages of life and death, the outpourings of contraltos, comedians or symphony orchestras are, like the impassioned oratory of politicians and the gyrations of ballet dancers, just "signals" or "modulation." Their interest lies not in their information or æsthetic content, but in the way they can be transmitted and reproduced by loudspeaker or on the television receiver screen.

But perhaps all this can be carried too far. Of late there has been much discussion on the technical means for a proposed metre-wave broadcasting system for this country, but practically nothing has been said in our pages, and very little elsewhere, on the way in which such a service would be used. Though it is not strictly our concern, it is essential to know what kind of audiences would be served if the best possible technical decisions are to be reached.

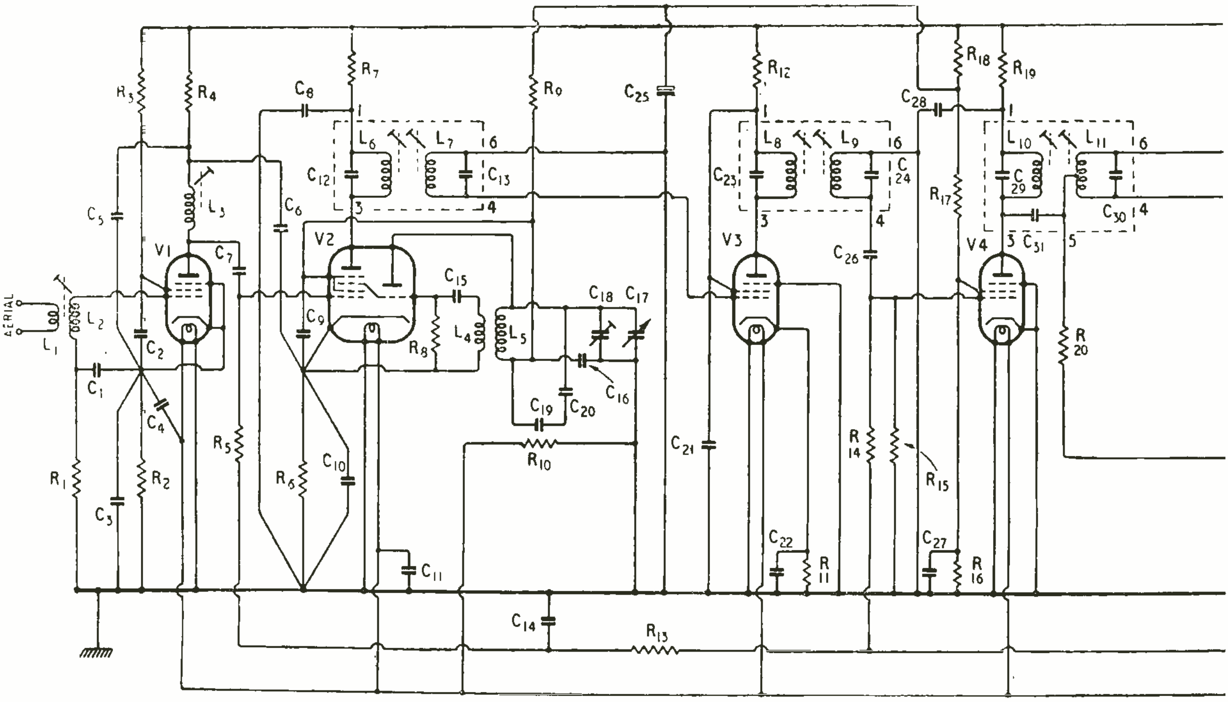
So far as the proposed extension of the B.B.C. service is concerned, the matter is relatively simple. In all probability the new service would be used very largely to fill in the gaps and to give better signals to the very large number of listeners who at present stand in need of them. There would also be the opportunity of providing signals of wider audio-frequency range. We doubt very much if the B.B.C. would decide to use the new channels for programmes different to those radiated on medium and long waves.

In considering the "independent" (non-B.B.C.) stations envisaged in the Beveridge Report and tentatively accepted in the Government White Paper, we move into much more controversial realms. It has been suggested that a multiplicity of small local stations conducted by public bodies would prove widely acceptable to listeners, and so would stimulate general interest in broadcasting; in addition, a valuable element of competition with the B.B.C. service would be introduced. Those who hold these views point to the success of small local stations in America. But can we accept American experience as a guide? We believe in that country local patriotism or the community spirit is much more highly developed than here; even so, the small stations independent of national networks do not seem to be on the increase.

Coming to more materialistic considerations, who in Great Britain could afford to pay for the running of such stations? We must assume, of course, that the present ban on advertising will be maintained. No doubt, certain "pressure groups" with wealthy supporters will apply for licences, but would the propaganda programmes certain to be sponsored by such societies be likely to have a wide acceptance among listeners? Similarly, we may guess that some of the richer educational foundations would enter the field, but probably none of them could afford full national coverage, and anything much less would probably be thought unattractive. However, a group of educational bodies might well set up a network of stations, with a system of time-sharing for individual members.

In the present age of austerity we cannot visualize a stampede on the part of municipalities and the like to set up stations, nor that the ratepayers would approve of the use of their money for running them. And, even if this view is wrong, would there be a steady supply of acceptable programme material? In fact, is there any real future for "parish pump" broadcasting? No doubt, the average citizen would like to have a ready source of information on important local happenings and also on minor local disasters such as interrupted train services, gale and frost warnings, and the like. But, to derive full benefit from such a service, he would need an elaborate receiver with a calling device—a relatively expensive matter.

So we come back to the question of economics, which, in this matter at least, seems to outweigh most technical considerations. Much as we want to see independent stations licensed, if only experimentally, we must not be blind to the difficulties.



DESIGN FOR AN

F. M. Receiver

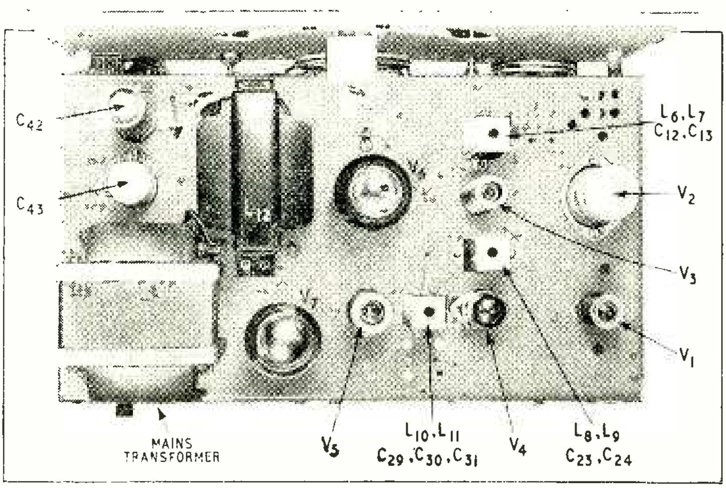
1.—Simple, Inexpensive Set for the 90 Mc/s Band

By J. G. SPENCER

(Research Department, B.B.C.)

ONE of the points which has often been discussed when comparing amplitude modulation and frequency modulation for v.h.f. sound broadcasting is the relative cost of receivers for the two systems. It has been suggested that f.m. receivers will be more costly to manufacture, and that tuning is more difficult to achieve and maintain than for the corresponding a.m. receiver. On the other hand it is generally accepted that a wide-deviation f.m. system will result in a much better signal-to-noise ratio than a.m.

The design of the receiver described in this article was undertaken in order to find out whether it is practicable to obtain satisfactory performance from a receiver employing simple circuits and inexpensive components. It was designed for v.h.f. reception only and was intended to be comparable in cost and complexity with a medium priced domestic broadcast superheterodyne, but to realize the improvement in audio bandwidth which is possible at v.h.f. and the reduction in background noise of a wideband f.m. system. A total of seven valves is employed, their functions being, r.f. amplifier, frequency changer, i.f. amplifier, limiter, combined discriminator and first audio amplifier, output valve and rectifier. This is rather more than the medium-wave counterpart, but is largely offset by the absence of a ganged tuning



This top view of the receiver shows the position of the valves, mains equipment and controls. The chassis used measures 14 in x 8 in x 2½ in and the panel 14 in x 8 in. There is a ⅝-in spacing between panel and chassis to accommodate the cord drive for the tuning capacitor.

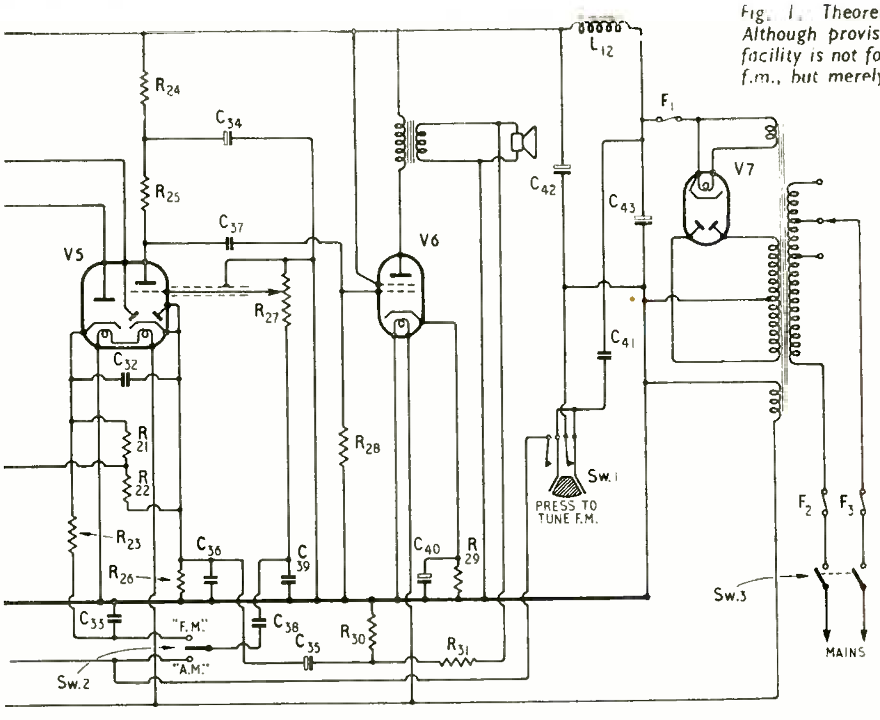


Fig. 1. Theoretical circuit diagram of the receiver. Although provision is made for a.m. reception, this facility is not for direct comparison between a.m. and f.m., but merely because an a.m. signal will appear on the limiter (V_4) grid when receiving an a.m. transmission.

assembly and the simple construction of the r.f. and i.f. coils.

Circuit.—The receiver is designed for an f.m. system employing ± 75-kc/s deviation and 50-μsec pre- and de-emphasis and covers a frequency band of 87.5 Mc/s to 95 Mc/s. The circuit is given in Fig. 1.

The first stage is a pentode r.f. amplifier (V_1), which is followed by a triode-hexode oscillator and mixer (V_2.) The r.f. circuits are not continuously tuneable as the frequency coverage of the receiver is only some 8 per cent of the mid-band frequency and the increased sensitivity at the ends of the band which could be obtained by employing continuous tuning would not justify the difficulties involved in ganging. No lumped capacitance is used in these circuits, since by tuning with stray capacitances only, the L to C ratio is kept high, thus reducing the Q and giving a sufficiently uniform pass-band response while maintaining a high tuned impedance.

A.G.C. is applied to the mixer stage, the control voltage being derived from the limiter grid, to prevent the limiter being over-run by large carrier inputs.

The oscillator is a conventional tuned anode circuit, one point of interest being the frequency drift compensating device R_{10} and C_{19}. This is a high negative temperature coefficient ceramic capacitor which is heated by a resistor connected across the valve heater supply. Its function is to correct for the rapid initial drift of local oscillator frequency which occurs immediately after switching on due to heating in the oscillator valve.

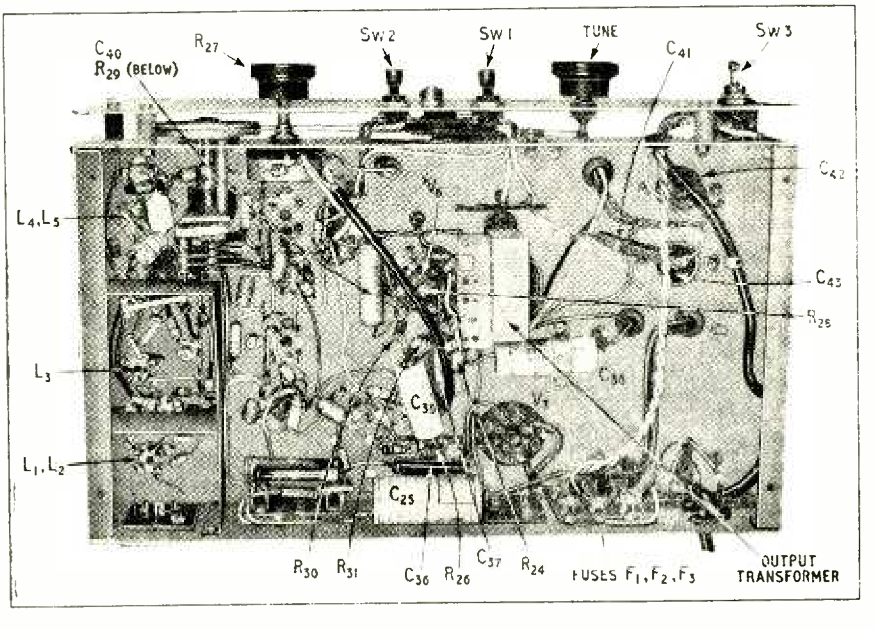
The i.f. amplifier is a single high slope pentode (V_3) and is followed by a pentode limiter stage (V_4).

Provision for a.m. reception is made by utilizing the limiter grid as a detector, and the audio output is fed to V_5 through the i.f. filter R_{11}, C_{39}, and the a.m./f.m. switch SW_2.

To facilitate accurate tuning on f.m., a spring-loaded push-button switch SW_1 is provided, which when pressed, injects into the limiter grid circuit an a.c. voltage derived from the cathode of the rectifier V_7. This amplitude modulates the carrier and if the receiver is incorrectly tuned gives an audible hum in the output. When the receiver is correctly tuned however and the i.f. carrier is at the mid-frequency of the discriminator, the latter does not respond to amplitude modulation and the hum is at a minimum.

V_5 is a triple-diode-triode, functioning as a Foster-

View of the underside of the chassis showing the general layout and the annotation will enable most of the visible components to be identified.



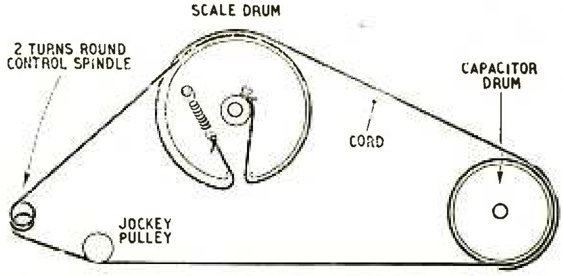
Seeley phase discriminator and first audio amplifier. Only two of the diodes are employed but a normal double-diode-triode cannot be used as the two diodes must have separate cathodes.

The output stage is a single tetrode with negative feedback from the output transformer secondary applied to the cathode of V_5.

Construction.—Winding data and diagrams for the coils are given in Table 1 and Fig. 2. All the i.f. coils should be lightly brushed with polystyrene varnish after winding, to prevent any subsequent movement of slack turns.

TABLE 1.

COIL	WINDING DETAILS
L_1	1 turn 20 s.w.g. insulated wire interwound with L_2.
L_2	6 turns 20 s.w.g. spaced to occupy $\frac{3}{8}$in on Neosid former Dwg. 351/8BA with Dwg. 500 dust core grade 901.
L_3	6 turns 20 s.w.g. spaced to occupy $\frac{3}{8}$in Former and core as L_2.
L_4	2 turns 20 s.w.g. insulated wire interwound with L_5.
L_5	3 turns 20 s.w.g. spaced to occupy $\frac{5}{16}$in on former as L_2. No core.
L_6 L_7	Each consists of 40 turns 38 s.w.g. enamelled wire close wound with 10-mm spacing between adjacent ends of coils. Both coils to be wound in same direction and connections made to pin numbers shown in Fig. 2. Aladdin former Type PP5937 and PP5939 with cores grade "A," Type PP5839. Can, John Dale Ltd. Type DTV1.
L_8 L_9	Each consists of 35 turns 32 s.w.g. enamelled wire close wound with 6-mm spacing between adjacent ends of coils. Former, cores, can and winding direction as L_6 and L_7 with similar pin connections.
L_{10}	22 turns 32 s.w.g. enamelled close wound.
L_{11}	26 turns 32 s.w.g. enamelled close wound in two layers of 13 turns each, one layer outside the other, and centre-tapped (see text). Spacing between adjacent ends of L_{10} and L_{11} is 5 mm Former, cores and can as L_6 and L_7. Connections as in Fig. 2.



Schematic layout of the cord drive located behind the panel. A $2\frac{1}{8}$-in drum is used for the capacitor and one of $2\frac{3}{4}$-in, running loose on a spindle fixed to the panel, carries the pointer. The driving head is the J.B. Type A.

Insulated sleeving is called for in the grid coil of the oscillator assembly, as there is a potential difference of 100 V between the two windings. The overall diameter of the sleeving used should not be too large in order that it may be interwound with the anode coil when the latter is wound with turns equally spaced and filling the specified winding length.

The i.f. transformers are quite straightforward, to facilitate adjustments of coupling, should they be necessary, the primaries are not wound directly on the former, one turn of adhesive cellulose tape is put on first, adhesive side outward, and the primary is wound over this. Provided the coil is not wound on too tightly it will then slide quite easily along the former.

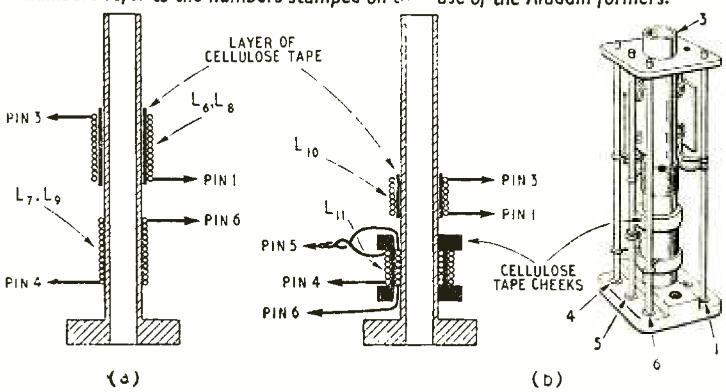
The i.f. tuning capacitors C_{12}, C_{13}, C_{23} and C_{24} are mounted inside their respective cans.

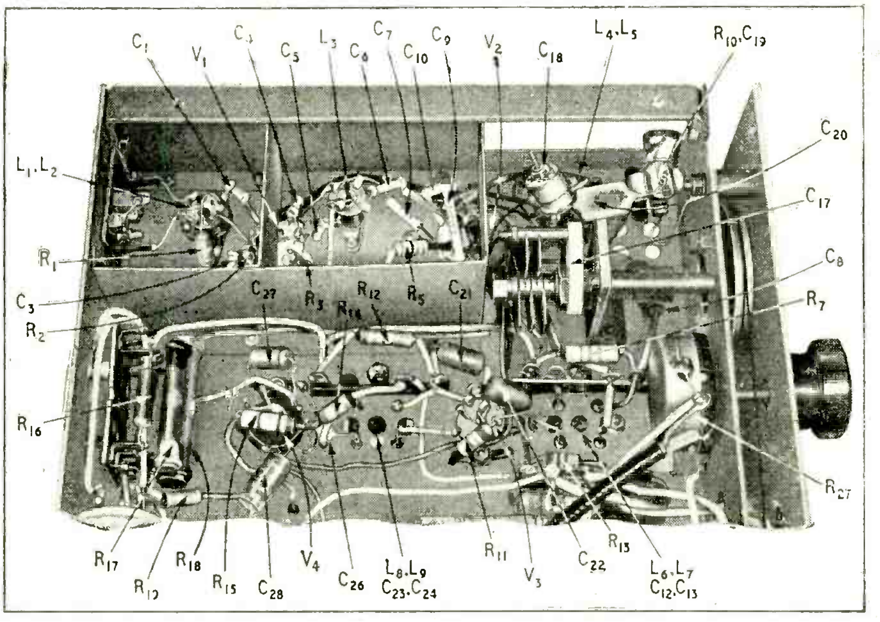
The secondary of the discriminator transformer, L_{11}, is centre-tapped. In order to minimize leakage inductance and to ensure symmetry of the two halves about the centre tap, which is essential for correct operation, it is wound in two layer form. The suggested winding procedure is as follows:—Start the first layer about $\frac{1}{4}$ in up from the base of the former, wind on 13 turns and cut off the wire, leaving an inch or so for connecting and securing the two ends of the coil temporarily with cellulose tape. Next wind on a few turns of cellulose tape cut down to a width of $\frac{1}{8}$ in, hard against each end of the coil. This will provide two end cheeks between which to wind the second layer and will prevent the end turns of the latter from "spilling" over. Put one turn of cellulose tape, cut to the required width, over the first section to provide a smooth base for the second layer and then wind on the second section, starting again at the base end of the former and winding this time in the *reverse* direction. Finally connect together the ends of the two sections remote from the base of the former to make the centre tap. Great care should be taken that both halves are identical, with no loose turns or gaps in the winding, to ensure that the coil is symmetrical about the centre tap.

The discriminator primary, L_{10} is wound in the same way as those of the i.f. transformers to allow for coupling adjustment. Capacitors C_{29}, C_{30} and C_{31} are mounted inside the discriminator can.

If the specified chassis layout is adhered to, little difficulty should be experienced with the construction of the receiver.

Fig. 2. Sketch of i.f. (a) and discriminator (b) transformers. The pin numbers refer to the numbers stamped on the base of the Aladdin formers.





Enlarged view of the r.f. and oscillator portion of the receiver. The majority of the components are annotated and can be identified by reference to the circuit diagram.

All decoupling circuits should be returned to the same earth point for each valve to avoid the possibility of coupling through common chassis paths. In the case of the r.f. circuits the decoupling point is the cathode pin of the valve holder, as shown in the circuit diagram. This is particularly important because the impedance of even a short length of wire is appreciable at the signal frequencies involved.

For the same reason all wiring in the r.f. section of the receiver must be as short and direct as possible ; C_{16}, for example, is connected directly between the moving vane contact of the tuning condenser and the low potential end of the oscillator anode coil. Any lead of excessive length here will appreciably lower the oscillator frequency, and may make it impossible to tune to the top end of the band.

An earthing clip must be provided at the socket

LIST OF PARTS

Capacitors :

C_1—C_6, C_{11}	= 1,000 pF (Ceramic)
C_7, C_{33}, C_{39}	= 100 pF (Ceramic)
C_8, C_{28}	= 0.01μF
C_9, C_{10}	= 2,200 pF (Ceramic)
C_{12}, C_{13}	= 20 pF (Ceramic)
C_{14}	= 0.1 μF
C_{15}	= 20 pF + 10 per cent (T.C.C. Type SCT7)
C_{16}	= 680 pF (T.C.C. Mica Type 101SMP)
C_{17}	= 5–15pF (see text)
C_{18}	= 2–8pF (Pre-set)
C_{19}	= 20 pF ± 10 per cent (T.C.C. Type SCD4)
C_{20}	= 18 pF ± 10 per cent (T.C.C. Type 101SMP)
C_{21}, C_{22}, C_{27}	= 0.03μF
C_{23}, C_{24}, C_{30}, C_{31}, C_{32}	= 50pF
C_{25}	= 32μF (100 V wkg.)
C_{26}	= 30pF
C_{29}	= 70pF
C_{34}, C_{43}	= 8μF (450 V wkg.)
C_{35}	= 25μF (12 V wkg.)
C_{36}	= 0.003μF
C_{37}	= 0.02μF
C_{38}	= 0.05μF
C_{40}	= 50μF (12 V wkg.)
C_{41}	= 1,000 pF (Mica)
C_{42}	= 16μF (450 V wkg.)

Resistors:

R_1, R_{19}	= 39kΩ
R_2, R_{11}	= 180Ω
R_3, R_7	= 4.7kΩ
R_4, R_9	= 1kΩ
R_5, R_{14}	= 47kΩ
R_6	= 220Ω
R_8, R_{15}, R_{21}, R_{22}	= 100kΩ
R_{10}	= 68Ω (Erie Type 8)
R_{12}	= 2.2kΩ
R_{13}	= 1.5MΩ
R_{16}	= 5.6kΩ
R_{17}	= 10kΩ (1 W)
R_{18}	= 10kΩ (2 W)
R_{20}	= 10kΩ
R_{23}	= 470kΩ
R_{24}	= 27kΩ
R_{25}	= 270kΩ
R_{26}	= 3.3kΩ
R_{27}	= 500kΩ (Pot)
R_{28}	= 1MΩ
R_{29}	= 90Ω
R_{30}	= 5Ω
R_{31}	= 100Ω

Switches :

SW1 Spring loaded push switch, contacts one make one break.
SW2 Single pole change-over.
SW3 Double pole on-off 230 V 1A pattern.

Choke L_{12}, 15–20H, 100 mA.

1 Cord drive drum, 2⅛ in	Jackson Bros.
1 Cord drive drum, 2¾ in	Jackson Bros.
1 Cord drive head Type A	Jackson Bros.
1 Pully ½ in dia and pivot	Jackson Bros.
1 Cord suspension spring	Jackson Bros.

Valves :

V_1, V_3	= Mazda 6F12
V_2	= Marconi-Osram X81
V_4	= Mullard EF42
V_5	= Brimar 6T8
V_6	= Marconi-Osram KT61
V_7	= Brimar 5Z4G

Mains transformer .

250-0-250 V r.m.s. 100 mA ; 6.3 V 3A ; 5 V 2 A

Note. All capacitors 350 V wkg. unless otherwise stated. All over 1 μF electrolytic. Miniature type, preferable but only essential in r.f. and oscillator sections. All resistors ½ W unless otherwise stated.

of the frequency changer to earth the metal can of the X81. Any of the retaining devices which grip the base of the valve are satisfactory.

For the frequency drift compensating network, C_{19} and R_{10} are mounted in physical contact with each other in a small spring clip of the type used for mounting vitreous wire-wound resistors. The construction of this assembly is shown in Fig. 3.

To minimize oscillator frequency drift it is important that the components in the oscillator circuit should be of the types specified in the list of parts.

Small changes of wiring in this part of the circuit may alter the effect of the drift compensating network. This can be adjusted by changing the capacitance of C_{20}. Increasing this capacitance will increase the upward movement of frequency during the warming-up period and vice versa.

Ventilating holes should be provided in the chassis deck above the oscillator section and in the cabinet base below it to facilitate ventilation.

The tuning condenser C_{17} used in the prototype receiver was a Raymart type MC15DX, nominal capacitance 5 to 15 pF, with one stator vane removed. Thus modified it gives a range of 3 pF to 11.5 pF and any component of similar physical size and with this capacitance range can be used. The tuning range obtained with this variation of capacitance is from 86.5 Mc/s to 96.0 Mc/s, which is somewhat wider than the normal requirements for this band.

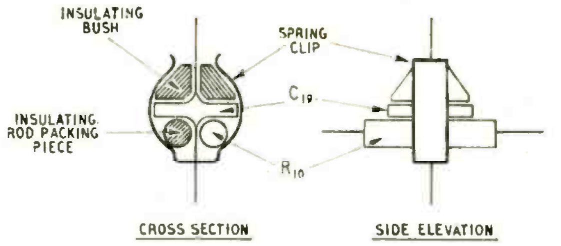


Fig. 3. Details of the frequency drift compensating unit which is described in the text.

Screened wire is used for the lead from the gain control R_{27} to the grid of V_5 to avoid hum pickup and low capacity cable should be used to prevent attenuation of the upper audio frequencies. Coaxial r.f. cable is ideal for the purpose.

The values of the resistors R_{30} and R_{31} are chosen for an output transformer designed for a 3-Ω load. Should a transformer with a different ratio be used these values should be adjusted for the correct voltage feedback.

(To be concluded)

Ringing-Choke E.H.T. Systems

Part 1—Half-wave Rectifier

By W. T. COCKING, M.I.E.E.

IT has now become almost standard practice to derive the e.h.t. supply for a television receiver from the line flyback. There are, however, cases where it may be desirable to use some other system and one of the most convenient of these is the so-called ringing-choke method. It is, in fact basically the same as the ordinary flyback method but because the e.h.t. and scanning circuits are quite separate each can be of optimum design for its own needs and, in particular, a simple voltage-regulating system can be provided.

Like the flyback system, the ringing-choke circuit depends on the interruption of current in an inductance or, rather, since capacitance is never negligible, in a tuned circuit. The circuit oscillates as a result and the voltage waveform is a damped oscillation. In the scanning circuit such oscillations cannot be permitted or must be confined to a single half-cycle within the flyback period. In the e.h.t. system they can be allowed.

The basic circuit is shown in Fig. 1, where R represents the circuit losses and C the total stray capacitance. If the Q ($= R\sqrt{C/L}$) is reasonably high the natural frequency of oscillation is very nearly $f = 1/2\pi\sqrt{LC}$.

If the valve is suitably biased and a large saw-tooth voltage is applied to the grid, its anode current will remain cut-off for a considerable part of the cycle. This grid voltage is shown in Fig. 2 (a), in which the cut-off voltage is indicated by AB, and the resulting anode current has the form (b). The current rises more-or-less linearly to a maximum value i_p in the period τ_r and is then suddenly cut-off. This kicks the tuned circuit into oscillation and the resulting anode-voltage waveform is like Fig. 2 (c).

It is not difficult to show that the magnitude of the first positive peak of voltage is, very nearly,

$$V_m = i_p\sqrt{xL/C} \qquad (1)$$

where x is the fractional *current* overshoot in L and is equal to $\epsilon^{-\pi/2Q}$. The first negative half-cycle has the value $-i_p\sqrt{x^3L/C} = -xV_m$. Thereafter each positive half-cycle has a peak value x^2 times its previous positive peak and each negative peak is x^2 times the previous negative peak. The number of cycles which occur before the train of oscillations becomes negligibly small depends on the damping. In practice, when the valve starts to conduct, its a.c. resistance damps the circuit and the oscillations do not usually persist for more than a cycle or so after it has started to conduct. Although the valve is a pentode, the type normally used has quite a low a.c. resistance for a pentode—of the order of 20,000 Ω only. The valve can, therefore, damp the circuit quite heavily.

The e.h.t. supply is obtained from these oscillations by applying them to a rectifier which can be a half-wave type or a voltage-multiplier. For a half-wave rectifier, the output cannot exceed V_m and will usually be some 10% less.

The foregoing relation between the amplitudes of successive peaks holds only in the absence of rectifiers. When these are present they extract energy from the circuit and the following cycle is consequently of smaller amplitude. An exact analysis is quite difficult. A fairly exact one has been made for a half-wave rectifier,[1] however.

Consider a train of damped oscillations as shown in Fig. 3. They are produced by the sudden interruption in the supply of a current i_p to L—the current being supplied by the valve of Fig. 1. The initial energy stored in L is $Li_p^2/2$. With no rectifier, the energy is transferred to the capacitance when the current has fallen to zero and the amount stored in it is then $CV_m^2/2$. This energy is less than that originally stored in L because some has been lost as heat in the circuit. From (1) $CV_m^2/2 = xi_p^2L/2$ and so the lost energy is $(1 - x)\ Li_p^2/2$; it is from this relation that equation (1) is obtained.

Now with a half-wave rectifier the circuit becomes Fig. 4. For simplicity we assume a perfect rectifier which is an open circuit when the voltage across C_1 is less then the voltage on the tuned circuit and a short circuit when it is greater. We assume also that C_1 is so large that the voltage across it cannot change appreciably in any time interval under consideration. Let C_1 be charged to a voltage V_1 less than V_m. When the voltage across C reaches V_1 the rectifier conducts and C and C_1 become in parallel. The voltage across both is then held at V_1 and the current in L flows into C_1, except for some, V_1/R, in the shunt damping resistance. When the total current in L has fallen to V_1/R the voltage can no longer be maintained and falls, so that the rectifier open-circuits to disconnect C_1. This capacitance has gained energy during the conductive period of the diode and it gives this out again in its turn to the load circuit.

The circuit is left with energy $CV_1^2/2$ in C and the voltage V_1 across it. The difference, $Li_p^2/2 - CV_1^2/2$, has been partly expended as heat in the circuit resistance and partly passed to C_1. In effect, a new cycle of oscillation now commences with initial energy $CV_1^2/2$. The second positive peak can have an amplitude of only x^2V_1 and must always be less than V_1. The rectifier thus cannot become conductive again on any positive half cycle after the first. The rectifier action is entirely confined to the first positive half cycle.

Basic Energy Relations

Precise relations for finite damping were given in the article already referred to. If the circuit losses are low enough to be ignored, however, it is very easy to derive some simple relations which, if only approximate, have the great merit of showing the important factors. If losses are negligible, the initial energy $Li_p^2/2$ in L and the energy stored in C at the peak, $CV_m^2/2$ are equal.

When the diode conducts the energy in C is $CV_1^2/2$, the difference $Li_p^2/2 - CV_1^2/2$ is passed into C_1. Now during the whole time C_1 is delivering a constant current i_0 to the load circuit; it delivers an output power i_0V_1 and so during one complete cycle of duration τ (the interval between successive interruptions of i_p) it loses energy $i_0V_1\tau$. In the equilibrium condition the energy gains must equal the energy lost and so

$$i_0V_1\tau = C(V_m^2 - V_1^2)/2 \quad \ldots \quad \ldots \quad \ldots \quad (2)$$

If the output energy $i_0V_1\tau = W_0$ and the energy initially stored in the tuned circuit $\frac{1}{2}Li_p^2 = \frac{1}{2}CV_m^2 = W_s$ the above equation can be written in the very simple form

$$\frac{V_1}{V_m} = \sqrt{\left[1 - \frac{W_0}{W_s}\right]} \quad \ldots \quad \ldots \quad \ldots \quad (3)$$

$$\approx 1 - \frac{W_0}{2W_s} \text{ when } 1 \gg W_0/W_s.$$

For constant stored energy, V_m is also constant, and so we find that the output voltage V_1 falls as the output energy increases. The mean current taken by a cathode-ray tube varies with the mean picture

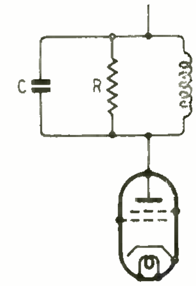


Fig. 1. Basic circuit of ringing-choke e.h.t. supply unit without the rectifier system.

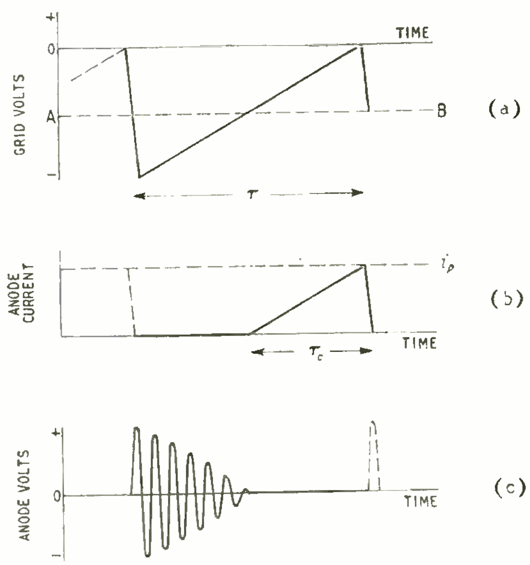
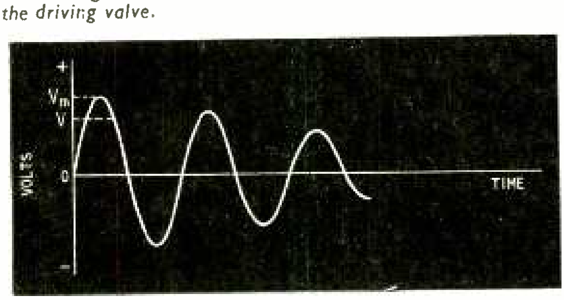


Fig. 2. Waveforms in the circuit of Fig. 1; (a) grid voltage, (b) anode current and (c) anode voltage.

Below: Fig. 3. Damped oscillation forming the anode potential of the driving valve.



[1] "Flyback E.H.T.," by W. T. Cocking, *Wireless World*, August and September 1950.

brightness and unless the voltage stays constant both focus and deflection sensitivity vary in some degree. The voltage regulation of the supply is, therefore, an important matter.

It may be expressed in several ways. One is to take the ratio of the voltage change from full load to no load to either the full-load or the no-load voltages [that is, $(V_m - V_1)/V_1$ or $(V_m - V_1)/V_m$]; the figure is the fractional voltage regulation or, if multiplied by 100, the percentage voltage regulation. Another method is to express it as an equivalent resistance by dividing the change of output voltage by the change of output current which causes it [that is, $R_i = (V_m - V_1)/i_0$]; it is in some ways a good method, but means little unless the voltage is stated also. However, the other way also means little unless the change of current is stated.

In this article the change of current used is always 100μA, and is from zero to that figure. The regulation is then $(V_m - V_1)/V_m = 1 - V_1/V_m$ and can be obtained directly from equation (3). As long as W_0/W_s is small compared with unity

$$\frac{V_m - V_1}{V_m} = \frac{\Delta V_1}{V_m} = \frac{1}{2} \cdot \frac{W_0}{W_s} \quad \ldots \quad (4)$$

If it is desired to express the regulation in the form of an internal resistance, this is readily done, for

$$R_i = \frac{V_1}{i_0} \approx \frac{V_m}{i_0} \cdot \frac{1}{2}\frac{W_0}{W} = \frac{V_1/i_0}{2W_s/W_0 - 1}$$

Here V_1/i_0 is, of course, the resistance of the external load circuit.

This expresses the regulation of the system due to the LC circuit and assumes a perfect rectifier. With any practical rectifier the regulation will be poorer. The relation is very important for it shows that, apart from the rectifier, the regulation depends only on the ratio of the output to the stored energy and that good regulation requires a large stored energy which, in its turn, naturally means a large power input to the stage.

Required Voltage Regulation

Since the deflectional sensitivity of a magnetic c.r. tube is proportional to $1/\sqrt{V_1}$ it is necessary for the regulation to be 2% if the picture width and height are to change by only 1% for a change of beam current of 100 μA. On a 10-in picture this means a change of 0.1 inch. In practice a bigger change is often tolerable because changes of picture brightness from black to peak white are rare. Normal brightness changes are probably no more than 25% of the maximum possible, and then a regulation of 8% will not alter the picture size more than 1%. Because of this, a regulation of 8–10% is often considered satisfactory and one of 4–5% is thought to be good. Since the effect of the rectifiers is not included in the present discussion it is desirable to make the computed regulation around 2%.

As equation (4) shows, this demands $W_0/W_s = 0.04$; that is, the stored energy must be 25 times the energy supplied to the load. If the circuit of Fig 4 is driven at line-scan frequency the period τ is nearly 100 μsec. If the output voltage of V_1 is 10 kV and the current i_0 is 100 μA, the output power P_0 is 1 watt and the output energy is 10^{-4} joule. The stored energy must then be 0.0025 joule, and as it must be supplied afresh every scanning cycle (10,000 c/s), the power needed is 25 watts. This is apart from losses, such as the anode dissipation of the valve.

Referring to Fig 2 (b) the anode current of the valve is of triangular waveform and rises more or less linearly to i_p in the period τ_c. Assuming the rise to be actually a linear one, the mean anode current of the valve and the back e.m.f. across L are

$$i_a = \frac{i_p}{2} \cdot \frac{\tau_c}{\tau} \quad \ldots \quad (5)$$

$$E_L = L i_p/\tau_c \quad \ldots \quad (6)$$

In practice it is necessary for the h.t. supply voltage to be greater than E_L by the minimum permissible anode voltage V_a of the valve, usually 60–100 V.

Turns Ratio

One minor difficulty arises. Any practical valve has a peak anode voltage rating which must not be exceeded. In the circuit of Fig 4, V_m must not exceed this figure, and so the output is limited. This is easily overcome, however, by tapping the anode down the coil, as shown in Fig 5. If the ratio (turns 1–3)/(turns 1–2) is n, then the equations already given still apply if all currents and voltages pertaining to the valve are multiplied and divided respectively by n. That is, design is carried out for a unity ratio and then the ratio is chosen to bring the conditions within the limits of the valve and to the most convenient values.

Because of leakage inductance and stray capacitance, the performance is affected in other ways, and if it is to be reasonably close to calculation n must be restricted. It is inadvisable to make n more than about 1.5 for an air-core coil or about 2.5 for an iron-core component. Greater ratios can be used, but more experimental work in the determination of final values will be needed.

As an example of the procedure, let us now consider the example which has already been taken; that is, of a supply of 10 kV at 100 μA with a regulation of 2%. As we have seen, the stored energy W_s is 0.0025 joule.

It is hardly safe to take the self-capacitance of the coil as less than 10 pF and a metal rectifier for e.h.t. will add about 15 pF, so 25 pF is about the minimum safe value to take for C. A valve rectifier would add less, in itself only about 1 pF. The filament winding would increase it considerably above this, however, and it is a very troublesome matter for the experimenter to adjust a filament winding correctly.

Now since $W_s = \frac{1}{2}CV_m^2$ and for 2% regulation $V_m = 10.2$ kV, we find $C = 2 \times 0.0025/1.02^2 \times 10^8 = 4.8 \times 10^{-11}$ F = 48 pF. This is the capacitance required to store the necessary energy at 10.2 kV. It is greater than our assessment of the minimum practical value, and so capacitance sets no limit and we can proceed on the basis of C = 48 pF.

The value of L required depends on the peak current which the valve can provide, and we need to know the turns ratio n. A valve such as the PL81 is rated for a peak voltage of 7 kV positive or 5 kV negative. It is necessary to take the lower value because the anode voltage does swing negative on the second half cycle of oscillation. For this valve, n must be 2, at least. With an EL 38, the peak rating is 8 kV and no restriction is placed on the sign of the voltage. With this valve n need be 1.3 only. Assume this; then i_p for the valve is 150 mA and in the circuit is 150/1.3 = 115 mA.

Since $W_s = \frac{1}{2}L i_p^2$ we have $L = 2 \times 0{\cdot}0025/0{\cdot}115^2$

$= 3.76 \times 10^{-1}$ H = 376 mH. The natural frequency of oscillation is $1/6.28\sqrt{0.376 \times 48 \times 10^{-12}} = 10^6/26.5 = 3.78 \times 10^4 = 37.8$ kc/s. The time of one cycle is 26.5 μsec. This frequency is rather low, for if τ_c is made 50 μsec there is time for something less than two cycles of oscillation only during the non-conductive period of the valve. If we arbitrarily take τ_c as 50 μsec, the back e.m.f. across L is $E_L = 0.376 \times 0.115/50 \times 10^{-6} = 870$ volts. On the valve this becomes 870/1.3 = 670 V. The h.t supply must, therefore, be around 750 V The mean anode current is $i_a = \frac{150}{2} \cdot \frac{50}{100} = 37.5$ mA and the power drawn from the h.t. supply is $760 \times 0.0375 = 28.5$ W. The anode dissipation of the valve is 28.5 – 25 = 3.5 W.

There are two features about this design which are unsatisfactory, apart from the large total input power; they are the low frequency of oscillation and the very high voltage needed for h.t. The latter can be reduced only by increasing the current, and this may entail the use of valves in parallel.

If poorer regulation can be tolerated the power can be reduced by operating with less stored energy. This entails a reduction of capacitance, and so there is a limit to the amount by which the stored energy can be reduced, a limit set by what it is practicable to achieve in capacitance.

It was earlier estimated that the capacitance was likely to be 25 pF as a minimum. Taking it as 24 pF for convenience (one-half of 48 pF), the stored energy is halved and so the regulation becomes 4%. The inductance is halved and becomes 188 mH for the same current. The natural frequency is four times as great (151.2 kc/s) and the number of cycles permissible for $\tau_c = 50$ μsec is nearly eight. The tapping point on the coil, being set by the peak voltages remains unchanged. Since L is halved and the current is unaltered, E_L is halved and becomes 355 V so that the h.t. supply drops to about 425 V. The valve currents are unaltered and the input power falls to $425 \times 0.0375 = 16$ W.

This is a considerable improvement, but the power is still high. If we could again halve the capacitance the regulation would become 8% and the back e.m.f. on the valve would drop to 167.5 V, so that an h.t. supply of 257.5 V would suffice. The power input would become 9.75 W. This is a reasonable condition and by varying the tapping point on the coil to change the ratio of valve voltage to current we could modify the conditions over a small range to suit a particular h.t. supply voltage.

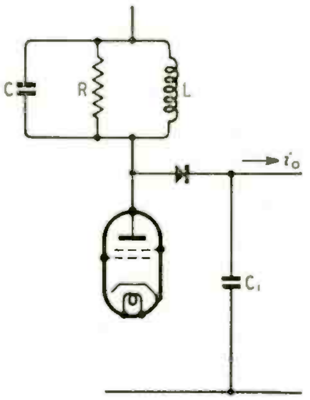
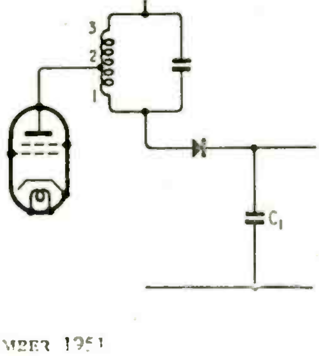


Fig. 4. Basic e.h.t. supply circuit ; a rectifier and reservoir capacitor have been added to Fig. 1.

Fig. 5. When the voltage across the inductance exceeds the peak voltage rating of the valve the anode can be tapped down the coil.



It is almost certainly possible to achieve a capacitance of only 12.5 pF by careful design when a valve rectifier is used. It is very doubtful if it is possible with existing types of metal rectifier. A regulation of 8% would be tolerable for some purposes, and a system of this basic regulation or worse can be made to have any required improvement by the addition of a voltage regulator. It is possible in this way to obtain an improvement of the order of 5 : 1.

Repetition Frequency

So far no mention has been made of the effect of varying the repetition frequency of the saw-tooth driving waveform, and it has been assumed that it will be at line-scan frequency, some 10 kc/s. This is usually the most convenient frequency, since the e.h.t. supply unit can then be driven from the line timebase.

If τ is increased, by lowering the frequency, the output energy W_0 required per cycle is increased in proportion. For the same voltage regulation the stored energy W_s must also be increased in proportion. This stored energy has to be supplied anew only $f(= 1/\tau)$ times as often, so that the input power remains unchanged. If the conductive period of the driving valve is increased in proportion, so that τ_c/τ is constant, E_L will be inversely and i_a directly proportional to τ. The voltage/current ratio in the driving valve will change, which may or may not be convenient. Generally speaking, therefore, the frequency of the driving wave is not very important, and there is usually no point in departing from the time-base frequency.

For the same regulation, therefore, there is usually no point in making the driving frequency different from the scanning frequency. Generally it is a disadvantage to make it different because a special generator of the driving waveform becomes necessary whereas, if operation is at line-scan frequency, the valve can be driven from the line time base. Moreover, if the frequency is appreciably reduced, a larger reservoir capacitance must be used.

If the regulation is not kept unchanged, however, conditions are different. If W_s is kept constant while τ is increased the regulation varies as $1/\tau$ and as W_s has to be supplied $1/\tau$ times a second, the input power varies as $1/\tau$ and falls as τ is increased.

The whole point of using a regulator with a circuit of this type is to enable the input power to be reduced without affecting the regulation. Now at a driving frequency of 10 kc/s it does frequently happen that it is impossible to make C small enough for the regulation to be worse than 5% or so. The input power is then still large and cannot be reduced by adding a regulator. However, by increasing τ (lowering the frequency) the regulation is made worse and the input power reduced and the regulator is worth while. Because of this there are cases where a lower driving frequency is an advantage and frequencies down to 1 kc/s are used commercially; e.g., in the Mullard 25-kV e.h.t. unit for projection television. As will appear later, the use of a voltage-multiplying rectifier offers an alternative and more convenient solution, and for the rest of this article a 10-kc/s driving wave will be assumed.

Aircraft Radio on Show

Suppressed Aerials, Latest Radio, Radar and Navigational Aids

THE higher speeds now attained by passenger aircraft has given the radio engineer a new set of problems to tackle and not the least of these is the installation of aerials. Even if it carries only a portion of the many radio aids to navigation now available a modern airliner may require up to a dozen different aerial systems, for on long distance routes, m.f. and h.f. communications, d.f., v.h.f. and some of the many homing and position finding systems, and possibly a radio altimeter, will be essential equipment.

In very few cases can one aerial be used for more than one service and the problem is how to fit all those required on a thoroughly streamlined aircraft without introducing "drag" and so impairing its flying efficiency.

The latest technique is to build the aerials into the body of the aircraft and this is a matter that must be decided at a very early stage in the construction of the 'plane, and preferably at the drawing-board stage. Some examples of this practice were seen at the recent flying display and exhibition held by the Society of British Aircraft Constructors at Farnborough, Hants. The installations designed for the English Electric Canberra and the De Havilland Comet and Ambassador were shown by the Marconi Company and a few other examples were seen elsewhere. An account of some measurements made on various types of these "suppressed" aerials, as they are called, was given in *Wireless World* of December, 1949.

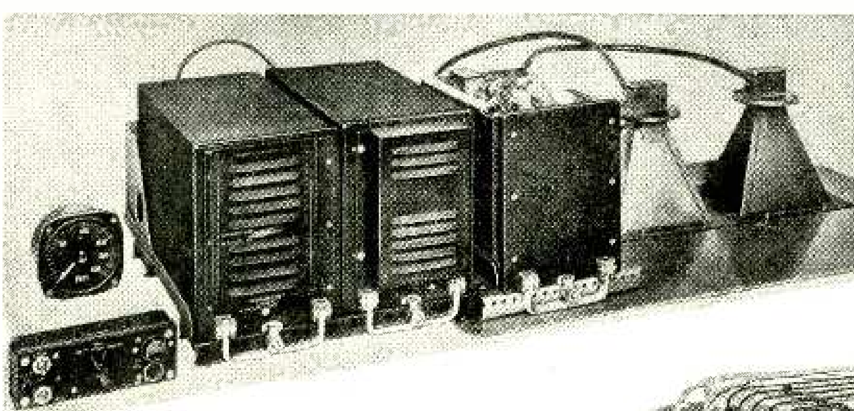
Typical of the way in which the actual structure of the aircraft is being used as a radio aerial is that of the tail fin of the Comet. This is a metallic structure and is insulated from the body of the aircraft by a 4-in section of insulation (fibreglass is used in this case). The metal skin of this fin is used as an aerial for h.f. and m.f. communications and in the top part, under a dome of fibreglass, is a wide-band v.h.f. aerial designed to cover the aircraft band of 118 to 132 Mc/s.

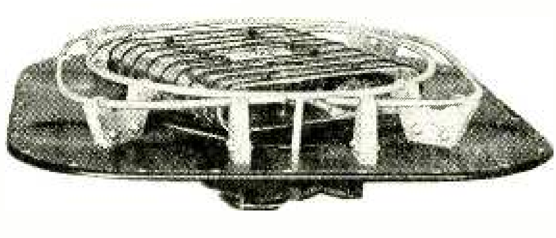
Doors enclosing retractable landing gear; body inspection covers and so on are also pressed into use to accommodate some form of radio aerial.

A new type of radio altimeter, or terrain clearance meter, made its appearance this year. Two firms were showing it and both employ the same basic principle. It is a frequency-modulated system and in the case of the Standard Telephones design, the Type STR30, operates in the 4,300-Mc/s band. A klystron-type oscillator is used for the transmitter, the output circuit being a section of waveguide two wavelengths long. Inside this is a tuning device resembling the vane of a variable capacitor and it is rotated by a small motor giving a sweep of 100 Mc/s or of 10 Mc/s as required, the former being used for the low altitude range covering 0-500 ft and the latter for the high, covering 0-5,000 ft. Separate indicating instruments are used for each range with the view to preventing ambiguity in reading and also to enable the most suitable type of scales to be employed, in this case logarithmic for the low and linear for the high. The lowest height marking is 5 ft and the accuracy is said to be ±2 ft or ±3 per cent, whichever is the greater.

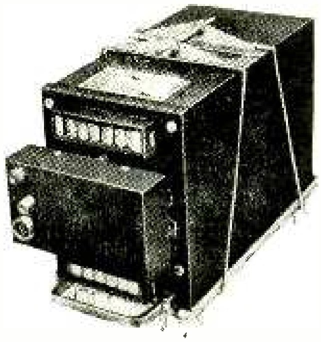
Separate aerials taking the form of small horns for recessed mounting in the aircraft are used for transmitter and receiver and these can be mounted as close as 1 ft apart, measured centre to centre.

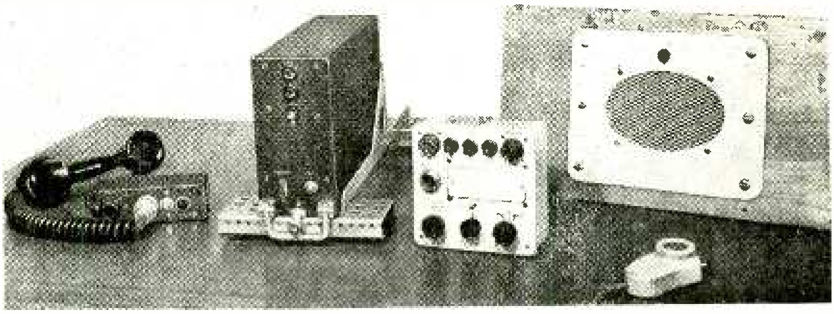
The other radio altimeter was shown by Salford Electrical. It has been produced to Ministry of Supply requirements and is a single-range instrument covering 50-5,000 ft with a required accuracy of 3 ft ±3 per cent. Present indications are that readings below 50 ft will be quite reliable and the upper limit probably better than the specification. It also embodies a frequency modulated system employing a mechanical means of sweeping the frequency





Above: Standard Telephones radio altimeter Type STR30; the two horn "aerials" are on the right and the remote control unit with one height indicator on the left. Right: Recessed iron cored loop (inner) and sense aerial (outer) of the Marconi Type AD7092A automatic direction-finding equipment.





Left: Plessey Type PTR61, v.h.f. transmitter-receiver fitted with remote control attachment. The equipment provides 6 channels send and receive, for immediate operation. Right: Redifon Type A145 airborne passenger announcement system showing pilot's control (left), amplifier unit, steward's control and microphone and one of the 13 loudspeakers.

over a band of 50 Mc/s and it operates at a mean carrier frequently of 1,630 Mc/s. Slot aerials are used and mounted in weatherproof boxes designed for fitting flush with the skin of the aircraft.

The most up-to-date types of v.h.f. airborne radio-telephone equipment can be divided into two main categories. In the one are those sets capable of providing, at the turn of a switch, any one of the full number of radio channels available in the 118- to 132-Mc/s band and in the other sets which provide immediate selection of a limited number of channels and facilities for changing to any of the others by fitting the appropriate crystals.

Two firms, Marconi and Standard Telephones, have multi-channel sets of the first kind and both provide a complete coverage of the available channels with 24 crystals only and this includes both send and receive.

Basically, the principle of operation is the same in both sets but there are many differences in carrying out the idea. Two oscillators are used in the Marconi AD115 equipment, one, the major oscillator, has 14 switchable crystals whose frequencies are adjusted so that after a pre-determined multiplication a carrier output on each of the whole numbers of the working frequencies is obtained; e.g., 118, 119, 120 and so on to 132 Mc/s.

The other, or minor, oscillator is also crystal controlled and provides an output which when mixed with the major oscillator's output adds the required decimal portion of the frequency, for example, 0.1, 0.2, 0.3 Mc/s and so on.

At present the band 118 to 132 Mc/s is operated with 200-kc/s channel spacing and so 70 channels only are usable but future requirements will be for 100-kc/s spacing and then the 140 channels will be required. This equipment gives 15-20 watts output, has full remote control and operates on telephony or m.c.w.

In the Standard Telephones STR12C equipment 70 channels with 200-kc/s spacing are provided, but it is a simple matter to double this number when the need arises. A small remote control unit contains 24 miniature crystals and three oscillators, but two only are in use at any one time. It carries also two frequency selecting switches, one for whole numbers the other for the decimals, on-off switch and telephony or m.c.w. telegraphy switch. The carrier output is 15 watts.

Typical of the sets in the second category are the two Ekco models CE40, 11 channels, and CE58, 22 channels; Murphy MR60 and MR80, 5 and 23 channels respectively and Plessey PTR61 with six channels. The majority of the equipments in this category are low power sets being intended mainly for privately owned and light aircraft, where the requirements are a limited number of channels immediately available and facilities for changing to others, if necessary, in the air.

Some of the larger passenger aircraft now have several cabins, each seating 12 or more people and, although interconnected, dividing bulkheads isolate them to some extent. In these aircraft are now being fitted passenger announcement loudspeaker systems, generally under the control of the steward or stewardess but with over-riding control from the pilot's or navigator's positions.

An amplifier for an installation of this kind is made by Redifon; it is the Type A145, gives 15 to 20 watts audio output and is capable of operating 13 loudspeakers distributed throughout the aircraft. It fits the standard aircraft racking and has all cabling brought in at the back via plugs and sockets to simplify servicing.

Wide-band aerial amplifiers designed to do away with the forest of aerials which distinguish most ground stations working long-distance point-to-point and ground-to-air communication services were seen at the S.B.A.C. show. Plessey has developed one, the Type PV14, covering 2-25 Mc/s and which will operate up to ten communications receivers from a single aerial without mutual interference. The amplifier consists of two identical sections each having two EF91 valves in parallel and feeding five ECC91 valves operated as cathode followers. Each supplies a separate receiver. A modification of this amplifier is available for dual diversity reception, each half operating up to five receivers from two separate aerials.

Another example of a wide-band amplifier is the Redifon Type MCU1. It is designed to operate up to eight receivers from a single aerial. The input from the aerial is taken through a band-pass filter which accepts all signals within the band 2-20 Mc/s but heavily attenuates those outside this band. Following the filter are eight EC91 triodes operating as cathode followers and each feeding into a separate output for the eight receivers.

One of the latest secondary radar navaids, the interrogator-responder system known as DME (Distance Measuring Equipment) was shown by Ferranti. This operates in the 1,000-Mc/s band and provides the pilot of an aircraft with continuous visual information of the distance, and any deviation from the direct line of flight, to a selected ground beacon. Its effective range is about 200 nautical miles. Both ground and airborne equipments were on view.

Another navigational system well represented was Decca, which firm had a model of an anti-static aerial for aircraft consisting of a vertical streamlined and insulated mast with its leading edge cased in metal and acting as a shield for the aerial fitted in the centre of the mast. It is claimed that the earthed metal shield protects the aerial from charged rain and other static effects and provides a better signal-to-noise ratio than the usual unprotected aerial. This firm also included the latest Mark VII airborne Decca receiver designed for use in fast flying civil aircraft. It operates on a wider "lane" spacing than hitherto and includes a local oscillator which is locked to the master station's signals so that the operation of the set is not dependent entirely on the continuous reception of the master station. Complete interruption of several seconds' duration does not affect the operation or reliability of the system as a navigational aid. Including the control unit it weighs under 40lb.

SHORT-WAVE CONDITIONS

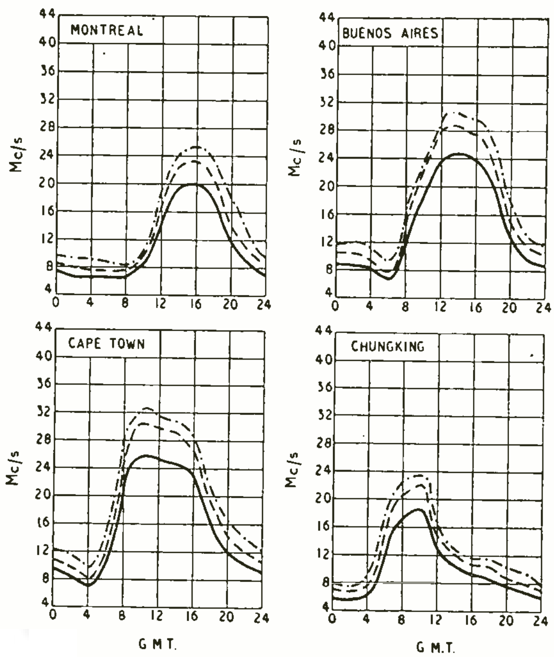
September in Retrospect : Forecast for November

By T. W. BENNINGTON*

DURING September the average maximum usable frequencies for these latitudes increased by day and decreased by night, which variations were in accordance with the normal seasonal trend. Daytime working frequencies did not, however, appear to increase, and 17 M/cs remained about the highest regularly usable frequency for east/west paths, though those up to 22 Mc/s were sometimes usable. Over north/south paths 24 Mc/s remained about the highest regularly usable daytime frequency. At night only the lower short-wave frequencies (6—7 M/cs) were generally usable, due mainly to the disturbed conditions which generally prevailed.

There was a sharp decrease in the amount of Sporadic E recorded. Dutch and German stations on frequencies around 94 Mc/s were frequently received during the first half of the month, and on isolated days towards the end, their signals being presumably heard due to tropospheric propagation.

* Engineering Division, B.B.C.



——— FREQUENCY BELOW WHICH COMMUNICATION SHOULD BE POSSIBLE ON ALL UNDISTURBED DAYS

– – – – PREDICTED AVERAGE MAXIMUM USABLE FREQUENCY

–·–·– FREQUENCY BELOW WHICH COMMUNICATION SHOULD BE POSSIBLE FOR 25% OF THE TOTAL TIME

The average sunspot activity was considerably higher than during the previous month.

The month was notable for the very large amount of ionospheric storminess which occurred. Although the equinoctial months of March and September are generally badly disturbed, this September was exceptional for the long duration of the disturbed periods. In fact the whole period from the 9th to 28th was more or less severely disturbed, this being probably due to several different ionospheric storms following each other in quick succession, and possibly connected with the central meridian passages of sunspots on the 9th, 15th and 20th. There were accompanying magnetic disturbances of severe intensity and on several occasions aurora was observed in this country. The height of the disturbance occurred on the 25th, when the aurora was widespread and the magnetic disturbance reached the intensity of a "great magnetic storm." In the afternoon and evening of this day short wave reception was very poor and there was severe flutter fading with a "rumbling" background on nearly all stations. Both the rapid fading and the "rumble" were noticed even on medium wave reception later in the evening.

Five Dellinger fadeouts were reported during the month, those at 1057-1230 on 7th and 1500-1700 on 15th being of severe intensity.

Forecast: During November the daytime m.u.f. for these latitudes should continue to increase, whilst that for the night-time should continue to decrease. Working frequencies should, therefore, be relatively high by day, and on east/west circuits those up to 20 Mc/s should be regularly usable. It is unlikely, though, that those above 26 Mc/s will become usable over such circuits, except, perhaps, on one or two isolated occasions. Over north/south circuits frequencies up to 26 Mc/s should remain regularly usable, and those up to 32 Mc/s occasionally so, during the daytime. Medium-high frequencies will have to be used for an increasingly large proportion of the daily time, owing to the continued decrease in the hours of daylight. At night very low frequencies will have to be employed, and 6 Mc/s should be about the highest regularly usable frequency over most circuits.

Sporadic E capable of propagating very high frequencies is unlikely to be prevalent. Medium-distance communication will be controlled by the F_2 layer, and should therefore be possible on medium-high frequencies during the day, and only on the lowest short-wave frequencies at night.

The curves indicate the highest frequencies likely to be usable over four long-distance circuits from this country during the month.

Ignition Interference Suppressor

Suggestion for an Improved Television Limiter Circuit

By RONALD G. YOUNG

ONE of the difficulties encountered in receiving televised images is that of removing the "blobs" produced by unsuppressed car ignition systems. These are due to spot defocusing caused by intense positive or negative interference pulses (depending on whether grid or cathode modulation is used) being applied to the cathode ray tube.

There are two kinds of suppression systems in use and each depends on a clipping action on the waveform. The first, shown in Fig. 1, is a limiter with manual adjustment (applied to a cathode-drive modulator). If adjusted correctly this undoubtedly gives the better overall results, but it has the disadvantage that adjustment of the contrast control alters the threshold of clipping. At first sight this may seem irrational until it is realized that every adjustment of contrast requires a corresponding adjustment of brightness—which means a change of black level and peak white level.

Unless one resigns oneself to a constant contrast setting this can become a nuisance, so various attempts have been made to devise self-setting suppressors. A simple circuit used by home constructors and in certain commercial receivers is shown in Fig. 2. It gives extremely efficient suppression as the effect is augmented by instantaneous negative feedback from anode to grid. Although in theory the 0.1-μF capacitor should charge to a value equivalent to peak white, it actually reaches a value somewhat below this level and tends to clip highlights. Images above a certain brightness therefore lack detail and this is particularly noticeable when the relevant object is against a dark background.

The writer has attempted to devise a simple circuit (Fig. 3) which will combine the merits of both these methods and at the same time minimize their disadvantages as far as possible. It will be seen that a manual control is supplied, which can be set for optimum results on a normal picture. If, however, the contrast level is reduced (and brightness increased) the circuit self-biases itself to highlight level. This works out very well, in the writer's experience, because at low contrast there is little likelihood of a gloomy background, and, what is more important, over a long period of use it has been found that resetting is quite unnecessary under any circumstances. This in spite of repeated trials to see if the setting could be improved.

The method of setting recommended is simple. Choose a programme consisting of a fairly mixed range of contrasts (newsreels are probably as good as anything in this respect). Then reduce the value of the variable resistor until the highlights begin to be affected and lose detail. Finally adjust the setting so that no effect can be detected, just beyond this point.

In fringe areas, where more or less severe variations of signal take place, it may be found preferable to connect the 5-MΩ resistor to h.t.+ rather than to the anode. The connection shown, however, has been found better for normal conditions of steady reception, since the anode connection supplies a small amount of d.c. level to the diode and reduces any tendency for loss of highlight detail when receiving exceptionally dark pictures such as night scenes.

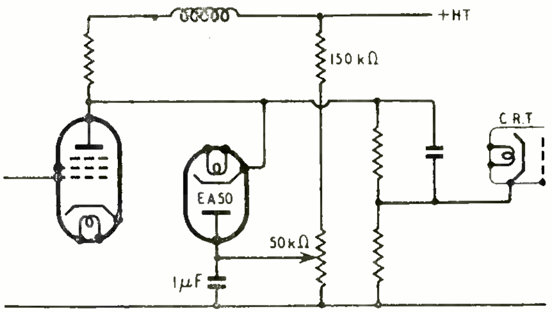


Fig. 1. Simple limiter with manual adjustment.

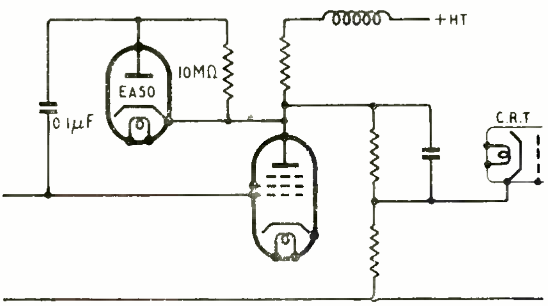


Fig. 2. Self-bias limiter acting by negative feedback.

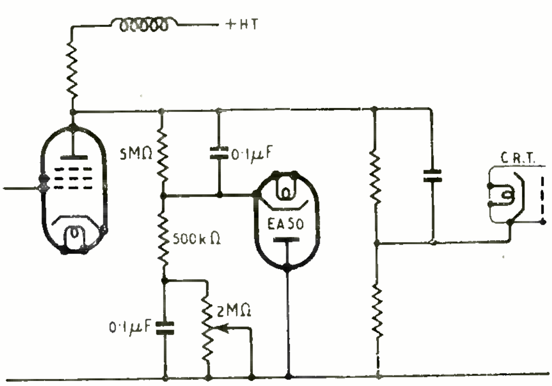


Fig. 3. Limiter combining manual setting with automatic self bias. Note that the 2-MΩ control may be connected by long wires because of the 0.1-μF capacitor acting as a filter.

Sensitive T.R.F. Receiver

3-Valve Circuit with Amplified A.G.C.

By S. W. AMOS,* B.Sc.(Hons) and G. G. JOHNSTONE,* B.Sc.(Hons)

THE 3-valve receiver descibed in this article was designed to use the amplified a.g.c. circuit described in last month's issue. It uses a t.r.f. circuit, chosen because such circuits are easier for home constructors to align than superhets. Nevertheless the perfomance of the receiver compares very favourably with that of a 3-valve superhet with a frequency-changer, i.f. amplifier and double-diode-pentode output; in fact the sensitivity and a.g.c. performance are better than that of the superhet. The selectivity is inferior but permits interference-free reception of 12 medium-wave signals during daylight in London, three of the signals being between the Home Service (908kc/s) and the Light Programme (1214kc/s).

It is unusual to apply a.g.c. to a t.r.f. receiver because the gain is not normally adequate to make its application worthwhile. If the receiver has to operate at maximum gain to give adequate output from an aerial signal of, say, 1mV amplitude, the a.g.c. can do nothing to maintain the output when the signal fades below 1mV; applied to such an insensitive receiver, a.g.c. is only useful in levelling the output from comparatively strong signals, though it may also serve to prevent detector overloading on strong signals. To make the best use of a.g.c. as a means of reducing fading, high sensitivity is essential and is obtained in this receiver by the use of high-slope pentodes as r.f. amplifier, detector and output valve. With such valves it is possible to obtain sensitivity of the order of 10μV as will be seen from the following calculations.

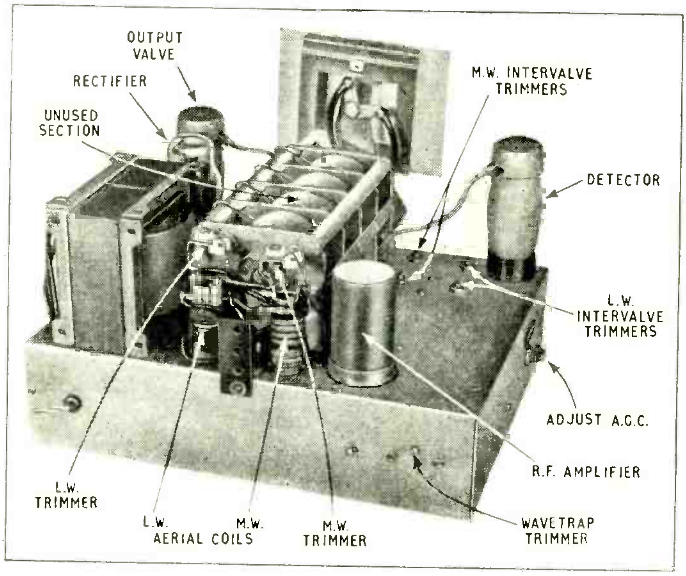
An EF50 or SP61 is used as an output valve with a load of 20 kΩ; with a g_m of 6mA/V (a practical figure) the gain is 120. A similar valve is used as detector with an anode load of 300kΩ; the working mutual conductance is much lower but the gain is still approximately 100. In the r.f. stage a dynamic anode load of 30kΩ or higher is used giving a gain in the region of 200. With an aerial circuit gain of 5 (a conservative figure) the overall r.f. gain is 10^3 or better, and the total receiver gain from equivalent aerial generator to final anode is in the region of 10^7. With the output-valve anode load assumed, the anode voltage swing is 31.6 volts r.m.s. for the standard 50mW output, and the r.f. aerial generator output necessary (at 30 per cent. modulation) to produce this output is approximately 10μV. The sensitivity realized in practice is slightly less than this calculated value and is approximately 20μV.

The provision of such high gain introduces a number of design difficulties. One, already mentioned, is that of detector overloading and is most effectively overcome by the a.g.c system. Overloading is also possible at the grid of the r.f. amplifier since "straight" pentodes of the EF50 type overload with signal inputs greater than approximately 1 volt. To prevent this, provision is made for the introduction of a wavetrap tuned to the strongest signal. Further, and most important, high gain is an embarrassment unless the receiver has high selectivity; this point is illustrated by the following calculation. Assume that it is intended to receive a relatively weak signal (100μV amplitude) displaced by 50kc/s from a powerful neighbour operating at 1Mc/s with a signal amplitude of 10mV. From universal selectivity curves[1], the rejection of the strong signal given by a single LC circuit with a Q of 100 tuned to the weak signal is 20 db. Thus to give a signal/interference ratio of 20 db, three tuned circuits are necessary.

In practice conditions even more difficult than this may easily be encountered. To cope with such conditions a wavetrap tuned to the Home Service frequency and providing a further degree of selectivity, is necessary. This not only helps station separation, but also prevents overloading of the r.f. stage. Such a wavetrap is incorporated in the receiver described (which is used in the London Area) but it should be realized

[1] See for example "Radio Receiver Design," by K. R. Sturley Part I, p. 124 (Chapman & Hall).

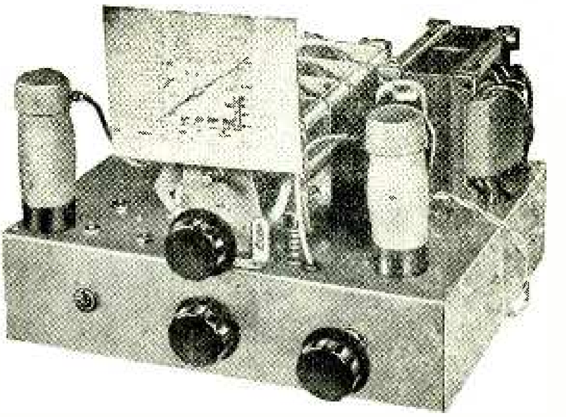
Top of chassis viewed from the back, showing trimming adjustments.



*B.B.C. Engineering Training Department.

that it will not be necessary in areas of generally low field strength, and should not in every region be tuned to the Home Service for the best results. For example in the Daventry area, it may be most advantageous to tune the wavetrap to the Third Programme on 647kc/s. Some idea of the value of the wavetrap can be gathered from the fact that the receiver in Central London and without interference receives clearly three stations, Hilversum (1007kc/s), West of England Home Service (1052kc/s), and Midland Home Service (1088kc/s) between the London Home Service and the Light Programme ; it certainly cannot do this without the wavetrap.

The three tuned circuits are best arranged as a single circuit and two coupled circuits acting as a bandpass filter. Experiments showed that best results are obtained when the single circuit is connected between aerial and r.f. valve and the coupled circuits between r.f. valve and detector.



The Circuit

The full circuit diagram of the receiver is given in Fig. 1. V1 is the r.f. amplifier (an EF50) with a.g.c. voltage applied to the suppressor grid, V2 is an anode bend detector (SP61 or EF50) and V3 is an audio output stage (SP61 or EF50).

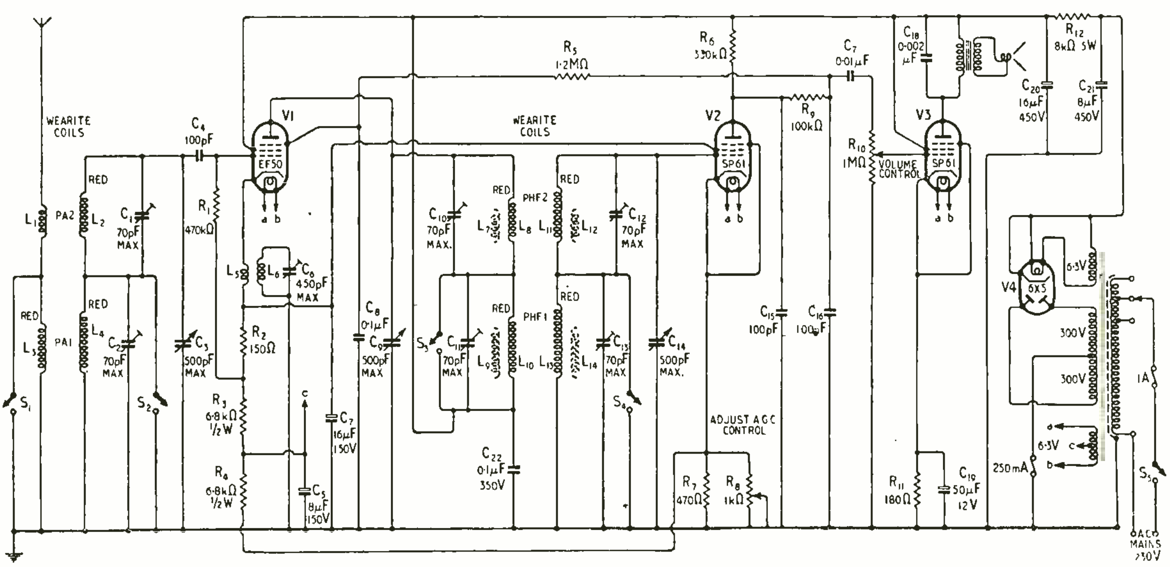
The aerial input circuit is quite conventional and uses Wearite PA1 and PA2 coils. The cathode of V1 is maintained at a potential of 100 volts (approximately) above earth by high-value cathode resistors, R_3 and R_4. This cathode provides the screen potential for V2 and for this reason it is decoupled by a 16μF capacitor C_7. The grid leak of V1 is returned to a tapping point on the cathode resistor chain, R_2 acting as the bias resistor. The wavetrap previously mentioned is also included in the cathode circuit and provides negative current feedback at the rejection frequency. It was decided to place the wavetrap in the cathode rather than the aerial circuit for two reasons ; first, it avoids the mistuning effect of aerial wavetraps ; secondly, it avoids the marked changes in receiver sensitivity over the waveband caused by aerial wavetraps. This latter effect has been discussed in an earlier article[2]. The design of the wavetrap in this set depends on local conditions, and is described later.

The intervalve circuit is a bandpass filter, used to provide the necessary selectivity. Several methods of coupling were tried, and coupling by mutual inductance was adopted, because performance is quite satisfactory, and is simple to achieve. Wearite coils were again used, the coupling being obtained by adjustment of the spacing between coils. The filter consists of two PHF1 and two PHF2 coils for long and medium waves respectively ; unmodified PA2 coils are not suitable for this position because the large primary coil is self-resonant at the high-frequency end of the medium waveband causing a pronounced fall in Q and receiver sensitivity at these frequencies. If PA2 coils must be used, this difficulty can be overcome by connecting a fixed capacitor of 200pF (approximately) across the primary coil to shift the resonant point out of the medium-wave band.

Mutual-inductance coupling gives a pass band directly proportional to frequency ; therefore for a

[2] "Wavetraps," by S. W. Amos, *Wireless World*, January 1945

Fig. 1. Complete circuit diagram of the receiver. The primary windings L_7, L_9, L_{12} and L_{14} of the Wearite coupling coils are left unconnected. All resistors are ½-watt unless otherwise indicated.



given degree of coupling the required pass band can be achieved at one frequency only. Best results were obtained by spacing the coils to give optimum coupling (i.e., maximum gain) at 800kc/s approximately in the medium waveband. Overcoupling is used on the long-wave band, to preserve a reasonable bandwidth. The spacings necessary with PHF coils are indicated in Fig. 2.

An approximately constant pass band can be obtained by using a suitable combination of two forms of coupling, e.g. shunt capacitance and mutual inductance, and readers interested in using such mixed couplings can find design details in most standard textbooks[3].

The anode-bend detector bias is provided by R_7 and R_8 in parallel, which carry the cathode current of V1 in addition to that of V2. This arrangement was adopted to enable a low value of cathode resistor to be used; this is necessary to preserve high d.c. gain. R_8 is variable to enable the quiescent anode potential of V2 to be adjusted to equal the cathode potential of V1, i.e. to give zero quiescent suppressor-cathode potential at V1. The screen of V2 is fed from the cathode of V1, so that in effect the screen voltage is stabilized. As mentioned in last month's article, this condition is also necessary for high d.c. gain. On receipt of a signal the average anode current of V2 increases and the anode potential falls, thereby applying negative bias to the suppressor grid of V1.

C_{15}, R_9 and C_{16} form an r.f. filter, and R_{10} is the volume control. It is permissible to control volume at this point because overloading of V2 is prevented by the operation of the a.g.c. circuit. V3 is the output stage, and is of conventional design, but uses an SP61 for high gain. The anode load required is 20kΩ, and the maximum power output is approximately 1 watt.

The power pack is also of conventional design, resistance-capacitance smoothing being used as the total h.t. current consumption is relatively low (20mA approx.).

If greater power output is required, an output valve of the 6V6 type may be used, but an output transformer of different ratio will be necessary to provide the output valve with the correct load. The smoothing resistor will need to be reduced or preferably replaced by a smoothing choke to provide the additional h.t. current whilst maintaining the h.t. voltage at the correct value of 230 volts.

The cathode of V1 is 100 volts positive (approximately) with respect to earth, and to reduce the heater-cathode potential to a reasonable figure, the centre-tap of the heater winding is returned to the junction of R_3 and R_4. The heaters are thus approximately 50 volts positive with respect to earth; this is advantageous because the resulting positive heater-cathode bias reduces considerably the hum in the audio-frequency stages. Capacitor C_5 is essential to prevent ripple voltages being fed to the cathode of V2. If the mains transformer has no heater centre tap, one side of the heater supply may be connected to the point *c* in the cathode circuit of V1.

The layout of the receiver is illustrated in the photographs, and prospective constructors are advised not to depart radically from the arrangement of the r.f. section shown, as with such gain instability may occur.

In spite of the fact that the r.f. amplifier grid is under the chassis and the detector grid above the chassis, it was found essential to mount the aerial coils above the chassis, and the bandpass filter below. With the coil positions reversed, instability occurred due to coupling between the aerial and the bandpass filter.

It was found necessary to shield the aerial circuit switch wafer from the bandpass filter wafer, to avoid slight instability on long waves; only a small screen was required, actually a mounting bracket for a Yaxley-type switch.

A four-gang tuning capacitor was used, as these could be obtained relatively cheaply. The unused section separates the aerial section from the bandpass sections, and thus serves to reduce the chance of instability due to proximity coupling effects. A three-gang capacitor could, of course, be used, but there is a risk of instability due to proximity of aerial and bandpass sections.

The aerial circuit trimmers are mounted on top of their respective coils and the intervalve circuit trimmers are mounted alongside the respective coils with the adjusting screws projecting through the chassis. The wavetrap capacitor adjusting screw can be adjusted through a hole in the rear flange of the chassis. Thus all adjustments can be carried out with the receiver standing normally on the bench.

[3] See for example "Radio Receiver Design," by K. R. Sturley. Part I, Chapter 4, Section 4.5 (Chapman & Hall).

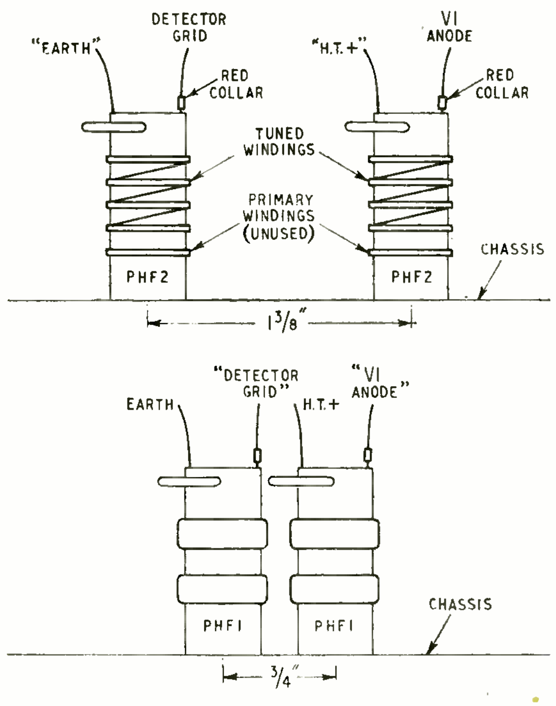
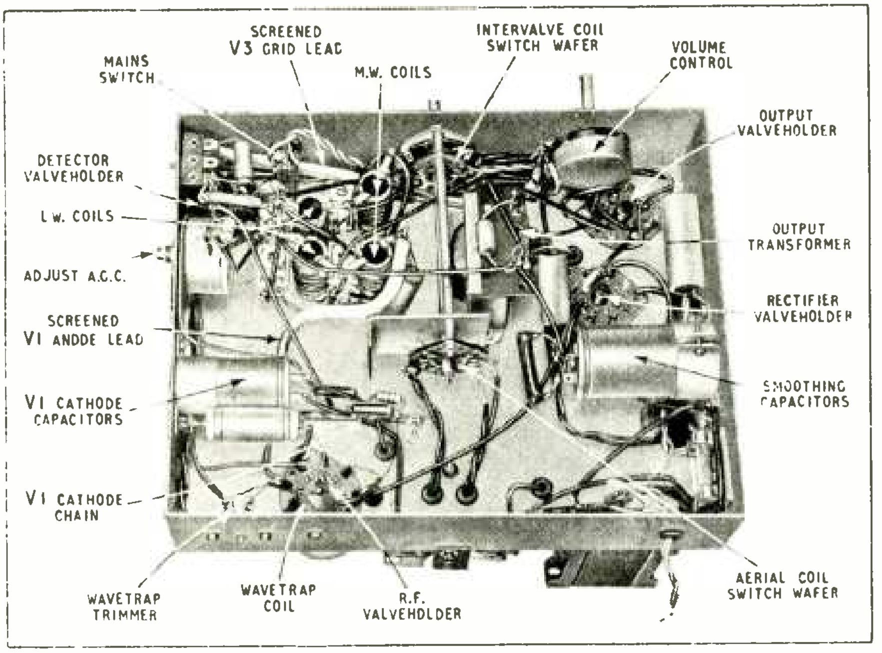


Fig. 2. Medium- and long-wave coil spacing in bandpass filter.

Alignment

First, the suppressor of V1 should be strapped to the junction of L_5 and R_2, to render the a.g.c. inoperative. This may give rise to some distortion due to detector overload during alignment, but such distortion should be ignored. Tune to a signal at the 550-metre end of the medium band, and set the dial pointer on the capacitor shaft so that it indicates the wavelength correctly. Swing the tuning capacitors



Underside of chassis. Note screening bracket adjacent to aerial coil switch wafer.

to the 200-metre end of the band, and, using a relatively weak signal, adjust C_1, C_{10} and C_{12} for maximum output from the receiver, with the dial pointer indicating the correct wavelength. This adjustment may upset the calibration at the other end of the band, and it may be necessary to repeat the adjustments.

On long waves tune to a relatively weak signal near 1,000 metres and adjust C_2, C_{11} and C_{13} for maximum receiver output, with the dial pointer indicating the correct wavelength.

It may be necessary to adjust R_8 initially to obtain signals, but in general this should not be so. After alignment has been completed the suppressor-cathode strap on V1 should be removed.

Adjustment of A.G.C.

The quiescent anode potential of V2 must be adjusted to equal the cathode potential of V1, and the receiver should be switched on for at least ten minutes before this is done. The best method of making this adjustment is by the use of a high-impedance d.c. meter which is connected in turn to measure the anode-earth and cathode-earth potentials, whilst R_8 is adjusted to give equality of readings. The meter impedance must be high, preferably several megohms, because the anode potential of V2 is affected by the meter resistance.

Two alternative methods are available. A meter (0–10mA) may be connected in series with the screen feed of V1, a 0.1-μF capacitor being connected from earth to the screen side of the meter to avoid instability, and adjustment made in the absence of a signal. It will be found that at one extreme setting of R_8, the meter reading is a minimum of approximately 2.5mA and at the opposite extreme a maximum of approximately 8mA. R_8 should be adjusted to the point at which the meter reading just begins to increase from its minimum value. Such a meter may be incorporated permanently in the receiver as an "S" meter, since its readings vary with received signal strength.

The third method does not require any meters. It will be found that the receiver is "dead" at one extreme setting of R_8 and "lively" at the other extreme setting. With R_8 set to the latter position, the receiver is tuned to a very weak signal, or noise. R_8 should then be rotated until it is at the point where the output of the receiver just begins to fall.

Once R_8 has been correctly adjusted it should not require readjustment unless V1 or V2 is replaced. The receiver has been in continuous use over a period of several weeks, including periods when the mains voltage was low, and there has been no need to readjust R_8.

The frequency to which the wavetrap, if required, should be tuned depends on local conditions. Details of the inductor used for rejection of the London Home Service are given in Fig. 3; the capacitor has a maximum capacitance of 450 pF. The number of turns required on the secondary winding L_6 depends on the rejection required and many be calculated as follows. The rejection of the wavetrap is given by

Number of decibels $= 20 \log_{10} (1 + g_m Z)$

where g_m is the working mutual conductance of V1 and Z is the impedance across L_6 at resonance. For 20 db rejection, which was considered adequate, $\log_{10} (1 + g_m Z) = 1$, from which $1 + g_m Z = 10$, therefore

$$Z = \frac{9}{g_m}$$

With the screen-cathode voltage applied to V1, the working mutual conductance is approximately 4mA volt. Therefore $Z = \frac{9}{0.004} = 2{,}250$ ohms. The

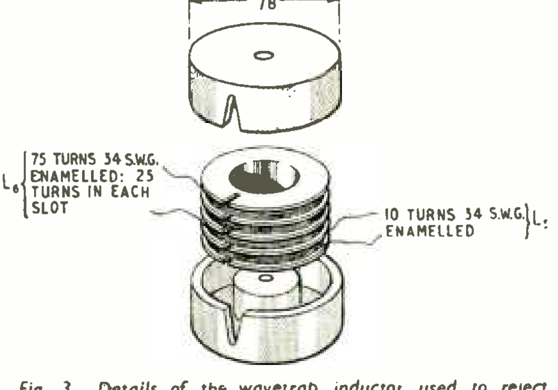


Fig. 3. Details of the wavetrap inductor used to reject London Home Service.

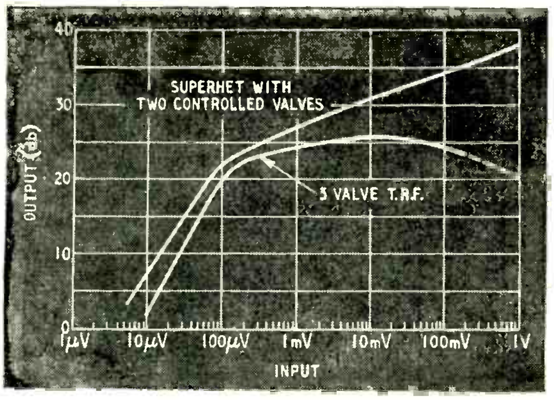


Fig. 4. Comparative a.g.c. curves illustrating the performance of a superhet with two controlled valves and the t.r.f. receiver described in this article.

inductance of L_6 is approximately $160\mu H$ and the Q-value 150. The dynamic impedance at 907kc/s is thus given by

$$Z_0 = L\omega Q = 160 \times 10^{-6} \times 6.284 \times 10^3 \times 150 = 137{,}000 \text{ ohms}$$

The impedance measured across L_5 is related to the dynamic impedance thus

$$\frac{n_1^2}{n_2^2} = \frac{Z}{Z_0}, \text{ from which } n_1 = n_2\sqrt{\frac{Z}{Z_0}}$$

where n_1 is the number of turns on L_5 and n_2 is the number on L_6.

$$\text{Therefore } n_1 = 75 \times \sqrt{\frac{2{,}250}{137{,}000}} = 9.6$$

In fact 10 turns were used as shown in Fig. 3.

To reject signals at the high-frequency end of the medium waveband, it may be necessary to reduce the number of turns on both coils and/or the capacitance of the trimmer. To reject signals at the low-frequency end of the medium waveband, it may be necessary to increase the turns on both coils, but it should not be necessary to increase the capacitance.

The tuning of the wavetrap is best carried out after the receiver has been aligned, and before the suppressor cathode strap on V1 is removed.

Valves

An EF50 was used as r.f. amplifier, and cannot be replaced in this position by an SP61 because the SP61 has a long " tail " to its anode-current suppressor-bias characteristic, and gives poor a.g.c. performance for this reason. EF50's could be used throughout, without change of circuit values.

Constructors proposing to redesign the receiver using a valve other than an EF50 as r.f. amplifier, are advised to consult the valve characteristics, to ensure that the anode-current/suppressor-volts characteristic has reasonably early cut-off, not greater than 60-70 volts at the most.

Performance

As mentioned before, the measured sensitivity is $20\mu V$ on medium waves, and this does not vary appreciably over the whole band. On long waves the sensitivity is higher. The selectivity is good, but is masked by the a.g.c. action, which causes signals to " spread " over a relatively wide band. The a.g.c. is better than that of a superhet with two controlled valves, as shown by the curves in Fig. 4. The a.g.c. circuit arrangement used in this receiver is the subject of a patent application.

LIMITS OF RADIO INTERFERENCE

New British Standards Specification

A RECENTLY published revision of the British Standards Institution B.S.800 defining new tolerable limits of radio interference, specifies the magnitude, duration and frequency of occurrence of radio interference which may be generated by various types of electrical appliances over the frequency band 200 kc/s to 1,605 kc/s. The limits laid down are considered adequate for the protection from such interference of the majority of radio broadcast receivers operating within this band of frequencies.

The specification does not apply to the ignition systems of motor cars, nor to industrial, scientific and medical r.f. equipment, which are covered by other British Standards and Codes of Practice, nor to interference arising from defective domestic apparatus.

The principal amendments in the new edition of B.S.800 are :—

(a) Simplification of the technique of measurement of the noise voltage at the terminals of the interfering appliance.

(b) An increase in the permissible upper limit of the terminal noise voltage from 500 to 1,500 microvolts.

(c) Revision of the limits for the duration and frequency of occurrence of radio interference.

(d) Use of the "radio interference free mark," which was introduced in the 1939 edition of B.S.800 but not brought into use owing to wartime conditions, is further postponed until the specification can be extended to cover television frequencies. This is necessary because electrical appliances which could satisfy the requirements in the 200-1,605-kc/s band might still cause intolerable interference in the television bands.

Copies of this new publication, B.S.800 : 1951 can be obtained from the British Standards Institution, Sales Department, 24, Victoria Street, London, S.W.1, and the price is 3s by post.

RECORD PLAYER

Design for the Home Constructor

IN response to requests for particulars of equipment suitable for use with " Goldring " gramophone pick-ups, the makers, Erwin Scharf, 49-51A, De Beauvoir Road, London, N.1, have issued a booklet (price 2s) which gives constructional details of a recommended amplifier and loudspeaker cabinet design.

An interesting feature of the loudspeaker is that the unit is placed horizontally and radiates into a corner of the room, with a spherical diffuser just above the diaphragm which is designed to give an apparent reduction in the size of the source of sound when reproducing speech.

The amplifier is of economical design and gives an output of 3 watts from a single tetrode, using 26db of negative feedback. A tone-compensated volume control is included and also a variable top-cut control.

LETTERS TO THE EDITOR

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

Reactivating Dry Batteries

R. W. HALLOWS, who wrote in the October issue on this subject, may be interested to know that during the war years we supplied many hundreds of trickle chargers for reactivating l.t. batteries.

These were standard commercial 6-volt chargers, and were connected to a 4.5-volt battery for about 30 minutes. The off-charge voltage then rose to about 6.0 and it was important that the battery was not used for a few hours after charging. With the increased supply of l.t. batteries after the war very few chargers remained in use, despite the considerable saving in cost. It appeared that the consideration was the saving of batteries rather than the saving of expense.

The N.P.L. tests quoted revealed results comparable with our own findings, but the advantages of recharging are, of course, considerably less with present-day hearing aids, owing to the low l.t. and h.t. currents of about 30mA and 1mA respectively. A. EDWIN STEVENS.

Amplivox, Ltd.,
London, W.1.

RECHARGING, restoring or reactivating dry cells is not new. The process has been used commercially in U.S.A. and a description of experimental and commercial equipment was given in *Q.S.T.* for June, 1944. Suggested starting currents for charging were given as:—

Size of cell	*Current, mA*
$1\frac{1}{8}$in × $3\frac{1}{2}$in	10-15
$1\frac{1}{8}$in × $1\frac{1}{2}$in	7.5-10
$\frac{3}{4}$in × $1\frac{1}{8}$in	5-10
$\frac{1}{2}$in × $1\frac{1}{2}$in	5-7.5

A fairly standard charging time of 22-24 hours seems to be satisfactory for discharged cells.

These notes may be useful for amateur experiment.

It is stated that with correct treatment 75-90 per cent of all used cells can be restored to give from 10 to 25 times original service. THOMAS G. WARD.

Bideford, N. Devon.

Crystal Menace?

ADMITTEDLY the possibility of harmonic radiation, mentioned by C. Kidd in your October issue, was not one of the factors considered when designing the Modern Crystal Set (*Wireless World*, September, 1951), but the two tuned circuits, one having unusually high capacitance, might be expected to make the effect very small. A test since made confirms this expectation.

The set was tuned to the London Home Service, the crystal current being 100μA, and a sensitive communications receiver on the same bench was connected to an aerial 20 feet away, led in through a screened lead. Completely independent earthing was not feasible, so the sets shared an earth lead from the first floor to ground level. Under these conditions weak harmonics were detected up to the seventh. The strength of the most powerful one, the third, was equivalent to a 2.5-microvolt signal. When the 200-kc/s Light Programme was tuned in with a crystal current of 4μA no harmonics whatever could be detected.

On the indication of these results no further measurements or consideration of redesign seemed necessary. In reaching this opinion I took into account two other points. The first was that in regions of very high signal strength, where incidentally there is nearly always already severe re-radiation from other non-linear elements, listeners will tend to use a small aerial aperiodically coupled to the parallel-tune modification of the set. The other was that any modifications that occurred to me, including the fairly obvious one of substituting bottom capacitance coupling for the present arrangement, have minor disadvantages which make their adoption a pity unless they are really essential.

If anyone in the London area has made tests which show that the matter ought not to be so lightly dismissed I shall be most interested to hear his results.

General Electric Company, B. R. BETTRIDGE.
London, W.C.2.

Diathermy Interference

LIKE R. Cussins (your Sept. issue), I too have observed an objectionable interference pattern on several types of television receivers, both of t.r.f. and superhet designs. The pattern takes the form of a "herring bone" or "oak grain" band across the screen and occupies approximately one third of the height. Its position on the screen is usually fairly stable although pattern design may change slightly.

I have been informed from several unofficial sources that the cause of this interference is diathermy equipment. Having had some experience in the design of such apparatus several things puzzled me concerning the nature and existence of the pattern.

One was that the pattern was not present when the Holme Moss transmissions were off the air, another was the evidence of modulation (a.f.) on the pattern, and a third was the considerable range attributed to the suspect diathermy equipment.

It was while studying a particularly pronounced specimen of this interference that I solved the first two puzzles. The pattern was obviously the result of a beat frequency caused by the harmonic or fundamental of some signal and that of Holme Moss transmission.

By injecting into the aerial sockets of a television receiver a pulse modulated frequency variable about 51-Mc/s and a fixed c.w. signal of 51Mc/s, I managed to reproduce the indentical interference pattern.

Further experiments proved, as was expected, that the two signals had to have good stability to maintain the pattern constantly in its position on the screen.

Slight variation in stability caused the inside detail pattern to change without its position being altered.

Knowing the approximate power ratings of diathermy equipment, and also the degree of stability to be expected of its frequency adjustment (the patient forms part of the resonant circuit) I doubt if diathermy is the source of the interference.

Reports of this type of interference are being received from places twenty miles away from the nearest hospital.

It would appear that attention should be paid to other possible sources such as radar stations, aircraft beacons and navigation installations. I would hasten to add, however, that before an onslaught be made upon the "authorities" demanding the elimination of such stations, a little further analysis of the pattern should be made.

H. WILLAN CRITCHLEY.

Scarborough, Yorks.

Automatic Monitoring

R. DANZIGER, writing in your August issue, seems to think that the general principles used in the B.B.C. automatic monitors, discussed in a recent I.E.E. paper, are those described by him in your June, 1948 issue.

He has evidently missed the main reasons for the successful application of Automatic Monitoring to the B.B.C. system.

First, it is not practicable to balance out programme signals which are derived from the two ends of even a relatively short (electrically) system. Phase distortion (or delay) on the connecting transmission line and its asso-

D

ciated apparatus, although it may be inaudible to the listener, prohibits this unless a very rough degree of balance is acceptable. We have used a rectified output arrangement to overcome this trouble and obtain balances which permit the detection of noise components 40-50db below programme peaks.

Secondly, we have provided the facility in the circuits, not only to give the proper relative aural sensitivity at both high and low levels, but to render the monitor properly proportioned to other forms of distortion such as frequency response, overload and transmission equivalent changes.

I would like to make it quite clear that any claim to success in our automatic monitors is not that we were the first to wish that programmes could be so monitored, but, as far as I know, we were the first to attain a reliable monitor that would on the average be at least as good as the man it replaced.

Actually, work on circuits basically similar to that suggested by Mr. Danziger was attempted in the B.B.C. considerably before 1948, but no claim was published as successful application of the design was regarded as the criterion of its value.

It is relevant to note that by early 1948 our final laboratory models had worked successfully and the first provisional patents were filed in June of the same year.

London, W.1. F. A. PEACHEY.
B.B.C. Designs Department.

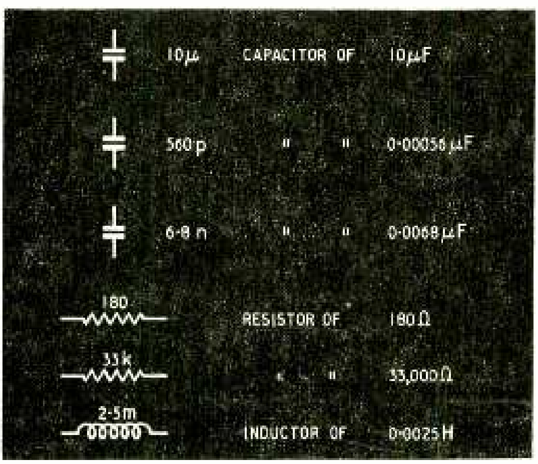
Units in Indonesia

IN your August issue A. C. Kay suggests a new unit of capacitance.

In my personal opinion this is undesirable and even unnecessary if another metric value, the nF (nano-farad) could be accepted for one-milliardth of a farad, in addition to the μF for one-millionth of a farad and the pF for one-billionth of a farad, already adopted in most countries. Thus 0.001 μF = 1 nF = 1,000 pF.

Originally introduced—so far as I know—in Germany and also used in other Continental countries before the war, this *nano* abbreviation is now, in the Indonesian PTT, as normal as *km* for length of wire. Of course, it took a few months before everyone was used to this *n* and there was some confusion with *μ*, but now we just don't understand why anybody still writes 0.015 μF if he actually means 15 nF.

In circuit diagrams one can leave out F, Ω and H, since it is obvious that a resistor is Ω and not F or H. For example:



Still one step further is the use of a code in which no dot appears; this is quite convenient since some countries use commas instead of dots. In this system, which is used by some manufacturers to indicate their parts, 1m5 means 0.0015 H and 2n2 means 0.0022 μF and M47 means 0.47 MΩ, etc.

Radio Division, PTT, V. J. de GRIJS.
Bandung, Indonesia.

"The Modulation Battle"

MR. BEAUMONT'S letter in your October issue fills me with amazement. Being already biased in favour of a.m., perhaps I got the wrong impression, but I thought the matter was solely one of economics and politics. The engineer may grant a small advantage to f.m., but his business is to provide the cheapest equipment to do a given job.

With regard to politics: the B.B.C. would prefer f.m.; it saves them money, even if relatively a small amount. The Government would also prefer f.m.; the higher cost of receivers means more purchase tax.

London, N.W.5. W. M. DALTON.

Recording Studios

I READ with interest the excellent article by P. A. Shears on acoustic treatment of small recording studios (*W.W.*, September, 1951). Perhaps it will stimulate many home recordists to embark upon the oft-neglected art of studio treatment. The reverberation formula Mr. Shears gives as Eyring's is actually that due to Millington. Eyring's formula is

$$T = 0.05V\ S\ \log_e (1 - X_{av})$$

where X_{av} is the average value of absorption coefficient for the room. This formula gives less tedious calculations than Millington's.

Mr. Shears does not mention that preferred dimension ratios exist for room proportions. This is important in order to prevent several low-frequency eigentones occurring at nearly the same frequency. Height, width, length ratios of 1 : 1.26 : 1.6 are considered satisfactory for small studios.

The eigentone formula given is only exact for rectangular flat-walled rooms with completely rigid boundaries, but gives a useful approximation in many practical cases.

Panel absorbers of the type described have to be rather carefully designed and erected, as there is a risk that if their "Q" is too high they will continue to emit sound after being acoustically excited and thus give reverberant sound "coloration" at their resonant frequency. Unless carefully mounted, panels may also produce buzzing or rattling noises when strongly excited. Similar enclosed resonant absorbers consisting of a volume covered with lino or roofing felt in place of a semi-rigid panel are now claimed to give similar absorption coefficients without the above disadvantages of panels.

A useful and low-priced book which might be added to the references is "Applied Architectural Acoustics" by M. Rettinger (Chemical Publishing Coy., Inc., Brooklyn, New York) M. L. GAYFORD.
London, S.E.18.

Redundant Word?

ON page 422 of the October issue of *Wireless World* appears a concocted word which I submit should not exist in a journal generally accepted to be of value in the education of technical people. This obnoxious word "wattage" is natural to the ignorant who do not appreciate that the watt is a *unit* of power, or rate of working.

It is unfortunate, I know, that the word "voltage" is perforce in common use since with alternating quantities the usual unidirectional terms tend to be meaningless, but this exception is no excuse for replacing a perfectly good word "power" by "wattage," any more than for the common mistake made by the uninitiated in referring to "amperage" (ugh!) when the correct term is "current." R. L. HACKWORTH.
London, N.8.

Paris Television Show

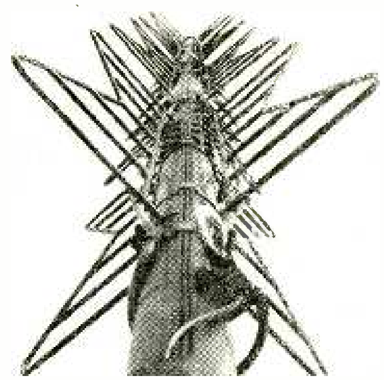
Domestic Receivers for Two Standards

By A. V. J. MARTIN*

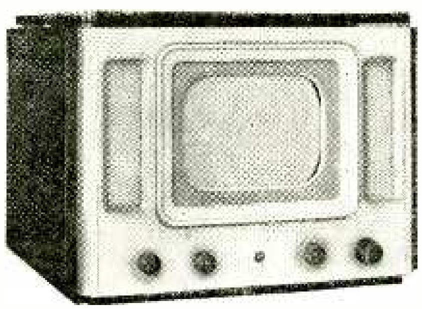
THE first specialized television exhibition in the world was held in Paris at the Musée des Travaux Publics from September 28th to October 10th, under the name Premier Salon de la Télévision. It met with great success and at the week-ends the crowds of visitors were such that the organizers had to limit the number of admissions. The possibility of prolonging the exhibition for a few days was considered, but other arrangements had been made and it proved impossible.

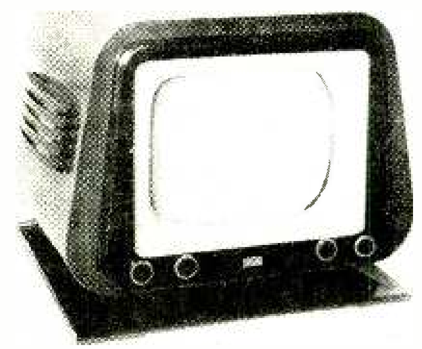
The organizers were the Télévision Française authorities and the Syndicat National de la Construction Radioélectrique. Excluding the Press, there were 23 exhibitors. Three of them were aerial makers, two were valve and c.r.t. manufacturers, and the remaining 18 were television set makers. The Télévision Française had made a big effort and put up a complete studio comprising a semi-circular stage, about 21 yards in diameter, surrounded by 800 seats for the public. Four dual-standard cameras (441/819 lines) were in use and the scene was lit by projectors with a total power consumption of 300kW. The "live" cameras were supplemented by films run from a film-scanner, which could be seen by the visitors through a glass panel. Programme material, either direct or from films, was available to the exhibitors continuously from opening till closing time.

* Editor. *Télévision*, Paris.



The 185-Mc/s turnstile vision aerial on top of the Eiffel Tower.





Model for 819 lines by Radio-Industrie. It has a 10-in flat-faced tube and 22 valves. Below: Receiver with 12-in tube by Ducretet-Thomson. Available for 441 lines with 16 valves or 819 lines with 19 valves.

The v.f. signals originating in the Salon were sent by coaxial cable to outside-broadcasting vans packed in the street and thence by 30-cm microwave link to the studios of the Télévision Française. There they were demodulated, controlled and amplified, and sent to the Eiffel Tower transmitters through the usual coaxial cable. Depending on the standard in use, they went either to the old 441-line transmitter at the foot of the Tower and by coaxial cable to the aerials on top (46Mc/s vision), or to the new 819-line transmitter on the fourth floor of the Tower and by a very short coaxial link to the 4-bay turnstile aerial (185.25Mc/s vision). The accompanying sound was radiated on 42Mc/s for the 414 lines and on 174.1Mc/s for the 819 lines.

Thus in both cases the programmes were received at the Salon in the usual way through the standard transmitters, and the televisors were shown under actual working conditions. The three aerial makers exhibiting had supplied and installed on the roof of the building the necessary banks of aerials for both the standards, and the signal was distributed to the stands by ordinary coaxial feeders.

On the Stands

Altogether 81 different receivers were shown. Most exhibitors had a standard chassis in different cabinets—some of these incorporated a broadcast receiver or a record changer, and others were for long-distance reception with one or two r.f. pre-amplifier valves. Seventy per cent of the sets were for the high-definition 819-line standard and included six dual-standard 441/819-line receivers. The number of valves varied between 15 and 22 for 441 lines and between 14 and 23 for 819 lines.

There were remarkably few projection receivers. Fifty per cent of the sets had 12-in tubes, ten per cent had 14-in tubes, and the other sizes, varying from 6in to 24in, were each under five per cent of the total. Table models were in a majority and were followed second and third by consoles and large-size combination models. Sensitivities ranged from 10μV (long-distance) to 500μV (local). There were frequently two versions of the same receiver, one for 441 lines (46Mc/s), generally of the t.r.f. type, and one for 819 lines (185.25Mc/s), always a superhet. For the same sensitivity there was a difference of two to four valves between the two versions. The high-definition sets were up to twenty per cent dearer, though some makers were actually offering both versions at the same price.

The three aerial makers exhibited a wide range of products for both standards, from a small-size "compressed" indoor aerial to an array of stacked five-element Yagis on a telescopic 59-ft aluminium mast. One of the makers, Portenseigne, had a stand illuminated by ultra-violet light and the aerials were coated with fluorescent paints of different colours. The effect was striking, especially as the background was an enlargement of a photograph of the Paris rooftops where all the television aerials were also fluorescent. Belling & Lee and Antiference were represented by their French distributors.

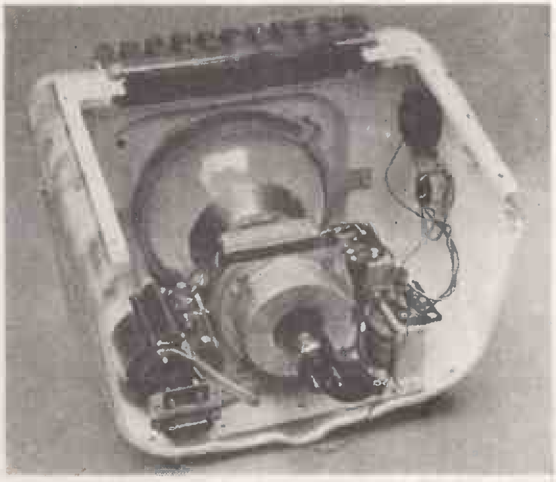
Dual-standard (441 and 819 lines) console by Ducastel, available with 12-in or 14-in tube.

There were also two valve manufacturers. Mazda were showing the noval series and flat-faced c.r.ts and had a large-size luminous exhibit demonstrating ion-trap working. Visseaux had American-type tubes and flat-faced, metal-glass and all-glass rectangular tubes up to 20in diagonal.

This exhibition was the first opportunity for the set makers to meet the public at large and take advantage of their remarks. Two general trends were evident: the set buyer wants a high-quality picture and he also wants a large-size picture. This last remark excludes, at least this year, the projection televisors, which are thought to lack brilliance and contrast. Regarding the first trend, high definition has, beyond the shadow of a doubt, been victorious in what we call "the cold war of the lines." Mr. Everybody has, at last, had a chance to see similar sets working side by side under similar conditions on both standards and does not hesitate a second—he wants the better picture provided by the 819 lines and reacts strongly against the lininess of the old 441 standard, especially on the large pictures he likes. What is more, he thinks that the difference in price is more than counterbalanced by the difference in quality and does not care a farthing about bandwidths and international agreements. As for the picture size, it is evidently linked with the fact that he is interested only in the 819 lines; the minimum size seems to be the 12-in tube and interest is strongly directed towards flat-faced 16-in and 20-in tubes, preferably of the rectangular type which permits smaller cabinets.

Generally speaking the prices are high, mainly because televisors are not mass-produced in France at the moment. It is thought, however, that the exhibition will go a long way towards increasing the popular appeal of television, and a very substantial cut in prices, from 30 to 50 per cent according to the makers, is expected as soon as large-scale production begins. For the moment, prices are such that television is within reach of only the richest part of the public, and this probably explains the trends towards quality and large size, even at higher cost. Nevertheless, top quality certainly and large pictures probably are good foundations upon which to start a television industry.

Midget set with 6½-in tube by Sonora. The cabinet is an aluminium casting.



Odds and Ends

The smallest and cheapest receiver in the show: the miniature Sonora, 16-cm tube (over 6-in), 90 deg deflection angle, 14 rimlock valves, 441 lines, £54 10s (or 14 noval valves, 819 lines, £69 10s). . . . The biggest direct viewing tube: 24in in an 819-line receiver by Ducretet-Thomson. . . . The most expensive receiver: a beautiful piece of furniture in mahogany (outside) and sycamore (inside), including a flat 16-in tube, 819-line televisor, 12-band broadcast receiver, and three-speed record-changer, by Télé-Ariane, price £550. . . . The biggest cabinet: by Philips, the Jumbo type for clubs, cafés, etc., with a 48-in diagonal picture (Schmidt projection system). . . . The largest picture: 84in diagonal on an outside screen, given by a Radiola projection receiver in two transportable cases. . . . The use of a 7-in electrostatic tube: by L.M.T. in a popular-priced receiver. . . . Dual-standard televisors: the Ducastel models for both 441 and 819 lines with switch selection.

Imitation Nickel Plating

In view of recent Government restrictions on the use of nickel for plating purposes, manufacturers will be interested in the imitation nickel-plate finish given by "Nicklit," a product of Metal Processes, Ltd., Kingsbury Road, Erdington, Birmingham, 24. This can be applied to brass and copper—and steel, too, if it is first coppered or brassed—by simple immersion in a warm chemical bath. There is no deposit—only a chemical change in the metal itself—so that the existing surface remains unaffected.

WORLD OF WIRELESS

Recording Television History ◆ Amateur Show ◆ International Brit.I.R.E. ◆ F.M. for Amateurs ◆ Transcontinental Television

Baird Plaque

"IN 1926 in this house John Logie Baird (1888-1946) first demonstrated television." This wording is on a plaque erected by the London County Council on 22, Frith Street, Soho, which was unveiled by Sir Robert Renwick, K.B.E., president of the Television Society, on October 24th.

It was on January 27th, 1926, that Baird gave a demonstration to some forty members of the Royal Institution and other visitors in an upper room in the house, using the apparatus that is now in the Science Museum, South Kensington. Although Baird and others had previously given demonstrations of televised silhouettes, this was his first demonstration of pictures with gradations of light and shade. When writing Baird's obituary—he died on June 14th, 1946, at the age of 58—we stated "His greatest contribution to television may be summed up in the words, 'he was the first to make it work.'"

B.B.C. Report

THE oblique references to the preference of the B.B.C. for f.m. for the proposed chain of v.h.f. stations are substantiated by the statement in the B.B.C. Report for 1950/51* that "a recommendation for the use of frequency modulation on v.h.f. was submitted to the Government, together with an outline proposal for a chain of stations through the country to give listeners the Home Service, the Light Programme and the Third Programme on f.m."

The Report also states that, so far as colour television is concerned, it is hoped that the radio industry will design and manufacture equipment which can be thoroughly studied and tested before any decision about a future colour television system for public service is made.

Amateur Radio Exhibition

THE fifth annual amateur radio exhibition, organized by the Radio Society of Great Britain, will be opened by Charles I. Orr-Ewing, O.B.E., at 12 noon on November 28th, in the Royal Hotel, Woburn Place, London W.C.1 On each of the succeeding three days it will open at 11 and will close daily at 9 p.m.

In addition to the stands of the fourteen exhibitors, there will be an exhibition of home-built amateur radio gear lent by R.S.G.B. members. The exhibitors include:—Air Ministry (R.A.F.), Admiralty (R.N.V.(W.)R.), Avo, Cosmocord, E.M.I., Eas.bind, English Electric, G.E.C., Panda Radio, Philpott's Metalworks, Salford Electrical Instruments, *Short Wave Magazine*, Television Society, *Wireless World* and *Wireless Engineer*, and Woden Transformer.

Demonstrations of equipment will be given during three one-hour periods each day. Admission is 6d.

* H.M.S.O., 122 pages, price 4s 6d.

Brit.I.R.E.

AT the recent annual general meeting of the British Institution of Radio Engineers it was announced that H.R.H. the Duke of Edinburgh had accepted Honorary Membership of the Institution, of which his uncle, the Earl Mountbatten, is Vice-patron.

The topographical list of members of the Institution shows that, of the 56 countries in which membership is distributed, India has more than any other country overseas. The general secretary of the Institution (G. D. Clifford) is therefore visiting India in the near future with a view to establishing Sections under an Indian Advisory Committee. His itinerary includes Bombay, where there is already a Section, Delhi, Calcutta, Madras and Jubbulpore.

A convention will be held in Bombay in February with papers on the development and application of radio and electronic engineering in India.

At the annual meeting the following members were re-elected to office: Paul Adorian, president; W. E. Miller and L. H. Paddle, vice-presidents; and Sir Louis Sterling, J. L. Thompson, Grp. Capt. S. Lugg and N. C. Cordingly, members of the Council. In addition, G. A. Marriott, Prof. Emrys Williams and G. Wooldridge were elected to the Council.

Now Ready

THE *Wireless World* Diary for 1952 is now available from booksellers and stationers. This useful diary and reference book, now in its 34th year of publication, is a veritable mine of information of the sort that is so often wanted by radio men and yet not available in tabloid form.

As usual, the diary gives a week at an opening and the 80-page reference section includes base connections for 670 valves, useful formulæ, graphical design data and considerable general information. It is available in morocco leather at 6s 1½d, or rexine at 4s 3½d (including Purchase Tax).

Radio and Rearmament

IT will be recalled that it was announced in the House a month or two ago that a committee was to be set up through which liaison between the Ministry of Supply and the radio industry could be maintained on matters affecting defence.

The radio industry representatives on the Radio Rearmament Advisory Committee, as it is called, which held its first meeting at the end of September, have now been announced. They are: A. G. Clarke (Plessey), L. T. Hinton (S.T.C.), M. M. McQueen (G.E.C.), F. S. Mockford (Marconi's), E. J. Power (Murphy), J. W. Ridgeway (Ediswan), E. E. Rosen (Ultra), and C. O. Stanley (Pye).

New Amateur Facilities

FREQUENCY modulation and pulse modulation are now permitted to be used by amateurs in the United Kingdom. Announcing this, the R.S.G.B. states that, as a result of representations by the Society, both pulse amplitude and pulse width modulation are to be permitted within the 2,350-2,400, 5,700-5,800 and 10,050-10,450Mc/s bands. A 50Mc/s guard band is thereby provided at each end of the normal amateur bands. Power will be limited to 25 watts mean d.c. input and 2.5kW peak r.f. power.

Frequency modulation will be permitted temporarily for one year on frequencies between 144.5 and 145.5Mc/s provided that no interference is caused with Government services.

A further band has been allocated for television transmission — 425-455Mc/s with a maximum d.c. input power of 25 watts. This decision has been made following test transmissions by R.S.G.B. members in collaboration with the Air Ministry and the Ministry of Civil Aviation.

Coast-to-Coast Television

ALTHOUGH America's transcontinental television radio-relay link was used initially on September 4th for the transmission of scenes from the Japanese Peace Treaty Conference at San Francisco, it was not officially opened until September 28th. The overall length of the chain of 107 radio-relay stations is 2,992 miles, the distance between stations varying from 19 to 50 miles.

The system will ultimately employ six channels in each direction, operating on frequencies in the 3,700-4,200 Mc/s band, although initially only one is in use. To avoid interference due to "skip transmissions" two frequencies separated by 40 Mc/s are used alternately on each channel along the route.

It is reported that 94 of the country's 107 television transmitters were linked to the "circuit" for the initial transmission.

International Acoustics

THE first issue of *Acustica*, the international journal on acoustics, sponsored by the Acoustics Group of the Physical Society in this country and similar organizations in France and Germany, has now made its appearance.

The aim of the journal is "to cover the science of acoustics in all its aspects—theoretical and experimental, purely scientific and applied." Articles are in English, German or French with summaries in the alternative languages. *Acustica* will be issued six times a year, for which the subscription is 36 Swiss francs. The British representative on the Editorial Board is Dr. E. G. Richardson, of Kings College, Newcastle-on-Tyne, and the publisher, S. Hirzel, Claridenhof, Gotthardstrasse 6, Zurich, Switzerland.

Fire Risks

FIRES caused by broadcast and television receivers during the years 1947-49 are analysed in the report of the Fire Research Board of the D.S.I.R. published by H.M.S.O. under the title "Fire Research, 1950." The table showing the rate of incidence of fires reveals that whereas the number of fires per 10,000 licensed broadcast receivers (including radiograms) has increased from 0.21 in 1947 to 0.34 in 1949, the figures for television sets have decreased from 6.4 to 3.7 during the same period.

The facts given in the report are more reassuring than those quoted in our Editorial in January this year, when the figures given by a responsible member of the Home Office indicated that the curve was rising very steeply.

Athlone Fellowships

TO enable Canadian engineering graduates to take post-graduate training in this country, thirty-eight Athlone Fellowships are to be awarded by the Government each year.

These Fellowships, of which 28 will be awarded annually to newly graduated candidates and ten to graduates from industry, will be tenable normally for two years.

Three of this year's holders of Fellowships are taking post-graduate courses in electronics at Imperial College, which, in one case, will be followed by a year's research at T.R.E.

Speed of Light

THE apparatus used by the N.P.L. in the experiments which showed that the figure normally accepted as the speed of light was inaccurate by eleven miles a second, is now on show and will be demonstrated at the I.E.E., Savoy Place, London, W.C.2, until the end of November.

A cavity resonator is used in which a radio wave is reflected backwards and forwards between the two ends. When the time of travel between the ends equals the time interval between successive waves, they build up to an electrical resonance which can be detected with very high precision. The waves follow one another at a frequency of 10 thousand million per second (10 kMc/s) and it is necessary to measure this frequency with an accuracy better than one part in a million.

Radio and Power Cuts

WHILST on the one hand the B.B.C. is co-operating with the British Electricity Authority by broadcasting warnings of impending power cuts, criticism is levelled against it in the electrical press for its inconsistence in its approach to the problem of the power supply position at peak hours. Our associate journal, *Electrical Review*, criticizes the lengthening of the children's hour on television during a period in which the highest peak load occurs in winter. *The Electrician* gives figures of the increased power consumption during the recent broadcast on the Turpin-Robinson fight in New York. During the half an hour of the broadcast 100,000 kWh, requiring about 70 tons of coal, were consumed.

The warnings of impending electricity cuts are to be broadcast by the B.B.C. on 1,500 metres between 7.30 a.m. and 12.30 p.m., and 3 p.m. and 6 p.m. In addition, arrangements have been made with relay organizations to interject warnings in the transmitted programmes.

PERSONALITIES

H.R.H. The Duke of Edinburgh, F.R.S., has accepted the office of President of the City and Guilds of London Institute for the Advancement of Technical Education. As already recorded His Royal Highness has also accepted Honorary Membership of the British Institution of Radio Engineers.

J. T. Marler, who joined the Marconi International Marine Communication Co.'s Dalston Works in 1907, has been appointed manager of the company's Operating Division in succession to S. Stansbridge, who recently retired. He will continue to represent the company on the Radio Officers' Panel of the National Maritime Board.

J. McG. Sowerby, B.A., M.I.E.E., who is a frequent contributor to *Wireless World*, has left Cinema-Television, Ltd., where he has been concerned with the design and development of electronic instruments since 1946, and joined English Electric, Ltd. From 1940 to 1946 he was with the Ministry of Supply and was responsible for the design and development of electronic instruments for Chemical Warfare Research.

OBITUARY

The death occurred on September 7th of **Commander F. G. Loring,** O.B.E., R.N., M.I.E.E., at the age of 82. After his naval career, during which he specialized in wireless telegraphy, he was appointed, in 1908, the first Inspector of Wireless Telegraphy at the Post Office. On his retirement from the Post Office in 1930 he became a director of the International Marine Radio Co.

Dr. Anton Philips, who, with his brother, founded in 1891 the electric lamp factory which has grown into the world-wide Philips organization, died at Eindhoven, Holland, on October 7th at the age of 77.

C. H. G. Hobday, managing director of Hobday Bros., died on September 1st at the age of 52.

IN BRIEF

Receiving Licences.—Approximately 12,443,850 broadcast receiving licences, including 933,050 for television, were current in the U.K. at the end of August, an increase of 8,950 during the month. The month's increase in television licences was 17,850, the lowest since July last year.

Components Exhibition.—Next year's exhibition of components, organized by the Radio & Electronic Component Manufacturers' Federation, will be held from April 7th to 9th at Grosvenor House, Park Lane, London, W.1.

French Decca Chain.—The French Government has ordered from the Société Française Radio-Electrique, licensees of the Decca Navigator Co., a chain of Decca stations.

Dutch Television. — The Netherlands broadcasting authority (a corporate body on which is represented the four major broadcasting organizations) has brought into regular use—although at present only twice a week—its first television station. It is operating on the proposed C.C.I.R. standards—625 lines, negative modulation, vestigial sideband transmission (upper sideband retained) and f.m. sound. The 5-kW Philips vision transmitter operates on 62.25 Mc/s and the sound transmitter on 67.75 Mc/s. Transmissions are horizontally polarized.

S.W. Listeners are invited by the International Short Wave Club to participate in a competition designed to encourage the sending of better reports of short-wave reception. Postcards, giving details of the reception of an amateur or broadcasting s.w. station, should be sent to A. E. Bear, 100, Adams Gardens Estate, London, S.E.16, before January 1st.

"The Old N'Ions," as members of the Northampton Engineering College Past Students' Association are known, will be holding their twenty-fourth annual dinner and reunion on November 30th at the Connaught Rooms, London, W.C.2. Particulars are obtainable from R. W. C. Gilbert, 6, Ella Road, London, N.8.

New B.B.C. Stations.—Two more of the twelve proposed low-power stations to improve reception of the B.B.C. Home Service in certain areas came into operation on October 7th at Whitehaven (692 kc/s) and Barrow (1,484 kc/s). Both transmitters will ultimately have a power of 2 kW, but initially are lower.

Servicing Exam.—The results of this year's Radio Servicing Certificate Examination, held jointly by the Radio Trades Examination Board and the City and Guilds of London Institute, show that of the 290 candidates for the examination held in May, 117 passed in both the written and practical tests. Forty-six candidates passed the written examination but were referred in the practical test, and 19 candidates who were referred in the 1950 practical test completed the examination.

Wharfedale Wireless, the publishers of the book "Pianos, Pianists and Sonics," by G. A. Briggs, which was mentioned in our August issue, are organizing an essay competition on (a) Which in your opinion is the most interesting chapter in the book, and why? and (b) Which chapter do you find the least interesting, and why? Entry forms and details are available from Wharfedale Wireless Works, Idle, Bradford, Yorks.

Sets for Fijians.—In order to encourage the import of cheap broadcast receivers it is proposed to waive the duty on approved sets. An importer, R. O. Sharma, P.O. Box No. 8, Nadi, Fiji, who will be glad to receive information from interested manufacturers, advises us that the sets should cover the short-wave bands (with band-spread tuning) in addition to the m.w. band. As mains supply is not available in the majority of areas, the sets should be of the "all-dry" type.

Correction.—In the review, on page 403 of last issue, of the new book "Magnetic Recording," by S. J. Begun, a printer's error occurred in the name of the company with which the author is associated. It is, of course, the Brush Development Company.

F.M. in Germany.—According to a correspondent, all but the cheapest broadcast receivers on the market in Germany now incorporate both a.m. and f.m. There are some twenty stations operating at present and about as many being built. The agreed i.f. is 10.7Mc/s.

U.S. Radio Chief.—President Truman has appointed Haraden Pratt, who has been secretary of the Institute of Radio Engineers since 1943, as his personal adviser on telecommunications.

World Radio.—According to figures published in the September issue of our New York contemporary, *Tele-Tech*, the western hemisphere, which has approximately 14 per cent of the world's population, has 75 per cent of the world's transmitter power. So far as the United States is concerned, it has, according to *Tele-Tech*, 65 per cent of the world's transmitter power, just over 50 per cent of the broadcast receivers of the world and 98 per cent of its television sets.

Canada's Department of Transport announces the appointment of F. G. Nixon as Assistant Controller of Telecommunications in the Department. Prior to joining the Radio Division of the Transport Department in 1937 he was doing research work with the National Research Council.

School Television. — Experimental transmissions of television for schools is planned by the School Broadcasting Council and the B.B.C. for next summer. During the experimental period selected schools will be equipped with various types of receivers—direct-viewing and projection—and the industry is being asked to co-operate.

City and Guilds.—The new secretary of the City and Guilds of London Institute, in succession to G. C. Stephenson who has filled the post since 1924, is J. W. Voelcker, B.Sc., A.M.I.E.E., who, since returning to this country from the U.S.A. in 1925, has been with English Electric. He is honorary secretary in this country of the Massachusetts Institute of Technology and president of the M.I.T. Club of Great Britain.

Danish Television.—Regular one-hourly transmissions on alternate week-days began from the Danish television station on October 2nd. The experimental transmissions were stopped some months ago. The Copenhagen 625-line 100-watt vision transmitter operates on 62.25Mc/s with negative modulation. Double sideband transmission is employed. The f.m. sound transmitter operates on 67.75Mc/s with a power of 50 watts. Transmissions are horizontally polarized.

Cable & Wireless announce additions to both the Middle East and West Indian radio services. The Cyprus-United Kingdom radio-telephone service, which was opened last May, is now extended to the U.S.A., Canada, Cuba, Mexico and parts of Europe. In Lybia, the company's stations at Tripoli and Benghazi are being equipped for radio-telephone services, which will operate between both these points, and between them and Malta, with extensions to the United Kingdom. A radio-teleprinter circuit is now operating between Bermuda and Montreal, and the Jamaica-Nassau radio-telegraph circuit has been replaced by a similar circuit between Bermuda and Nassau.

E.I.B.A.—The Electrical Industries Ball, organized in aid of the funds of the Electrical Industries Benevolent Association, will be held at Grosvenor House, Park Lane, London, W.1, on November 9th. In the report of the Association for 1950 donations from a number of radio concerns are acknowledged, including £193 collected at the London luncheons of the Radio Industries Club, £160 from the R.I. Club Ball, and £113 from the R.I. Club, Glasgow.

Marconi College, claimed to be the first wireless college in the world, celebrated the fiftieth anniversary of its opening on October 12th. Originally established by Marconi's Wireless Telegraph Co. at Frinton-on-Sea, Essex, it has been at Chelmsford since 1904.

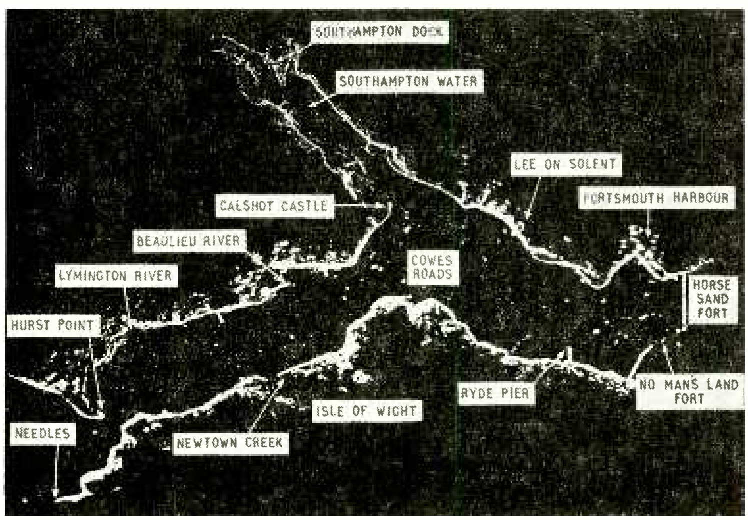
Electro-Acoustics.—A twenty-week course of lectures on electro-acoustical transducers is being held on Monday evenings at Southall Technical College, Beaconsfield Road, Southall, Middx. The fee for the course, which began on October 8th, is £1.

Four-year Course.—Applications for enrolment for the third four-year course in electronic engineering, which commences at E.M.I. Institutes on January 15th, should be received by November 30th. Details of the scholarship scheme, by which the £400 fee is halved, are available from the Institute, 10, Pembridge Square, London, W.2.

"Mechanical Handling," our associate journal, is organizing the Third Mechanical Handling Exhibition and Convention, to be held at Olympia from June 4th to 14th, 1952.

R.D.F. Reunion.—We have been asked by ex-Flt. Sgt. V. H. Wotton to announce that he is endeavouring to organize a reunion of 1941-43 members of No. 31 R.D.F. School, R.A.F., Clinton, Ontario. His address is 216, Vicarage Farm Road, Heston, Middx.

'The Guilds' Engineer."—The second number of the journal of the Engineering and Radio Societies of the City and Guilds College, South Kensington, which has this title, includes several articles of radio interest; among them a summary by H. Bishop, B.B.C. Chief Engineer, of his presidential



RADAR MOSAIC of the Solent, Spithead and Southampton Water composed of twenty-one photographs of the p.p.i. presentation on a Decca Type 159B marine radar set installed in the Company's motor yacht "Navigator."

address to the College's Radio Society and two student papers; "Frequency Modulation Receivers," by P. M. S. Hedgeland, and "Trends in the Design of Small Power Transformers for use in Communication Equipment," by E. S. Parkes. The journal costs 5s.

INDUSTRIAL NEWS

Tannoy.—Three companies now constitute the Tannoy organization—Tannoy Products, Ltd. (formerly Sound Rentals, Ltd.), Tannoy Rentals, Ltd. (handling the rental of equipment), and Tannoy, Ltd. (handling development work). With the reorganization, W. J. Haines, who has been with Tannoy eighteen years, is appointed general production manager of the main company, and A. E. Dunevein (previously with Standard Telephones & Cables), general commercial manager. Guy R. Fountain and his son Michael are directors.

Nagard, Ltd., designers and manufacturers of electronic research and industrial equipment, will be transferring their offices and factory from Brixton, London, S.W.9, to 18, Avenue Road, Belmont, Surrey (Tel.: Vigilant 0345), on November 1st.

F. C. Robinson & Partners, Ltd., electronic instrument specialists, of Deansgate, Manchester, announce the appointment of Frank P. McKellen as sales manager. He was, until recently, senior signals officer at the British Military Headquarters in Berlin.

Loudspeaker Diaphragms will be manufactured at the rate of 30,000 per week by the new plant being installed at the works of Fibre Form, Ltd., Garratt Mills, Trewint Street, Earlsfield, London, S.W.18. (Tel.: Wimbledon 6228.) It is expected that production will gradually be increased to 50,000 diaphragms a week.

Sales Department of Astor Boisselier & Lawrence, Ltd., specialist technical wax manufacturers, is now at 9, Savoy Street, London, W.C.2. The telephone numbers remain unchanged—Temple Bar 5927 and 6942. The company's head office and works are at West Drayton, Middx.

MEETINGS

Institution of Electrical Engineers

Ordinary Meeting.—"The London-Birmingham Television-Cable System" by T. Kilvington, B.Sc. (Eng.), F. J. M. Laver, and H. Stanesby on November 8th.

Radio Section.—"The Life of Oxide Cathodes in Modern Receiving Valves" by G. H. Metson, M.C., Ph.D., M.Sc., S. Wagener, Dr. Phil., M. F. Holmes, B.Sc., and M. R. Child on November 14th.

Discussion on "Should Broadcasting be Superseded by Wire Distribution?" on November 26th. Opener, P. P. Eckersley.

The above meetings will be held at 5.30 at the I.E.E., Savoy Place, London, W.C.2.

East Midland Centre.—"The Development and Application of the Vibrator as a Competitor of the Rotary Convertor" by J. H. Mitchell, Ph.D., B.Sc., at 6.30 on November 6th at Loughborough College.

Cambridge Radio Group.—Address by D. C. Espley, O.B.E., D.Eng., chairman of the Radio Section, at 6 on November 6th at the Cambridgeshire Technical College, Cambridge.

Mersey & North Wales Centre.—"The Life and Work of Oliver Heaviside" by Prof. G. H. Rawcliffe, M.A., D.Sc., at 6.30 on November 5th at the Liverpool Royal Institution, Colquitt Street, Liverpool.

North-Eastern Radio Group.—"Crystal Triodes" by T. R. Scott, B.Sc., on November 5th.

"An Electronic Process-Controller" by J. R. Boundy, B.Sc., and S. A. Bergen, M.B.E., on November 19th.

Both meetings will be held at 6.15 at King's College, Newcastle-on-Tyne.

North Midland Centre.—"The Nervous System as a Communication Network" by J. A. V. Bates, M.A., M.B., B.Chir., at 6.30 on November 13th at the Hotel Metropole, Leeds.

North-Western Radio Group.—"An Investigation into the Mechanism of Magnetic Recording" by P. E. Axon, O.B.E., M.Sc., at 6.30 on November 28th at the Engineers' Club, Albert Square, Manchester.

South Midland Radio Group.—"The Life and Reliability of a Radio Valve" by H. G. Metson, Ph.D., M.Sc., at 6 on November 26th at the James Watt Memorial Institute, Great Charles Street, Birmingham.

North Staffordshire Sub-Centre.—"Television" by C. T. Lamping at 7 on November 5th at the P.O. Central Training School, Stone, Staffs.

Rugby Sub-Centre.—"Crystal Diodes" by R. W. Douglas, B.Sc., and E. G. James, Ph.D., and "Crystal Triodes" by T. R. Scott, B.Sc., at 6.30 on November 21st at the Rugby College of Technology and Arts, Rugby.

South-Western Sub-Centre.—"The Operation and Maintenance of Television Outside-Broadcast Equipment" by T. H. Bridgewater at 3 on November 28th at the Rougemont Hotel, Exeter.

Ipswich District Meeting.—Lecture on "Television" at 6.30 on November 12th at the Crown and Anchor Hotel, Ipswich.

London Students' Section.—"The Use of Working Scale Models in the Development of Broadcasting Aerials" by T. R. Boys at 7 on November 27th at Savoy Place, London, W.C.2.

Students' District Meeting.—"Medical and Industrial Uses of Radio Frequency Energy" by H. Burton, B.Eng., at 7 on November 19th at the George Hotel, Reading.

British Institution of Radio Engineers

London Section.—"Developments in High-Frequency Transmitter Cables," by R. C. Mildner (Telcon), at 6.30 on November 21st at the London School of Hygiene & Tropical Medicine, Keppel Street, London, W.C.1.

North-Eastern Section.—"Television Aerial Design," by G. L. Stephens (Belling & Lee), at 6.0 on November 14th at Neville Hall, Newcastle-upon-Tyne.

Scottish Section.—"The Brain as a Piece of Communication Equipment," by H. W. Shipton, on November 6th at University College, Dundee; on November 7th at the University, Edinburgh; and on November 8th at the Institute of Engineers and Shipbuilders, Glasgow. These are joint meetings with the Institute of Physics and each begins at 7.0.

Institution of Electronics

Southern Branch.—"The Technique of Trustworthy Valves," by G. P. Thwaites, B.Sc., A.M.I.E.E., (S.T.C.), at 6.45 on November 14th at University College, Southampton.

Royal Institution

"Radio Astronomy," by Prof. J. A. Ratcliffe, O.B.E., M.A., F.R.S. (Cambridge University), at 9.0 on November 23rd at the Royal Institution, 21, Albemarle Street, London, W.1.

British Sound Recording Association

"Electrical and Mechanical Problems of Record Reproduction," by K. R. McLachlan and R. Yorke, at 7.0 on November 16th at the Royal Society of Arts, John Adam Street, London, W.C.2.

Portsmouth Centre.—"Recording at the B.B.C.," by R. C. Patrick (B.B.C.), on November 1st.

"Microgroove Recording and Reproduction," by E. D. Parchment (Decca), on November 14th.

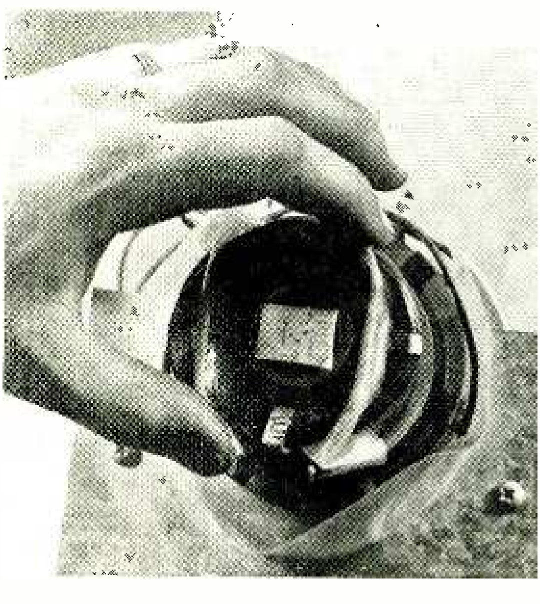
Both meetings will be held at 7.0 at the Central Library, Guildhall, Portsmouth.

Television Society

"The Murphy V200 Television Receiver" by P. Kidd (Murphy Radio) on November 8th.

"Television Distribution by Wire" by K. J. Easton (Central Rediffusion Services) on November 23rd.

Both meetings will be held at 7 at the Cinematograph Exhibitors' Association, 164, Shaftesbury Ave., London, W.C.2.



APID TESTING of deflection coils is facilitated at the Du Mont Laboratories, New Jersey, by the use of a one-inch tube which permits the yoke to be over the face of the tube, thereby obviating the need for disconnecting the tube.

Amateur Radio Developments

A Review of Current Techniques

By J. P. HAWKER*

MORE than 7,000 amateur transmitting licences—double the peak pre-war figure—have been issued in the United Kingdom since the resumption of licensing in 1946. While it is perhaps true that the enthusiastic amateur to-day lacks the facilities necessary for highly original research and usually obtains his licence chiefly for the pleasure to be derived from radio operating as a hobby, he can, and does, play a not unimportant rôle in the practical application of new laboratory techniques to the general field of two-way communication. In this article it is proposed to review briefly a few of the trends noticeable in post-war amateur equipment in order to show a little of what the amateur experimenter is doing, and why.

One of the most serious problems facing the amateur transmitter since the war has been the mutual interference arising from the greatly increased activity. For example, if at any given moment 5 per cent of the licensed amateurs of the world wished to operate in the popular 14-Mc/s band then the 400 kc/s available would have to accommodate no less than 6,000 stations, of which possibly half would be using telephony. But it is not in the nature of the enthusiast to be unduly dismayed by such statistics, and indeed the problem has been tackled, with a fair degree of success, by:—(1) simplifying transmitter frequency changing; (2) increasing receiver selectivity, and (3) reducing the band-width of transmissions.

Transmitter Frequency Changing.—In 1939 probably some 90 per cent of British amateurs used crystal-controlled transmitters and were limited to a few fixed frequencies. Those who anticipated that post-war operation would be along similar lines were soon proved wrong. From 1946 onwards variable frequency control rapidly grew in popularity as more and more amateurs found it essential to be able to pick a "clear" channel in the crowded bands. But in reverting once again to master oscillators, the amateur, perhaps more so than the designer of comparable commercial equipment, has been concerned with obtaining, from relatively simple and cheaply constructed apparatus, a good quality note as free as possible from frequency drift and keying chirp. In practice he has concentrated upon the use of a low-power receiving-type valve as an oscillator, fed from a stabilized power supply and followed by an isolating stage which provides from 1 to 3 watts of r.f. output. By operating the oscillator stage on 1.7 or 3.5 Mc/s with bandspread tuning, the v.f.o. (variable frequency oscillator) unit can be made stable enough for all practical purposes without the complications of temperature compensation and elaborate coil construction found in most commercial equipment of comparable stability. The amateur, incidentally, has done much towards popularizing the series-tuned modified Colpitts, or "Clapp," circuit shown in Fig. 1. The adoption of variable frequency control has led also to an important change in amateur operating technique; the practice of "netting," i.e., the use of the same frequency by two or more stations in communication, is now generally employed on all h.f. bands. While the system possesses many advantages for amateur working, the piling up of transmissions on the frequency of any unusual DX[1] station is at times a severe handicap.

As with the development of broadcast and communication receivers, there has been steady progress towards the simplification of transmitter tuning and band-changing. The amateur possesses a distinct advantage over the commercial designer in that his frequency bands are largely in harmonic relationship and represent only a comparatively small portion of the h.f. spectrum, complete frequency coverage is therefore not required. On the other hand, power efficiency of the final stage is of greater importance than for commercial applications owing to the strict limitation of input power. Much interest has been shown in recent months in the American development of a reasonably high-Q "all-band" power amplifier multiple-tuning system which can tune to any amateur band between 3.5 and 30 Mc/s without switching or coil changing. The basic arrangement of this tuner is shown in Fig. 2, where L_1 is a considerably smaller value inductance than L_2. On lower frequencies

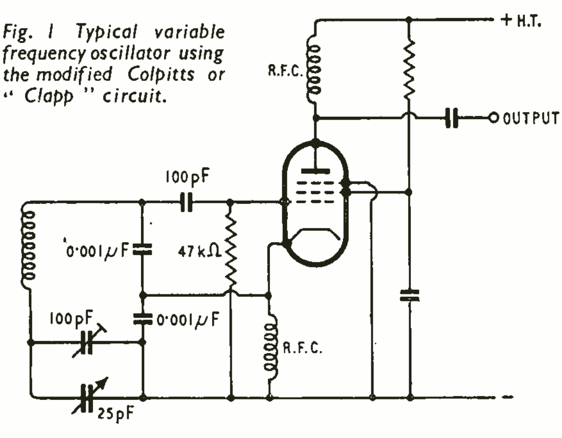


Fig. 1 Typical variable frequency oscillator using the modified Colpitts or "Clapp" circuit.

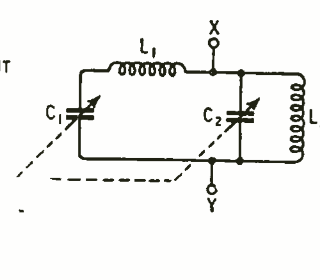


Fig. 2 Basic arrangement of the multiple tuner as used to cover all amateur bands between 3.5 and 30 Mc/s.

* Amateur Transmitting Station G3VA.

[1] On h.f. bands DX means any foreign station, but on v.h.f. it is often used to denote any station beyond line-of-sight distances.—Ed.

L_1 acts merely as a rather long lead to C_1, which is thus effectively in parallel with C_2, while on higher frequencies L_2 behaves as an r.f. choke. Thus across the points X and Y the circuit tunes simultaneously to two widely different frequencies; by careful selection of the inductances no two amateur bands need appear at identical settings of the ganged tuning capacitors. The design of band-switched exciter units has also been facilitated by the use of wide-band interstage couplers and coil turret assemblies.

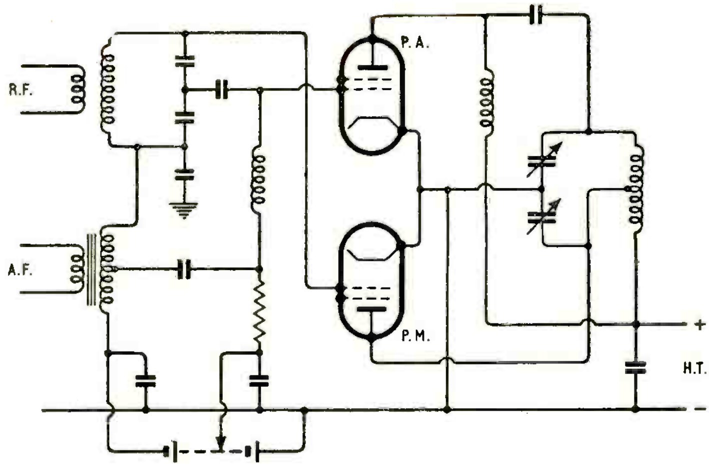


Fig. 3. Skeleton circuit of the "Taylor super modulation system," now being used by a number of British amateur stations.

Receivers.—An interesting development in the search for improved receiver selectivity for telegraphy operation has been the use of a very low second i.f. (50-100 kc/s) in double-conversion superheterodyne circuits. A popular arrangement is to feed the output from a conventional 465- or 1,600-kc/s i.f. stage into an additional unit comprising a mixer and local oscillator, one or more stages of amplification at 85 kc/s, followed by demodulation and audio amplification; such a unit usually being termed a "Q5-er." Peaked audio filters and other audio-selection devices have also become more popular in recent years, though of course these aids to selectivity are not of recent origin. Crystal filter, "Q5-er" and audio filter is a combination whose selectivity, in practice, is usually limited chiefly by the stability of transmissions, the slightest drift of the incoming signals resulting in their sudden disappearance. Receivers for amateur communication with switched side-band selection have also been successfully demonstrated in this country and in the United States. But it should be reported that, compared with the 'thirties, relatively few amateurs now use entirely home-constructed receiving equipment except for v.h.f. working.

Efforts at reducing the band-width of telephony transmissions to permit the operation of more stations in any given band of frequencies, have been made by the more progressive amateurs; techniques used including speech-clipping with cut-off filters and "splatter" suppression. An attenuation at 4,000 c/s of 26 db with reference to the response at 1,000 c/s was recommended at the 25th Anniversary Congress of the International Amateur Radio Union in 1950. Experimental single-sideband suppressed-carrier transmissions are regularly made by a number of stations throughout the world, but the added complications seem likely to restrict the use of this system.

Television Interference.—Increased amateur activity is not the only major problem which has influenced current techniques; television interference (TVI) is also radically affecting the design of amateur transmitters. Although such interference only amounts to a small percentage of the total number of television interference complaints investigated by the G.P.O. it does represent (to the individual amateur) one of the most difficult problems with which he has ever been confronted. Owing to the unfortunate choice (from an amateur viewpoint) of the television frequency in the London area, Alexandra Palace transmissions are most susceptible to interference from the third harmonic of 14-Mc/s amateur transmissions, particularly in areas where the television signals are weak. In addition, the intermediate and image frequencies of several makes of television receivers are such that, through no fault of the amateurs concerned, these sets are liable to suffer interference from amateur transmitters in the immediate neighbourhood. The most successful answer to harmonic interference so far lies in screening and filtering the transmitter to a far greater extent than is normal amateur practice and in careful harmonic monitoring. In fringe areas complete screening of the transmitter is usually necessary, involving precautions to prevent the escape of r.f. power along mains supply leads, keying and power lines or even through meter apertures. The r.f. output is then fed to the aerial, or aerial matching unit, through a screened co-axial line via a multiple-section low-pass filter designed to attenuate the unwanted output above 30 Mc/s. Outstanding work in connection with the cure of amateur TVI has been carried out by a number of amateur investigators here and in the U.S.A., but the problem still remains a serious one in crowded districts where the distance between an amateur transmitting and the nearest television receiving aerial may be only a few feet.

Modulation Systems.—The desire to eliminate costly high-power modulation equipment is reflected in the development of narrow-band frequency-modulation using simple reactance modulation circuits. N.b.f.m. transmitters are designed to operate with a maximum deviation of the order of 2.5 to 3 kc/s and thus occupy no more ether-space than a conventional a.m. transmitter. Another advantage that the system possesses over normal f.m. systems, where the deviation is often of the order of 75 kc/s, is that n.b.f.m. transmissions can be received satisfactorily on an a.m. receiver simply by tuning to one side of the carrier frequency. In the U.K. the terms of the amateur licence prohibit the use of n.b.f.m. on frequencies below 28 Mc/s, but elsewhere the system, which is particularly suitable for mobile work, is proving effective on frequencies down to 3.5 Mc/s. For similar reasons, interest has also been shown in "Taylor super modulation" a high-efficiency grid-modulation (a.m.) system in which a low-power audio-frequency amplifier is arranged to trigger a Class C power amplifier and also a heavily biased "positive modulator" valve. With r.f. drive only applied, the p.m. valve remains in the cut-off condition, but on applying an audio signal this valve releases additional r.f. power into the common tank circuit during positive half-cycles; see Fig. 3.

While the average input power of the British amateur is now probably about 80 watts, considerable interest has been maintained in "flea-power" transmission. For example, during the 1949 R.S.G.B. low-power contest, Mr. T. F. Herdson (G6ZN), of Horbury, Yorkshire, made 116 contacts in 24 hours using a simple 3.5-Mc/s Hartley oscillator and one 90 V h.t. battery giving an input between $\frac{1}{4}$ and $\frac{1}{2}$ watt. Similarly, the 200 or more stations taking part each year in the R.S.G.B. national field day are limited to a power input of 5 watts, yet long-distance contacts are regularly achieved. Such results, however, probably depend more upon operating skill than upon the use of any new techniques. Most pronounced feature of medium-power transmitters has been the popularity of beam tetrode valves, particularly the type 807 and its equivalents, which are widely used as frequency doubler, buffer amplifier and single-ended or push-pull power amplifier.

Another feature of post-war amateur technique has been the development of rotary beam aerials for long-distance transmission and for v.h.f. applications; although even to-day such structures—for the h.f. bands at least—are less common in this country than overseas, owing partly to the cost of suitable materials and partly to the restrictions imposed under local by-laws and the Town and Country Planning Act. Two- or three-element beams for 28 Mc/s, and more rarely for 14 Mc/s, give reasonably sharp horizontal lobes and low vertical angle radiation. These beams generally use Yagi-type arrays and can be swung so as to radiate signals in any desired direction, often being controlled from the normal operating position by a mechanical or selsyn-type device to indicate the direction in which the beam is pointing at any given moment. Rotating aerials of this type have few equivalents in commercial practice.

Similarly, the influence of the amateur as an operator/technician can be seen in the electronic keyer, also primarily an amateur development. Unlike the better-known "bug" key, the electronic keyer automatically controls the length of the dashes as well as the dots and, in some models, the interval between each symbol. The main drawback to these ingenious devices is the amount of practice required in order to become proficient in their use, but the "tape-like" character formation which is eventually possible has encouraged their adoption by amateurs seeking to raise the standard of manual telegraphy operation.

V.h.f. Developments.—Perhaps no aspect of post-war amateur activity has attracted so much attention in non-amateur circles as the results achieved on v.h.f. To the professional communications engineer, accustomed to regarding propagation at these frequencies as being limited to little more than "line of sight," the transatlantic contacts on 50 Mc/s during the sun-spot peak of 1947-48, the 1,200-mile contact in the United States and 520-mile contact between a West Country station (G2BMZ) and Germany from fixed locations on 144 Mc/s, and the 161-mile contacts on 420 Mc/s all represent interesting examples of "freak" conditions. But the amateur has also demonstrated that low-power 144-Mc/s transmissions can be received over distances greater than 100 miles with a regularity far exceeding that which would have been thought possible only a few years ago. To what extent have such results been attained by the use of unorthodox or new techniques?

It should be emphasized that, generally speaking, the amateur is restricted to the use of standard commercial types of valve in the lower-price range and the by-no-means-new e.h.f. types available as "surplus," a factor of increasing importance as frequencies are raised. Similarly, the workshop facilities required for the construction of e.h.f. "plumbing" are possessed by few experimenters. Yet it is interesting to note that whereas on the h.f. bands the British amateur tends to look to his fellow enthusiasts in the United States for many of his new developments, this is far less true of the v.h.f. and e.h.f. bands on which results in this country compare most favourably with those achieved elsewhere.

The amateur v.h.f. receiver, unlike most commercial equivalents, is required to tune over at least part of any particular band without losing the degree of stability normally associated at these frequencies only with crystal-controlled local oscillators. Much attention has accordingly been paid to the development of stable oscillator-tripler stages with the fundamental circuit on about 50 Mc/s; and also to tunable intermediate-frequency stages for use in conjunction with c.c. (crystal-controlled) oscillators

The well-equipped amateur radio station at the Uxbridge Festival of Britain Industrial Exhibition. A QSL card of appropriate design giving the station's call sign, G2FMF/A, is used to acknowledge the exchange of signals.

though it should be mentioned that the elimination of spurious responses has proved extremely difficult where a wide-coverage receiver is required. Another interesting development is the occasional use of panoramic reception, whereby the state of activity over all or part of a band is displayed on the screen of a cathode-ray tube by means of an f.m. oscillator.

The paramount importance of the first r.f. stage has encouraged the use of neutralized push-pull twin-triode valves such as the 6J6 or EC91 and also the currently popular Wallman cascode circuit (Fig. 4) which comprises a neutralized grounded-cathode triode followed by a grounded-grid triode, the usual combination for 144 Mc/s being a triode-connected 6AK5 and a half-section of a 6J6, EC91 or 12AT7. A few amateurs, by using noise-generator techniques, have been able to make systematic measurements of the sensitivity of their v.h.f. receivers, though the practical application of the noise generator on 144 Mc/s and above has not proved easy. On 420 Mc/s, crystal diode mixers, sometimes with crystal-controlled injection and "lighthouse" r.f. amplifying stages, have rapidly replaced the super-regenerative circuits favoured when the band was first released in 1948. The introduction of the 12AT7 and similar commercial valves is now permitting a less specialized approach to be made to this band.

For v.h.f. transmitting, commercial practice has been followed in the wide use of such valves as the 832, though at 420 Mc/s the output from this type is very limited and the "life" uncertain. Efficiency of power amplifiers in this band is being steadily improved as new valve types become available, and the South London U.H.F. Group have demonstrated an amplifier capable of an efficiency of about 60 per cent at 25 watts input. On both 144 and 420 Mc/s, multi-stage stabilized transmitters with a fundamental crystal frequency of about 8 Mc/s are now used by most amateurs working in these bands. Some interest is also being shown in the possible use of overtone crystal oscillator circuits with an ouput at about 72 Mc/s as a means of eliminating a number of frequency-doubling stages.

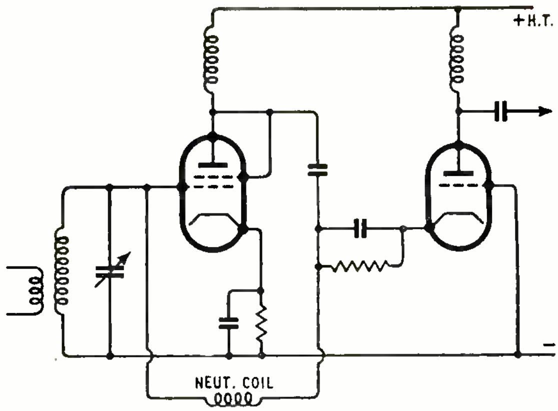


Fig. 4. The Wallman cascode r.f. amplifier, popular on the 144-Mc/s band.

Yagi and stacked-array aerials are equally popular, though the wider horizontal coverage of the stacked-array is proving increasingly useful in bands where the limited amount of activity makes searching for pencil-beam signals as much a trial of patience as of equipment.

SOURCES OF INTERFERENCE

INEFFICIENT aerial-earth systems are, according to figures published in the Post Office *Telecommunications Journal*, by far the biggest individual cause of interference with sound broadcasting; but in the case of television the main individual cause is electric sewing machines. In both sound and television, however, faulty receivers hold second place.

In an endeavour, therefore, to reduce the ever-growing number of calls made on the Post Office Interference Investigation Service, a new pamphlet has been issued giving simple tests which can be made by listeners and viewers to ascertain whether or not the trouble is in the installation. "Good Wireless and Television Reception," as it is called, includes a form for enlisting the services of Investigation Officers if the cause of interference appears to be outside the control of the set owner.

In the appended table the most frequent sources of interference are given as percentages of the cases investigated.

	SOUND Complaints	%	TELEVISION Complaints	%
Unknown; interference not observed by P.O. staff	18,018	23.8	7,068	29.2
Inefficient aerial/earth systems	15,246	20.1	947	3.9
Faulty receivers	9,507	12.5	1,972	8.2
Faulty wiring of buildings	5,029	6.6	234	0.9
Refrigerators	2,255	3.0	331	1.4
Fluorescent tubes	1,787	2.4	—	—
Radiation from receiver time-base circuits	1,725	2.3	—	—
Radio transmitters	1,469	2.0	1,007	4.2
Bedwarmers	1,423	1.9	—	—
Motors, misc.	1,334	1.8	315	1.3
Sewing machines	1,162	1.5	2,374	9.8
Overhead power lines	900	1.2	632	2.6
Drills	791	1.0	221	0.8
Radiation from radio receivers i.fs.	622	0.8	156	0.6
Misoperation of receivers	539	0.7	204	0.8
Thermostats, misc.	539	0.7	184	0.7
Smoothing irons	528	0.7	—	—
Vacuum cleaners	527	0.7	257	0.9
Neon sign tubes	503	0.7	192	0.8
Underground mains	492	0.6	—	—
External cross modulation	414	0.5	—	—
Fans	391	0.5	521	2.1
Calculating machines	353	0.5	150	0.6
Hairdryers	292	0.4	697	2.9
Motor car ignition	—	—	1,096	4.5
Medical apparatus (valve-operated)	—	—	306	1.2
Filament-type lamps	—	—	305	1.2

Dimensions

A Useful Check on Formulae and Calculations

By "CATHODE RAY"

IF you indulge occasionally in bouts of algebra, do you find, as I do, how distressingly easy it is to miss out a "squared" sign somewhere, or accidentally turn a " × " into a " +," or misplace a bracket? If one eventually spots the mistake, it may not be soon enough to avoid wasting a lot of time and effort; and if one doesn't . . . !

It may not be known to everyone who works about with formulæ how helpful it is to keep an eye on their "dimensions." You derive a formula for the impedance of a particular kind of circuit, shall we say, with the idea of finding out how it varies with frequency. If you have made a slip anywhere in the algebra the odds are considerably in favour of it affecting the dimensions of the equation; and (when you know how) it takes only a few moments to check that. Not every error can be detected by this test, but a worth-while proportion can. Quite apart from fault-finding, attention to dimensions is a more intelligent attitude to formulæ than mere blind substitution of figures.

The basic principle is that one can't add or subtract or equate things that are of different kinds or "dimensions," such as hours and miles, or square yards and gallons. But the quantities of them can be multiplied or divided, giving a quantity with different dimensions from either. A mile is a measure or unit of distance or length, and an hour a unit of time. Adding 100 miles to 4 hours is nonsense, but the number of miles can be divided by the number of hours, giving a quantity 25 of a unit of speed—the mile-per-hour. The dimensions of speed are length divided by time. Mere numbers, like the 25 in this case, can be ignored, because they have no dimensions in themselves and are there merely to fit in with the particular units chosen. The 25 would become some other number if one worked in cms/sec instead of miles/hour.

So if the upshot of some mathematical manipulation were a formula such as

$$v = \sqrt{25d + \frac{1}{t^2}}$$

where v was the speed (or velocity) of something or other and d and t were a distance and a time respectively, you would know straight off that it was wrong. Velocity is neither the square root of distance nor the reciprocal of time.

So far as dimensions are concerned, width, breadth, distance, height, circumference, diameter, perimeter, etc., are all the same—length. If any two lengths are multiplied together the product is a quantity whose dimensions are length-squared, or area. And the product of three lengths is length-cubed or volume. So if you were to read that the volume of a sphere was $4/3\ \pi r^2$ (r being the symbol for radius, which is a length) you would know for certain that it was wrong, and would probably suspect (quite rightly) that the ^{2} was a misprint for ^{3}. (π, being the ratio of two lengths, is a mere dimensionless number.)

I have brought length in rather prominently at the start, because it is one of the recognized fundamental dimensions. It would be difficult to think of any more fundamental quantity in which to express length. One could, of course, say that it is velocity multiplied by time, but that would hardly be helpful seeing that velocity is itself derived from length and time. In fact almost all the multitudinous physical quantities, except electrical and magnetic, can be expressed in terms of three fundamental dimensions: length, time, and mass. That is why systems of units are named by three letters, such as c.g.s. (meaning the centimetre-gramme-second system) and m.k.s. (metre-kilogramme-second). We have already noted the simple example of velocity or speed, which is length/time.

To avoid confusion with other meanings of symbols, the dimensions of quantities are written in square brackets: $[L]$* for length; [T] for time; [M] for mass. The "dimensional equation" for velocity would therefore be

$$[v] = \frac{[L]}{[\mathrm{T}]}$$

but it is usually written

$$[v] = [L\mathrm{T}^{-1}]$$

using the conventional alternative method of indicating division, by a negative "index." All mechanical quantities can be expressed by "powers" of length, time, and mass. L is of course L^1, or the first power of L. And any quantity to the power 0 is 1, which is unit quantity with no dimension—a mere numeral. And if we remember the rules about powers or indices—to multiply, add them; to divide, subtract—then dimensional equations are simple. There should be no difficulty about this one:

$$[\mathrm{A}] = [L^2]$$

where A stands for area. For volume we shall use another italic letter to distinguish from voltage:

$$[V] = [L^3]$$

If we come across a volume divided by an area we could therefore write

$$\frac{[L^3]}{[L^2]} \text{ or } [L^3\, L^{-2}] = [L]$$

Acceleration is change of velocity per unit time, so its dimensions are $[v]/[\mathrm{T}]$ or $[L\mathrm{T}^{-2}]$; force is equal to the acceleration imparted to unit mass, so dimensionally is $[L\mathrm{T}^{-2}\mathrm{M}]$; and so on. The dimensions of any mechanical quantity can be expressed by three numbers—the powers of L, T and M; in this case, 1, − 2, 1.

But it is about time we got on to electrical quantities, before this subject begins to look more difficult than it really is. In most cases it is remarkably easy, because there is no need to analyse right down to

* I have taken the liberty of using an italic letter for length, to distinguish it from inductance (L) which we shall be using later.

basic dimensions. A large proportion of the equations likely to be seen in *Wireless World* concern impedances. All impedances can be reckoned in ohms and therefore have the same dimensions. (That is, if one is concerned only with magnitude and not with the more subtle distinction of phase. It is possible, if necessary, to maintain the distinction between resistance and reactance by writing the dimensions of inductive reactance as $[jR]$ and capacitive reactance as $[-jR]$; but the examples to follow will take account of magnitudes only.)

There are some very commonly used formulæ for finding the parallel reactance and resistance equivalent to a given series combination, and *vice versa*. In this example

$$R_s = \frac{R_p X_p}{R_p^2 + X_p^2}$$

where the symbols are too obvious to need a key, I either have or have not introduced a deliberate mistake. Perhaps you would like to say which, without looking it up in a book. By using the dimensions idea one can tell at a glance. Writing it out in full dimensional equations:

$$[R] = \frac{[R^2]}{[R^2]} = [R^0]$$

which is absurd. One might guess that a ^{2} has dropped out of the numerator; actually it should be $R_p X_p^2$.

Notice that in this simple example it was unnecessary to break down any of the quantities into more fundamental dimensions, because they were all the same at the beginning, so one had only to compare the indices on each side of the equation.

In calculating complicated circuits the algebra spreads over the paper in an alarming way, and it is very easy to make a slip when multiplying out the factors and adding similar terms. Suppose you had been dealing with Fig. 1 in this way and had arrived at the following:

$$Z = \frac{R_1 R_2 (R_1 + R_2) + R_1 X_2 + R_2 X_1}{(R_1 + R_2)^2 + (X_1 + X_2)^2} + j\frac{R_1^2 X_2 + R_2^2 X_1 + X_1 X_2 (X_1 + X_2)}{(R_1 + R_2)^2 + (X_1 + X_2)^2}$$

A slip in such an effort would be excusable, so to go and use the formula straight away without looking it over would be inexcusable. Since all the denominator terms are resistance (or reactance) squared, the numerator terms must all be cubed. Most of them are, but two culprits immediately stand out—$R_1 X_2$ and $R_2 X_1$. Again, a ^{2} must have dropped out from each. Assuming that in other respects the equation is correct, we can make a shrewd guess at whether it is the R or X that ought to be squared. For the circuit is quite symmetrical, and so are the resistance and reactance halves of the formula; the numerator terms in the resistance half are the same as those in the reactance (j) half except that R and X are interchanged. So as it is the R's that are squared on the reactance side we would expect the X's to be squared on the resistance side. And that, in fact, is correct; the resistance numerator should be $R_1 R_2 (R_1 + R_2) + R_1 X_2^2 + R_2 X_1^2$.

A very familiar equation is the one relating the resonant frequency (f_r) of a tuned circuit with the inductance (L) and capacitance (C):

$$f_r = \frac{1}{2\pi\sqrt{LC}}$$

Here there is no difficulty about frequency; it is a

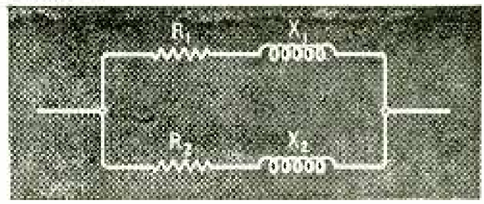


Fig. 1. Although this circuit looks fairly simple, the formula for its impedance is quite impressive and deserves to be checked by "dimensions."

number (of cycles) divided by a time (usually one second), so it is the reciprocal of time, and its dimensional equation is therefore

$$[f] = [T^{-1}]$$

But we have at the moment no clue to the dimensions of L and C, except that we know that when multiplied by frequency they are related to one another by their common relationship to reactance. But that fact doesn't get us any farther, because it is the one from which our equation was derived (by the act of making the inductive and capacitive reactances equal and defining f_r as the frequency that makes them so).

We might try another approach by looking up the formulæ for capacitance and inductance. Here is a well-known one for the capacitance between parallel plates:

$$C = \frac{0.0885AN}{t} \qquad \text{in pF}$$

where A is the area of each plate in sq. cms., N the number of spaces between plates, and t the thickness of each spacing in cms. N being just a number it can be ignored dimensionally, and so presumably can 0.0885; [A] is $[L^2]$ and $[t]$ is $[L]$, so

$$[C] = [L]$$

Or so it seems. And here is one of the many inductance formulæ:

$$L = \frac{0.00987\, d^2 N^2 K}{l} \qquad \text{in } \mu H$$

where d is the diameter of the coil in cms, N the number of turns, l the length of the coil, and K is "Nagaoka's constant." Inquiry shows that K is just a number, so all we are left with is d^2/l, which is a length, so we have

$$[L] = [L]$$

If you happen to know that at one time it was quite usual for both capacitance and inductance to be reckoned in centimetres, you may be satisfied with the above two results. But if you are so relentless as to go back to the frequency formula and incorporate these new findings, the outcome will not be quite so happy:

$$[f] = [T^{-1}] = [L^{-\frac{1}{2}}][C^{-\frac{1}{2}}] = [L^{-\frac{1}{2}}][L^{-\frac{1}{2}}] = [L^{-1}]$$

Therefore $[T] = [L]$

or time equals length. If that were true it would make things very much simpler—or would it? Anyway if it is, I'm a brass monkey and you are—anything you don't like—and it doesn't matter, because all science is nonsense. So on the whole it may perhaps be better to look over our capacitance and inductance formulæ and see if we've forgotten anything. If we had looked up the more painstaking kind of reference book we might have found them complicated by the factor μ for inductance and κ for capacitance—permeability and permittivity respectively. The only excuse for omitting them is that it was supposed to be understood that the formulæ concerned air-cored coils and air-dielectric condensers, and that with the particular units employed the values of μ and κ are then both 1 so can be left out. But they must not be forgotten altogether—when considering dimensions, anyway. Presumably the absurdity about length being time would be put right if the dimensions of μ and κ were included. What are their dimensions ?

If I could give you the right answer to that I would at once become a sensation, because scientists have long wanted to know. The best that can be done is to work back from the frequency formula, putting $[C] = [L\kappa]$ and $[L] = [L\mu]$:

$$[f] = [T^{-1}] = [L\kappa]^{-\frac{1}{2}}\,[L\mu]^{-\frac{1}{2}}$$

$$\text{So } [T] = [L]\,[\kappa\mu]^{\frac{1}{2}}$$

$$[\kappa\mu]^{\frac{1}{2}} = [TL^{-1}]$$

Time divided by distance is a quantity that could perhaps be named " slowness of movement," but its reciprocal is more commonly used—speed or velocity. So turning both sides of the equation upside down we get

$$[\kappa\mu]^{-\frac{1}{2}} = [LT^{-1}] = [v]$$

Any healthily inquisitive person would now ask " What velocity ? " and this time the answer *is* available, and a very interesting one it is too—the velocity of electromagnetic waves through a medium having permittivity κ and permeability μ. But, you may say, there must be something wrong about this ; κ and μ for air are both 1, and the speed of light through air is rather more than 1 cm. per sec ! But this is forgetting the little matter of units. Our capacitance and inductance formulæ were for pF and μH, not F and H ; and there were numerical constants beside. If you insist on κ and μ being 1 without any constants being brought in, then you will have to accept 186,282 miles as the unit of length ! Since you will probably find that more than a trifle inconvenient (imagine reckoning the flux density in a loudspeaker gap in lines per 34,701,000,000 square miles !) you will probably be glad to accept the numerical constants in the formulæ already quoted, because when the convenient sub-units (pF and μH) are used these constants are not absurdly large or small. If, however, you are prepared to suffer some numerical inconvenience—within reason, of course—for the sake of principle, then you might go for the alternative, the m.k.s. system, in which the units are the metre, the farad and the henry ; and to make everything right the values of κ and μ for empty space (which are denoted by κ_0 and μ_0) must be very nearly $1/(36\pi \times 10^9)$ and $4\pi/10^7$ respectively. They could be given other values within this framework, so long as $1/\sqrt{\kappa_0\,\mu_0}$ was equal to 299,790,000 metres per sec. or whatever the true velocity of light may be. You see, nobody knows the actual separate values of κ_0 and μ_0, or their dimensions ; all we know is the value and dimensions of their product, $\kappa_0\,\mu_0$. It is as if we knew the voltage across a given resistor but had no means of finding either its resistance or the current through it. We would know IR without knowing either I or R.

All this about κ_0 and μ_0 may seem rather academic and in the air (or perhaps, more appropriately, in space !), but it is an issue that cannot be dodged if one is to tackle electrical and magnetic dimensions, because every one of them involves κ_0. or μ_0. One of the dangers, in fact, of " practical " formulæ is that by making these factors equal to 1 they can be left out and are liable to be forgotten.

Since we don't know their dimensions separately we are stuck. The only way out is to conceal our ignorance by introducing a fourth fundamental dimension to supplement *L*, T and M. This fourth dimension is still a matter of controversy. Officially it is μ. But for some purposes it is more convenient to use electrical charge Q ; unit, the coulomb. Another alternative quartet that has been proposed is : *L*, T, I, V, leaving mass out. Each different selection of the fundamental four means a different list of dimensions for all the electric and magnetic quantities. If only we knew the dimensions of either κ_0 or μ_0, all this uncertainty would be avoided. If, as might well be, κ_0 and μ_0 are expressible in terms of *L*, T and M, there would be no need at all for a fourth fundamental dimension.

But since in order to go any further it is necessary to make some sort of a choice, I will follow a number of authorities in taking Q (quantity of electric charge, not tuned circuit " goodness " factor), and on this basis here are the dimensions of the main electromagnetic quantities.

Quantity	Symbol	*L*	T	*M*	Q
Capacitance ..	C	− 2	2	− 1	2
Current	I	0	− 1	0	1
Electric Charge ..	Q	0	0	0	1
Electric field strength ..	ϵ	1	− 2	1	− 1
Frequency ..	f	0	− 1	0	0
Inductance ..	L	2	0	1	− 2
Magnetic field strength ..	H	− 1	− 1	0	1
Magnetic flux ..	Φ	2	− 1	1	− 1
Magnetic Flux density ..	B	0	− 1	1	− 1
Magnetomotive force	F	0	− 1	0	1
Permeability ..	μ	1	0	1	− 2
Permittivity ..	κ	− 3	2	− 1	2
Power	P	2	− 3	1	0
Reluctance ..	S	− 2	0	− 1	2
Resistance (also reactance and impedance) ..	R	2	− 1	1	− 2
Voltage or e.m.f.	V, E	2	− 2	1	− 1

Although this table is not exhaustive, it includes the quantities most commonly used in practice—enough to provide plenty of practice for a start. Here is a very simple example—the time constant of a resistance-capacitance combination, which as you probably know is RC. To get the dimensions of this product, you *add* the index numbers for R and C. Under *L*, C is − 2 and R is + 2, so that goes out. T is + 2 and − 1, so that goes in, to the first power. M and Q both go out, so the result is [RC] = [T], which is obviously correct for a time constant. Now suppose you know that an inductive circuit, consisting of L and R, also has a time constant, but you don't know the formula. You could arrive at it by using the table. Try it.

Next consider another simple and well-known formula :

$$\lambda = \frac{3 \times 10^8}{f}$$

λ being wavelength and f frequency. $[\lambda]$ is, of course, $= [L]$, and $[f] = [T^{-1}]$. So it looks as if we are back at our old absurdity $[L] = [T]$. But having been caught once in this sort of trap we are too wise to buy it again, especially as 3×10^8 is easily recognizable as the approximate velocity of light in space. Putting in its dimensions makes everything right. By now it ought to be clear that one must be on guard against concealed dimensions—hidden under some numerical " constant " which is really a dimensioned quantity with a particular value written in. And in this connection, the speed of light or radio waves in space is such an important constant scientifically that it is sometimes forgotten that in air it is slightly less and in paraffin wax or polythene or other solid or liquid dielectric it is a good deal less, because it depends on the value of κ. So the wavelength for a given frequency depends on where the waves are travelling.

Here is another example :

$$Z_0 = \sqrt{\frac{L}{C}} \sqrt{1 - \frac{\omega^2 LC}{4}}$$

If this is to be correct, then ω^2 LC must be dimensionless, because it is to be added to 1. And as the whole second factor under the root sign would then be dimensionless, $\sqrt{(L/C)}$ must have the same dimensions as Z_0, which presumably is an impedance. (Actually it is the characteristic impedance of a simple low-pass T filter section.) As to the first point, ωL is a reactance, and so is $1/\omega C$, so ω^2 LC is a reactance divided by a reactance and is, therefore, dimensionless. The second point could be checked in a similar way, but let us use the table. We first subtract the C index numbers from the L numbers (because L is divided by C) and then halve the result (to give effect to the square-root sign).

	L	T	M	Q
L	2	0	1	−2
C	−2	2	−1	2
L/C	4	−2	2	−4
$\sqrt{(L/C)}$	2	−1	1	−2

As you see, the last line is the same as for resistance, impedance, etc. If you would like another example or two to check, here is the formula for the frequency at which a Wien-bridge type of oscillator oscillates:

$$f_0 = \frac{1}{2\pi\sqrt{R_1 R_2 C_1 C_2}}.$$

And if you want something to get your teeth into, here is one from p. 410 of the November, 1950, issue (No ! Not guilty this time !) :

$$\frac{\dfrac{2\,\omega\,C\,R}{\omega^2 C^2 R^2 - 1} + \dfrac{2\,\omega\,C_1 R_1}{\omega^2 C_1{}^2 R_1{}^2 - 1}}{1 - \left(\dfrac{2\omega\,C\,R}{\omega^2 C^2 R^2 - 1} \cdot \dfrac{2\,\omega\,C_1 R_1}{\omega^2 C_1{}^2 R_1{}^2 - 1}\right)} = 0$$

Actually it is nothing like so hard as it looks, and anybody who has had some practice with the kind I have just worked out should be able to O.K. it almost at a glance.

The next one will send you back to the table, and to make it a little more interesting I have introduced a deliberate mistake—a superfluous ^{2}. Can you work out which one it is ?

$$C = \frac{L^2 I^2}{V^2{}_{HT}} \left(\frac{V_{HT}/V_M}{1 + V_{HT}/V_M}\right)^2$$

The correct version is on p. 314 of the September, 1950, issue, but to save you the trouble of looking it up I will give the answer at the end.

Lastly, here is a formula for the effective height (in metres) at f kc/s of a rectangular frame aerial having N turns H metres high and W metres wide. The question is, does the 300,000 conceal any dimensions, and if so what ?

$$2NH \sin\left(\frac{\pi f W}{300{,}000}\right)$$

In case the " sin " bothers you, I may explain that it must be the sine of an angle, and an angle is equal to the ratio of two lengths.

Apart from its value for checking, study of dimensions gives one a more intelligent interest in the formulæ one encounters, and often enables one, by grouping the symbols according to the dimensions, to extract a useful meaning from a new algebraical result.

And with that little summary of the matter, it only remains for me to say that the 300,000 in the last example must have the dimensions of a velocity, as you might have guessed from the number—though you might possibly have been put off by the absence of the other 000, which cancels out because f is in *kilo*cycles per second. And the intrusive ^{2} in the previous example is the one attached to L.

New Unit of Sensitivity ?

THE great pioneers of electricity are immortalized in the names of the standard electrical units. Why should the equally great pioneers of radio be denied a similar honour? There are plenty of radio units now awkwardly expressed in electrical terms that deserve decent names of their own.

The thought is brought to mind by a recent leading article in our French contemporary *Toute la Radio.* It points out that the present expression for receiver sensitivity—so many microvolts to give standard output—is unfortunate and misleading because the greater the sensitivity the lower is the figure for expressing it. A way to improve matters, it says, would be to turn the figure into millivolts and give its reciprocal; thus a sensitivity of 20μV would become 50 and a sensitivity of 50μV (which is lower) would become 20. For the name of the proposed unit, the article suggests the French pioneer General Gustave Ferrié. He was head of the French military wireless service, which he started in 1900, but is remembered chiefly as the designer of the famous Eiffel Tower station. He did a good deal of original research and was associated with Marconi in some of the early cross-Channel experiments. Britain honoured him with a doctorate of science of Oxford University and he was a vice-president of the old Wireless Society of London, now the R.S.G.B.

General Gustave Ferrié 1868—1932

So which do you prefer, a sensitivity of 25 microvolts or 40 ferriés?

CORRECTION

The Haynes e.h.t. unit illustrated on page 393 in the October issue is not oil-immersed as stated, but it is housed in a metal container.

Holme Moss Television Station

B.B.C's Third Transmitter Opens

THE new transmitter is situated some eight miles south of Huddersfield on the moor 1,750ft above sea level. The aerial, which is supported by a 750-ft mast, comprises two tiers of four folded dipoles to give all-round coverage. The radiation pattern is restricted in the vertical plane and by this restriction a horizontal gain of 4db is obtained.

The vision transmitter has a power output of 45kW corresponding to peak white and is claimed to be the most powerful television transmitter in the world. The figure of 45kW does not include the aerial gain; if this were added in accordance with American practice, the station would be classed as one of 110kW. The frequency is 51.75Mc/s and the radiated sidebands lie below the carrier frequency.

The accompanying sound transmitter has a carrier power of 12kW and operates on 48.25Mc/s. The outputs of the two are combined in the transmitter building and fed to the aerials via a 5-in diameter coaxial cable having an impedance of 51.5Ω. This is fitted with expansion joints every 150ft and is blown to prevent condensation.

The combining unit is made of coaxial resonant sections arranged in the form of a balanced bridge so that substantially the whole of the output of each transmitter is fed to the aerial and very little indeed into the other transmitter. The loss in the resistance load on the bridge is only 300W.

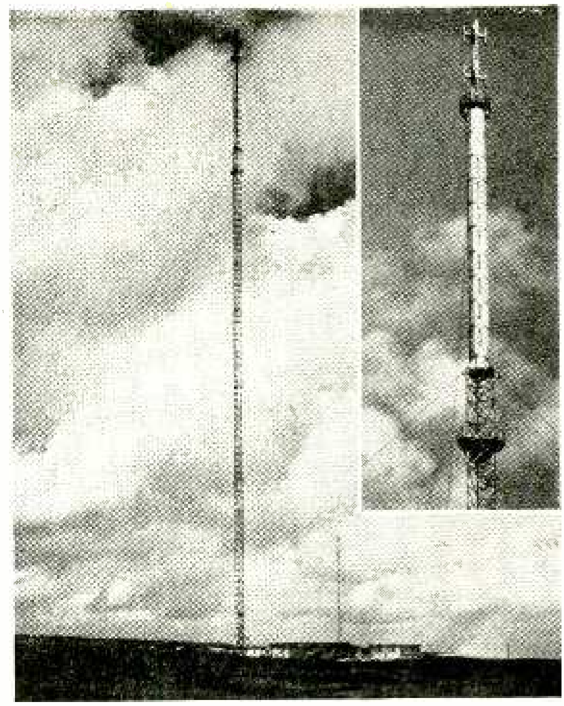
The vision transmitter starts off with a crystal-controlled drive unit operating at one-sixth carrier frequency. Following stages multiply the frequency and amplify it. The power stages comprise a push-pull class C air-cooled triode stage which drives a push-pull cathode-follower stage. In its turn this drives the output stage, which is grid-modulated, and uses water-cooled triodes in push-pull.

On the video side the incoming signal is amplified and the picture-sync pulse ratio is adjusted to 7/3. In the sub-modulator and modulator stages shunt-regulated amplifiers are used. The one in the modulator stage has an initial shunt-regulated amplifier with two ACM3 valves followed by a shunt-regulated cathode follower. This modulator has an output impedance of only 5Ω and is capable of dealing with the varying grid current of the r.f. stage. This varies from zero to 3A and has a shunt capacitance of 400pF!

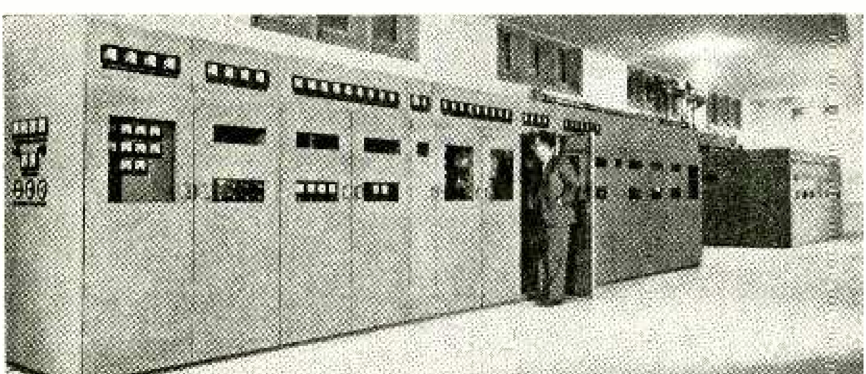
The shunt-regulated amplifier is one in which the valve concerned has another valve as its load, this load valve being driven also by a signal derived from the first. In the cathode-follower version, the second valve forms the cathode load of the first and its grid is driven from the voltage developed across a resistance in the anode of the first one. The principles involved have already been described[1], and result in an extremely-low output impedance being obtained and a correspondingly great bandwidth.

The vision signal is taken to Holme Moss from London via Birmingham by standard coaxial cable of

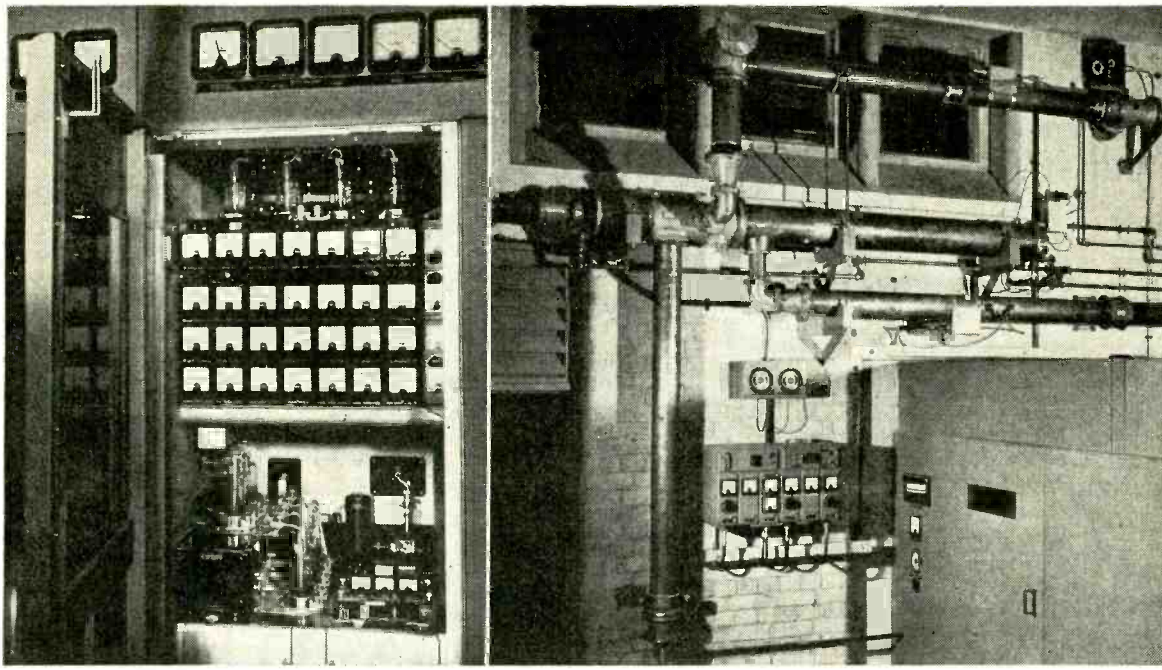
[1] "Shunt-Regulated Amplifiers,' by V. J. Cooper, *Wireless Engineer*, May, 1951, p. 132.



Above: A view of the 750-ft mast of the Holme Moss transmitter showing the station buildings and the stand-by mast. The detail of the television folded-dipole aerials and the v.h.f. slot aerial appears inset



Left: The 45-kW vision transmitter (left) and the 12-kW sound transmitter (right)



(Left). The final stage of the vision modulator showing also the meter panel. (Right). The sound and vision signal combining unit. Here the signals from the two transmitters are mixed before being passed to the aerial

the type being laid throughout Europe for communication circuits. The cable actually contains six $\frac{3}{8}$-in coaxial tubes, 16 paper-insulated quads for control circuits and 172 quads for local telephone traffic. Two only of the coaxial tubes are available for television, the remainder being used for multi-channel telephone circuits. The signal is shifted in frequency and occupies the band 0.5–4.5Mc/s; special repeaters are used and, since harmonics of the carrier frequency lie within the pass-band, the repeaters are designed to keep second-harmonic production at least 75db below the fundamental.

At the station the signal is frequency-changed in two steps back to the video form, the change in two steps being necessary to avoid the production of interfering freqnencies.

For the future station at Kirk O'Shotts, the signal is to be conveyed by a radio link from Manchester, so that the present Manchester–Holme Moss cable will then form a spur off the main channel.

The cable, repeaters and terminal equipment have been installed and are operated and maintained by the Post Office. The transmitters, both sound and vision, have been supplied by Marconi's W.T. Company and are operated by the B.B.C.

On account of the exposed nature of the site, the building is of the cavity-wall type with double windows and is well heated. Since winter may at times isolate it, stocks of food and bedding are held in case the staff are unable to leave the station.

In addition to the main transmitters and aerial, a complete low-power transmitter (5kW vision, 2kW sound), and a second aerial system on a 150-ft mast, have been installed for emergency use. The main transmitters can be used on the emergency aerial, but with power restricted to 20kW.

NEWS FROM THE CLUBS

Birmingham.—The annual general meeting of the Slade Radio Society will be held on November 23rd. At the meeting on December 7th G. P Thwaites, of Standard Telephones & Cables, will talk on the manufacture of cathode-ray tubes. Meetings are held on alternate Fridays at 7.45 in the Parochial Hall, Broomfield Road, Erdington. Sec.: C. N. Smart, 110, Woolmore Road, Birmingham, 23.

Cleckheaton.—"The History of the R.S.G.B." is the subject of the talk by C. Sharp, G6KU, at the November 7th meeting of the Spen Valley Radio & Television Society. Films provided by the Yorkshire Electricity Board will be shown at the meeting on November 21st. Meetings are held on alternate Wednesdays at 7.30 at the Temperance Hall, Cleckheaton. Sec.: N Pride, 100, Raikes Lane, Birstall, nr. Leeds.

Kingston.—An exhibition has been organized by the Kingston & District Amateur Radio Society in aid of the United Appeal for the Blind. It will be held from 2 to 10 p.m. on November 10th at the club's headquarters, Penrhyn House, Penrhyn Road, Kingston-on-Thames, and exhibits will include the radio-controlled model boat "Miss Eedee," which recently crossed the Channel. A transmitter will be in operation and home-constructed gear will be exhibited. Sec.: R. S. Babbs, 28, Grove Lane, Kingston-on-Thames, Surrey.

Leicester.—"Ele.trons" is the title of one of the films to be shown to members of the Leicester Radio Society on November 6th at the Club Room, Holly Bush Hotel, Belgrave Gate, Leicester. Sec.: L. Milnthorpe (G2FMO), 3, Winster Drive, Thurmaston, nr. Leicester.

Manchester.—Another club was added a few months ago to those already active in and around the city. The Waterloo Radio Society, as it is called, meets each week at St. Albans School, Barrow Hill Road, Waterloo Road, Cheetham. Sec: J. C. Henderson, 47, Maple Street, Cheetham, Manchester, 8, Lancs.

Manufacturers' Products

New Equipment and Accessories for Radio and Electronics

Tape Recorder Unit

AN endless loop of tape is used in the magnetic recorder mechanism recently put on the market by Phidelity Magnetic Products, Ltd., of 65-66, Chancery Lane, London, W.C.2. This is 600ft long and gives 30 minutes of reproduction at a speed of $3\frac{3}{4}$in per second. A higher running speed is also provided for, and this, with the aid of the footage counter. permits rapid selection of various parts of the loop. By means of contactor strips joined into the tape an automatic stop relay can be operated, so that if the loop is used for a number of short recordings it can be stopped at the end of each. For normal use a single contactor strip serves to identify the start and finish of the loop.

Suitable for building into a complete tape recorder, the unit is light in weight and has the unusually small dimensions of 10in × 6in. It can be supplied with record and erase heads of either low impedance or high impedance.

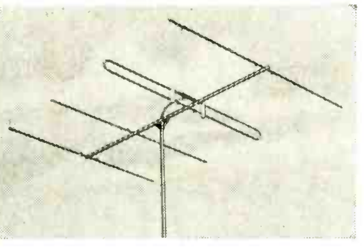
Miniature Earphone

ANYONE who has experienced the discomfort of having his ears flattened against his head for several hours at a stretch will appreciate the advantages of the miniature hearing-aid type of earphone. The ME3 model produced by Bonochord, of 48, Welbeck Street, London, W.1, is an example of what can be done in small size and light weight—it measures $1\frac{3}{16}$in (diam) by $\frac{3}{8}$in (depth) and weighs $\frac{1}{3}$oz. Inside is a radial Alcomax magnet with a Radiometal pole-piece and a polystryrene bobbin wound with nylon-covered wire. For general use (not as a hearing-aid) the diaphragm is made of annealed steel and has an armature of silicon steel in the centre—by varying these the frequency response can be altered within limits. The impedance is 80Ω at 800 c/s and the d.c. resistance of the coil is 42Ω. Maximum power admissible is 25 milliwatts.

Electrical connection is made through spring contacts which retain the plug with a definite click-action.

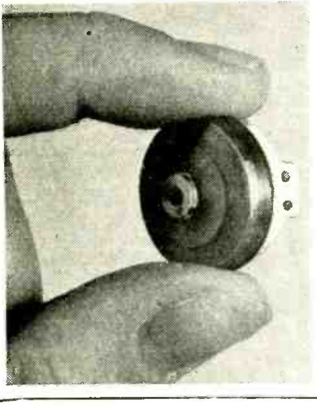
Amateur Beam Aerial

DESIGNED for use on the 2-metre amateur band, the Eddystone beam aerial in the illustration has a bandwidth of 144-146 Mc/s when properly adjusted to the mid-band point. The radiator is a folded dipole formed of two brass tubular U-sections which fit into a centre section permanently fixed to the main boom; the other elements slide into support tubes welded on to the boom at the correct spacings. All elements can be adjusted in length and then locked. Overall gain is 9db and the back-to-front ratio is 20db.



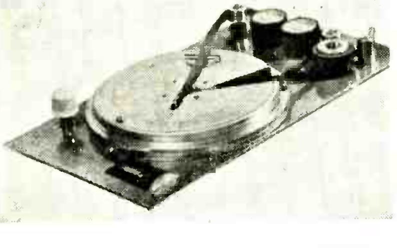
Eddystone amateur beam aerial.

The aerial is constructed of brass and copper and weatherproofed with durable black enamel. Measuring 43in × 42in (maximum) and weighing $2\frac{3}{4}$lb, the array has a low wind resistance and can be mounted on unstayed masts of up to 25ft in height. It is available from the makers, Stratton & Co., Ltd., Alvechurch Road, West Heath, Birmingham 31, at £4 16s 3d.



Bonochord miniature earphone type ME3.

Phidelity tape recorder unit.



RANDOM RADIATIONS

By "DIALLIST"

Simple, My Dear Watson!

A CORRESPONDENT, who tells me that, although he has long been a land-line telegraph operator, he knows nothing of wireless, is puzzled by the performances of a single-valve short-wave receiver which he has rigged up. He is not so much surprised by the fact that he can pick up morse transmissions from most parts of the world as by his ability to change from station to station without tuning. One night he ranged, without touching a thing, from Sweden to Panama, from Italy to Dutch Guiana, from Poland to Brazil, the United States, Holland, Honduras and many other countries. How, he asks, could this be possible? Simple, my dear Watson! Anyone who remembers using a home-made single-valve set in the early days of short-wave transmission and reception could give the answer at once. Just a case of hand capacitance, or body capacitance, to use the alternative name for the same thing. It occurs to me that many of the younger readers of *W.W.* may never have had experience of, or been exasperated by, this interesting effect. If you do your short-wave listening with a modern superhet, it isn't likely to be noticeable; but with a simple single-valve set it is usually very much in evidence.

Hand Capacitance

The tuning of such a set is a very critical business, particularly on faint signals. If large unscreened coils are used (as they were in those days by most of us, and as I gather they are now by my correspondent), capacitance between the body of the operator and the coils—and, for that matter, other parts of the receiver—can have quite remarkable effects on the tuning. A common experience in the old days was to work up some faint signal to reasonable strength by long and patient hairbreadth tuning—and then to lose it (often for good and all!) by a small movement of hand or head. There were not so very many short-wave stations then, so that losing one did not often mean an automatic change to another, as it well might with that kind of set on to-day's crowded wavebands. Those who used early short-wave single-valve receivers will recall the metal screens behind the front panels and the enormously long extension tuning spindles that we fitted in the hope of eliminating the effects of this capacitance. There was an apocryphal tale of an expert who, on being asked by the twentieth beginner in one day "How can I avoid hand-capacity?" (we called it capacity then), replied wearily "Try tuning with your toes, young man."

Television in the States

ON THE DAY on which these notes were written I had a visit from a young friend who had just arrived back by air from a visit to Washington and New York; it was, in fact, less than 36 hours since he had left America. As he is a television enthusiast, we naturally soon found ourselves discussing the comparative merits and demerits of 50-c/s, 405-line, and 60-c/s, 525-line television. He had been greatly impressed by the size of c.r.t. screens in the U.S.A., by the number of programmes available at almost any reasonable hour and by the fact that it seemed to be the normal thing for hotels to be prepared to install a television set in any visitor's room in a matter of minutes, should he desire one and be willing to pay the charge made for the use of it. And, moreover, anyone can have the benefit of television, whether or not he owns a receiver or hires one in his hotel room; for television sets are part of the ordinary equipment of countless shops, bars, restaurants and so on. Television, in a word, is now firmly established as part of the everyday life in the big cities in the U.S.A.

The Technical Aspect

My young friend formed the opinion that the general standard of television there is, from the technical point of view, nowhere near that set by the B.B.C. Note that I write "the general standard". the big transmitting stations, run by important manufacturing concerns, have high technical standards, which are rigidly maintained. But these stations are vastly outnumbered by others, often of very low power to our way of thinking, whose main purpose is to use television as the jam which mitigates the underlying dose of publicity. The quality of the transmissions from these stations was generally speaking not too good; and often it was very poor. Defective linearity was the most frequent shortcoming, but other forms of distortion also occurred in many of the transmissions. His general impressions may be summed up like this: it was pleasant to have such a number of alternative programmes on tap for such a large part of the day, but not so good to find so few genuinely watt-worthy. America is a little ahead of us in the matter of large-picture receivers and naturally a good deal ahead in long-distance relaying; but, taking it all round, our quality standards are higher and better maintained in both transmission and reception. Our 405-line system gives at least as good a "direct" picture as their 525-line, and a much better picture from the majority of O.Bs and relays.

Preferred Values

ONE DAY during a wartime radar course I was being put through a practical test by the chief instructor. "What's the value of that resistor?" he asked, pointing to one of the dozens that could be seen from the back of a stripped receiver. "Somewhere about 50,000 ohms," I replied. "Come, come, I want a less vague answer than that. These radar sets are precision instruments." Being a student of rather senior rank I ventured to say: "Yes, I know; but the value of that particular resistor isn't all that critical. The book says 47,000 ohms, but I'm open to bet that if we take this one out and measure it, it will be some way off that figure." Well, we did take it out and it measured up at 49,250 ohms. It might equally well have shown any value between 42,300 and 51,700 ohms, for it was one of the ± 10 per cent tolerance range. I don't know what happened in the other Services, but in the Army there was a tendency at one time to accept those preferred-value 47s as fundamental truths—and it's quite possible that people were occasionally ploughed for giving "wrong" answers that were actually right. One sometimes finds the same sort of tendency in civil life. After all, 47 . . . *looks* like an exact figure and is therefore apt to be misleading. The purpose underlying the adoption of these preferred values was to enable manufacturers to market colour-coded resistors of *about* 500, 5,000, 50,000 and 500,000 ohms. With a ± 10 per cent or ± 5 per cent tolerance 47 . . . is a convenient middle figure—for manufacturing purposes. It isn't so convenient for other purposes and I would like to see a return in circuit diagrams and so on to the fives and fifties. What do you think?

The Bowl Fire

THE PROBLEM I offered in the September issue was, briefly, this: with various domestic electrical appliances at work in the room, a wireless receiver produced loud interference noises from its loudspeaker. No electrical measuring instruments were available. How (a) could you most quickly determine which, if any, of the appliances at work was guilty? And (b) given that a bowl fire was responsible, what do you think was happening? I warned readers that it was something that I'd never come across before. The quickest way of tracking down the culprit is to switch off the appliances, one at a time. Cutting out the bowl fire brought instant peace. It was switched on again and the noises restarted almost at once. This bowl fire had a screw-in heater element and a small intermittent arc was seen to be occurring at a point near the outer end of the socket between the male and female threads. I had the chance next day of examining the thing before it went off to be repaired. It was connected by a properly wired 3-pin plug to a wall socket. The phase-lead connection was to the central "button" of the heater but the male thread of the heater and the female thread of the socket were coated with the dirt and oxidization of years of happy-go-lucky neglect. Moral: if you've a bowl fire, take out the heater element every so often and give both its thread and that of the socket a clean up with an old piece of fine emery cloth.

Manufacturers' Literature

Message Repeater, a tape equipment for recording and repeating messages over a telephone network, described in a booklet from the Westinghouse Brake & Signal Company, 82, York Way, King's Cross, London, N.1.

Automatic Announcer tape equipment suitable for railway stations, described in another booklet from Westinghouse.

Osram Valve Manual Part 1, including receiving valves, c.r. tubes and electronic devices, available from The General Electric Co., Magnet House, Kingsway, London, W.C.2, at 5s.

"High Definition" television receiver with a 15-in tube, described in a leaflet from Sound Sales, Ltd., West Street, Farnham, Surrey.

Hearing Aid, a new Melotone model claimed to be economical to maintain, described in a leaflet from Cunningham Beattie, Ltd., 49, Wigmore Street, London, W.1.

UNBIASED

By FREE GRID

Comfort While You Look

JUST lately Mrs. Free Grid has been away from home, having gone on a mountaineering expedition by helicopter with some other members of a "Women's Uplift Society" to which she belongs. This has rather left me to my own devices and I have been compelled, among other things, to patronize one of those establishments fitted with a dozen or more washing machines—laundrettes I believe they are called—which enable people to rend their own garments instead of leaving the job to somebody else.

I was washing out my smalls the other day and marvelling at the ingenuity of the slick business man who had first thought of the money-making possibilities of fitting up a large empty shop with rows of washing machines, when the idea came to me of trying to make an honest penny myself by fitting up a similar shop with lines of television sets where people might come and enjoy the television programmes in comfort.

Now some of the less well-informed among you may ask why I should expect people to patronize my proposed public television parlour when they can enjoy the programmes in greater privacy in the comfort of their own homes. But anybody who is in touch with housing conditions to-day knows that privacy is at a premium and our budding Benedicts are forced into the Rank atmosphere of the local amatorium where they are compelled to sit herded together in the darkness with a complete absence of home comforts.

There will be none of that sort of thing in my proposed establishment, which will have curtained cubicles and comfortably cushioned armchairs to reproduce, as far as possible, the conditions of home as it should be.

Washing my Smalls.

But anybody who expects to find what our American friends would probably call a "petting parlour," or maybe a "necking niche," will have Mrs. Free Grid and her Watch Committee to reckon with, as the guiding principle will be comfort and not cuddles while you look.

Which Came First?

ONE of the most interesting articles in the September issue of *W.W.* was that on radio telearchics. I must confess, however, that I feel very troubled about the misleading effect which the opening sentence may have on some of you. To save you the messy business of unwrapping your fish and chips, I will quote the exact words of the learned scribe: "Probably one of the earliest radio telearchic systems was that demonstrated at the Paris Exhibition of 1906, when Professor Branly, using his famous coherer, showed how apparatus could be switched on and off at a distance."

Now I don't quarrel with the facts as stated, but I feel much less easy in my mind about the interpretation expressed in the opening words. I cannot help thinking that if I let this go unchallenged, some of you, who are too young to know anything of the early days of wireless, may think that radio telearchics was invented subsequently to wireless telegraphy, and I have more than a suspicion that the writer of the article, through a mental oversight, may even think that himself.

Actually, the reverse is true and radio telearchics was first in the field; indeed, it *had* to be as you will realize if you will give the matter a moment's thought. We will go no farther back than Marconi and his contemporaries of the 'nineties, all of whom sought a practical means of sending messages without the aid of wires over distances outside the range of optics and acoustics. Now in those days Mr. and Mrs. Piddington had not made telepathy the popular pastime it is to-day and so Marconi and other pioneers could not hope that their ether-borne messages would act directly on the brain cells of the intended recipients. It was obviously necessary, therefore, to devise means whereby the incoming wireless waves would switch on some sort of machinery which would automatically switch itself off when they ceased to arrive. The coherer and the morse inker (and later the headphone diaphragm) provided the answer to the problem, the decoherer and the back-spring of the inker-armature restoring the *status quo* when wave-trains ceased to arrive. Whichever way you look at it, therefore, telearchics had of necessity to *precede* telegraphy; it had, in fact, to be invented as a necessary preliminary to communication.

Earls Court, 1913.

Talking of telearchics, I should like to say how good I thought the demonstration was at Earls Court, but I don't think it was better than a telearchic display I saw, also at Earls Court, as long ago as 1913. In view of the limited technical resources available then, it certainly was marvellous but not quite so wonderful as *W.W.'s* over-enthusiastic Venerable Bede of those days would have us believe when he wrote in the September, 1913, issue that the model airships taking part in the demonstrations were "propelled by wireless."

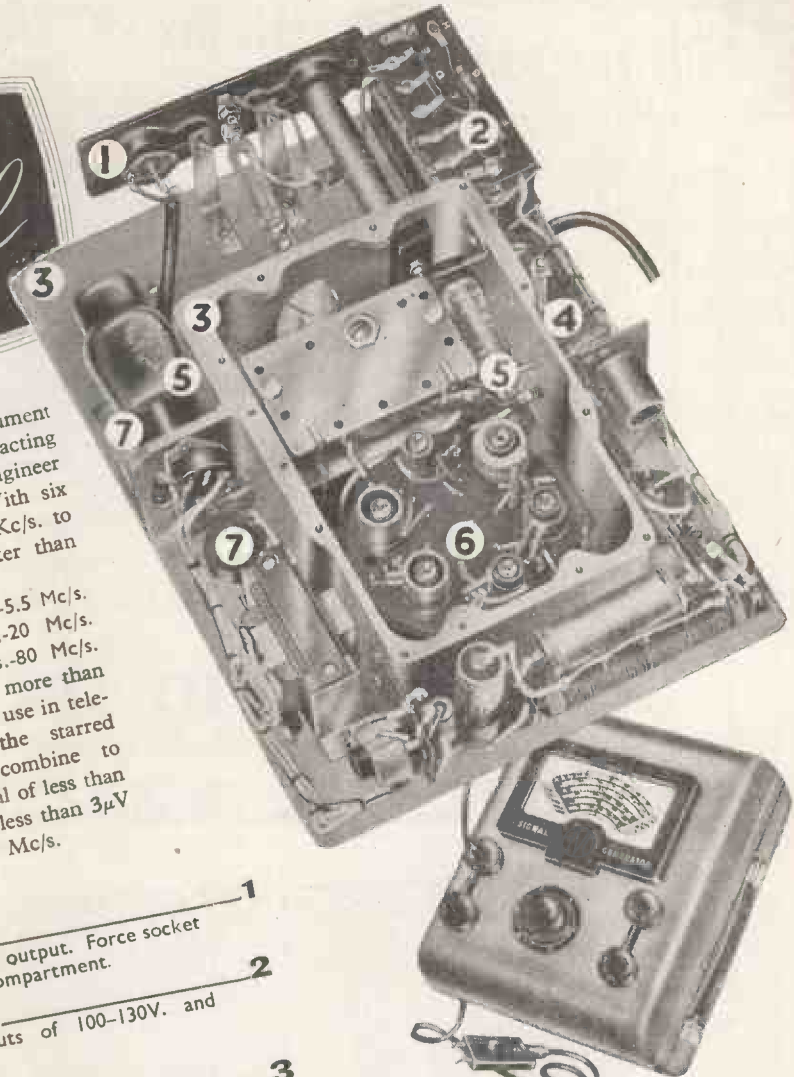
Modulation

THE divided opinions in technical circles about the respective merits and demerits of a.m., f.m. and p.m. are strongly reminiscent of the state of affairs which existed forty years or so ago when the burning question of the hour was c.w. or spark, or, in terms of personalities, Poulsen or Marconi. C.W. seemed, in broad theory, as though it ought to be the answer to the wireless maiden's prayer, but, in practice, it certainly was not. Long years afterwards, of course, c.w., with improved and, indeed, totally different methods of generation, turned the tables and pushed spark clean off the map, if I may mix my metaphors.

Casting our minds forty years on, it is highly probable that improved technique will have enabled one particular method of modulation to put all others out of court. I wonder which it will be?

AVO

WIDE RANGE
Signal GENERATOR



An inexpensive yet precision instrument designed especially to meet the exacting needs of the modern service engineer and laboratory technician. With six frequency ranges covering 50 Kc/s. to 80 Mc/s., its accuracy is better than ±1% of the scale reading.

50 Kc/s.-150 Kc/s.	1.5 Mc/s.-5.5 Mc/s.
150 Kc/s.-500 Kc/s.	5.5 Mc/s.-20 Mc/s.
500 Kc/s.-1.5 Mc/s.	20 Mc/s.-80 Mc/s.

Scale sub-divisions provide more than adequate discrimination for use in television circuits. Note the starred features below, which combine to maintain a minimum signal of less than 1μV up to 20 Mc/s. and less than 3μV between 20 Mc/s. and 80 Mc/s.

★OUTPUT — 1
Co-axial socket for attenuated output. Force socket located totally within H.F. compartment.

MAINS TRANSFORMER — 2
Marked tagboard for inputs of 100–130V. and 200–260V., A.C. 50/60 c/s.

★CAST ALUMINIUM H.F. COMPARTMENT and CHASSIS — 3
Large number of fixing holes for H.F. compartment cover ensures excellent electrical bonding and good screening. — 4

FUSE — 5
Easily accessible when replacement is necessary.

VALVES — 6
Standard types run at a rating to ensure long life.

TURRET COIL SWITCHING — 7
Standard "AVO" practice.

★ATTENUATOR SYSTEM
Employs close tolerance, high stability midget carbon resistors, low reactance rotary potentiometer modified for H.F. operation with carefully designed screening.

Other features include:

ILLUMINATED SPOT RANGE SELECTOR
Gives rapid identification of operational band with intensified lighting round precise frequency. Fine hair line gives close discrimination, particularly on high frequencies.

STOPS
Separate stops prevent turning of dial with respect to condenser

★MAINS FILTER SYSTEM
This is screened from main electrical assembly.

BUSHING PLATES
provide additional rigidity for rotary controls.

SLOW MOTION DRIVE
substantially free from backlash.

MAINS MODEL 100—130V. and 200—260V. A.C., 50—60 c/s.
OR BATTERY MODEL..........£30

AVOCET TRADE MARK

Sole Proprietors and Manufacturers :—

The AUTOMATIC COIL WINDER & ELECTRICAL EQUIPMENT CO. LTD.
WINDER HOUSE · DOUGLAS STREET · LONDON · S.W.1 *Telephone: VICTORIA 3404/9*

S.G.2.

Simphonic

MAGNETIC TAPE RECORDERS

Users include:

- UNIVERSITIES
- SCHOOLS
- HOSPITALS
- CLINICS
- RESEARCH LABORATORIES
- COMMERCIAL UNDERTAKINGS
- BUSINESS HOUSES
- RECORDING STUDIOS
- ACTORS, SINGERS and MUSICIANS

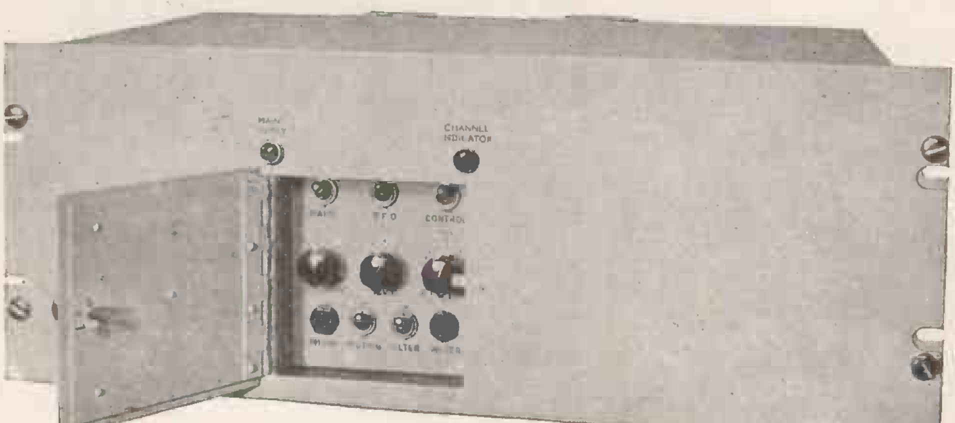
★ The well known SIMPHONIC 2B is still available for early delivery. Please write for details, also data on the NEW MODEL 1A shown above.

SIMON SOUND SERVICE

Recorder House, 48/50 George St., Portman Square, London, W.1, Eng.

Telephone: Welbeck 2371 (5 lines) *Telegrams:* Simsale, Wesdo, London *Cables:* Simsale, London

---



An Important Receiver...

. . in the extensive Redifon range of communications radio is the R.93—a fixed frequency, single channel receiver covering 2 to 20 Mc/s. Its crystal controlled oscillator and other special features make this the ideal unattended receiver for point-to-point and ground-to-air channels and it has full remote control facilities. Specialised applications of the R.93 include monitoring, diversity reception or frequency shift working.

The Redifon range includes MF. HF and VHF transmitters, receivers, radio telephones, navigational aids, AF amplifying systems and other electronic equipment. Enquiries for single units or complete networks including aerials, masts, power supply, land line amplifiers, remote controls and other apparatus are welcome.

AIRPORT Redifon Radio

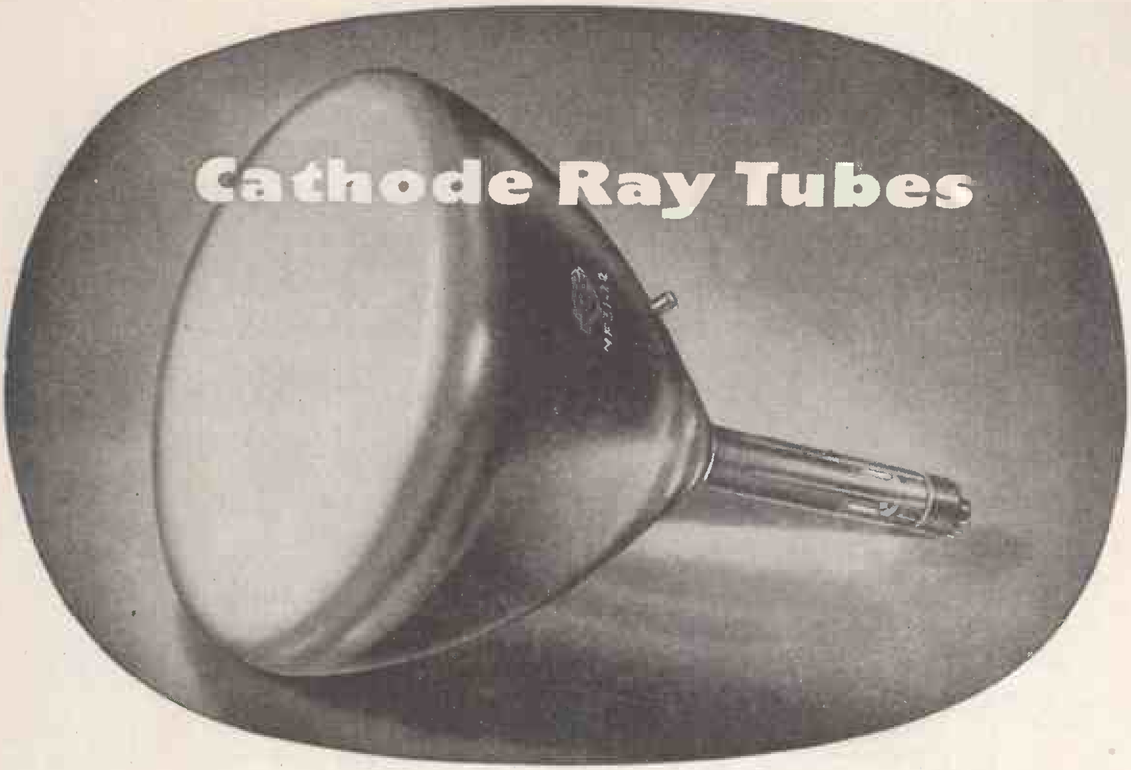
Radio Communications Division

The R.93 is designed to the specification of International Aeradio Limited

REDIFON LIMITED, BROOMHILL ROAD, WANDSWORTH, S.W.18

DESIGNERS & MANUFACTURERS OF RADIO COMMUNICATION & INDUSTRIAL ELECTRONIC EQUIPMENT

Phone: VANdyke 7281



for Radar, Research and Industrial Applications

The cathode ray tube is now accepted as an essential component in all electronic equipments where it is required to obtain a rapid indication or display of physical phenomena. As such it forms the basis of oscilloscopes, test apparatus, monitors, flaw detectors and numerous other research, industrial and communications equipments. The Mullard range of cathode ray tubes has now been extended to meet all these applications.

TUBES FOR RADAR DISPLAYS.

Of particular importance among this range are the Mullard C.R. Tubes MF31-22 (12-in.) and MF13-1 (5-in.) both of which are designed to meet the continuous operation and arduous conditions of service encountered in marine radar applications. Having long-persistence aluminised fluoride screens, these tubes are suitable for use in P.P.I. systems.

SMALL TUBES FOR INSTRUMENTS

A variety of 1¾-in. and 2¾-in. electrostatic C.R. Tubes with green, blue or persistent screens are also available. These tubes are all characterised by low inter-plate capacitances and are designed for operation with voltages from between 800 and 1,000 volts. These features, coupled with the fact that the tubes are fitted with standard B9G bases and have a seated length of less than 6 ins., make them suitable for use in small, compact oscilloscopes, and in a variety of industrial, communications and research testing and measuring equipments. All these tubes can be obtained in versions suitable for either symmetrical or asymmetrical deflection.

For larger equipments, a high-grade electrostatic 5-in. tube is also available.

Abridged technical details on the tubes for radar displays are listed below. Full data on the complete range of cathode ray tubes is available on request.

Type	Description	Base	Max. Screen Diameter (mm.)	Max. Overall Length (mm.)	V_h (V)	I_h (A)	Va1 max. (V)	Va2 max. (KV)
MF13-1	5″ radar tube with metal-backed magnesium fluoride screen	Octal	127.5	292	6.3	0.3	450	11
MF31-22	12″ radar tube with metal-backed magnesium fluoride screen	B12A	308	471	6.3	0.3	400	11

Mullard

MULLARD LTD., CENTURY HOUSE, SHAFTESBURY AVENUE, LONDON, W.C.2

MVT106

23 759 MODEL A ENVELOPES SOLD +

29 438 MODEL B ENVELOPES SOLD +

MODEL C FOR
HOLME MOSS
now available!

Join the select band of radio amateurs who have built their own Television Receiver. It's a wonderful hobby—a real thrill for you and long lasting pleasure for the whole family when completed.

The " View Master " has been specially designed by a leading Television Engineer to give the highest standard of performance with exceptional simplicity in wiring and layout. Assembled in six easy stages, it can be built by anyone who can read a wiring diagram and use a soldering iron.

Constructor Envelope now available contains full size wiring diagrams with 36-page booklet for building and operating the " View Master."
Price 5/- from any Wireless Shop or 5/6 post free from Publishers, George Over (Rugby) Ltd., Rugby.

—the most popular home-constructor T.V.

LONG PLAYING ON STANDARD RADIOGRAMS
NOW POSSIBLE WITH THE CHANCERY ATTACHMENT G33

This instrument is precision engineered to convert existing equipment (78 r.p.m.) to $33\frac{1}{3}$ r.p.m. This is effected by an epicyclic transmission and reduction mechanism, (pat. pending) ensuring a constant speed of $33\frac{1}{3}$ r.p.m. necessary for true reproduction of long playing records. Elimination of "wow" and flutter has been achieved to a remarkable extent. The G.33 has been designed for simplicity of conversion, having merely to be placed on the existing turntable in the same manner as a gramophone record. When desired to revert to 78 r.p.m. records removal is just as simple. It is suitable for the conversion to long playing of all automatic record changers except those fitted with non-removable eccentric spindles (i.e. Collaro).

Chancery
INSTRUMENT

72/6
(Inc. P. TAX)

Export priorities are causing some delay to deliveries on the Home Market.

DESCRIPTIVE LEAFLET AVAILABLE ON RECEIPT OF S.A.E.

Consult your Local Dealer, or if in any difficulty write direct to—

CHANCERY PRECISION INSTRUMENT SERVICE LTD.
SALES DEPT., 64 GEORGE STREET, BAKER STREET, LONDON, W.I. *Telephone: WELbeck 4715 & 1485*

NSF CUTLER-HAMMER APPLIANCE SWITCHES C-H

The penalty of fame

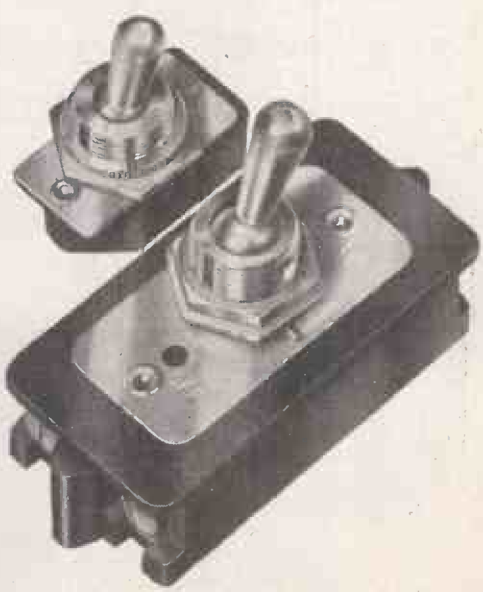
The name, Cutler-Hammer, needs no introduction to the electrical and electronics industries, for it is the Hallmark of one of the finest appliance switches in the world and enjoys a well deserved reputation.

From the first, the design of the switch has been influenced by continuous research into the practical and theoretical aspects of electric appliance control. Materials used have been carefully selected irrespective of price. Production methods have kept pace with modern trends. Inspection has been ruthless in safeguarding quality.

As a result, more and more electrical appliance and electronic equipment manufacturers are specifying Cutler-Hammer, for they know that the name carries the same guarantee of reliability and efficiency as their own branded products.

It is this popularity — this fame, as it were — that is now an embarrassment to us. Material shortages and priorities mean that we cannot meet all demands with our usual dispatch. Some delays in supplies are inevitable. Maybe in the light of your past experience, you will think Cutler-Hammer switches worth waiting for.

In the meantime, we will endeavour to make the 'wait' as short as possible.



Certain types of Cutler-Hammer switches have been granted limited Type Approval by R.C.S.C. to R.C.S/151.

N·S·F LIMITED

KEIGHLEY · YORKS Phone: Keighley 4221/5 Grams: ENESEF, Keighley

LONDON OFFICE: 9 Stratford Place, W.I. Phone: Mayfair 4234

Licensees of Igranic Electric Co. Ltd. for the above products of Cutler-Hammer Inc. Milwaukee, U.S.A.

VITAVOX

LOUDSPEAKERS AND MICROPHONES

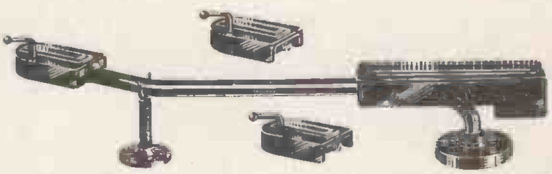
. . . for solving sound problems

The VITAVOX range of microphones, loudspeakers and reproducers is sufficiently wide in its scope to meet all practical requirements in the field of sound reproduction. Thus the solution to your sound problem is primarily the selection of the right Vitavox model to meet your specific needs and the manufacturers will be pleased to assist you by sending full details of Vitavox products on request.

Specify **VITAVOX**

VITAVOX LIMITED, WESTMORELAND ROAD,
LONDON, N.W.9
Telephone: COLindale 8671-3.

Three heads are better than one!



For Standard and Microgroove Recordings

Green Spot with .001" radius sapphire for microgroove recordings.

Red Spot with .0025" radius sapphire for modern standard recordings.

Yellow Spot with .003" radius sapphire for older standard recordings.

These pickup heads are fitted with an easily replaceable armature system complete with a semi-permanent sapphire. Armature mass 20 mg.

Extremely low mass at needle point (4/5 mg. only), allowing for reduction in downward pressure to 10/12 grams for standard recordings and 7/9 grams for microgroove recordings.

Prices: With one head £4 10 0 plus £1 19 0 Purchase Tax. Extra heads each £2 10 0 plus £1 1 8 Purchase Tax. Spare armature system with sapphire 14/8 including tax.

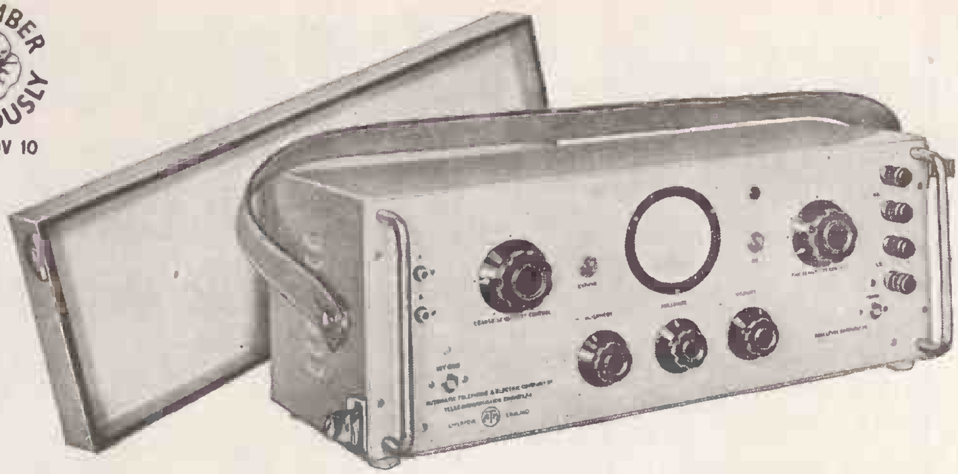
Licensed under Letters Patent No. 586900 and/or 615424.

a Connoisseur product

Tel.: HALIFAX 69169.

Manufactured by A. R. SUGDEN & CO. (ENGINEERS) LTD., Well Green Lane, Brighouse, Yorks.

REMEMBER GENEROUSLY
SAT · NOV 10



PRECISION MEASUREMENTS IN LINE TRANSMISSION

In the measurement of losses and gains greater accuracy can be achieved if a visual instead of an audible means is employed. The illustration depicts an electronic voltage comparator in which a cathode ray tube is used as an indicator of the relative magnitudes of a standard signal and the unknown signal to be tested. In the position of maximum sensitivity an input signal of 30 microvolts will give a 1 cm deflection on the screen which allows a comparison accuracy equivalent to 0.1db. Measurements can be made from 100 c/s to 200 Kc/s. This instrument, which is extremely simple to operate, is used as the sensitive detector in the measurement of losses in channelling equipment, amplifier gains, crosstalk and harmonic distortion in amplifiers, etc.

Distributor

AUTOMATIC TELEPHONE & ELECTRIC CO. LTD.

(Radio and Transmission Division), Strowger House, Arundel St., London, W.C.2

Telephone: TEMple Bar 9262. Cablegrams: Strowgerex, London.

Manufacturers

AUTOMATIC TELEPHONE & ELECTRIC CO. LTD., Liverpool & London

TELEPHONE MANUFACTURING CO. LTD., St. Mary Cray, Kent

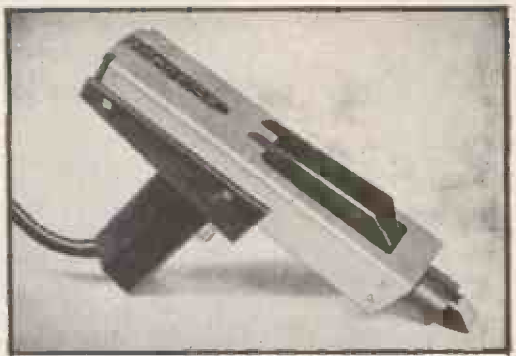
ATE/TMC

A8411-B.105

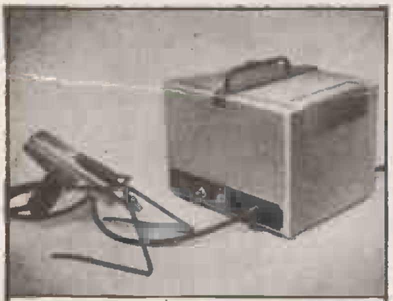
AN ULTRASONIC SOLDERING IRON

Can be used for soldering aluminium, and other metals that form refractory oxides

THE problem of soldering metals that form refractory oxides has now been overcome.
A new soldering iron, developed by Mullard Ltd., destroys oxide film by ultrasonic stimulation and provides a "clean" metallic surface.
This means that perfect soldering of aluminium, and other metals, can now be achieved without scraping or brushing molten metals. Standard soft solders can be used. And no flux is needed.
A small electronic amplifier supplies the ultrasonic power. Two controls, a mains and a trigger switch, ensure simplicity of operation. Unskilled workers can use the apparatus without discomfort, since the ultrasonic frequency used is inaudible to the human ear. Full information about the Mullard Ultrasonic Soldering Iron—the only commercial model in the world — is available on request.



The soldering iron has a nickel silver bit driven by a magnetostriction transducer. The transducer is arranged to run at its natural resonant frequency by a feed-back system. A conventional low voltage winding heats the soldering bit.



The Mullard Ultrasonic Soldering Iron and Amplifier. The unit operates from A.C. mains and is robustly made to suit workshop conditions.

Mullard

CONDUCTIVITY EQUIPMENT · POTENTIOMETRIC TITRATION APPARATUS · ELECTRONIC POLAROGRAPHS · TEMPERATURE CONTROLLERS · UNIVERSAL MEASURING BRIDGES · VALVE VOLTMETERS F.M. SIGNAL GENERATORS · OSCILLOSCOPES

NORTHERN AGENT: F. C. Robinson & Partners, Ltd., 287, Deansgate, Manchester, 3.
MIDLAND AGENT: Hadley Sound Equipments Ltd., 72, Cape Hill, Smethwick. *Tel: Smethwick 0977.*
SCOTTISH AGENT: Land, Speight & Co. Ltd., 73, Robertson Street, Glasgow, C.2.

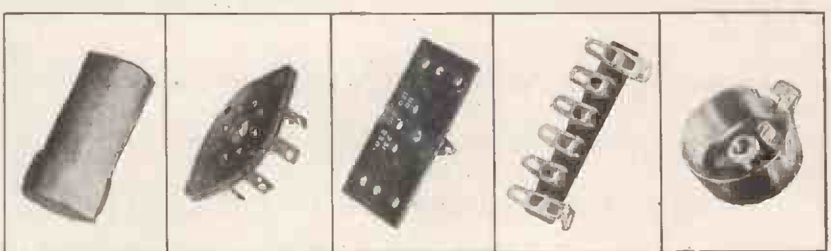
Mullard Ltd., Equipment Division, Century House, Shaftesbury Avenue, London, W.C.2. Telephone: GERrard 7777

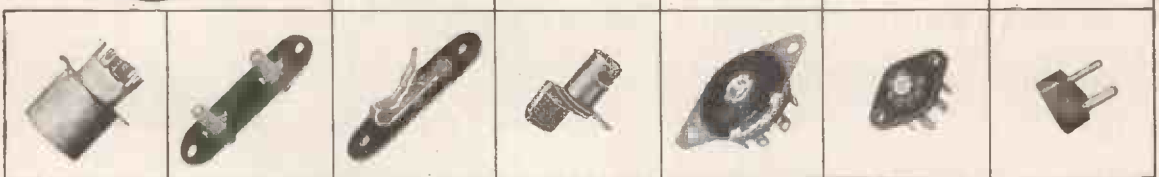
Mullard

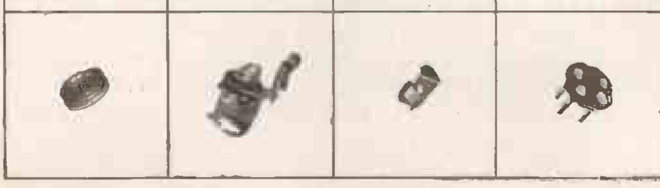
(MI.340)

CINCH components are now available to all radio and T.V. constructors

At last, every amateur, radio and T.V. constructor can use the components preferred for their quality, economy and reliability by manufacturers the world over. Just a few of the items available are illustrated. Post your order NOW and ask for details of the full range.







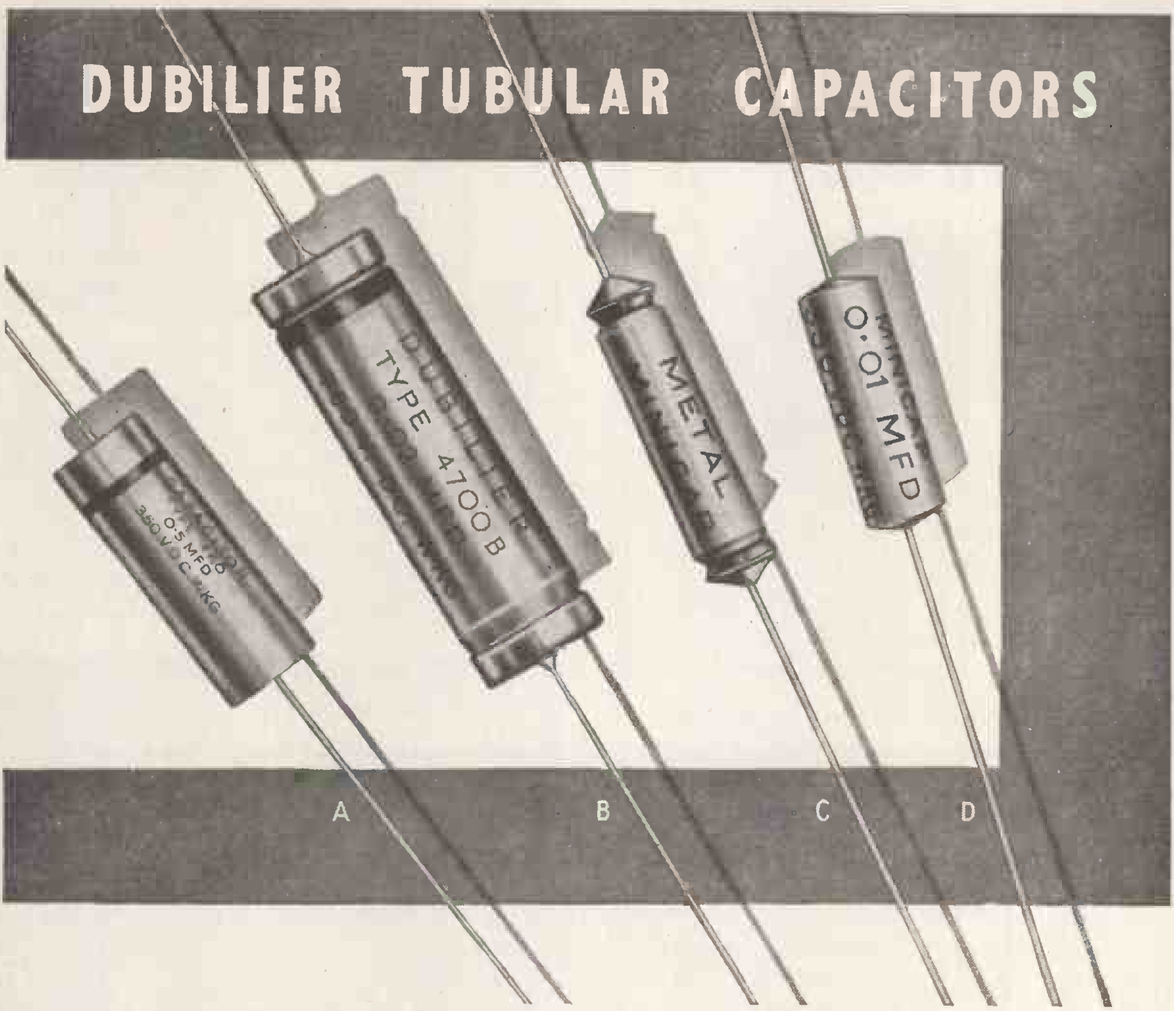
Send your requirements to :

RADIO TRADERS LTD.,

Wholesale and Export Radio and Electric Components

23, WARDOUR STREET, LONDON, W.1

Telephone : Gerrard 3977
Telegrams : "Radiotrade"



Of the many forms of capacitors available, one of the most popular is the Tubular Paper, which fits most conveniently into any wiring assembly. In order to meet specific requirements, Tubular Capacitors must be chosen with care by the designer and engineer; Dubilier Tubular Paper Capacitors are produced in a wide range covering all needs, for instance :—

A. Type 460 Tubular Paper Capacitors for all general requirements.

B. Metal-cased Tubular Paper Capacitors for use in Tropical conditions.

C. Metal-cased "Minicap" Tubular Paper Capacitors to withstand severe tropical conditions and high altitudes.

D. "Minicap" Tubular Paper Capacitors for miniature application combining minimum size and weight with excellent electrical properties.

We shall be pleased to forward full technical details of these Capacitors upon request, and our technicians are always at your service for consultation with regard to their use.

DUBILIER
CONDENSER CO. (1925) LTD.
CAPACITORS

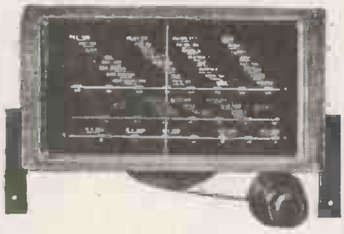
MAKERS OF THE WORLD'S FINEST CAPACITORS

DUBILIER CONDENSER CO. (1925) LTD., DUCON WORKS, VICTORIA ROAD, NORTH ACTON, W.3

Phone : Acorn 2241 (5 lines). Cables : Hivoltcon, London. Marconi International Code. Grams : Hivoltcon, Westphone, London

D22

EXACT EFFORTLESS TUNING



The S.L.8 Spin wheel drive gives easy control through a ratio 24-1. Fitted with constant velocity coupling, it eliminates strain on the Condenser, providing mechanical and electrical isolation from vibration and noise.

Complete with 3-band glass scale 9in. × 4¼in. Printed short, medium and long wavebands with station names. Scale length 7in. Supplied with florentine bronze escutcheon.

PRICE 27/6.

S.L.5, similar but fitted with reverse vernier drive, gives ratios of 18-1 search and 50-1 reverse vernier.

PRICE 26/6.

Replacement Scales calibrated to Copenhagen Plan now available for:

Airplane Drive 2/3 retail	Full Vision Drive 2/9 retail
Squareplane Drive 2/6 retail	S.L.8 or S.L.5 Drive 4/6 retail

PRECISION COMPONENTS BY

REGISTERED TRADE MARK

JACKSON

BROS. (LONDON) LIMITED
KINGSWAY · WADDON · SURREY

Telephone: Croydon 2754
Telegrams: Walfilco, Souphone, London

ICS

HOME STUDY

backs radio experience with sound technical knowledge

MANY men who wished to link their radio experience with a sound technological background have received successful instruction by means of an ICS Course Its value has been proved not only to amateurs but to men who already have a professional interest in radio and television engineering, including those taking qualifying examinations. It is invaluable, also, to students who wish to prepare themselves for a job in this field. Courses of instruction covering radio and, if necessary, television, include the following:

Complete Radio Engineering . Radio Service Engineers . Radio Service and Sales . Advanced Short-Wave Radio . Elementary Electronics; Radar and Radio Television Technology.

And the following Radio Examinations

British Institution of Radio Engineers . P.M.G. Certificates for Wireless Operators . City and Guilds Telecommunications. Wireless Operators and Wireless Mechanics, R.A.F.

Students intending to sit for the above Examinations should enrol NOW for preparatory Courses.

Using a specially prepared study programme, students study at their own pace, in their spare time and, with time for revision, sit with full confidence of success.

(I.C.S. Students are coached until successful)

Write today for our FREE "RADIO" booklet which fully describes the above ICS Courses and the facilities for the complete study of Radio and/or Television technology. The ICS Advisory Department will also give free and impartial advice on the need for and the means of instruction.

GENEROUS DISCOUNT GRANTED TO ALL MEMBERS OF H.M. FORCES.

International
CORRESPONDENCE SCHOOLS

Dept. W.L.28., International Buildings, Kingsway, London W.C.2

COILS and I.F. TRANSFORMERS

ETA

ELECTRO TECHNICAL ASSEMBLIES
SEASIDE RD., ST. LEONARDS-ON-SEA
Phone: Hastings 471

GOODMANS

HIGH FIDELITY—12" P.M.

TWIN CONE AXIOM 150

REMEMBER GENEROUSLY
SAT • NOV 10

This 12" high fidelity unit has a twin curvilinear diaphragm, (Patent No. 451754). A carefully designed magnet assembly using anisotropic material provides a total flux of 158,000 maxwells on a 1¾" pole. The back centring device is a dustproof bakelised linen disc with concentric corrugations.

The combination of these features gives this precision-built instrument an outstandingly wide coverage from 40 to 15,000 c.p.s. free from bass modulation effects.

An ideal high fidelity reproducer for the record enthusiast and the connoisseur of wide range musical reproduction, it gives exceptionally fine transient and frequency response.

For use with this model we recommend Goodmans High Fidelity Heavy Duty Output Transformer Type H.4. Nett Weight 5 lbs.—2.3 kg.

A Bass Reflex Cabinet measuring approximately 30"x23"x16" and a corner cabinet have been specially designed for this loudspeaker and working drawings are available

Frequency Coverage	40/15,000 c.p.s.
Overall Diameter	12 5/16"-31.3 cms.
Overall Depth	6 15/16"-17.6 cms.
Fundamental Resonance	55 c.p.s.
Voice Coil Diameter	1¾"-4.4 cms.
Voice Coil Impedance	15 ohms at 400 c.p.s.
Maximum Power Capacity	15 Watts Peak A.C.
Flux Density	14,000 gauss
Net Weight	12 lbs. 13 oz.-5.8 kg.
Finish	Grey Rivelling Enamel

£10.5.6 LIST

GOODMANS INDUSTRIES LIMITED
Lancelot Road, Wembley, Middlesex. *WEMbley 1200*

SEAMLESS ONE-PIECE METAL BELLOWS

Combining the properties of:

1. A compression spring capable of repeated flexing
2. A container which can be hermetically sealed
3. A packless gland

Hydraulically formed by a process unique in this country

for Automatic coolant regulation. Movement for pressure change. Packless gland to seal spindle in high vacua. Reservoir to accept liquid expansion. Dashpot or delay device. Barometric measurement or control. Pressurised couplings where vibration or movement is present. Dust seal to prevent ingress of dirt. Pressure reducing valves. Hydraulic transmission. Distance thermostatic control. Low torque flexible coupling. Pressure sealed rocking movement. Pressurised rotating shaft seals. Aircraft pressurised cabin control. Refrigeration expansion valves. Thermostatic Stream Traps. Pressure amplifiers. Differential pressure measurements. Thermostatic operation of louvre or damper. *Write for List No.* N.800-1.

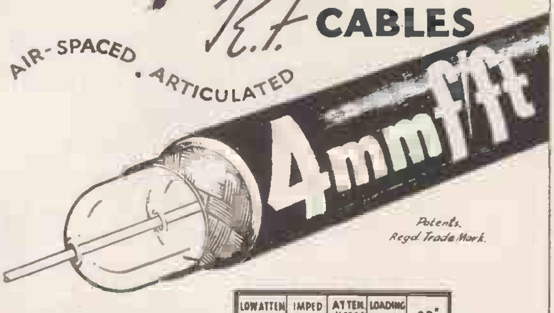
by DRAYTON

B10

Drayton Regulator & Instrument Co. Ltd., West Drayton, Mdx. • W. Drayton 2611

Only with CO-AX *R.F.* CABLES

AIR-SPACED . ARTICULATED



Patents. Regd Trade Mark.

THE LOWEST EVER CAPACITANCE OR ATTENUATION

IMMEDIATE DELIVERIES

SPECIALISTS IN AIR-SPACED ARTICULATED CABLES SINCE 1929

TRANSRADIO LTD.
CONTRACTORS TO H.M. GOVERNMENT
138A CROMWELL ROAD, LONDON S.W.7
ENGLAND

LOW ATTEN. TYPES.	IMPED OHMS	ATTEN. db 100 ft. at 100 Mc/s.	LOADING Kw.	O.D."	
A 1	74	1.7	0.11	0.36	
A 2	74	1.3	0.24	0.44	
A34	73	0.6	1.5	0.88	HIGH POWER FLEXIBLE
LOW CAPAC. TYPES.	**CAPAC mmf/ft.**	**IMPED. OHMS.**	**ATTEN. db 100 ft. 100 Mc/s**	**O.D."**	
C 1	7.3	150	2.5	0.36	
P.C.1	10.2	132	3.1	0.36	PHOTOCELL CABLE
C 11	6.3	173	3.2	0.36	
C 2	6.3	171	2.15	0.44	
C22	5.5	184	2.8	0.44	
C 3	5.4	197	1.9	0.64	
C33	4.8	220	2.4	0.64	VERY LOW CAPACITANCE
C44	4.1	252	2.1	1.03	

SIGNAL GENERATORS · BRIDGES · VALVE VOLTMETERS · Q-METERS · OUTPUT METERS

WAVEMETERS · FM · AM · TV · RADAR · TELECOMMUNICATIONS

TELECOMMUNICATIONS · VALVE VOLTMETERS

REFER TO MARCONI . . .

SIGNAL GENERATORS · Q-METERS · OUTPUT METERS

WAVEMETERS · FM · AM · TELECOMMUNICATIONS · INDUSTRY · MEDICINE

TELECOMMUNICATIONS · FM · AM · TV · RADAR

MASTERY OF MEASUREMENT

Marconi mastery of measurement is turned to account in a wide range of radio communication and allied measuring instruments. Embodying the skill born of years of experience, they nevertheless employ the latest techniques in circuits and contemporary styling. If you are professionally engaged in the radio communications field, write now for your copy of this 70 page, fully illustrated catalogue and find how the 30 preferred instruments can help you.

MARCONI instruments

MARCONI INSTRUMENTS LTD · ST ALBANS · HERTS · Phone: ST ALBANS 6161/7

London Office: Marconi House, Strand, W.C.2. Midland Office: 19 The Parade, Leamington Spa. Northern Office: 30 Albion Street, Hull.

WODEN TRANSFORMER CO. LTD

TRANSFORMERS FOR RADIO · TELEVISION AND ELECTRONICS

The Reliability factor is one of the outstanding reasons for the continued demand by discerning Manufacturers for WODEN transformers. Quality is paramount and every precaution is taken to ensure that the reputation, which has been established over many years, is safeguarded. For example, apart from the usual rigid inspection, every transformer leaving our Works is fully impregnated by the latest vacuum and pressure process.

The need for competitive prices has not been overlooked. Our long experience and modern facilities enable us to keep production costs down to the lowest possible level. If, then, your requirements are for transformers with assured reliability at reasonable cost, we are at your service.

Our comprehensive catalogue is available on request.

WODEN TRANSFORMER CO. LTD.
MOXLEY ROAD BILSTON · STAFFS · PHONE: BIL. 41959

-towards perfection-

Britain's finest range of TUNER UNITS

LE1/2. Two T.R.F. for maximum quality from local stations.

LES. Superhet for areas where reception is more difficult or for greater selectivity than the LE1/2 provides.

DT/4. The most famous tuner of all.

Selectivity Position 1. T.R.F.

Selectivity Position 2. Superhet, wide band.

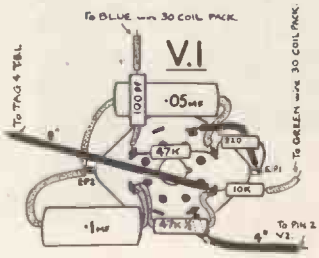
Selectivity Position 3. Superhet maximum selectivity.

This tuner does not offer a compromise, but fidelity from local stations (1) more general reception (2) and full superheterodyne sensitivity and selectivity (3).

Leaflet with full details please write :—

THE LOWTHER MANUFACTURING CO.
(The Laboratory Production Unit)
Lowther House, St. Mark's Road, Bromley, Kent. RAV. 5225.

Have you "A.A."?*



This small reproduction of a SUB-ASSEMBLY taken from one of our series of *unique* LIFE-SIZE, "EASY AS A.B.C." CONSTRUCTION SHEETS illustrates how really simple radio assembly for the Home Constructor can be! If YOU have average ability (*A.A.) and could wire this simple unit then you can tackle any, or all, of the TWELVE GUARANTEED OUTFITS given in our HOME CONSTRUCTOR'S HANDBOOK, knowing that with OUR sheets *failure is impossible!*

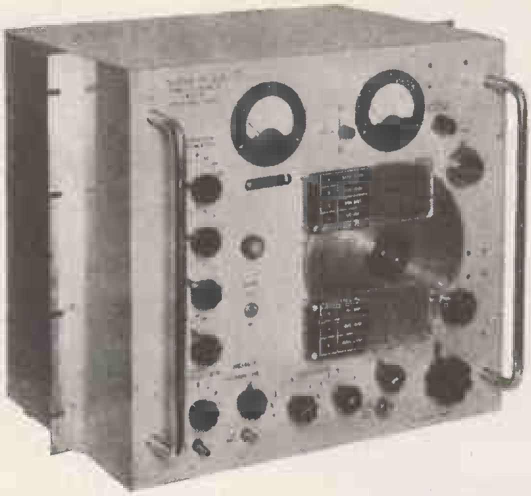
Our world-famous publication has ONCE AGAIN BEEN ENLARGED and now contains the following FULL PAGE circuits, with illustrations, descriptions, full parts lists† and details, as well as a host of extremely useful information, data, formulae, etc.

- 3 Valve 3 wave FEEDER
- 4 Valve 3 wave FEEDER (with "hi-fi" switching for high quality on locals)
- 5 Valve 3 wave AC SUPER
- 5 Valve 3 wave AC/DC SUPERHET
- FEEDER AMPLIFIER and Power Pack
- 6 Valve 3 wave A.C. SUPERHET
- 6 Valve 3 wave AC/DC SUPERHET
- SIGNAL TRACER
- 4 Valve BATTERY SUPER
- 5 Watt quality AMPLIFIER
- 10 Watt quality AMPLIFIER
- SIGNAL GENERATOR

(† All Parts are obtainable from us by mail and are clearly marked and identified with our Construction Sheets.)

The price ? 2/6 Only which makes this Book just about the best value-for-money obtainable anywhere to-day!! Many thousands of Constructors like yourself are using our splendid circuits, so SEND NOW FOR YOUR COPY. The 1951/2 ISSUE is obtainable by mail ONLY FROM :

RODING LABORATORIES (Dept. W.N.)
694, LEA BRIDGE ROAD LONDON, E.10



SELECTIVE

TRANSMISSION MEASURING SET

MODEL RP 3110

Designed and manufactured for G.P.O.

This is a precision instrument for measurements on multi-circuit coaxial cable carrier systems by means of a comparison with locally generated signals of known frequency and level.

Frequency coverage; 60 Kc/s—3 Mc/s in 7 ranges.

Calibration accuracy: below 0·2% or 2 Kc/s whichever is the greater.

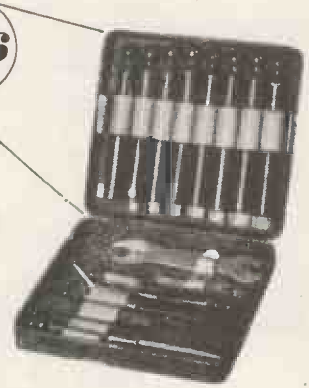
Power supplies : 200 — 250 Volt. 50 c/s

Range of measurements;
through levels + 10 db to - 61·5 db
or terminated levels + 10 db to - 81·5 db
referred to 1mW in 75 ohms

BRITISH COMMUNICATIONS CORPORATION LTD.

GORDON AVENUE, STANMORE, MIDDX.

Telephone : GRIMSDYKE 2266 Cables : DISC, STANMORE



A *workshop* in your *pocket!*

THE TELEVISION AND RADIO SERVICE ENGINEER'S MASTER TRIMMER KIT

Contains :

- 1 End Trimmer.
- 1 Side Trimmer.
- 1 Yaxley Switch Contact Adjuster.
- 1 Low Capacity Trimmer.
- 1 Screwdriver.
- 1 Set of Feeler Gauges.
- 1 Set of six Box Spanners from 1 to 8 B.A.
- 1 Set of four Spanners from 0 to 8 B.A.

In durable black crackle finish metal case.

Export enquiries invited

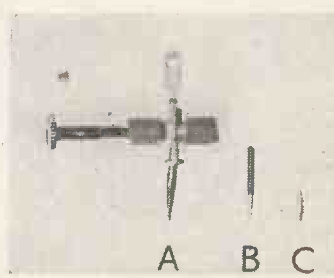
SEND YOUR ORDER TO:

J. & S. NEWMAN LTD. 100 HAMPSTEAD RD., N.W.1 *Tel.: EUSton 5176/7*

BRIERLEY DIAMOND MICROARMATURE PICK-UP

This new pick-up has many noteworthy characteristics, some of which are listed below :—

1. The mass of the moving parts is less, we believe, than in any other pick-up of any type—other than our own Ribbon which is, of course, unique.
2. The output voltage—about 1/25th v.—is high enough to cause no trouble.
3. It is sufficiently robust to be used by any reasonably intelligent and careful family.
4. The use of a diamond point has, *inter alia*, the enormous advantage that a very large number of records may be played with negligible point wear. This results in a sustained "new" performance together with the elimination of that mental irritation at the gradual and perceptible "falling off" unavoidable with less wear-resistant points.
5. Organised production on a reasonable scale should give us a satisfactory "spares" and repair service and has enabled us to produce this pick-up at a price which many may at first have believed to be either a mistake or a printer's error.



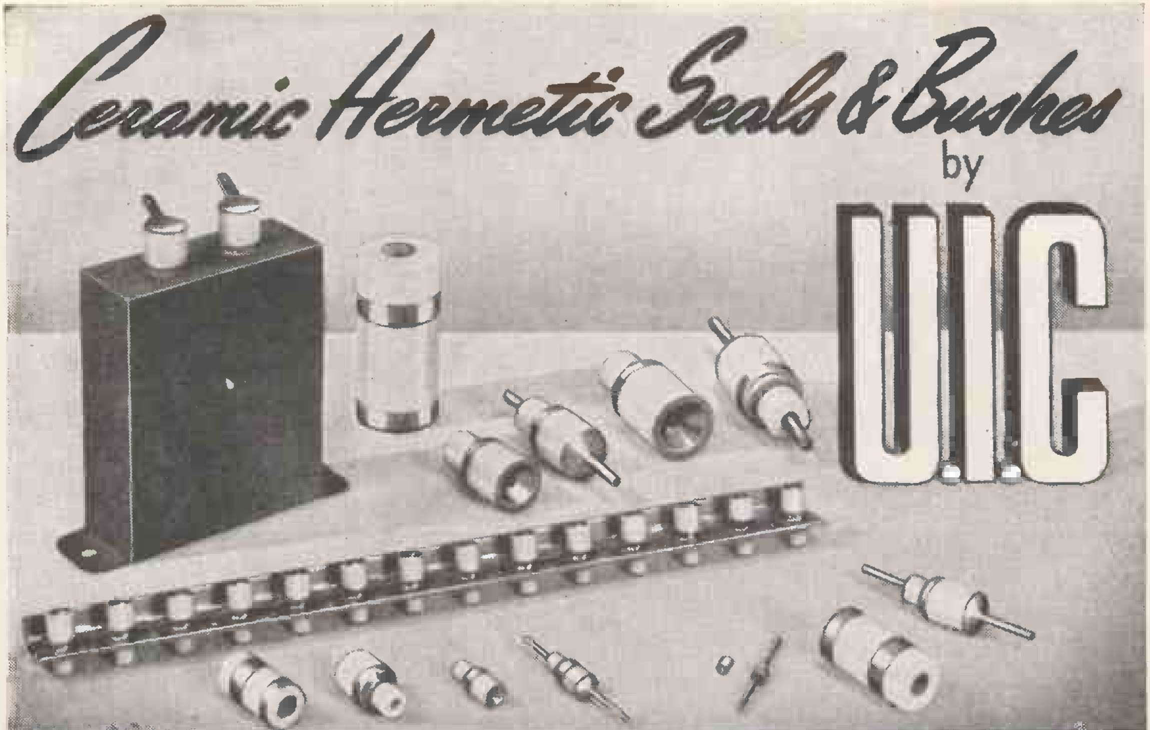
Photograph of A. Standard Needle, B. Miniature Needle and C. Brierley Microarmature.

Pick-ups, types JB/P/A/ID (78) and JB/P/A/IMD (LP) £6/0/0. Purchase Tax, £2/12/-

Mumetal Coupling Transformer, type JB/T/A, £1/5/-.

Full details sent on request.

J. H. BRIERLEY (Gramophones and Recordings) LTD.
KIRKBY TRADING ESTATE · LIVERPOOL



UNITED INSULATOR CO. LTD. OAKCROFT RD. TOLWORTH · SURBITON · SURREY

TELEPHONE: ELMBRIDGE 5241 CABLES: CALANEL, SURBITON

HIGH SENSITIVITY

"F" "K"

Because of their High Sensitivity the S. G. BROWN Type "F" (Featherweight) Headphones are a popular choice by all requiring efficient, long, and dependable service.

D.C. Resistance 4,000 ohms. Impedance 14,000 ohms at 1,000 c/s. Weight, 9 oz.

The S. G. BROWN Type "K" Moving Coil Headphones supply that High Quality Reproduction so essential for DX work, monitoring, laboratory purposes, etc.

D.C. Resistance 47 ohms. Impedance 52 ohms at 1,000 c/s.

Send for Brochure "W." It gives details of all types of S. G. Brown headphones.

S.G.Brown, Ltd.

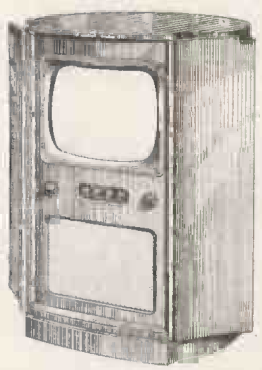
SHAKESPEARE STREET, WATFORD, HERTS.

(1)

AMBASSADOR OF GREAT BRITAIN

television

Clearly Unsurpassed



Your Ambassador dealer will be proud to show you a truly unique television receiver. Nowhere will you find anything to compare either in picture quality, cabinet style or price.

Ask to see the Ambassador T.V.5, 15" tube, 13½" × 10½" picture. Price £136. Literature on request.

Ambassador Radio, Princess Works, Brighouse, Yorks


There's a place for YOU

YOU CAN MAGNETICALLY RECORD using your Gramophone Motor as a Drive

Necessary parts, also usable later for a more ambitious job, plans available, 1 Spool Diamond Magnetic Recording Tape and 1 take-up spool, 2 Corner Brackets, 1 Roller, 1 Record-playback Head Kit, 1 Friction Clutch, 1 Dual-purpose Supersonic Oscillator and Two-stage Preamplifier and your Radio Chassis. Set of parts £7 . 15 . 0 or items supplied separately.

Also Constructional Data for Wire and Tape Recorders 5s.

PARK RADIO OF MANOR PARK, 676/8, 783 Romford Road, London, E.12

LEADING (AS USUAL)

As soon as manufacturers' stocks became available for the DE LUXE models WE HAD THEM ! ! !

ALL COMPONENTS FOR "E.E." AND OTHER TELEVISORS

Your enquiries are invited

TELE-RADIO (1943) LTD.

177, EDGWARE ROAD, LONDON, W.2

Phone: PAD. 5606
PAD. 6116

Shop Hours:
Mon.-Sat. 9 a.m.—6 p.m.
Thursday 9 a.m.—1 p.m.

McELROY-ADAMS MFG. GROUP LTD.

(Sole concessionaires U.K. for Hallicrafter communication equipment)

46 GREYHOUND ROAD, LONDON, W.6.

SPECIAL PURPOSE AND TRANSMITTING VALVES.

Eimac 304 T.H.	130/- each	Taylor T200	60/- each
Hytron H.Y. 65 ...	90/- ,,	R.C.A. C.R.C. 860...	15/- ,,
Raytheon R.K.28A...	90/- ,,	H.K.257B	70/- ,,
P.T.15	10/- ,,	R.C.A.830B	20/- ,,

PANORAMIC ADAPTOR

Model R.B.W.2. Suitable for use with the Hallicrafter receivers S27 and S36 or any communication receiver having an intermediate frequency of 5.25 megacycles. Price £45 each.

TRANSMITTER ARMY No. 12.

Frequency Coverage 1-17.5 Mc/s in four switched bands. C.W. and Phone built in modulator. Watts output 25. Operated from A.C. mains 100-250 Volts and complete with all tubes and delivered £25 each, carriage paid.

TRANSMITTER 1154.

Three band transmitter with all valves and in transit case. Bands, 200-500 Kc/s, 3.0-5.5 Mc/s, 5.5-10 Mc/s. £5/10/- each, carriage paid.

TUNING UNITS B.C.375E.

T.U.5, T.U.6, T.U.7, T.U.9, T.U.10, T.U.26. All 22/6 each.

SPEECH AMPLIFIER.

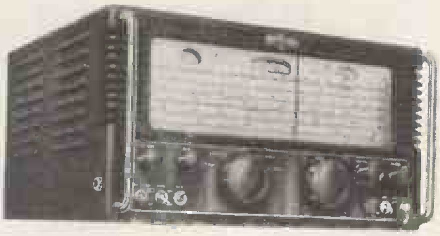
For use with R.C.A. Transmitter E.T.4336, complete with all valves. (British made). £24/10/- each, carriage paid.

MOTOR GENERATOR UNIT.

Motor 2 h.p. 230 Volt at 10 amps.
Output 12 Volts at 2 amps., 115 Volts at 1.5 amps, 500 Volts at 0.35 amps., and 1,800 Volts at 0.4 amps. Model No. 5LY123 A5. Price £18, plus carriage. Spare armatures available at £7 each.

Cables: Hallicraft, London. Phone: FULham 1802.

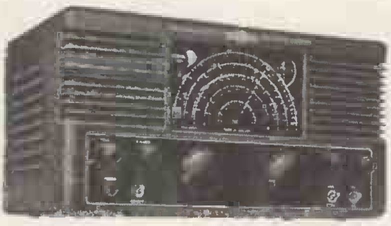
EDDYSTONE



COMMUNICATION RECEIVERS

The '680X'—Large straight-line dial. Polychromatic finish. Improved performance. Coverage 30 Mc/s to 480 Kc/s. Mainly for professional communication services.

The '750'—A fine, double superheterodyne receiver. Frequency coverage:—32 Mc/s to 1.7 Mc/s and 1465 Kc/s to 480 Kc's.



The '740'—An outstanding receiver of first-class construction at a moderate price. Frequency coverage:—30.6 Mc/s to 1.4 Mc/s and 205 Metres to 620 Metres. Mechanical bandspread. A.C. mains (110-240 volts) with provision for 6-volt battery operation.

Please write for Technical Brochure to:

STRATTON & CO. LTD., EDDYSTONE WORKS, BIRMINGHAM, 31

MARKS THE SPOT

Better television reception—a cleaner picture—less interference on sight and sound, and at lower costs. These are the facts which account for the rapidly increasing number of 'X' type aerials to be seen in both town and country. Send for copy of leaflet E/50/W.

MODEL X2P* POLE MOUNTING
for fitting to wooden or metal mast £2.17.0

MODEL X2W* 5 FT. MAST MOUNTING
complete with mast and wall mounting bracket £3.15.6

MODEL X2L* 5 FT. MAST MOUNTING
complete with mast and chimney lashing bracket £4.8.6

MODEL X2M* 10FT. MAST MOUNTING
complete with 1½ in. dia. aluminium alloy mast and chimney lashing equipment £6.3.6

* Add Suffix to model number to indicate frequency, i.e. 1 for London, 2 for Holme Moss, 3 for Kirk o Shotts, 4 for Midlands.

The electrical and mechanical design of the 'Antex' is fully protected. Pat. No. 630795 & Prov. Pat. 12178/49 & Reg. Des. 859630.

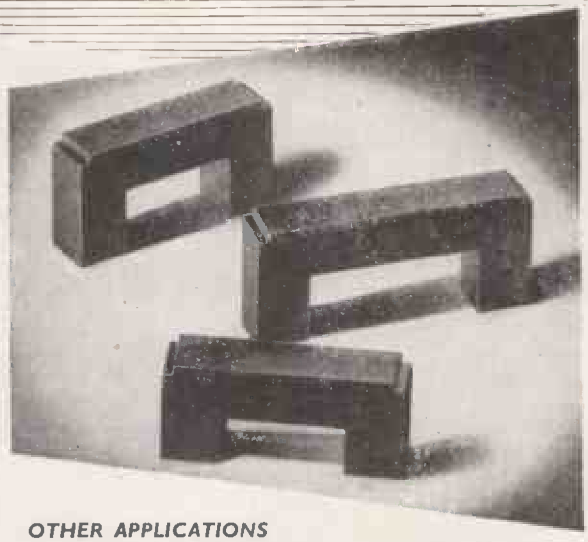
ANTIFERENCE 'Antex' TELEVISION AERIAL

ANTIFERENCE LIMITED · 67 BRYANSTON STREET · LONDON · W.1

FERROXCUBE

FERROMAGNETIC FERRITE

FOR TELEVISION



THE improvement in television components, with their smaller size and greater efficiency, is largely due to Ferroxcube, the new Mullard magnetic core material.
The uses of Mullard Ferroxcube in the production of TV components fall into these three main groups:

LINE OUTPUT TRANSFORMER COILS

Since the advent of wide-angle television tubes, with the accompanying demand for increased E.H.T. supplies, the need for line output transformers of the highest possible efficiency has been greater than ever. Mullard Ferroxcube, with its low iron losses, completely fulfils this need — also facilitating the assembly of small, compact transformer units by means of solid, non-laminated U-shape cores.

DEFLECTION COIL YOKES

Mullard Ferroxcube cores in ring form are ideal for producing the magnetic circuit around deflection coils. Used in this way, Mullard Ferroxcube makes possible the construction of efficient deflector coils with a high Q factor. In order to simplify assembly problems, these ring cores are supplied either in the form of a complete circle, as two semi-circles, or as castellated yokes.

LINEARITY AND PICTURE WIDTH CONTROLS

Mullard Ferroxcube can very conveniently be extruded into rods and tubes. In this form it is ideal for use in linearity and picture width controls, providing a smooth control in a compact assembly.

OTHER APPLICATIONS

In addition to its uses in television receivers, Mullard Ferroxcube is also being widely employed in line communications, radar, and other specialised electronic equipments. The purposes for which it is already being most successfully applied in such equipments include filter networks, wide band transformers, magnetic amplifiers, and pulse transformers.

PLEASE WRITE FOR FULL DETAILS

Mullard

Mullard FERROXCUBE

FERROMAGNETIC FERRITE

MULLARD LIMITED · CENTURY HOUSE · SHAFTESBURY AVENUE · LONDON · W.C.2.
(MF376)

B.P.L. TEST SETS

NOW AVAILABLE

AT **NET** PRICES

B.P.L. UNIVERSAL TEST SET
£5 - 18 - 6

B.P.L. SUPER RANGER 1,000 Ω/v.
£13 - 10 - 0

B.P.L. SUPER RANGER 20,000 Ω/v.
£15 - 10 - 0

Prices include postage and packing and are applicable to Home Market only.

Send your order direct to:

BRITISH PHYSICAL LABORATORIES
HOUSEBOAT WORKS, RADLETT, HERTS
Tel.: Radlett 5674-5-6

NEON TEST PROD

Suitable for testing up to 250 V. supplies.
Will indicate polarity and detect leakage.
Housed in moulded rubber black case.
Totally shockproof and safe.

Tests on A.C. & D.C.

FOR EVERY SERVICEMAN
PRICE 10/- RETAIL

NEW

A.F. BULGIN & CO., LTD.,
BYEPASS RD., BARKING, ESSEX

ASSOCIATION OF PROFESSIONAL RECORDING STUDIOS

President: THE EARL OF HAREWOOD.
Chairman: H. LYNTON FLETCHER, M.A.
General Secretary: M. K. HOWELLS, A.C.I.S.,
14, Wynchgate, Harrow Weald, Mddx.
Tel.: Grimsdyke 101.

THE ASSOCIATION OF PROFESSIONAL RECORDING STUDIOS — APRS

This is the sign of a registered and bona fide Recording Studio. Do you hold the Association's Certificate? If you make recordings either professionally, or as an amateur, write for information to the General Secretary.

Full membership.......... £3 . 3 . 0 per annum
Associate membership.... £2 . 2 . 0 per annum

STRICTLY EXPORT ONLY



HALTRON

Leading Exporters of all types of Radio Receiving and Transmitting Tubes. Current Production and Ex-Government Surplus Special Purpose Tubes. Over 400 types in large quantities, available Ex-Stock. Suppliers to Foreign Governments, Airlines, etc.

HALL ELECTRIC LTD

89, CHARLOTTE ST., LONDON, W.1. *Phones: MUSEUM 9661 (5 lines)* *Cables: HALLECTRIC, LONDON*

To HAMS & DEALERS

RADIO HAM SHACK, NEW YORK

WANT US TO BUY

ALL AMERICAN MADE GOVERNMENT SURPLUS EQUIPMENT IN NEW OR GOOD SECOND-HAND CONDITION

TEST SETS • TRANSMITTING TUBES
CLYSTRONS • THYRATRONS • MAGNETRONS
XTAL DIODES • SIGNAL GENERATORS
FREQUENCY METERS • COMMUNICATION RECEIVERS

All kinds of American made surplus radio components and equipment.

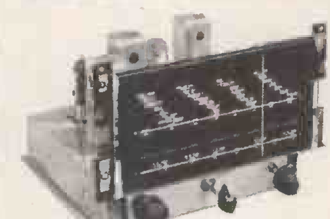
We are interested in any quantity, from one upwards. Drop us a line and we will clinch the deal by return of post or send our representative to see you.

SOLE AGENTS IN GT. BRITAIN.

ALTHAM RADIO CO BRAZENNOSE ST MANCHESTER 2 *Tel: DEAnsgate 5387*

dmAR 15

TUNERS



Our Type 84 is the ideal Quality Tuner for your high-quality amplifier. This four stage Super-Het Unit has a lively performance with very low distortion. Fitted variable selectivity 7K.C. and 10K.C. Wave-band coverage 16-50m., 195-550m., 900-2,000m. Using latest Mullard valves ECH42, EF41, EBF80.

£17 . 6 . 8
TAX PAID

Manufacturers of Ventex Cabinets.

C. T. CHAPMAN (Reproducers) Ltd. FLAxman 4577/8
RILEY WORKS, RILEY STREET, CHELSEA, S.W.10
Daily Demonstrations at Webb's Radio

"ADCOLA" SOLDERING INSTRUMENTS

Reg. Trade Mark

Reg. Design, 860302

Designed for Wireless Assembly and Maintenance.

SUPPLIED FOR ALL VOLT RANGES FROM 6/7v to 230/50v.

The three Adcola Models cover the requirements of the **Television, Telecommunication and Radar Engineers** and assure thorough jointing.

3/16 in. dia. Bit. Standard Model— 22/6
1/4 in. dia. Bit. Standard Model— 25/-
3/16 in. dia. Detachable Bit — — 30/-

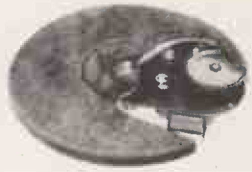
Patented in England and Abroad.

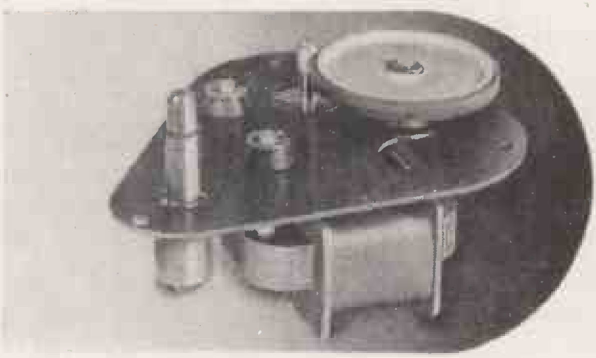
Sole Manufacturers:

ADCOLA PRODUCTS LIMITED
General Offices & Works: CRANMER COURT, CLAPHAM HIGH STREET, LONDON, S.W.4. *Tel.: MACaulay 4272.*

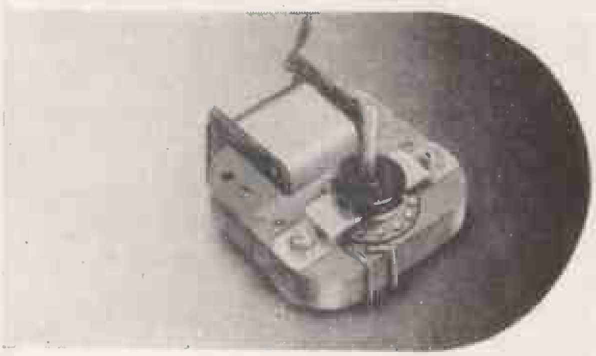
Two of the latest

FROM THE RANGE OF B.S.R. GRAMOPHONE UNITS





MU15. GRAMOPHONE MOTOR UNIT This De-luxe 78 RPM unit is fitted with an 8″ diameter turntable, allowing it to be mounted in a neat compact case while still being able to play all sizes of records. It is the ideal gramophone unit for portable record players or gramophones and radiograms designed for space consideration. It is the manufacturers' choice where dependability coupled with low cost is essential. Models available for 78 RPM or 33⅓ RPM. Ideal for use with any type of pick-up.



TP1. SHADED POLE INDUCTION MOTOR This, the latest motor from the BSR factories has been designed to give the maximum efficiency with the minimum physical dimensions. It is a motor with a thousand uses.

SPECIFICATION:—

Voltage: 200/250, **Frequency:** 50 cycles. (Other voltages and frequencies to order.)

Starting Torque: 1.0—1.5 inch ozs.
Full Load Torque: 1.2—2.0 inch ozs.
Mains Consumption: 10—15 watts.
} Depending on temperature rating.

Speed (light): 2900 RPM

Shaft Diameter: .1560″ $\pm^{.0000}_{.0002}$ **Weight:** 1 lb.

BIRMINGHAM SOUND REPRODUCERS BSR (BRITISH THROUGHOUT) **LIMITED**

CLAREMONT WORKS, OLD HILL, STAFFS. ENG. GRAMS: 'ELECTRONIC, OLD HILL, CRADLEY HEATH'

Wireless World

RADIO, TELEVISION AND ELECTRONICS

41st YEAR OF PUBLICATION

Managing Editor: HUGH S. POCOCK, M.I.E.E.
Editor: H. F. SMITH

NOVEMBER 1951

In This Issue

PUBLISHED MONTHLY: Price 2/- (last Tuesday of preceeding month) by ILLIFE & 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 ... and their Applications

INDIRECTLY-HEATED VALVES FOR BROADCAST RECEIVERS

The I.F. Stage

The I.F. stage requires a valve capable of providing a large gain with the desired bandwidth. It must give stable operation under all conditions, and its characteristics must be suitable for the application of A.V.C. A.V.C. must not, however, cause serious variations in the response curve of the stage, and the valve must be capable of handling input and output voltages over a wide range of signal levels without undue distortion.

All these requirements are met by the Mullard EF41 and UF41 medium-slope, high impedance variable-mu pentodes.

The anode-to-control-grid capacitance of these valves is sufficiently small to ensure stable operation with normal I.F. transformers, provided that reasonable care is taken with the wiring layout.

Using critically-coupled I.F. transformers having a single circuit impedence of 0.2 MΩ, gains in the order of 200 are obtainable when the following stage is of high impedance. When, however, as is usual, a single I.F. stage is followed by the detector and A.V.C. diodes, the damping imposed by these diodes limits the gain from the grid of the I.F. valve to the detector input to about 100, assuming a detector load of 0.5 MΩ.

In normal 4-valve receivers where the detector is followed by an A.F. amplifier and high-sensitivity output pentode, the input required at the detector for full output can easily be obtained from the I.F. valve with moderate input signals. In order to reduce the risk of overloading on strong signals where the A.V.C. circuit is supplying a large bias voltage, the A.V.C. characteristics of the EF41 and UF41 are so matched to those of the corresponding frequency changers that, when the same A.V.C. voltage is applied to both stages, the gain of the I.F. valve with sliding screen voltage is reduced more slowly than that of the frequency changer.

The signal voltages on the I.F. valve are therefore not allowed to become excessive, and modulation distortion in this stage is small.

These valves may also be used as R.F. amplifiers before the frequency changer stage. For this application the screen voltage should be obtained via a potentiometer.

R.F. VOLTAGE AMPLIFYING PENTODES

Type EF41 for A.C. Mains and Car Radio Sets

Type UF41 for D.C./A.C. Mains Sets

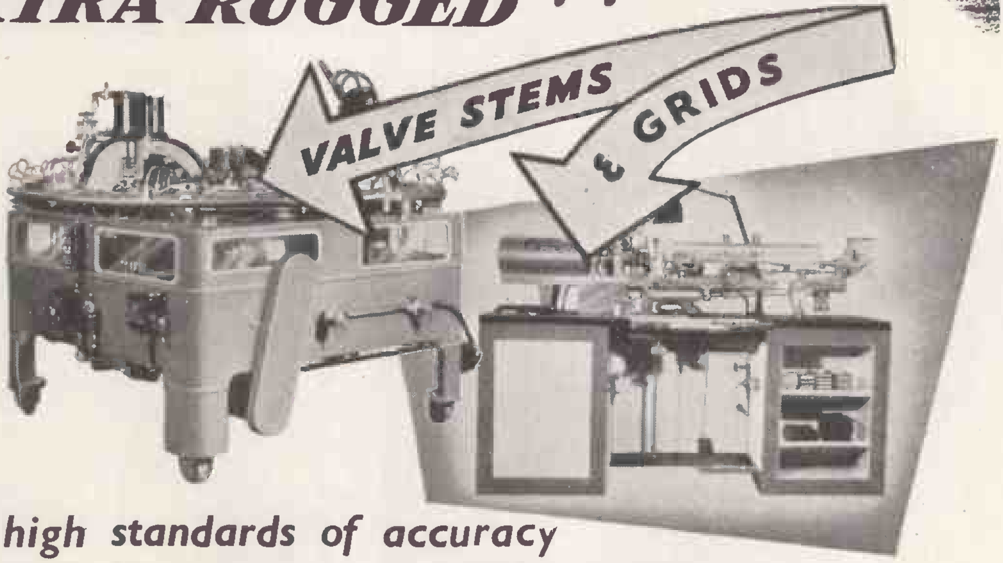
	EF41	UF41
Heater		
V_h	6.3	12.6 V
I_h	0.2	0.1 A
Characteristics		
V_a	250	170 V
V_{g2}	100	100 V
I_a	6.0	6.0 mA
I_{g2}	1.7	1.7 mA
V_{g1}	—2.5	—2.5 V
g_m	2.2	2.2 mA/V
r_a	1	1 MΩ
μ_{g1-g2}	18	18
R_{eq}	7.4	8.0 KΩ
R_{g2}	90	39 KΩ
V_{g1} (100:1 reduction in g_m)	—39	—28 V
Limiting Values		
$V_{a(b)}$ max.	550	550 V
V_a max.	300	250 V
p_a max.	2	2 W
$V_{g2(b)}$ max.	550	550 V
V_{g2} max. (I_a=6mA)	125	150 V
V_{g2} max. (I_a < 3mA)	300	250 V
p_{g2} max.	0.3	0.3 W
I_k max.	10	10 mA
V_{h-k} max.	50	150 V

THE COMPLETE SERIES

	FREQUENCY CHANGER	R.F. or I.F. AMPLIFIER	DET., A.F. AMPLIFR. & A.V.C. DIODE	OUTPUT PENTODES	RECTIFIERS
6.3V Heater	ECH42	EF41	EBC41	EL41; EL42	EZ40; EZ41
0.1 A Heater	UCH42	UF41	UBC41	UL41	UY41

Reprints of this article together with additional data may be obtained free of charge from the address below.

FAST production of EXTRA RUGGED . .



to new high standards of accuracy

Demands from Industry and the Services for valves of a higher standard of accuracy and reliability have called for consideration of the machines employed in their manufacture. The result has been that our engineers have produced these two outstanding machines, both of which have been designed for the high speed production of valve components to a standard of accuracy and ruggedness which so far has not been equalled anywhere in the world.

These machines are already operating in Britain, U.S.A. and other parts of the world. In the **Brimar Valve** works at Footscray, Kent, England, they are engaged in the production of the high accuracy, extra-rugged **Brimar** TRUSTWORTHY Valves.

Please ask us for comprehensive details of these outstanding machines.

NOTE THESE IMPORTANT FEATURES

The MITCHELL-BRIMAR Stem Machine

Designed to meet the need for a British stem machine. Capable of producing extra rugged miniature and noval stems with a high degree of accuracy, the Mitchell-Brimar stem machine offers these outstanding features :—

Processes actually carried out on the machine :

(*a*) Fine polishing of the glass disc.
(*b*) Bubble cushions raised in the glass around lower parts of pins.
(*c*) Hydrogen cleaning of the upper and lower parts of the pins.
(*d*) The setting of the correct radial compression strain in the glass disc.

Simple change-over permits production of B7G or B9G stems at will.
Production rate 700 per hour approx. with a loss of 2 per cent. max.
One operator only.
Accessible adjustments.
Easily and quickly dismantled.
Extremely robust construction.
Easy maintenance.
Automatic pin feed.
Automatic ejection of finished stem.

The BRIMAR Grid Winding Lathe

The Brimar Grid winding lathe has been developed in order to produce a finished grid **in one operation**, thus reducing costs and improving the product.

1. Constant and variable-pitch grid production.
2. Increased accuracy of grid lengths.
3. Elimination of "spring-back" when support wires are cut.
4. Maximum possible work can be done on grids on or at **the machine**. Thus it is possible to :
   (*a*) Wind to the final profile wherever the required profile permits.
   (*b*) Hot-stretch the strip after winding, to straighten support wires.
   (*c*) Burn out, during winding, the loose turns between grids.
   (*d*) Automatically stake grids during winding.
   (*e*) Cold-stretch, during the winding cycle, strips unsuitable for hot-stretching.
   (*f*) Chop grids accurately to length.
5. Unusual mechanical soundness.
6. Freely interchangeable parts.

MITCHELL STEM MACHINE BRIMAR

BRIMAR GRID LATHE

We regret that for the present our supplies of these machines must be for **EXPORT ONLY**

Standard Telephones and Cables Limited FOOTSCRAY · SIDCUP · KENT

THE "BELLING-LEE" PAGE

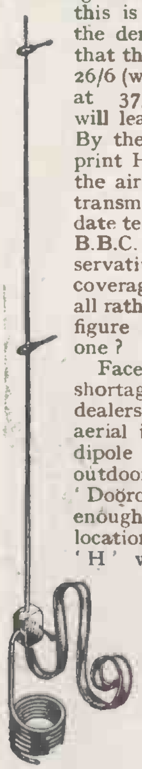
Providing technical information, service and advice in relation to our products and the suppression of electrical interference

What price snob appeal ?

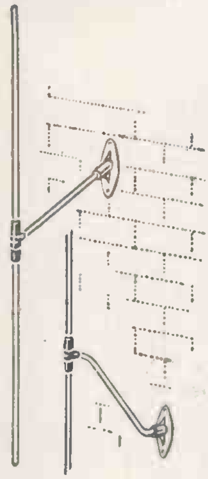
There was a time when television aerials were erected with a view to making neighbours jealous. In those days, the more elaborate the aerial the greater the heart burning of the neighbours. It seems that shortage of materials is now controlling this ridiculous state of affairs. We have always deplored the "overselling" of television aerials, apart from the fact that to sell a more expensive aerial than is necessary is not good for dealer-customer relationship ; an unnecessary array of aerials is apt to cause some local authorities to act against their erection. There will always be places within a few miles of a transmitter where an 'H' will be found necessary because of interference or "ghosts," but we are delighted to record that there has been an enormous increase in the sale of dipoles, both indoor and outdoor.

What is the average price of an aerial and what kind should I get ?

The latest designs bring down our average price of a TV aerial to something under four pounds inclusive of cable and we still sell all we can make of 'Multirod' and 'Senior H' for fringe area reception. Even so, this is not enough to meet the demand. We anticpiate that the sale of 'Doorods' at 26/6 (with feeder) and dipoles at 37/6 (without feeder) will leap ahead still further. By the time this appears in print Holme Moss will be on the air. Reports of the test transmissions at this early date tend to indicate that the B.B.C. have been very conservative in their estimated coverage, but would we not all rather have a conservative figure than an exaggerated one ?



Faced with the admitted shortages, we cannot see dealers erecting a senior 'H' aerial in a location where a dipole will do the job, or an outdoor dipole where a 'Doorod' aerial is good enough. There will be lots of locations where the senior 'H' will be essential and these aerials are hard to come by. In such locations an inferior grade of aerial will not do, and the sale of a receiver may be lost to a dealer who has the correct aerial. Normally it is silly to buy a senior 'H' aerial and to fit attenuators to reduce the signal input to the receiver. It is a waste of your money and material. The material in such an aerial would make three or four dipoles.



"Belling-Lee" Simple Dipoles. Alternative mounting.

Survey of Holme Moss Area

This is being written at the Radio Show, Earls Court. The number of visitors from the Holme Moss area is very surprising. All ask the question "I live at so-and-so, what aerial will I need" ? That is very difficult to answer; all indications confirm that, in general, coverage will be much greater than was expected by anybody. This means that fewer 'H' type aerials will be required "close in," and that those in the populated areas of the North East will have a greater chance to receive television.

Those who have been reading this page for over a year will recollect that when Sutton Coldfield opened we carried out an independent field strength survey on a radius of about 75 miles. We propose to do the same in Holme Moss area. The figures will be made known to readers as they become available. The last survey we carried out was greatly appreciated by Dealers, Press, Manufacturers and Technical Bodies. We will gladly add to our list names of those who would have use for such information. Members of the public are asked not to apply, as their interest can only be in respect of one location, and the field strength figures will be published in the "Wireless World" as they are produced.

It may interest some to learn that this new survey will be carried out on our new Mobile Research Unit. This has been built on a two-ton chassis and is more robust in every way. The experience gained with the first vehicle has made it possible to design one much more suitable from practical as well as technical standpoints.

Feeding two receivers from one aerial.

With the ever increasing popularity of television, tenants of semi-detached or terrace houses are suddenly faced with the fact that they have at least one thing in

FIG. 1

common with their immediate neighbours—a chimney stack !

Consequently the question of feeding two receivers from one aerial is one that occurs frequently in our correspondence.

Where co-axial feeder is employed we usually suggest the arrangement shown in figure 1.

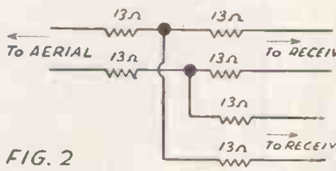


FIG. 2

The three resistors should all be of the same value, i.e. 27 ohms.

It should be noted that this system means that each set will receive a signal which is 6 d.b. down, compared to that being supplied by the aerial. It is therefore a matter for decision as to whether the signal strength allows for this degree of attenuation.

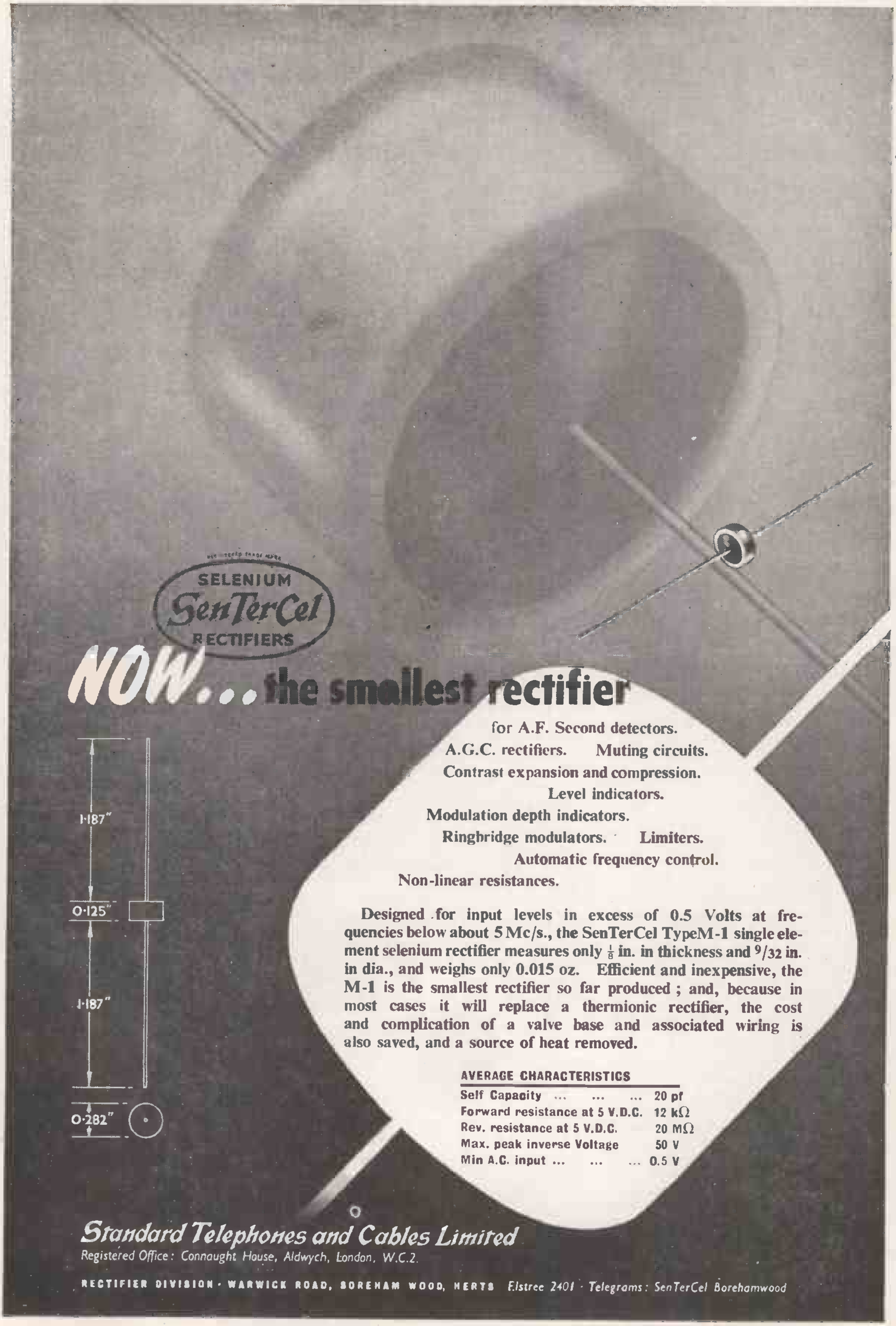
For twin feeder, a suggested arrangement is shown in figure 2.

What is a good aerial ?

Every month many thousands of people take delivery of their new television receivers, and many more decide to invest in one. To those in the latter category, our advice is to buy the best television aerial you can for your own location.

The best is neither the one that is the more expensive nor the one that looks most impressive. Truth to tell, the mechanical "goodness" or the engineering of a television aerial is more important than its "electrics." The electrical specification allows wide tolerances, but the aerial must stay up under adverse weather conditions ; must withstand corrosion in the places that matter, and must have a reasonably long life.

BELLING & LEE LTD
CAMBRIDGE ARTERIAL RD., ENFIELD, MIDDX., ENGLAND

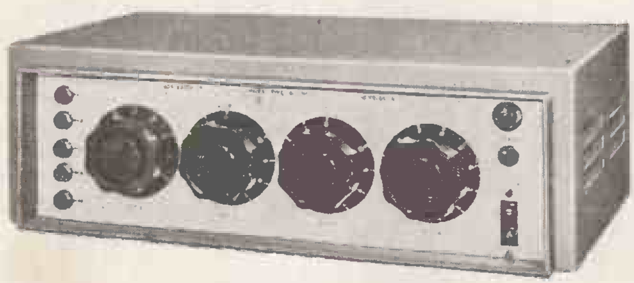

REGISTERED TRADE MARK
SELENIUM
SenTerCel
RECTIFIERS
NOW... the smallest rectifier
for A.F. Second detectors.
A.G.C. rectifiers. Muting circuits.
Contrast expansion and compression.
Level indicators.
Modulation depth indicators.
Ringbridge modulators. Limiters.
Automatic frequency control.
Non-linear resistances.
Designed for input levels in excess of 0.5 Volts at frequencies below about 5 Mc/s., the SenTerCel TypeM-1 single element selenium rectifier measures only ⅛ in. in thickness and 9/32 in. in dia., and weighs only 0.015 oz. Efficient and inexpensive, the M-1 is the smallest rectifier so far produced; and, because in most cases it will replace a thermionic rectifier, the cost and complication of a valve base and associated wiring is also saved, and a source of heat removed.
1·187"
0·125"
1·187"
0·282"
AVERAGE CHARACTERISTICS
Self Capacity ... ... 20 pf
Forward resistance at 5 V.D.C. 12 kΩ
Rev. resistance at 5 V.D.C. 20 MΩ
Max. peak inverse Voltage 50 V
Min A.C. input ... ... 0.5 V
Standard Telephones and Cables Limited
Registered Office: Connaught House, Aldwych, London, W.C.2.
RECTIFIER DIVISION · WARWICK ROAD, BOREHAM WOOD, HERTS Elstree 2401 · Telegrams: SenTerCel Borehamwood

"SUPER FIFTY WATT" AMPLIFIER

This amplifier has a response of 30 c/s. to 25,000 c/s, within ¼ db, under 2 per cent distortion at 40 watts and 1 per cent at 15 watts, including noise and distortion of pre-amplifier and microphone transformer. Electronic mixing for microphone and gramophone of either high or low impedance with top and bass controls. Output for 15/250 ohms with generous voice coil feedback to minimise speaker distortion. New style easy access steel case gives recessed controls, making transport safe and easy. Exceedingly well ventilated for long life. Amplifier complete in steel case, with built-in 15 ohm mu-metal shielded microphone transformer, tropical finish.

FOUR-WAY ELECTRONIC MIXER

This unit has 4 built-in, balanced and screened microphone transformers, normally of 15-30 ohms impedance. It has 5 valves and selenium rectifier supplied by its own built-in screened power pack : consumption, 20 watts.
Suitable for recording and dubbing, or large P.A. installations since it will drive up to six of our 50 watt amplifiers, whose base dimensions it matches. The standard model has an output impedance of 20,000 ohms or less, and any impedance can be supplied to order.



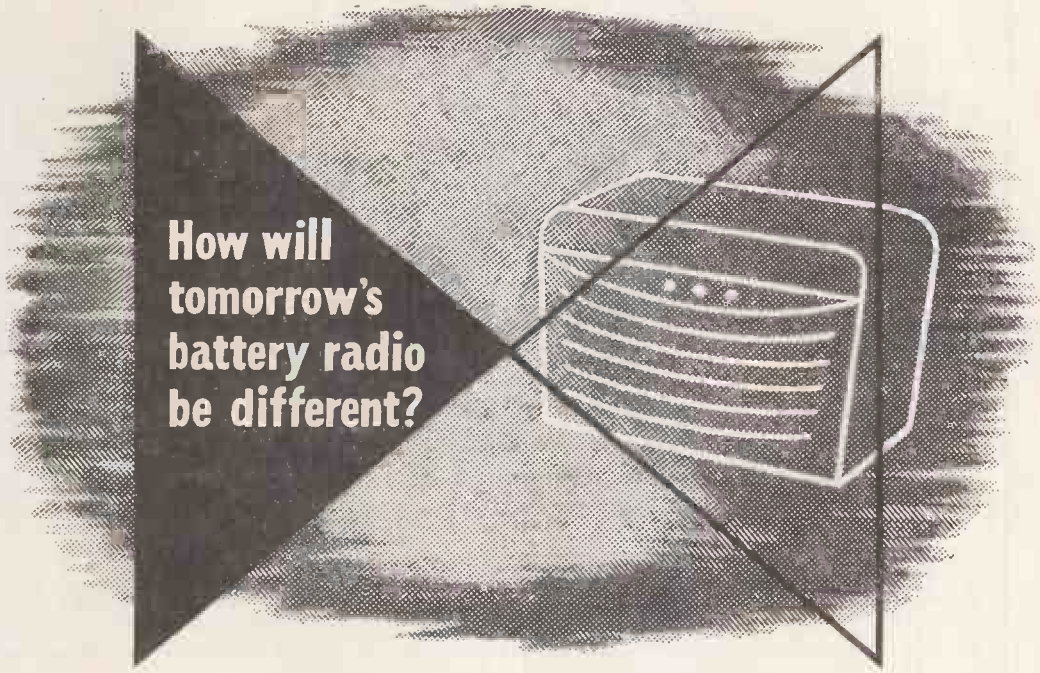
Manufactured by:

VORTEXION LIMITED

257-263, THE BROADWAY, WIMBLEDON, LONDON, S.W.19

Telephones: LIBerty 2814 & 6242-3 *Telegrams: "Vortexion, Wimble, London."*

A QUESTION FOR DESIGNERS



Circuits progress; new cases will evolve from new materials and techniques — but the one outstanding feature of tomorrow's battery radio is here today —

VENNER *Lightweight Accumulators*

One third the weight and half the size of standard accumulators of comparable capacity, these revolutionary miniature storage batteries *maintain a steady 1.5 volt output on load throughout their discharge period.*

Thus they eliminate the need for constant replacement due to voltage drop, which is the failing of all other conventional L.T. batteries.

In addition, Venner Lightweight Accumulators are completely non-spillable, are unharmed by high charge and discharge rates and may be left in discharged condition without damage.

The services of our technical department are freely at your disposal in investigating the many operational advantages of these accumulators.

For full technical data please write for leaflet VAO11/WW

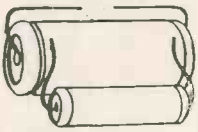
VENNER *ACCUMULATORS LTD*

Distributors for London and Home Counties :—
DAVID & SOLF LTD., 173, SLOANE STREET, S.W.1. Tel. : SLOane 353.

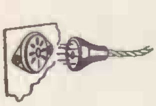
KINGSTON-BY-PASS, NEW MALDEN, SURREY. *Telephone:* MALden 2442 *(6 lines)*

ELPREQ PAGES

ELECTROLYTIC CONDENSERS

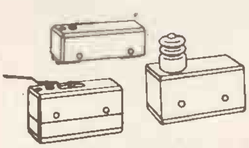


1 mfd. 150 v.	1/-
1 mfd. 250 v.	1/-
1 mfd. 450 v.	1/3
2 mfd. 350 v.	1/3
2 mfd. 450 v.	1/6
4 mfd. 350 v.	1/8
4 mfd. 450 v.	1/10
8 mfd. 150 v.	1/6
8 mfd. 350 v.	2/-
8 mfd. 450 v.	2/6
8 mfd. 500 v.	3/3
8 mfd. 500 v. centre-screw fixing	1/6
8 mfd. 600 v. centre-screw fixing	1/9
16 mfd. 350 v.	2/9
16 mfd. 450 v.	3/6
16 mfd. 500 v.	4/9
16 mfd. 700 v.	7/6
32 mfd. 150 v.	2/3
32 mfd. 250 v.	2/3
32 mfd. 350 v.	2/9
8 mfd. × 8 mfd. 350 v.	3/-
8 mfd. × 8 mfd. 450 v.	3/9
8 mfd. × 8 mfd. 500 v.	3/9
8 mfd. × 16 mfd. 450 v.	4/9
8 mfd. × 16 mfd. 500 v.	6/-
16 mfd. × 16 mfd. 450 v.	6/-
16 mfd. × 16 mfd. 500 v.	7/-
20 mfd. × 20 mfd. 200 v.	4/-
24 mfd. × 24 mfd. 200 v.	4/6
25 mfd. × 25 mfd. 200 v.	4/9
32 mfd. × 32 mfd. 150 v.	4/9
32 mfd. × 32 mfd. 450 v.	6/9
100 mfd. × 100 mfd. 150 v.	5/6
10 mfd. 25 v.	1/-
12 mfd. 50 v.	1/4
20 mfd. 50 v.	1/6
25 mfd. 25 v.	1/6
25 mfd. 50 v.	2/-
50 mfd. 12 v.	9d.
50 mfd. 50 v.	2/3
250 mfd. 12 v.	2/3
250 mfd. 25 v.	2/6
8 mfd. × 8 mfd. × 8 mfd. 450 v.	3/9



PLUGS FOR MODERN VALVE HOLDERS

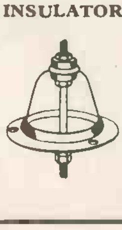
Each is fitted with a rubber shroud. Type 1, for B7G button base. Type 2, for B9A noval base. Price 1/4 each, discounts for quantities.



MICRO SWITCHES

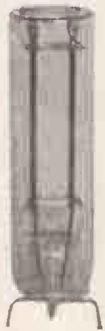
The three types illustrated are in stock. Leaf type, 3/6. Rubber plunger type, 3/3. Ball type, 3/-. Also Ultra small American type No. CR107/DC103, price 4/6. Other types may be available from time to time.

PYREX AERIAL INSULATORS



Ideal for aerial connections through cabin walls or through panels. Consists of glass dome with threaded rod and terminal ends, and metal fixing flange. Price 2/- each.

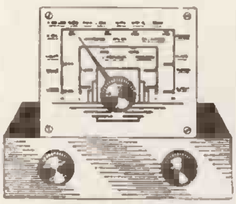
GUESS WHAT FOR £5



The valve illustrated in our September "Guess What" Competition was an EF50 with the metal case removed. Prizes were sent to the readers whose solutions were the first three correct ones opened. The names of the winners were posted in both our branches early in October.

This month's "Guess What" we think is a little harder, we invite you to tell us the name of the object illustrated. By way of a clue please note that we describe this item for sale somewhere in these four pages. Also please note the object is on show at our Fleet Street branch. We offer prizes of £5 to the first, £3 to the second, and £2 to the third correct answers opened.

There is no need to rush your answer to us, you can send it in when you next order from us. You have until first post on the 24th.



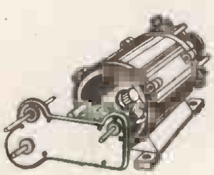
ALL MAINS CHASSIS

This is the equivalent of a 4-valve receiver for it uses three valves and a metal rectifier. It is all wired up ready to work off A.C. mains, complete with modern valves, ganged tuning, high precision dust-cored coil, first grade condensers and resistors, all on metal chassis. Tunes long and medium wavebands. Large clear dial. Receives home services; light programme Luxemburg etc. Chassis size approximately 9in. × 4in. × 5in. Complete with valves, but less speaker, 69/6. Suitable speaker with matching transformer, 16/6—nothing else needed. Postage and packing 2/6 extra.

10,000 B.V.A. VALVES AT PRE-BUDGET PRICES

R.1155

This is considered to be one of the finest communications receivers available today. The frequency range is 75 kc/s to 18 mc/s. Complete with 10 valves and is fitted in black crackled case. Made for the R.A.F. so obviously a robust receiver which will give years of service. We have only a few of these left now, they are in a used condition and have not been tested. Price is only £6/19/6. If you cannot call to collect please include an additional 10/- to cover cost of transit case and carriage. This is partly returnable to you if and when you return the transit case.



MULTI-SPEED MOTORS

You can adjust this motor to almost any speed you want, it will work directly off A.C. mains, or if you require greater power or greater speed work it through a metal rectifier. This motor is fitted with a gear box enabling speeds down as low as 1 r.p.m. to be obtained. Price 14/6, postage and packing 1/6 extra.

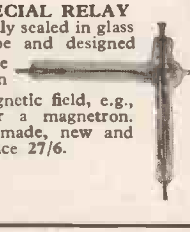
THIS MONTH'S SNIP

2¾in. Cathode Ray Tube, made by G.E.C. for the Government, No. CV964, ideal for scopes, miniature T.V., etc. This is an electrostatic tube, with standard base and green fluorescence. The sensitivity is X.097 m.m.v., and Y.13 m.m.v. and filament voltage is 4 v. Wiring data supplied—limited quantity, 17/6 each.

BOOKS AND PUBLICATIONS

"DEMOBBED VALVES." Gives the commercial equivalents of many thousands of service valves, and conversely gives the service equivalent of many thousands of commercial type valves, an invaluable publication recently revised. Price 2/3. "AN ELECTRONIC TIMER." Shows how to build a device for controlling timed operations. The timer can be set to any timing up to 3 minutes. Price 2/3. "THE ELECTRONIC SWITCH." Shows how to make a device for switching without mechanical contact. Price 2/3. "THE IMPULSE RELAY." Explains the working of an ingenious relay and gives several circuits including radio control. Price 1/9. "3½-WATT CONVERTIBLE AMPLIFIER." Shows how to construct a 3-stage amplifier with an output of 3½ watts, a unique feature is that this amplifier fits into our "Occasional" cabinet. Price 1/6. "THE I.F. AMPLIFIER." Gives details of a 465 kc/s. amplifier with A.V.C. detector and power output stage. Designed to fit into our "Occasional" cabinet, it is useful for aligning coil packs and for use as a signal tracer in radio servicing, etc. Price 1/6. "THE 'OCCASIONAL T.R.F.'" Shows how to build a T.R.F. Receiver for medium and long wave reception, of looks and quality output comparable with sets priced between £10 and £14. This costs less than £6 to build including cabinet. Price 1/6. "THE 'OCCASIONAL SUPERHET.'" In areas where field strength is low and interference is high, a superhet receiver is essential. For less than £8 one can be built into our "Occasional" cabinet. This publication gives all details. Price 1/6. "VALVE EQUIVALENTS." These are the best equivalents charts available today. Also the booklet can be used for keeping records of valve stocks. Price 2/6. "I.F. ALIGNMENT PEAKS." This book gives the I.F. frequencies of more than 4,700 receivers, British, American and Continental. A very popular British set is covered, and hints on finding the frequencies of unknown British sets are also given. Price 4/6. FOUR INTERESTING LEAFLETS' (1) The Infra-Red Cell; (2) A millibar barometer from a sensitive altimeter; (3) A.V.F.O. from unit type TU5B; (4) The circuit for light-operated relay. These are free with all orders for publications this month.

SPECIAL RELAY



Hermetically sealed in glass angle shape and designed to operate when in strong magnetic field, e.g., when near a magnetron. American made, new and unused price 27/6.

TRANSFORMER BARGAINS

All by famous makers such as Parmeko.

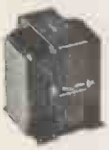
200 mA, 340-0-340 v. 6.3 v. at 4 amps, 5 v. at 4 amps, 4 v. at 3 amps, unshrouded but fully impregnated, a really first-class transformer. Price 25/-.

150 mA, 425-0-425 v. 6.3 v. at 6 amps, 6.3 v. at 6 amps, 5 v. at 3 amps, 4 v. at 2 amps, 4 v. at 1 amp. Price 65/-.

150 mA, 350-0-350 v. 6.3 v. at 4 amps, centre tapped, 5 v. at 3 amps, fully shrouded upright mounting. Price 32/6.

80 mA, 350-0-350 v. 6.3 v. at 4 amps, 4 v. at 3 amps, half shrouded drop through. Price 18/6.

80 mA, 320-0-320 v. 6.3 v. at 4 amps, 5 v. at 3 amps, half shrouded drop through. Price 19/6.



70 mA, 230-0-230 v. 6.3v. at 3 amps, 5 v. at 2 amps, fully shrouded upright mounting. Price 22/6.

60 mA 260-0-260 v. 6.3 v. at 3 amps, 4 v. at 2 amps, half shrouded drop through. Price 16/6.

60 mA, 260-0-260 v. 4 v. at 4 amps 4 v at 2 amps Price 16/6.

40 mA, 250-0-250 v. 6.3 v. at 4 amps Price 12/6.

FILAMENT TRANSFORMERS

6.3 v. at 1.5 amps, standard type for receivers. Price 6/6.

2 v. at 2.5 amps, highly insulated for television. Price 7/6.

STAND-BY BATTERY SET

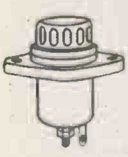
Made originally for the Government for use in canteens, etc., this 4 valve medium wave-band superhet uses 2 v. Mazda valves, and is complete with 5in. P.M. Speaker and usual controls. A good set to have by you so that you can carry on listening to a programme despite a power cut. Unused but storage soiled, £4/5/-, carriage 5/- extra.

COMPRESSED FIBRE BOARD

This ⅛in. thick board is easier to work with than plywood, and is an ideal material for emergency cabinets or for permanent speaker baffles, trays, bases, backs and for sound and heat insulation.

5ft. 11in. × 2ft. 11 in., callers only. Price 9/6.

2ft. × 2ft., 3/6; 2ft. × 1ft., 2/-; 1ft. × 1ft., 1/3.



INDICATOR LAMPS

Complete as illustrated. Price 1/6.

EXCELLENT CHRISTMAS PRESENT FOR MOTHER OR MARRIED SISTER.

The "Lectross" electric clothes drier/convector room heater is a device which can be a heater all the week and a clothes drier on washing days. It will make life easier in any home but is an extra boon to those who live in flats or have to do their washing in the evening.

We have sold a lot of these and all purchasers have been delighted. In fact they find it difficult to believe we can sell such a good heater at such a low price. We could not, but for the fact that the "Lectross" manufacturer's were forced into bankruptcy by the combination of a cancelled export order, and 100 per cent. Purchase Tax, which almost doubled the original price of 12 guineas, and so reduced home sales to almost nil. We bought all the driers from the liquidators, and we are able to offer them to you at £5/19/6, which is less than one half of the original retail price, and only one quarter of what the price would be if they could be made to-day. We have not many more of these left, so be advised and order promptly. We also bought all the spare parts, so you need have no fears about repairs, in fact we guarantee always to be able to supply spares.

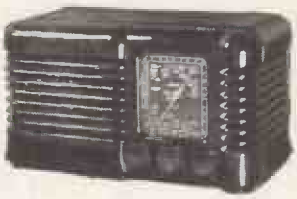
The size of the "Lectross" is 3ft. wide, 3ft. high × 5in. deep, it works off A.C. or D.C. mains consuming 750 watts, i.e., just less than one Unit.

The clothes which are hung over four chrome-plated rails are dried by the steady stream of hot air which comes from the bottom heater chamber.

If unable to collect please add 7/6 for carriage and packing, and also state your mains voltage.

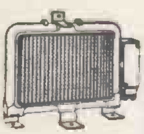
GIVE A RADIO YOU HAVE MADE.

You will find that the building of our all mains radio receivers is simplicity itself, and the more you make the less time each takes, everything down to the last nut and bolt is supplied and everything fits together in a professional manner. When finished the receiver looks and plays as well as those being offered in radio shops at anything between £10 and £14. So why not give one as a present to someone dear to you this Christmas.



The one illustrated above we call our "Occasional T.R.F." in a choice of colours, Ivory, Walnut or Green, and costs just less than £6 to make.
The one below we call "The White Lady," this is an extra fine cabinet of pure white. The complete receiver costs about £6/5/- to build. Constructional data for either set is available at 1/6 post free.

ELECTRIC HEATERS



Heavy cast framework totally encloses the elements, so these are 100 per cent. safe even in confined spaces, just right for your radio den garage, office, shop, etc. 900 watt (heavy) model, 23/6, plus 5/6 carriage. Other models available are 750 watt, 500 watt, 250 watt, all these are 23/6 each, plus 5/6 each carriage. The 250-watt model used as a foot-warmer keeps legs and body warm for less than a farthing per hour.

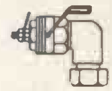
Orders by post are dealt with by our Ruislip depot. To avoid delay address to:— E.P.E. Ltd., Dept. 2, Windmill Hill, Ruislip, Mddx.

TERMINAL BLOCKS

Heavy duty type, 5 way 4in. long × 1in. wide × 1¼in. high. 30 amp rating. Price 1/6.
Heavy Duty type, 6 way porcelain 15 amp. rating. Price 1/6.
Heavy Duty type, 5 way porcelain 15 amp. rating. Price 1/3.
Heavy Duty type, 3 way porcelain 15 amp. rating. Price 9d.

SPECIAL COIL UNIT.

For use with American Receiver BC/AR/229, this coil unit C380 is in aluminium can, new and unused. 45/- each.



PYE PLUG AND SOCKET.

6d. each part.

10in. ENERGISED SPEAKER.

The resistance of field is 1100 ohms and the construction of the speaker is such that really good response must result. The ideal speaker for a quality amplifier or receiver. Limited quantity. Price 17/6 each. postage and packing 2/6 extra.

P.M. SPEAKERS.

3½in.	11	6
5in.	12	6
6½in.	12	6
8in.	14	6
10in.	25	0

as available.
Add 1/- per speaker for packing and insurance.

CATHODE RAY TUBES

Note—All these tubes have green fluorescence.
5CP1. 5in. electrostatic. American manufacture—medium persistence suitable for T.V. or scope, in original cartons, 19/6 carriage and insurance 2/6.
VCR517 6in. electrostatic, medium persistence, suitable for T.V. or 'scope work—unused, ex-new equipment, 22/6, carriage and insurance 5/-.
VCR97. We have had a new delivery of this now famous electrostatic 6in. T.V. tube, these are not the cut off type, they give a full picture, 42/6 carriage and insurance 5/-.
VCR516 9in. magnetic tube, long persistence which makes it rather unsuitable for T.V. Price £2/10/- postage and insurance 10/-.
CV961. 7in. electrostatic, short persistence, suitable for T.V. 47/6, carriage and insurance 2/6.

STOP PRESS. CANCELLED EXPORT SHIPMENT.

We have acquired some of consignment of the 5-valve Superhet Receivers chassis, these use only first-class components and are all wired up ready to operate, complete with valves and 8in. speaker.
They cover the long, medium and short wave bands and have gram input. Brand new and in perfect condition, limited quantity £10/10/-, plus 5/- carriage and packing.

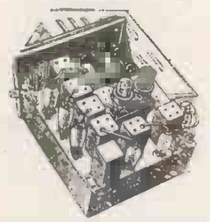
Orders under £2 add 2/6, under £1 add 1/9. Postable items can be sent C.O.D., additional charge approx. 2/6. List 6d.
Early closing days: Wednesday, Ruislip; Saturday, City.

ELECTRONIC PRECISION EQUIPMENT

152-153 FLEET STREET, E.C.4. Phone: CENTRAL 2833
WINDMILL HILL, RUISLIP, MDX. Phone: RUISLIP 5780

ELPREQ PAGES

EX-GOVERNMENT UNITS



10 VALVE 1½-METRE SUPER-HET.

Ideal for conversion into a Midlands or London region Televisor. These contain 6 valves type 2SP61, and one each RL7, RL16, and EA50. Six I.F. Transformers of 12 Mc/s, 4 Mc/s band width, and hundreds of other useful components. Price 59/6, plus carriage and packing 5/-. These receivers are unused and in original wrappings.

RECEIVER 3457

These cost over £100 each to build, they contain 15 valves type EF50 and one each of VR56, VR55, VR92, and 2 of types VR116 and VR54. These contain a host of valuable pot' meters, motors, relays, gear box, and components of all descriptions, and in addition they contain the famous "Pye" 45 Mc/s television strip. Brand new in transit boxes. Price £5/19/6.

RECEIVER TYPE 21

Battery operated superhet covering 4.2 to 7.5 Mc/s and 19 to 31 Mc/s., on 10 metre band, this operates as a double superhet. In brand new condition, complete with 9 valves and circuit diagram. Price £2/5/- plus 7/6 carriage, insurance and packing.

POWER PACK TYPE 392.

This is an extremely useful unit which works off A.C. without modification giving an output of 700 v. D.C. adequately smoothed. Here is a list of the components contained in the power unit: Mains Transformer for 200-250 v. 50 cycle, with secondaries of 700-0-700 v. at 70 mA, 4 v. at 2.5 amps., 12.5 v. at 1 amp. (Note these are Admiralty ratings, the transformers will stand at least twice these figures). Also 2 rectifier valves, type CV54, 10-watt resistors, three 4 mfd. 700 v. condensers, L.F. choke, 10 henry 100 mA., 2 slydlok fuses. The power pack is unused and is contained in a louvred case size 12in. × 5½in. × 8½in. Price 67/6.

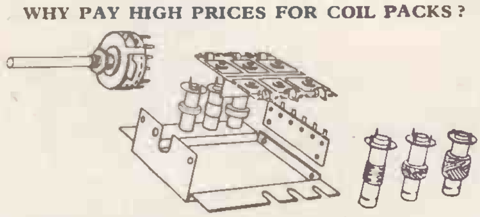
RECEIVER TYPE 78.

This covers the wave band 2.4 to 13 Mc/s and it is also fitted with a 1.000 kc/s crystal with an internal arrangement whereby its oscillator can be accurately checked with the crystal, the sets are complete with 5 valves, and they are brand new and unused. Size is 6½in. × 8½in. × 10in. approx. Price £4/10/-, plus 7/6 carriage, etc.

AMERICAN TYPE 6 INDICATOR.

This indicator known as A.S.B. uses the same circuit and the same equivalent parts as our famous Type 6. For instance, it uses tube type 5BP1 which is the American equivalent of the VCR.97, it uses valves type 6AC7 which are the American equivalents of the EF50, and of course, it is packed full of very useful components. This unit can be made into an excellent 'scope and the "Wireless World" data (available price 9d.) will be an excellent guide. Price for the indicator unit is £4/10/-, carriage 10/- extra.

WHY PAY HIGH PRICES FOR COIL PACKS?



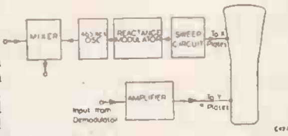
If you use our parts these literally fall together and our publication "Making Coil Packs" (Price 1/6) describes a simple method of alignment without using a signal generator and also gives circuits of typical receivers complete with gram arrangements.

PRICE LISTS OF PARTS

Set of 6 coils covering the three standard long, medium and short wavebands, 9/6; Punched metal chassis, 1/9; 6 Bank Trimmer assembly, 3/-; Midget wave-change switch, 4/-; Tag, panel condensers and other sundries to complete L.M.S. Coil Pack, 1/9.

When completed your Elpreq coil pack will look like this

VISUAL ALIGNMENT SIGNAL GENERATOR.



An interesting article in the October *Radio Constructor* described an instrument which is a combination oscilloscope and signal generator. It is designed to generate a signal into a superhet then permit visual inspection of same signal after passing through the superhet. The article further shows how the instrument could be made for the very low price of £5.

This uses a small tube and is quite a compact instrument, so if its only use is that of checking the band pass on the I.F. transformers, in a high fidelity receiver, its construction is justified. It can, of course, be used for a variety of different jobs other than the alignment of I.F's, in fact, it is a good servicing 'scope.

We can supply a complete kit of parts for £5 containing valves, tube and all components except chassis and case. A re-print of the article from the *Radio Constructor* is available price 9d.

The power pack not shown on the block diagram is, nevertheless, included in the kit.

IF/AF AMPLIFIER AND SIGNAL TRACER.

During servicing, from time to time you come up against sets with intermittent and obscure faults. Faults which with standard instruments are most difficult to trace and which usually are real time wasters. The most successful method of tackling these faults is by substituting a receiver known to be good, replacing the old set stage by stage until the faulty section is located. Obscure faults are often multiple faults and with these substitution is the only reliable method.

Our IF/AF Amplifier will permit you to fault trace by this method and in addition you can use it to align and calibrate receivers and coil packs, which have just been built or repaired.

The Amplifier is extremely useful in the laboratory, for instance to check the performance of valves or other components by noting the output for a given input, and when experimenting with new R.F. and I.F. circuits this saves you building a complete receiver.

Finally our IF/AF Amplifier and Signal Tracer can be used as a temporary power pack to provide H.T. and L.T. or can be quickly hooked up as an emergency receiver, gramophone amplifier, etc. Kits for three models are available, all are complete with valves. I.F. transformers, mains equipment, etc., they are in fact superhet receivers which only need an R.F. stage to complete them. And for the convenience of the user, room is left on the chassis and holes are drilled to accommodate the R.F. stage on other components under test.

Three models are available:

IF/AF DE LUXE.

This uses a standard type mains tranformer with full wave rectification and permits isolation from the mains. This is a complete kit with valves but less speaker. Price £6/10/- with diagram, etc., carriage and packing 5/- extra.

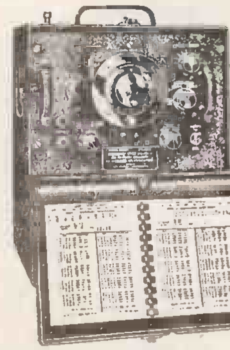
IF/AF UNIVERSAL.

This is on a smaller chassis and uses series working valves and is suitable for A.C. or D.C. mains. Price £6/5/- or with cabinet £7, post and insurance 2/6 extra.

IF/AF MODEL F.T.

This low price A.C. only model uses a filament transformer and half wave rectification. Price £5/15/- or with bakelite cabinet £6/10/-, postage and insurance 2/6 extra.

EX-GOVERNMENT UNITS



Frequency Meters BC.221.

American manufacture. Accuracy .005 per cent. Frequency range 125 kc/s-20 Mc/s. Crystal controlled and temperature compensated. Makes an excellent V.F.O. without impairing its use as a frequency meter. Brand new and unused, complete with instruction book, £35, carriage paid. We have also a limited quantity of used BC.221 Frequency Meters, carriage paid £15, and some without data charts, £10, spare crystals 35/- each.

BATTERY CHARGER 21

This is an excellent unit fitted with heavy duty mains transformer and metal rectifiers. Its output is 160-200 v. at ¼ amp, so it is ideal for charging wet H.T. batteries. It can, of course, be used for charging L.T. batteries, in fact it will charge 70 cells simultaneously or any number up to this. In addition to charging cells, this unit can also be used to work D.C. appliances off A.C. mains, or if its output is fed into a resistance network then you can have a source of D.C. for experimenting. The charger works off standard 200-250 mains, and is contained in a neat perforated case, price 22/6 plus 3/6 carriage.

D.C. TRANSFORMERS

Technicians will, of course, say that this is not a correct description, but it is a very useful way of describing a device which reduces D.C. mains to a voltage suitable for working toy trains, etc. These are really rotary transformers but when driven off the mains they give out 12 volts at ¾ amp. Another good point about these is that they are totally enclosed so that mains can be kept away from tiny fingers. Also they can be used as motors for driving models or to given H.T. from car batteries. Price only 5/6 each plus 2/6 postage.

RECEIVER R.1124.

This receiver contains a host of useful stuff, the most important of which is a coil pack which needs only the adjustment of its trimmers to receive AP. sound. It also contains Westectors, resistors switches and all the parts which make up a six valve superhet. The valves contained are three type 9D2 and one each of 8D2, 4D1 and 15D2. We understand that these receivers have never been used. Price only 18/6 each plus 2/6 postage.

RECEIVER 25/73

Add the Elpreq Coil Pack as described to this receiver and you have a really fine superhet, contains 6 valves, 465 kc/s I.F. transformer, etc. Price 24/6, data if required.

HIGH VOLTAGE RECTIFIERS

Being Ministry surplus these are available at really silly prices. This is your opportunity to experiment with that special plant you intended to make.

Type CV19, 63,000 v., max. 800 m a. £4 17 0
Type CV1504, 60,000 v., max. 1,200 m a.............. £5 17 0
Type CV74, 40,000 v., max. 600 m a. £2 17 6
Type CV1111, 14,000 v., max. 350 m a. 4 3
Type CV1120, 14,000 v. max. 50 m a. 4 3
Type CV1508, 8,000 v., max. 1,000 m a.............. 17 6
Type CV54, 7,000 v., max. 400 m a. 6 6

KLYSTRONS

Type No. 723AB, Type No. 714AB, Type No. CV129, £3 each.
Other types may be available in smaller quantities. Send details of your special requirements. £3 all types.

BOLOMETER 14 M.W. 10E 756

Used in connection with measurement of radio, infra red, etc., hermetically sealed in glass tube size 2½in. long, ⅜in. diameter. Price 35/-.

GAMMATRON

Triode transmitter type 54, 250 watts R.F. output, filaments 5v. at 5 amps. Price £1/15/0 each.

INFORMATION WANTED
Can any reader oblige us with information on Special Purpose Tube type CV271.

GERMANIUM DIODE

Made by G.E.C. or B.T.H., new and perfect. Price 4/6 each.

THERMAL DELAY SWITCH

Hermetically sealed with 4-pin base, the operating voltage is 6 v. with a delay of 1 minute. Price 12/6.

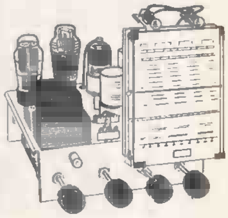
TUNGAR VALVE RECTIFIERS

Replacement for many home and industrial chargers :—
1 amp. type 68502. Price 9/6.
3½ amp. type 68507. Price 12/6.

MERCURY VAPOUR RECTIFIERS

CV2946—max. current 1.8 amps. max. 1,000 v. Price... 6 6
VU39—max. current 2.5 amps. max. 2,000 v. Price... 6 6
BD10—max. current 25 amps. max. 1,000 v. Price... £6 10

A.C. MAINS OPERATED 5-VALVE SUPERHET CHASSIS



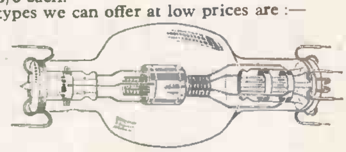
Completely wired, aligned and ready for immediate operation, covering three wavebands, 13-37 metres, 57-100 metres and 200-500 metres. A really excellent receiver ideal for new installations or as a replacement chassis in existing radiograms, etc. The set employs a 5-valve line up either international octal valves 6K8, 6K7, 6Q7, 6V6 and 5Y3 or "E" types ECH35, EF36, EBC33 EL33 and 5Y3 or 5Z4. The overall size is 8¼ in. deep × 11½in. wide × 11¼in. high the dial size is 6in. × 8in.

Note these points :—
(1) Coil assembly can be removed as one unit.
(2) Wave-band indicator shows through glass scale.
(3) 4 watts output will work 10in. or 12in. speaker.
(4) Negative feedback and tone control.
(5) Flywheel tuning and large clear dial.
(6) Dust cored coils and I.F. transformers.
(7) Sockets for pick-ups and extension speaker.

Only first-class parts have been used, e.g., mains transformer by "Parmeko," resistors by "Erie," "Welwyn" and "Morgan," fixed condensers by "Hunts" and "U.I.C.," trimmers and tuning condensers by "Wingrove Rogers," etc., etc.
Complete chassis less valves, £9/10/0.
Complete chassis with valves, £11/10/0.
Complete chassis with valves and 10in. speaker, £12/10/6.
If not collecting add 5/- carriage and insurance. Circuit diagram supplied free with chassis or separately price, 1/6.

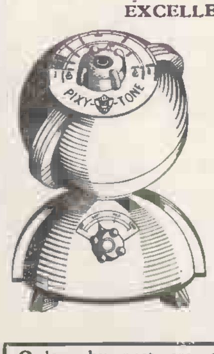
VALVES

We believe that we carry larger stocks than any other firm in Middlesex; in consequence we can offer most types of Receiving valves at pre-budget prices, which means a considerable saving of purchase tax. Our stocks are much too assorted to list in these pages, and, as prices are controlled, we suggest you order your valve requirements by C.O.D. or send what you think will cover the order ; we will refund any extras.
We have never specialised in Transmitting types, but naturally we stock a few of these, and in most cases, being war surplus, we can give you a considerable reduction on manufacturer's prices For instance, the one illustrated is a 250-watt Transmitting tetrode, heater rating 12 v. 8 amps. ; it measures 14½in. long and 6½in. across the bulb. It would cost anything up to £20 from the manufacturer, but we have a limited number to offer at 18/6 each.
Among other Transmitting types we can offer at low prices are :—
805 at 27/6, 807 at 12/6, PT15 at 27/6, 1625 at 12/6, 813 at 110/-, 6J6 at 13/6, ML6 at 10/6, 866A at 18/6, TZ40 at 47/6, 860 at 19/6, 872 at 47/6.



10,000 B.V.A. VALVES AT PRE-BUDGET PRICES

EXCELLENT XMAS PRESENTS

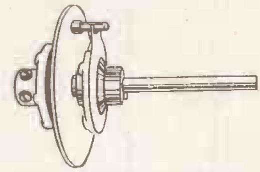


Novelty radio in coloured plastic cabinet only 6in. high, ideal for a nursery or bedroom, complete with built-in moving coil speaker, 2-gang tuning condenser, volume control and ON/OFF switch, all wired up ready to operate as soon as valves are fitted. Works off dry batteries. Valves required are three of type 1T4 and one of 3S4. Because of a frustrated export order, we are able to offer these sets brand new and perfect, complete except for valves, at the remarkable price of 49/6 each, postage and insurance 2/6 extra. Don't delay—send your order to-day.

Orders by post are dealt with by our Ruislip depot. To avoid delay address to:—E. P. E. Ltd., Dept. 2, Windmill Hill, Ruislip, Middx.

SPECIAL PURPOSE TOGGLE SWITCH

This is a two "on" position switch, the first only stays on when held down, the other stays on permanently. The two positions can be used independently, for instance to control one bright lamp and one dim lamp. American made. Price 2/6 each.



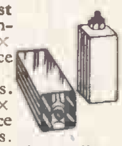
EPICYCLIC DRIVES

Double drive with wheel for driving pointer, 8.1 ratio. Price 3/9. Single drive. Price 2/9.

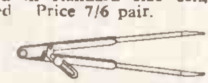
FEED-THROUGH INSULATOR

Ceramic with 2 B.A. rod and terminals. Price 1/9 each.

I.F. TRANSFORMERS

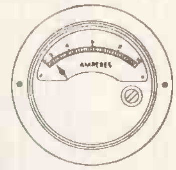


465 kc/s iron dust cores fitted in aluminium can size 1½in. × 1½in. × 3½in. Price 12/6 pair.
Midget type, 465 kc/s. size 1⅜in. × 1⅜in. × ⅞in. (M400B). Price 17/6 pair. 465 kc/s. ex-equipment in good condition fitted in standard size can, dust cored Price 7/6 pair.



METAL DIVIDERS

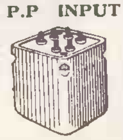
Really well made for Government workshops. Ideal for marking out on metal chassis. Price 3/6.



METER BARGAINS

This is a 2½in. moving coil meter, made up as a 1-amp. R.F. meter, thermo-coupled. With the thermocouple removed it will make excellent voltmeter or multi-range meter. Sensitivity of the movement is 3 m a. Price 8/6.
0-1 m a. 2in. flush mounting, moving coil. Price 15/-
0-9 amp. A.C. or D.C. 2½in flush mounting. Price 12/6.

P.P INPUT TRANSFORMER



Small size—push-pull, fully shrouded, 5/6 each. Push-pull output transformers to match. 6/6 each.

NEON LAMP

Earth leakage indicator, etc. As used in "Viewmaster." Price 2/3.

Orders under £2 add 2/6, under £1 add 1/9. Postable items can be sent C.O.D., additional charge approx. 2/6. List 6d.
Early closing days: Wednesday, Ruislip ; Saturday, City.

ELECTRONIC PRECISION EQUIPMENT

152-153 FLEET STREET, E.C.4. Phone: CENTRAL 2833
WINDMILL HILL, RUISLIP, MDX. Phone: RUISLIP 5780

SAFETY FIRST

Fused test prods. Fully insulated pencil type with retractable point. Contact is only made when desired by pressing top. Each prod contains a cartridge type fuse and spring. LASKY'S PRICE **4/11** per pair (one red, one black). Post 6d. extra.

VIBRATOR PACKS

For use with the P.C.R. Philips Communications Receiver. 12-volt input. Supplied complete with vibrator and metal rectifiers, etc.
LASKY'S PRICE **39/6**
Carriage 5/- extra.

CAR BATTERIES

By DELCO-REMY. Ex-American Army. Absolutely perfect, brand new and unused, in maker's original packing.
No. 1. 6-volt 140 A.H. approx. Size: 7in. deep, 13in. wide, 9½in. high. In genuine hard rubber case.
LASKY'S PRICE **£4/19/6**
Carriage 7/6 extra.
No. 2. 6-volt 90 A.H. Size: 9in. wide, 7in. deep, 8in. high. In genuine hard rubber case.
LASKY'S PRICE **87/6**
Carriage 7/6 extra.

T.V. SCAN COILS FOR LINE AND FRAME

Brand new, manufacturer's surplus. For 9in. or 12in. C.R. tubes. LASKY'S PRICE **14/6**
Post 1/-.

P.M. TELEVISION FOCUS MAGNETS

Suitable for any type of cathode ray tube. Tetrode and Triode. LASKY'S PRICE **16/11** each.
Postage 1/- extra.

SELENIUM METAL RECTIFIERS

12 volts 6 amps., 27/6, post 9d. extra.
12 volts 1 amp., 7/9, post 9d. extra.
12 volts ½ amp., 3/11, post 6d. extra.
350 volts 80 M/a., 7/11, post 6d. extra.
250 volts 60 M/a., 6/6, post 6d. extra.
Meter Rectifiers, 5 M/a., 6/6, post 6d. extra.

800 Volts at 5 M/a. and 1,200 volts on pulse circuits. Manufactured by S.T.C.
LASKY'S PRICE **9/-** each.
Post 1/-.

COIL PACKS

By Weymouth. No. 1. Standard long, medium and short wave coverage. Simple single hole fixing. For use with 465 Kc/s. I.F.'s. Size: 3¼in. × 2¼in. × 4¼in. Price 35/-. Postage 1/6 extra. No. 2. As above, but of miniature dimensions, as follows: 3¼in. × 1½in. × 2½in. Price 44/-. Postage 1/6 extra.
By Osmor. Type Q Packs. Superhet for 465 Kc/s I.F.'s. These packs are aligned and tested in actual receivers. Medium, short, short. Price 45/10. Long, medium and trawler band. Price 45/10. Postage 1/6 extra. All coil packs are supplied with full circuit.
ALL OTHER TYPES AVAILABLE.

ANTENNA ROD SECTIONS

Each section is steel heavily copper plated, 12in. long and ¼in. in diameter. Any number of sections can be fitted together. LASKY'S PRICE 2/6 per doz.; 6/- for 3 doz.; 11/- per half gross; 20/- per gross. Post free.

CATHODE RAY TUBES MASKS

9in. 7/6; 9in. fitted with armour plate glass 10/6; 10in. 9/6; 12in. Black 10/6. Soiled white 10/-. Brand new white 19/6; White, with fitted armour plate glass 21/-. Special for flat face tubes, 22/-. 15in. soiled white 12/-; new, perfect, 27/6. Postage 1/- extra on all masks.

FILAMENT TRANSFORMERS

All primaries 230 volts 50 c.p.s.

FIL/2, 6.3 v. 1.5 a.	Price 7/6
FIL/3, 6.3 v. 3 a.	Price 12/6
FIL/4, 2 v. 2 a.	Price 5/-
Special Transformer. 30 volts at 2 amps., with the following tappings:—3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24 and 30 volts	Price 19/6

All fil. trans. 1/- extra per item postage.

MAINS TRANSFORMERS

All 200-250 volts 50 c.p.s. primary. Finest quality, fully guaranteed.

MBA/3. 350-0-350 v. 80 M/a., 6.3 v. 3 a., 5 v. 2 a. Both filaments tapped at 4 volts. An ideal replacement trans.	Price 18/6
MBA/5. 350-0-350 v. 125 M/a., 6.3 v. 4 a., 5 v. 3 a. With mains tapping board	Price 27/6
MBA/6. 350-0-350 v. 100 M/a., 6.3 v. 3 a., 5 v. 2 a. With mains tapping board.	Price 22/6

Postage 1/6 extra per transformer.

CONDENSER CORNER

8 mfd. 500 v.w.	3/6
8 mfd. 450 v.w.	3/-
8×8 mfd. 500 v.w.	5/3
12 mfd. 50 v.w.	1/3
16 mfd. 450 v.w.	4/11
16 mfd. 500 v.w.	5/3
16×16 mfd. 450 v.w.	5/6
24 mfd. 450 v.w.	6/11
25 mfd. 24 v.w.	1/11
20×40 mfd. 350 v.w.	6/11
32 mfd. 450 v.w.	5/11
32 mfd. 500 v.w.	6/6
32×32 mfd. 350 v.w.	5/6
50 mfd. 12 v.w.	1/9
50 mfd. 50 v.w.	3/9
50 mfd. 350 v.w.	4/11
55 mfd. 350 v.w. A.C.	17/6

Postage extra.

TRICORNE SPEAKER CABINETS

For optimum acoustic performance with any good 12in. speaker. Labyrinth construction, walnut veneered and fully cross braced. Dimensions: 27½in. wide, 37½in. high, 14in. maximum depth. Supplied with fitted speaker fret, gold finish. Listed £11/11/-.
LASKY'S PRICE **£7/10/0**
Carriage 12/6 extra.

EX-A.M. RECEIVER TYPE R.D.F.1

Contains 14 valves: 2 VR66; 1 5Z4G; 1 VR137; 6 VR65; 1 VR63; 3 EA50. Hundreds of components, resistances condensers, etc. Frequency is 1½ metres, but can be converted to 2-metre working. The unit is contained in a grey metal case, size 11in. × 11in. × 8in. Weight 35 lb.
LASKY'S PRICE **35/-**
Carriage 5/- extra.

TYPE J/RA/1. 30 watts. HEAVY DUTY AMPLIFIER

Rack mounting, grey crackle finished. Uses KTZ63 and L63, feeding 2 KT66s in push-pull. Rectifier type U52. Meter and switch for checking all current readings. Panel light, bass brilliance and gain controls. Size: 19in. × 12in. × 12in. on a chassis 4½in. high.
LASKY'S PRICE **£13/19/6**
Carriage and packing 25/- extra.

J/RA/2. 10-12 WATT CHASSIS AMPLIFIER

Uses an L63 feeding 2 KT61s in push-pull. Rectifier type U50. Size: 6in. × 17in. on 2in. chassis.
LASKY'S PRICE **£7/19/6**
Carriage and packing 10/- extra.
Send 3d. stamp for further details of J/RA/1 and J/RA/2 Amplifiers.

TABLE MICROPHONE STAND

Two sections, chrome plated. Crackle finished base.
LASKY'S PRICE **21/-**
Post, packing 2/6 extra.

OUTPUT TRANSFORMERS

Miniature Pentode (1S4, 3S4)	3/-
Midget Pentode, 40 M/a.	4/3
Multi-Ratio Standard	6/11
Push-Pull, 80 M/a. Ratios of 40 : 1 and 40 : 1	8/6
Push-Pull for PX4's	12/6
80 M/a heavy duty, multi-ratio	12/6
10 Watt multi-ratio	16/11
30 Watt, 70 M/a. Multi-ratio	29/6
Bulgin intervalve transformers. Ratio: 4 : 1	3/11
5 : 1	5/11

Postage extra.

SMOOTHING CHOKES

20 M/a. 40 H.	3/11
40 M/a. 8 H.	3/11
40 M/a. 10 H.	4/3
75 M/a. 150 H.	8/6
80 M/a. 10-20 H.	4/11
120 M/a. 10-20 H.	7/6
150 M/a. 10-20 H.	10/6
250 M/a. 10-20 H.	15/6
150 M/a. 3 H.	3/3
250 M/a. 5 H.	10/6

Postage extra.

EX-A.M. COMMUNICATION RECEIVER TYPE R1155

BRAND NEW IN WOOD TRANSIT CASE. Aerial-tested before despatch. Supplied complete with 10 valves. Circuit: B.F.O., A.V.C., R.F. Amp., two I.F. stages, magic eye, etc. 5 frequency 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.
LASKY'S PRICE **£12/10/-**
Carriage (in wood case) 7/6 extra. Full modification data and circuit details supplied.

THE VIEWMASTER

The television set you can build at home from standard parts.
Alexandra Palace, Sutton Coldfield and Holme Moss operation.
Brilliant high definition black and white picture.
Superb reproduction.
Uses 9in. or 12in. Cathode Ray Tube.
Table or Console Model.
Incorporates all the latest developments.
Television for the home constructor at its finest.
Send to-day for the CONSTRUCTION ENVELOPE, a 32-page booklet crammed with top-rate information and all the necessary data, also 8 full-size working drawings and stage by stage wiring instructions.
Model "A" for use in London and Home Counties.
Model "B" for use in Sutton Coldfield Area. Model "C" for Holme Moss.
PRICE **5/-** per copy.
Post free.

LASKY'S RADIO

World Renowned for Service & Reliability

DUAL WAVE COILS

M. & L. T.R.F. AE, and HF.
LASKY'S PRICE **5/11** Per pair.
Post 6d. extra.

BRAND NEW AND UNUSED. CATHODE RAY TUBES. COSSOR 108K

10in. Magnetic tube. Uses a special ion trap which prevents screen burn.
LASKY'S PRE-BUDGET PRICE **£12/12/-**
Carriage and insurance 22/6 extra.

CO-AXIAL CABLE

Standard impedance.
Single screened, 1/- per yard.
Twin screened. 1/3 per yard.
Twin balanced feeder, 7½d. per yard.
Post extra. Any length cut to your requirements.

RADAR INDICATOR UNITS TYPE 162C

BRAND NEW IN MAKER'S ORIGINAL WOOD CASE. Contains 2 cathode ray tubes, one 6in. VCR517 and one 3in. VCR139. Also the following valves: three SP61, one 6J5, three EA50, one D1. Dozens of components, coils, resistances, condensers, seven pot. meters, etc. Enclosed in metal case, size 12in. × 9in. × 19in. Weight 40 lb.
LASKY'S PRICE **79/6**
Carriage 7/6 extra.

EX-A.M. RADAR INDICATOR UNIT TYPE 62

Unused but soiled. Containing 20 valves and a 6in. C.R. tube type VCR97. Valve line-up: 16 SP61; 2 EA50; 2 EB34. Dozens of components, resistances, coils, condensers, 117 Mc/s crystal, pot. meters, etc. Totally enclosed in metal case. Size: 18in. × 9in. × 11in. Weight 40 lb. Enamelled grey or black with coloured control knobs.
LASKY'S PRICE **69/6**
Carriage 10/- extra.

ANTENNA RELAY UNITS TYPE CBY/29125

BRAND NEW AND UNUSED. IN ORIGINAL CARTONS
American Air Corps equipment. Contains a 0-5 m/a. moving coil meter, also relay, insulators, 0.75 amp. heating element, switch, etc. A 50 pf. vacuum condenser 5 kV. working. Fitted in black metal case, crackle finished, size 4½in. × 5in. × 3½in.
LASKY'S PRICE **12/6**
Postage 1/6 extra.

TELEVISION CONSOLE CABINETS

DE LUXE MODEL

Beautiful Walnut Veneer

For 9, 10 or 12in. cathode ray tubes. Beautiful figured medium walnut finish, with high polish. Fitted with shelf for receiver, glass, speaker baffle and fret, and castors for easy movement. Undrilled. Suitable for use with the "Viewmaster", "Practical Television," "Practical Wireless," and "Wireless World" televisors.

LASKYS' PRICE

£8 . 10 . 0

Carriage 12/6 extra.

Outside dimensions of cabinet: 17in. × 16in. × 32in. high.

Why not convert your table receiver to a console?

BUILD A PROFESSIONAL RADIO OR AMPLIFIER AT LESS THAN HALF TODAY'S PRICE

You're SURE to get it at

STERN'S

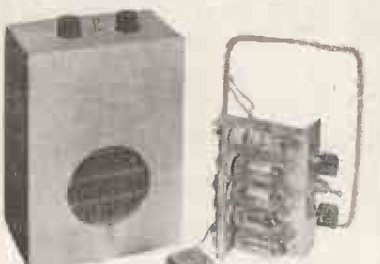
ESTABLISHED 25 YEARS

ALL KITS INCLUDE "EASY TO FOLLOW" POINT-TO-POINT WIRING DIAGRAMS

A MAINS OR BATTERY PORTABLE KIT

A Midget 4-valve Superhet Portable Set covering medium and long wavebands.
Designed to operate on A.C. mains 200/240 volts, or by an "Alldry" battery. The set is so designed, that the mains section is supplied as a separate unit which may be added at any time. The Kit therefore can be supplied (a) as an "Alldry" Battery Superhet Personal Set, which can then be accommodated in the Attache Case as illustrated above (size 9¼in. x 4½in. x 7½in.). This is attractively finished in Dark Green or Blue Rexine (b) or as a Combined Mains Battery Superhet Portable Receiver, for which a polished Wood Cabinet is available to accommodate both Mains Unit and Batteries together.
Circuit incorporates delayed A.V.C. and Pre-selective Audio Feedback. Kit is complete in every detail and includes ready wound frame aerials, fully aligned I.F. Transfs., and drilled chassis etc. Overall size of assembled chassis 8in. x 4in. x 2½in.
We can supply the set either as a complete Kit of Parts for **£8/16/9** (incl. P.T.), (plus Cabinet and Mains Unit), or by supplying the components separately. The complete Assembly Instructions, which include full price details (including prices of individual components), Circuit and Component Layout, etc., are available for **1/9** incl. postage.

A T.R.F. BATTERY "PERSONAL" KIT



A complete Kit of Parts to build a Midget 4-valve Alldry Battery Portable Set, covering medium waveband.
Consists of Regenerative T.R.F. circuit, employing Flat Tuned Frame Aerial with Denco Iron Dust Cored Coil.
Valve line up, two I.T.4's (R.F. Ampl. and Det.), 1S5 and 3S4 output.
Kit is complete in every respect and includes drilled chassis, and latest type Rola 3in. P.M. speaker. Overall size of assembled chassis 4½in. x 2½in. x 2½in.
We can supply the Complete Kit (less cabinet) for **£6/4/8** (inc. P.T.) or by supplying the components separately. The Complete Assembly Instructions, including individual component prices, Circuit and Component Layout, etc., is available for **1/-**, incl. post.

A KIT OF PARTS

Complete in every detail, to build a 3-valve Amplifier for A.C./D.C. mains 200-250 volts.
Has an output of 3 watts, and incorporates a Tone Control. Valve line up, 25A6, 6J7, U31.
Our price of **£4/12/6** for complete kit, includes a matched 6½in. P.M. speaker.
This Amplifier can also be supplied assembled and ready for use for **£5/12/6**.

A MIDGET 4-STATION "PRE-SET" RECEIVER

A complete Kit to build a 4-Station "Pre-Set" Superhet Receiver for A.C. mains operation.
The Set is designed to receive any three stations on medium waveband and one on long waves, each station being received by the turn of a Rotary Switch—No Tuning being necessary.
It is of midget size, being 8½in. x 4½in. x 7in. high, and has the performance of a far more expensive ready made set, but can be built for half the price.

Price of complete Kit of Parts (including aligned I.F. Transf. and drilled chassis, etc.), **£9/2/6** (incl. P.T.), (plus Cabinet **25/6**), or the components can be purchased separately. The complete Assembly Instructions including Individual Component Price List, Circuit and Component Layout, etc., is available for **1/9**.

STERNS "RADIO TUNER MANUAL" Price **2/6**. (Plus 3d. Post). Contains complete and detailed assembly instructions showing how to make —
A 1 Valve T.R.F. Tuning Unit, covering Long and Medium Wavebands.
A 4 Station "Pre-Set" Superhet Tuning Unit, producing 3 Stations on Medium Waveband and 1 on Long Waves.
A 2 Valve Superhet Tuning Unit, covering Short, Medium and Long Wavebands.
Each Tuner is for A.C. Mains operation. Circuit Diagrams and Practical Component Layouts are shown, together with complete component Price Lists.

THE WIRELESS WORLD MIDGET A.C. MAINS 2-VALVE RECEIVER

We can supply all the components to build this set, including Valves and Moving Coil Speaker for **£3/10/-**, including Designer's complete building instructions (these are available separately for **9d.**)

THE "SUMMER ALLDRY" BATTERY PORTABLE

As published in June issue of "Practical Wireless." We can supply, from stock, all the components to build this Midget 3-valve Portable for **£2/19/6** (less valves). This also includes dials, top panel and aly. sheet for chassis. The complete article and circuit, including Practical Layout and Price List, is available for **9d**.

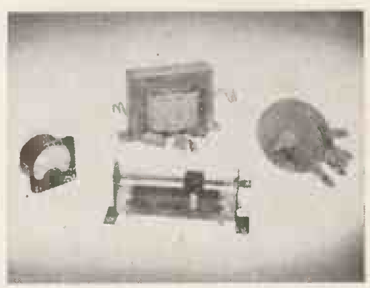
PICK-UPS

Cosmocord "G.P.20," for standard records, **£3/11/5**; interchangeable (G.P.19) Head for L.P. records, **£2/3/4**.
Decca lightweight "turnover Head" type, for L.P. and standard records, **£3/19/2**.
Marconi, Standard, lightweight Magnetic, **£1/15/10**
Marconi Matching Transformer, **7/6**.
Goldring, Standard, lightweight, Magnetic, **29/6**.

THE WIRELESS WORLD 3-VALVE SET

A Midget 3-valve T.R.F. Receiver for operation on A.C mains, covering long and medium wavebands.
We are able to supply all of the components to build this set, as designed, and specified in the Feb. 1950 issue including the drilled chassis, valves, and moving coil speaker, etc., at the following prices —
To construct complete chassis, less dial and drive assembly, **£4/17/9**. Ditto including dial and drive assembly, **£5/12/9**.
To construct the complete Set, including dial and drive assembly and cabinet, **£6/14/3**.
Overall size of cabinet is 7½in. x 5½in. x 11½in.
A reprint of the designer's article, giving Circuit and Assembly Instructions (this is available separately for **9d.**), together with a Practical Component Layout is included with each of above assemblies.

BATTERY CHARGER KITS



All Kits incorporate Metal Rectifiers, and are for use on A.C. mains 220-250 volts. All Kits include an easily followed Wiring Diagram.
For charging 6 v. battery at 1½ amps., **£1 2/9**.
For charging 6 volt. battery at 1½ amps., with Variable Resistor and Meter, **£2/2/6**.
For charging 12-volt battery at 1½ amps., **£1/6/-**.
For charging 12-volt battery at 1½ amps., with Variable Resistor and Meter, **£2/5/3**.
For charging 6 or 12 volt battery at 3 amps., **£1/18/-**.
For charging 6 or 12 volt battery at 3 amps., with Variable Resistor and Meter **£2/19/-**.

THE WIRELESS WORLD MODERN CRYSTAL SET

Designed for the Pre-selection of THREE STATIONS to suit local conditions, each station being received by the turn of a rotary switch. We are able to supply all components including drilled chassis to build this new type of Receiver, to the designer's specification, as published in October issue, for **36/3** (plus cost of selected coils).
A reprint of the designer's article (available separately for **9d.**), together with a practical component layout make the assembly very easy.

★ *Send 6d. P.O. for our STOCK LIST, it shows "hundreds" of Wireles*
When ordering please includ

STERN RADIO LTD., 109

Tel. : CENtr

GARLAND BROS

LANE PRECISION BUILT TAPE TABLE. High fidelity high impedance record-playback and erase heads in mumetal shields. Heavy balanced flywheel giving freedom from "wow" and "flutter." Fast rewind. Heads are half-track, giving one hour's playing time with 1,200-foot reel of tape. £16/10/-, plus carriage, etc., 10/-. Demonstrations at both Deptford and Lewisham branches.

TAPE DECK AMPLIFIER UE6. A six-valve record-playback amplifier suitable for use with high or low impedance heads. Features include variable bass and treble lift, recording level indicator and built-in oscillator supplying h.f. bias and erase sufficient for the highest coercivity tapes. Supplied in kit form, with punched chassis, all valves, components, circuits and full instructions. £10/10/-, plus carriage 5/-.

TAPE DECK AMPLIFIER HNE5, A five-valve record-playback amplifier suitable for use with high impedance heads. With built-in oscillator supplying h.f. bias and erase. Supplied in kit form, with punched chassis, all valves and components, circuits and full instructions. £7/10/-, plus 5/- carriage.

AMPLIFIER AC111. Further deliveries enable us to offer a limited number of kits for this popular amplifier. Specification: 7 valves (including rectifier). 10 watts push-pull output to 3 ohm or 15 ohm speaker. Supply available for tuner unit, etc. High and low gain inputs. Separate Bass and Treble controls. Negative Feedback. Varley mains and output transformers. Complete kit, with circuits and instructions, including circuit of suitable local-station quality tuner, £8/19/6, plus carriage 5/-.

MODIFICATION KIT UE2. Enabling the use of Amplifier AC111 as a high-quality tape record-playback amplifier, for use with high or low impedance heads. Incorporating pre-amplifier, oscillator supplying h.f. bias and erase sufficient for the highest coercivity tapes and recording level indicator. In kit form, with all valves, components, punched chassis circuits and full instructions. £4/4/-, plus 5/- carriage.

MAGNETIC RECORDING TAPE. Emitape, 600ft., 15/-; 1,200ft., 25/-. Durex, 1,200ft., 35/-. **SPARE TAPE REELS.** 7in. (1,200ft.) plastic, 4/- each

MAGNETIC RECORDING HEADS. High impedance half track heads, in mumetal shields. Record-playback, £2/10/-. Erase, £2/2/-.

AMPLIFIER 11/66. An improved version of our Amplifier AC11 for those who desire good quality reproduction at low cost. Valve line-up is 6J5-6J5-KT66-5Z4. Output 5 watts. Volume tone and variable feedback controls. High grade output transformer. Chassis completely isolated from mains. Complete kit, including punched chassis, all valves and components, with circuits and instructions, £5/2/6. Amplifier wired and tested, £6/2/6.

DECCA THREE-SPEED GRAM MOTORS. For 33⅓, 45 and 78 r.p.m. Instant single-lever speed selection. For A.C. only, 100-250 v. 50 cycle operation. Price (incl. P.T.), £7/3/4. (Please note manufacture of two-speed model now discontinued.)

DECCA TURNOVER PICKUP. A high fidelity crystal pickup with turnover head (two sapphires) for use on the above or other multi-speed motors. Price (incl. P.T.), £3/19/4.

LUSTRAPHONE MOVING COIL MICROPHONES. Type C51. Response substantially flat to 8 kc/s. Impedance 20 ohms. Fitted with switch, £5 each. Type C51/Z. As above, but impedance 200,000 ohms, £5/12/6 each.

GERMANIUM DIODES. Latest sub-miniature wire-ended glass-enclosed type, by a leading manufacturer. Minimum life 10,000 hours, low shunt capacity, no heater supply required. Special offer at 5/6 each, or £3 per dozen.

CLOSE TOLERANCE SILVER MICA CONDENSERS. 10,000pF (0.01μF) plus or minus 2%. Ideal for service bridges, etc., 1/- each. 9/- per doz., £4/10/- per gross. 1,000pF (0.001μF), ±1%, 1/3 each. 100pF (0.0001μF) ± 1%, 9d. each.

LECTRONA 10in. LOUDSPEAKERS. Cast chassis, impedance 3 ohms, 35/- each.

ELAC 5in. LOUDSPEAKERS. Impedance 3 ohms. 16/6.

ELAC 8in. LOUDSPEAKERS. Impedance 3 ohms. 17/6.

PLESSEY 6½in. LOUDSPEAKERS. Impedance 3 ohms. 14/6.

PLESSEY 3-SPEED AUTO-CHANGERS. Plays eight 78 R.P.M., ten 33⅓ R.P.M. or 45 R.P.M. records. Replaceable double-pointed sapphire stylus, £23/13/0.

MUIRHEAD SLOW MOTION DRIVES. As used on G-units and R.1224A. Precision-made and incorporating a slow-motion drive of the order of 50 or 60 to one; ideal for tuning or test equipment, 6/6 each.

MAT RESISTORS. 300 ohm, 250 watt, 2/3 each, 21/- per doz.

ACCUMULATORS. 2 v. 10 A.H. In black moulded bakelite case, unfilled but charged, 4/9 each.

WAFER SWITCHES, SP 10 w., 1/9; SP 11 w., 2/-; 4 p. 2 w. midget, 2/-; SP 3 w., 1/3.

TOGGLE SWITCHES. Arrow, D.P.D.T., Q.M.B. rating 250 v. 3 a. plated dolly and bush. Brand new, 3/- each; 33/- per doz. Ditto S.P.D.T., 2/3 each; 24/- per dozen. Black bakelite D.P.D.T., 250 v. 3 a., 2/6 each; 27/- per dozen. Ditto S.P.D.T., 1/9 each; 18/- per dozen.

BRIGHT ZINC PLATED CHASSIS. Two sided with fixing flanges, 13½ x 6 x 2½in., drilled for five valve superhet, 2/9 each. Two sided, 11 x 5¼ x 2in., drilled with seven octal (1⅛in.) holes, 2/9 each.

TINPLATE CHASSIS. Two sided, 10½ x 4½ x 2in. undrilled, 2/9 each.

MAINS TRANSFORMERS. MT1, 250-0-250 v. 80 m/a., 0-4-6.3 v. 4 a., 0-4-5 v. 2 a., 18/6 each; MT2, 350-0-350 v. 80 m/a., 0-4-6.3 v. 4 a., 0-4-5 v. 2 a., 18/6 each; MT3, 0-30 v. tapped to give 13 different voltage outputs at 2 a., 18/6 each; 300-0-300 v. 120 m/a., 6.3 v. 3 a., 5 v. 2 a., 22/6 each. All above transformers tapped 200-220-240 v. 100 w. auto., 0-10-120-200-230-250 v., 18/6 each.

SPECIAL PURPOSE VALVES. PT25H, high output pentode, 4 v. and 400 v., 5-pin British Ceramic base. Also successfully used, strapped as replacement for 4 v. triodes in quality amplifiers, 7/6 for two. VR116, 5/-; CV73, 4/-; 9003, 5/-; 954, 3/-; CV1141, 6/6; CV66, 6/6; VR136 (EF54), 7/6; VR137 (EC52), 7/6; VU111, 5/-; VU133, 3/6; CV54, 3/6; E1148, 3/6; VU33, 3/6; CV265, 3/6.

SPECIAL OFFER. EL50 6.3 v. 8 watt output pentode, 5/- each; 55/- per doz. Side contact valveholders to suit, 9d. each.

METAL RECTIFIERS TYPE RM2. The latest type rectifier. 125 v. at up to 100 m/a. (depending on temperature). Dimensions: 1⅞in. (diam.) x ¾in. Two of these in series required for mains voltage. Price 4/- each

TRF KITS. Complete with cabinet in ivory or brown bakelite, three valves and metal rectifier, chassis, loudspeaker and all components and accessories. For medium and long waves. A.C. only, 200-250 v. With circuits and instructions. Limited number only. £5/15/-.

EXTENSION SPEAKERS. In tasteful brown bakelite louvred cabinet and incorporating an Elac 5in. P.M. speaker (commended editorial columns this journal), and volume control, £1/7/6.

JUNEERO MULTI-PURPOSE TOOL WITH XACTO SLIDE GAUGE. Indispensable in the workshop and the home, ideal for the model maker and metal worker. Bends, shears and punches. For all the little jobs that waste your time, £1/7/6. **Juneero Engraving Tool,** engraves steel and other metals, plastics, wood, etc. For A.C. mains, 200-240 v. Complete, ready to plug in, 12/6.

ROTARY SELECTOR SWITCHES. Type 10D/373-374. 24 v. solenoid. 52 pulses for one rev. Four-position. Single stroke or continuous operation, platinum contacts, 3/- each, 15/- per half-dozen.

AERIAL RODS. Copper plated steel. Fit into each other to make up any length aerial. Per doz., 2/-; per gross, 18/-; per thousand, £4/10/-.

HEATER TRANSFORMERS. Pri. 230 v., Sec. 6.3 v. 1.5 a., 7/6; Pri. 230 v. Sec. 12 v. 1 a., 7/6.

PULLIN MOTORS. Type A/3R. For 24 v. D.C. 3½in. x 2½in. x 2in., 8/6 each.

METAL CUTTING SHEARS. A robust tool, one-inch blades, will cut up to 16 s.w.g. aluminium. Per pair, 2/-; per doz. pairs, 21/-; per gross pairs, £11.

SMALL-SIZE PAPER CONDENSERS. 2μF 100 v. wkg., dimensions 1¼in. x 1½in. x ¾in. Ideal for cross-over networks, etc., 4/6 per doz., 45/- per gross, £14/10/- per thousand.

PAPER CONDENSERS. 1μF 500 v. wkg., 2½in. x 2in. x ¾in. Inverted mounting, 1/- each, 9/- per doz., £3/12/- per gross. 1μF 600 v. wkg., 2½in. x 1¾in. x 1in. Upright mounting, 1/6 each. 15/- per doz. £7 per gross.

CRACKED CARBON HIGH STABILITY RESISTORS. 1% 1 watt: 1 meg., 1/3; 1% ½ watt: 10 k, 25 k, 30 k, 50 k, 500 k, 1/-; 2% 1 watt: 1.8 meg. 1/-; 2% ½ watt: 1.5 k, 13 k, 45 k, 250 k, 400 k, 9d.; 5% 1 watt: 5 k, 39 k, 510 k, 910 k, 1.8 meg., 9d.; 5% ½ watt: 3.9 k, 75 k, 130 k, 8d. Quantities of most of above values available at press date.

PLUGS AND SOCKETS. Pye angle, 1/-; Pye straight, 1/3; B. & L. 5-pin, 1/6; B. & L. 7-pin, 1/9; B. & L. 10-pin. 2/6; Jones 6-way, 1/6; Jones 8-way, 1/9; E.H.T. Single, 1/-; the above prices include plug and socket in all cases. Pye T-pieces, 9d. Pye Angle P. & S. to fit ¼in. cable, 1/3 complete.

SLEEVING. 2 mm. oiled silk, etc., 3/6 per 24 nominal yard lengths, assorted colours, 33/- per two gross ditto.

TWO-GANG CONDENSERS. .0005μF, with fixing feet. Size 2½in. x 2¾in. x 1¾in. Spindle diameter ¼in., spindle length 1in., 7/9 each. Midget two-gang condensers .0005μF with trimmers. Size 1½in. x 1¾in. x 2½in. Spindle diameter ¼in., spindle length 1in., 8/6 each.

CATHODE RAY TUBES. 5CP1, Electrostatic intensifier-type C.R.T., diameter 5in. max. second anode voltage 2 kv., max. intensifier anode voltage 4 kv., medium persistence screen. Brand new in original crate or carton, 22/6 each

ALL GOODS NEW AND UNUSED OTHERWISE STATED. GOODS SHOWN AS EX-EQUIPMENT HAVE BEEN FULLY TESTED AND ARE IN GOOD WORKING ORDER. **PLEASE ADD POST OR CARRIAGE ON ALL ITEMS. KINDLY PRINT NAME AND ADDRESS.** POST ORDERS TO OUR DEPTFORD ADDRESS. EARLY CLOSING THURSDAY, OPEN ALL DAY SATURDAY

GARLAND BROS

GARLAND RADIO	ALLEN & GOULD
CHESHAM HOUSE, DEPTFORD BROADWAY, S.E.8	5 OBELISK PARADE, LEWISHAM, S.E.13
TELEPHONE: TIDEWAY 4412/.	*TELEPHONE: LEE GREEN 403-*

UNIVERSITY RADIO LTD.

Offer Guaranteed Used Equipment at Attractive Prices

- **Decca Deccalion (Non-Auto Change) Portable Record Player**, built-in amplifier. 200/250 A.C. 1949 model, as new... £19 10 0
- **Sound Sales D.X. Plus 2 Tuner Unit**, complete, as new £24 0 0
- **G.E.C. Miniscope**, complete and perfect £10 10 0
- **Barker 148 Speaker**, as new...... £9 0 0
- **Barker 148A**, as new £12 10 0
- **Evershed 1,000 volt Megger**, in wooden case, portable, Zero to 200 megohms, perfect......... £16 10 0
- **R.C.A. Re-entrant Horn Speakers**, 25 watt speech, 15 ohms, perfect and complete, 4 only, each......... £10 0 0
- **12 volt D.C. to 230 A.C. 100 watt Rotary Converters**, perfect... £6 0 0
- **Taylor 65C Signal Generator**, as new, 200/250 A.C......... £15 0 0
- **Taylor Valve Tester 45A**, with charts, as new......... £15 0 0
- **Latest Model "AVO" Wide Range Signal Generator**, as new £23 0 0
- **"AVO" Valve Testers** (1948-49), as new £12 10 0
- **E.D.C. Rotary Converter**, 200/240 D.C. to 220/240 A.C. complete with filter unit in metal cabinet, 120 watts, perfect £12 0 0
- **As above**, 200 watts £16 10 0
- **As above**, 110 D.C. to 230 A.C. 200 watts £15 0 0
- **B.P.L. Signal Generator**, A.C. 200/250 as new £9 0 0
- **"AVO" (1948) Signal Generator**, as new £11 0 0
- **Universal Avo Minor**, as new... £7 0 0
- **Eddystone 640 Receiver**, complete with valves, perfect and as new £22 10 0
- **L.S.L. Valve Analyser and A.C./D.C. Test Meter Combined**, complete with charts. Brand new £9 10 0

WE NEED GOOD USED EQUIPMENT URGENTLY PLEASE SEND, BRING OR PHONE FOR OFFER

- **Hunts Resistance Capacity Bridge**, model C.R.B., perfect and as new £10 10 0
- **Taylor Circuit Analyser, Model 20A**, perfect and as new £11 10 0
- **"AVO" Model 40**, as new...... £12 10 0
- **"AVO" Model 7**, as new £14 10 0
- **Taylor A.C./D.C. Test Meter, Model 90A**, as new £9 10 0
- **Valradio Converters**, 50 or 75 cycles, works overhauled, 200/250 D.C. to 200/250 A.C., at 300 watts £12 0 0
- **Pullin Series 100 A.C./D.C. Test Meter**, as new £8 10 0
- **Canadian Receiver, type V R.L.**, complete with valves, power-pack, etc., 19 valve, as new £21 10 0
- **Taylor 65.B Signal Generator**, as new £12 0 0
- **Radio-Vision Hambander**, as new £12 10 0
- **Sound Mirror Tape Recorder**, table-cabinet model, with spare tape, as new £55 0 0
- **LANE TAPE DECK**, brand new £16 10 0
- **Taylor-Windsor Oscilloscope**, model 30A, as new £25 0 0
- **Evershed 500 volt Megger**, in aluminium case, as new......... £15 0 0
- **Goodman's Axiom 12in. Speaker**, as new £8 0 0
- **Goodman's Andiom 60**, as new £7 10 0
- **Trixette Portable Auto-changer** (mixer type), with built-in amplifier and speaker, as new... £27 10 0
- **Barker 150 Speaker**, brand new £18 18 0
- **BC348**, with built-in A.C. power-pack, as new £21 0 0
- **Wharfedale Twin Speaker** in Wharfedale corner-cabinet. Listed £52. Our price, as new... £32 0 0

WE NEED AR 88's - BC 221's - 348's - 342's ALSO COSSOR DB'SCOPES 339A OR 3339 Etc. WE WILL PAY WITHIN £2.0.0 OF THE MARKET PRICE

- **B.T.H. ¼ h.p. Motors**, 3-phase 420 to 440 volts A.C., 1,440 revs., as new, each £2 10 0
- **Labgear Electronic Fault-Tracer**, as new £18 10 0
- **Taylor-Windsor Wobbulator**, model 55A, as new £12 10 0
- **Advance B3C Signal Generator**, complete with charts, as new £16 10 0
- **Advance Model E-1**, as new...... £19 10 0
- **Collaro 1948/9 Microgram**, non-autochange, as new £16 10 0
- **Collaro Bar-type**, centre-driven A.C. Mixer-Changer, as new ... £15 0 0
- **Weston E772 20,000 O.P.V. A.C./D.C. Test Meter**, as new £16 0 0
- **Vitavox Bitone Speaker**, as new, in polished wood cabinet. Listed at £60. Our price......... £40 0 0
- **Sewing-Machine Motors**, A.C./D.C., complete with foot-control pedal, pilot light, etc., brand new, in maker's carton, 4 only... £6 6 0
- **Ex-W.D. Wave-Meter**, complete and perfect £8 10 0
- **AVO latest model Electronic Valve-Tester**, complete and as new, with all charts £40 0 0
- **C.D.P. Disc Recorder**, less amplifier, as new £26 0 0
- **BC.342**, as new, with all valves ... £21 0 0
- **Avo 1949 Capacity and Resistance Bridge**, as new, price £8 0 0
- **Cossor Impedance Bridge, Model 3389**, as new, price £19 10 0
- **Cossor Ganging Oscillator, Model 343**, as new, price......... £20 0 0
- **M.C.R.I.**, complete, with coils, power pack, phones, etc., as new £8 0 0
- **Evershed**, 500 v. wee megger, in leather case, as new, price £9 10 0
- **Garrard R.C.65**, record changer, as new, price £16 10 0
- **Taylor 120 A.C./D.C. Test meter**, as new, price £7 0 0

Owing to pressure of business we have been unable this month to list as many lines as in our previous advertisements but we have in stock Marconi Signal Generators, Record Changers, P.A. Equipment of all types, Communications Receivers, Test Meters, Quality Speakers, VOIGT Speakers in Cabinet as new, Transmitters, etc.

★ We have a large selection of British and U.S.A. Valve Testers, Test-Meters and Signal Generators, etc. Your enquiries are welcome. S.A.E. please.

THESE ITEMS ARE ONLY A SMALL SELECTION FROM OUR STOCK OF EQUIPMENT. YOUR ENQUIRIES FOR ANYTHING THAT YOU MAY NEED WILL BE WELCOME. **WE HAVE OTHER EQUIPMENT ARRIVING DAILY!**

CASH OR CHEQUE WITH ORDERS. ALL ITEMS LISTED ARE CARRIAGE EXTRA.

22 LISLE STREET, LEICESTER SQUARE, LONDON, W.C.2

OUR BRANCH AT 39a (opposite) IS OPEN ALL DAY THURSDAY.

Phone: GERrard 4447, 8582 and 5507. Hours 9 to 6. Thursdays 9 to 1.

PREMIER RADIO COMPANY

B. H. MORRIS & CO. (RADIO) LTD

BRAND NEW R1155 RECEIVERS, in original cases, complete with 10 valves, £12/10/-, 7/6 packing and carriage.

BRAND NEW R1355 RECEIVERS, in original cases, as specified for the "Inexpensive Televisor," complete with 11 valves, £2/15/-, 7/6 packing and carriage.

BALANCED ARMATURE LOW RESISTANCE HEADPHONES: Type 1, 5/11 set; Type 2, 7/11 set.

HIGH RESISTANCE HEADPHONES, 12/6 set.

MOVING REED HEADPHONES, Type 5 8/11 set.

LIGHTWEIGHT HIGH RESISTANCE HEADPHONES, 14/6 set.

TANNOY HAND MICROPHONES, with switch in handle, 4/11.

ACCUMULATORS, by world-famous maker, 2 volt 10 a., 4/11.

BURGOYNE SOLDER GUNS, 75/-.

GRAMOPHONE AMPLIFIER KIT

Consists of complete Kit of Parts for a 2½-watt Mains-operated 2-stage Amplifier for use with any type of pick-up. Volume and tone controls are incorporated. Output impedance is 3 ohms. Cat. No. AMP147. Price complete, 59/6. For 200-250 v. mains with valves and diagrams.

GRAMOPHONE UNITS

Connoisseur 2-speed Gram Unit, less pick-up	£20 19 3
Pick-up and 2 heads for above	£9 6 4
Conrad Rim Drive Gram Unit, less pick-up, 78 r.p.m.	£4 3 10
Conrad Rim Drive Gram Units, 33 r.p.m.	£4 7 5
Decca 3-speed Rim Drive Gram Unit, less pick-up	£7 3 4
Decca single-speed Rim Drive, less pick-up	£3 14 4

All the above are for use on A.C. mains only.

VCR97 C.R. TUBES

These tubes are new but have slight cut-off, 19/6, plus 5/- packing, carriage and insurance.

THREE-PIECE AERIAL

Ex-U.S.A. copper-plated steel, highly flexible with non-stick screw joints, tapering ⅜in. to ⅛in. Brand new in container, 6/9, packing and carriage 1/6.
Insulated Base, 2/6.

MAINS NOISE ELIMINATOR KIT. Two specially designed chokes with three smoothing condensers with circuit diagram. Cuts out all mains noise. Can be assembled inside existing receiver, 6/- complete.

BUILD A PROFESSIONAL LOOKING RADIO AT LESS THAN HALF TO-DAY'S PRICE

We can supply all the parts to help you.

Bakelite Cabinet (Brown or Ivory)	17 6
Packing and insurance	2 6
Punched chassis, 3-valve plus rectifier T.R.F.	3 9
Engraved Glass Dials, 180-550 and 800-2,200 m.	1 0
With station names, new wavebands.	
T.R.F. Coils, 180-550, 800-2,200 metres, pair	6 6
Drum (2¾in. diam.)	1 0
Driving head	1 0
Double pointer	4
Spring	3
Nylon cord (yard)	6
Dial Front Plate	2 6

SEND 1/6 FOR EASY TO FOLLOW POINT TO POINT DIAGRAMS, THE CIRCUIT DIAGRAM AND PRICED PARTS LIST, which shows you how YOU can build the Receiver illustrated above at a total cost of
£5/19/6

The Radio is a TRF 3-valve and metal rectifier Receiver for operation on 200/250 volt A.C. mains. Waveband coverage is 180/550 metres on medium wave, and 800/2,000 metres on long wave. The Dial is illuminated. The attractive bakelite cabinet to house the Receiver, size 12in. long, 5in. wide, 6in. high, can be supplied in either walnut or ivory colour.

SENSATIONAL OFFER

The famous Dulci Midget Receiver for use on either A.C. or D.C. mains, 200/250 volt. This is a 2-waveband 4 v. Superhet Receiver covering the short waveband from 13.6 metres to 50 metres, and the medium waveband from 200-550 metres. Can be supplied in either ivory or brown bakelite cabinet.

Size 7¾in. length.
6in. height.
5½in. depth.

This receiver is fully covered by the manufacturer's guarantee.

Price £8/15/0, carriage paid.

THIS OFFER CANNOT BE REPEATED

H.T. ELIMINATOR AND TRICKLE CHARGER KIT

All parts to construct an eliminator to give an output of 120 volts at 20 mA. and 2 volts to charge an accumulator. Uses metal rectifier, £2.

SUPERHET COILS

16-50, 180-550, 800-2,000 metres, set, including circuit, 10/6.

SUPER QUALITY TELEVISION MAGNIFYING LENS. To suit 5in., 6in., or 7in. Tubes. Increase picture size considerably, 25/- each.

METAL RECTIFIERS

Bridge type:

2 v. .5 amps.	2/-	6 v. 1 amp.	4/-
12 v. 1 amp.	8/-	12 v. 4 amp.	17/6

E.H.T. Pencil Type:
Output 650 v. 1 mA., 4/7 each.
1,000 v. 1 mA., 6/- each.
Outputs given are half wave. Two of either Rectifiers can be used in voltage doubling.

BATTERY CHARGER KITS

All incorporate metal rectifiers. Transformers are suitable for 200/250 v. A.C. 50 cycle MAINS.

Cat. No.		
2002	Charges 6 volt accumulator at 1 amp. Resistance supplied to charge 2 v. accumulator	£1 2 6
2003	Charges 12 volt accumulator at 1 amp.	£1 7 6

BRAND NEW CAR BATTERIES

Delco-Remy, in original cases
6 v. 100 a., £4/17/6, plus 7/6 carriage and packing.
6 v. 140 a., £5/10/-, plus 7/6 carriage and packing.
12 v. 85 a., British made, £5/10/-, plus 7/6 carriage and packing.
6 v. 170 mA., in teak case, £5/10/0, plus 7/6 carriage and packing.

T.V. WHITE RUBBER MASKS (CORRECT ASPECT). We can supply a specially designed White Rubber Mask for 6in. C.R. tubes at 8/6 each.
9in. White Masks, 9/6. 12in. White Masks, 16/11. Round or flat faced.

SORBO RUBBER MASKS, GREY FELT FINISH (NEW ASPECT RATIO). 9in., 5/-; 12in., 9/6.

P.M. MOVING COIL LOUDSPEAKERS

(3 ohm voice coils)

2½in. Goodmans	15/-
3in. Plessey	15/-
5in. Plessey	12/6
5in. Truevox	12/6
5in. Rola	13/6
6in. Truevox	12/6
8in. Plessey	14/6
10in. P.R.C.	27/6
12in. Truevox	70/-

Please add 1/6 for post orders under 40/-, 1/- under 20/-. Cash with order or C.O.D.

HEAD OFFICE AND MAIL ORDER (DEPT. W.W.)

207 EDGWARE ROAD, LONDON, W.2

Open every day until 6 p.m., including Saturdays. Closed 1 p.m. Thursdays.

TERMS OF BUSINESS:— CASH WITH ORDER OR C.O.D. OVER £1.

Phones: AMBassador 4033
PADdington 3271
PADdington 3272

D. COHEN
RADIO & TELEVISION COMPONENTS

MAINS TRANSFORMERS

These transformers are all famous radio manufacturers' surplus and are fully Interleaved, impregnated and guaranteed.

Primary 200-250 v. P. & P. on each 1/6 extra.

300-0-300, 100 mA, 6 volt 3 amp, 5 volt 2 amp, **17/6.**

320-0-320, 100 mA, 6 volt 3 amp, 5 volt 2 amp, **17/6.**

320-0-320, 120 mA, 6 volt 4 amp, 5 volt 2 amp, **25/-.**

Heater Transformer, 4 volt 3 amp, 4 volt 3 amp, 2 volt 3 amp, 2 volt 3 amp, **7/6.**

250-0-250, 100 mA, 6 v. 3 amp, 4 v. 3 amp, 4 v. 3 amp, **17/6.**

250-0-250, 60 mA, 6 v. 4 amp (to be used on common heater chain with 6 × 5 rectifier), **13/6.**

280-0-280, 80 mA, 6 v. 3 amp, 4 v. 2 amp, drop-through, **14/-.**

Drop thro', 350-0-350 v.7 0 mA, 6 v. 2.5 amp, 5 v. 2 amp, **14/6.**

Semi-shrouded, drop-thro' or upright mounting 280-0-280 80 mA, 4 v. 6 amp, 4 v. 2 amp, **12/6.**

Auto-wound H.T 280 volts at 360 mA, 4 v. 3 amp, 2 v. 3 amp, or 6 v. 3 amp. Separate 4 v. 3 amp rectifier winding (upright or drop-through), **10/6.**

350-0-350 v, 120 mA, 4 v. 6 amp, 4 v. 3 amp, drop-through, **21/-.**

Auto-transformer, various combinations of voltages including 110 v. 70 watt, and 3/4 volts windings at 1 amp, 2 volt 1 amp, drop-through or upright mounting, **10/6.**

Heater Transformer Pri. 200-250 v., 6 v. 1½ amp, **6/-.** P. & P. each **9d.**

ELECTROLYTIC CONDENSERS

16 + 16 mfd. 450 v. wkg., **5/6.**
50 mfd. 50 wkg., **1/9.**
100 mfd. 12 v. wkg., **1/3.**
50 mfd. 12 v. wkg., **1/-.**
25 mfd. 25 v. wkg., **1/2.**
16 × 8 mfd., 450 wkg., **4/-.**
8 mfd. 450 v. wkg., **2/6.**
250 mfd. 12 v. wkg., **1/3.**
16 mfd. 500 v., **4/-.**
8 mfd. 500 v., **3/-.**
8 × 8 mfd. 450 wkg., **3/6.**
32 mfd. 350 wkg., **2/6.**
32 + 32 mfd. small tube tag ends 200 v. wkg., **2/-.**
16 + 8 mfd. 350 wkg., miniature tag end, **3/-.**

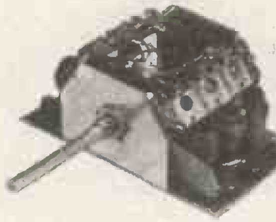
P.M. SPEAKERS

	with trans.	less trans.
3½in.	—	11/6
5in.	15/-	12/6
6½in.	14/6	11/6
8in.	17/-	14/6

10in. M.E. Speaker Field Coil, 1,100 ohms, speech coil 2-3 ohms, 17/6.

P. & P. on each of the above 1/- extra.

Constructor's Parcel. Comprising chassis 10½ × 5½ × 2in. with speaker and valve holder cut-outs, 5in. P.M. speaker with transformer, twin gang with trimmers, pair T.R.F. coils long and medium iron cored, four valve holders 20K volume control and wave-change switch. Post paid, **21/-.**



Three Wave-Band Coil Pack, iron cored coils, 16-50, 180-550, 1,000-2,000 metres. I.F. frequency 465 Kc. Size, 4½in. × 1⅞in. × 2⅜in., **24/-,** post paid. Double ended perspex trimming tool given free with each pack.

Walnut Bakelite Cabinet, 12in. × 7½in. × 6½in. scale aperture, 3½in. × 4in., complete with three wave-band scale, back plate, 5-valve superhet chassis, back, drum and push on pointer, **25/-,** post paid.

Walnut Bakelite Cabinet, 14½in. × 10½in. × 8in., complete with 5-valve superhet chassis, three wave-band scale, back plate, drum, 2-speed spindle, four pulley wheels, two springs, four brown knobs, and back, **25/-,** post paid.

Pensolda 6 volt Light Weight Soldering Iron, weight 3½ ounces complete with 1½ yards circular flex, **8/6.** Post & pack. **1/-.** Complete with suitable heater transformer Primary 230/250 volts, **10/6.** Post & pack. **1/9.** Transformer not sold separately.

LINE AND FRAME COILS, low line, high frame complete with mounting bracket (removed from chassis), guaranteed, **6/6.**

LINE AND E.H.T. TRANSFORMER. 5 Kv. (removed from chassis), guaranteed, **9/6.**

HEATER TRANSFORMER. Primary 230/250 secondary 2 volt 2½ amp., **5/-.**

FRAME BLOCKING OSCILLATOR TRANSFORMER, 4/6.

SMOOTHING CHOKE. 2 hen. 200 mA, **3/6.**

SMOOTHING CHOKE. 5 hen. 250 mA, **5/6.**

T.V. CHASSIS. Size 9½ × 9½ × 3½, **3/-.**

P.M. FOCUS UNIT. For any 9in. or 12in. tube, except Mazda 12in., state tube, **12/6.**

P.M. FOCUS UNIT. For Mazda 12in., **15/-.**

MAINS or BATTERY SUPERHET PORTABLE COILS. Comprising medium wave frame aerial and long wave loading coil, used as aerial coils. Midget iron cored screened L/M osc. coils, complete with circuit I.F. frequency 465 Kc., **9/6.**

6 IRON CORED LONG, MEDIUM and SHORT SUPERHET COILS coupling winding on all bands, 13.5-50, 180-550, 1,000-2,000 metres, complete with circuit, **8/6.**

METAL RECTIFIERS, 250 v. 60 mA, latest midget Selenium type, **6/6** post pd.

OUTPUT TRANSFORMERS. Standard type 5,000 ohms imp., 2 ohms speech coil, **4/9**; Push-Pull 6 v. 6 matching 10 watt 2 ohms speech coil, **6/9.** Miniature type to suit 1S5, **5/-.**

SET OF 3 BROWN KNOBS marked "wave change," "tuning," and "volume," **1/6.**

SMOOTHING CHOKES.	30 mA 300 ohm.	1/6
	45 mA 300 ohm.	3/–
	60 mA 6-8 hen.	4/9
	80 mA 10 hen.	6/6
6-pin 6 volt synchronous vibrator		8/6
6 volt standard 4-pin vibrator		8/6
Vibrator transformer 250-0-250 80 mA. 6 volt. Pri.		8/6

TELEVISION MASKS

White Rubber. 9in. with glass, **10/6.** White Rubber. 12in. with glass, **15/-.** 15in. white rubber mask, soiled, **12/6,** plus **1/-** P. & P.

Midget Components. Twin gang ⅞in. diameter, ⅞in. long. (The dimensions of this gang are slightly deeper than a standard volume control.) Pair Medium and Long iron cored T.R.F. Coils ⅞in. long × ⅞in. wide complete with a 4-valve all-dry circuit, tuning scale and pointer knob. All the items **10/-** post paid.

All-Dry A.C. Mains Supply Unit, size 3½in. long × 2⅞in. wide × 1¼in. deep. We can supply a complete all-dry circuit, using the above Midget Components to incorporate the above Power-Unit, **19/6,** post paid with circuit.

Midget Bakelite Cabinet. 7in. × 5½in. × 5in. c/w 5-valve S/h. chassis med./long wave scale and back (takes std. twin gang condenser and 3½-in. speaker). **15/-.** P. & P. **1/6.**

Line and Frame Coil Assembly. Frame coils wound but not fitted (full instructions supplied). High impedance frame; low impedance line, matching 5-1, **8/6.**

Wave Change Switches. 6-pole 3-way, **2/-**; 3-pole 2-way **1/2**; 4-pole 3-way, **1/9**; 5-pole 2-way midget, **1/9.** P. & P. 3d. each.

Pre-Aligned Midget 465 Kc. Q. 120, **9/-** per pair, post 6d. **Miniature 465 Kc. I.F.s.** Q.120, per pair **10/-.**

465 Kc. Midget I.F.s. Q.120, size 1½in. long, 1in. wide, ⅞in. deep, by very famous manufacturer. Pre-aligned adjustable iron dust cores, per pair, **12/6.**

Iron Cored 465 Kc. Whistle Filter, screened, each **2/6.**

Valve Holders. Paxolin international octal, **4d.** each. Moulded international octal, **7d.** each. EF50 ceramic, **7d.** each. Moulded B7G slightly soiled, **6d.** each.

Line Cord. 3-way 0.3 amp., 180 ohms per yard, **1/3** per yard.

Ceramic P.F.S. 3 each of the following: 330, 220, 180 and 82, **2/6.**

Trimmers. 5-40 pf., **5d.**; 10-110, 10-250, 10-450 pf., **10d.**

Twin Gang .0005 Tuning Condenser, 5/-. With trimmers, **7/6.** Post and packing 6d.

Twin Gang Midget .00037 with perspex dust cover and trimmers, **8/6.** Post and packing 6d.

Mains Droppers. 0.3 amp. 460 ohms, tapped 280 and 410, **1/6**; 0.2 amp. 717 ohms, tapped at 100 ohms, vitreous, **1/6**; 0.3 amp. 950 ohms, tapped 700 and 825, **2/6**; 0.2 amp. 1,000 ohm, vitreous, tapped, **2/6.** P. & P. on each, 3d.

Volume Controls by famous manufacturer. Long spindle and switch ¼, ½, 1 and 2 meg., **4/-** each; 20, 25 and 50 k., **3/6** each. Post and packing 3d. each.

Volume Controls, by famous manufacturer. Long spindle less switch, 5 k., 50 k., 500 k., 1 meg **2/6** each. P. & P. 3d. each.

Terms of business: Cash with order. Dispatch of goods within 3 days from receipt of order. Where post and packing charge is not stated please add 1/- up to £1 and 1/6 up to £2. All enquiries and Lists, stamped addressed envelope.

23, HIGH STREET (Opposite Granada Cinema), ACTON, W.3

Hours of Business: Saturdays 9-6 p.m. Wednesday 9-1 p.m. Other days 9-4.30 p.m. *Telephone: ACOrn 5901*

CHARLES BRITAIN (RADIO) LTD

11, UPPER SAINT MARTIN'S LANE, LONDON, W.C.2

(Three minutes from Leicester Square Tube Station. Up Cranbourn Street)

Shop hours 9-6 p.m. daily (9-1 p.m. Thursday). Open all day Saturday. **Temple Bar 0545**

Best Buy at Britain's

OSCILLOSCOPE BARGAIN. We still have available a few of these excellent little scopes as advertised last month. Contained in a neat black metal case size : 7¾in. x 5½in. x 11in., complete with tube and valves and ready for operation on 200-250 volts A.C. mains. All brand new and boxed, they should be invaluable to the service engineer, experimenter, schools, etc., as the price is only **£10/10/-**, plus 5/- carriage and packing. Full details available on receipt of S.A.E.

COMMUNICATIONS RECEIVER R.1155. A first-rate Superhet Communications receiver capable of giving good quality reproduction of local stations as well as being ideal for reception of that elusive DX Short Wave station. Full circuit and operational details as well as conversion to A.C. mains operation are contained in the revised and enlarged "Wireless World" leaflet, which is supplied with each set or available separately at **1/3**, post paid. The receivers are in brand new condition and perfect working order and are moderately priced at **£11/19/6**, carriage and packing in original transit cases, 10/6. Any set gladly demonstrated to callers.

R.1155 POWER PACK AND OUTPUT STAGE. Enables this receiver to be operated direct from A.C. mains, just plug in and connect low impedance speaker (Note : Speaker not supplied), **£3/19/6**, carriage paid. This unit is manufactured by ourselves from new components and valves and assembled in a neat black A.M. case, size 8½in. x 6½in. x 4in. All the necessary leads and plugs are supplied and included in the price.

BAKELITE EXTENSION SPEAKER. Cream cabinet size, 6½in. x 6½in. x 3in. Containing 5in. Rola speaker 2/3 ohms. Brand new and boxed, **22/6**, plus 2/6 post and packing.

MAINS TRANSFORMERS. Three types, all standard primaries. Universal mountings. (1) 350-0-350 volt 80 mA. 0-4-6.3 v. 4 a. 0-4-5 v. 2 a. (2) 250-0-250 v. 80 mA. 0-4-6.3 v. 4 a. 0-4-5 v. 2 a. (3) 30 v. 2 a. Tapped at 3 v., 5 v., 6 v., 8 v., 9 v., 10 v., 12 v., 15 v., 18 v., 20 v., 24 v. All these transformers are brand new and boxed, fully guaranteed and priced at **18/6**, plus 9d. post.

SPECIAL OFFER. On manufacturer's surplus transformers—standard tapped primary. 375-0-375 v. 200 mA. 6.3 v. 8 a. 5 v. 3 a. 4 v. 2 a. 4 v. 2 a. Size 4½in. x 4in. x 5in. Semi-shrouded drop through type. A bargain offer at **39/6**, plus 1/6 post and packing.

FILAMENT TRANSFORMER. 230 volts 50 c.p.s. primary secondary 6.3 v. 1.5 a. Price **7/6** post paid.

MANSBRIDGE CONDENSERS. 10 mfd. 1,000 v. test. Size 3½in. x 3in. x 2in. Will work at 600 v. D.C. Price, three for **10/6**, post paid. These are brand new and boxed.

ELECTROLYTIC CONDENSERS. 16 mfd. 500 v. working, 600 v. surge, three for **11/6**, post paid. These condensers are tall can type single hole fixing. Minimum quantity by post is three.

MULTIPLE BLOCK CONDENSERS. Electrolytic, 8 x 16 x 4 x 4 x 6 mfd., all for 450-volt working, **4/9**, plus 9d. post, or two for **10/-**, post paid.

BLOCK CONDENSERS. Electrolytic 8 mfd. 500 v. working, three for **9/-**, post paid.

BIAS CONDENSERS. 20 mfd. 50 v. D.C. wkg., small can single hole fixing, **10/6** per dozen. 50 mfd. 25 v. single hole fixing can, **10/6** per dozen. 25 mfd. 25 v. wire end cardboard tubular, **15/-** per dozen. All brand new Minimum quantity 1 dozen.

PORTABLE TESTING INSTRUMENTS. These multimeters are perfect, brand new and contained in manufacturer's original boxes. The instrument is a moving coil volt ohm milliameter, complete in an attractive carrying case with handle. The dial is calibrated for readings of 0-1.5 v., 0-3 v., 0-60 mA. and 0-5,000 ohms. Further ranges may be added as desired A range switch is incorporated and the basic movement is 6 mA. 250 ohms resistance. Our price, **15/-**, plus 1/6 post and packing.

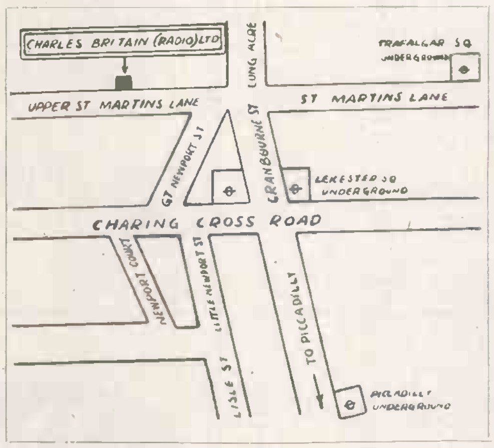
SIMPSON DUAL RANGE OHMMETER. Brand new American instruments. Incorporates 2½in. moving coil meter, ranges 0-2,000 and 0-200,000 ohms, **52/6**, post paid.

CAR BATTERY. American made by Reading, 6 v. 90 A.H. 7¾in. x 8¾in. x 7in. Brand new, in original packing **79/6**, plus 5/- carriage.

BATTERY CHARGERS. Contained in black crackle case, size 6in. x 7in. x 12in., includes a heavy duty transformer, metal rectifier, 0-5 ammeter on/off mains switch and 2 Slydlock fuses, 230 volts 50 cycles input, output 4 amp. 6 or 12 volt battery. The transformer, etc., is conservatively rated and the whole unit is of sturdy construction and super quality. Made to a very stringent specification, this equipment is well worth the price of **£4/19/6**, plus 5/- carriage and packing. In brand new unused condition.

NEW EXIDE ACCUMULATORS. 2 volt 15-20 A.H., in black bakelite case, size 6in. x 1¾in. square. Brand new at 4/6 each, plus 9d. post.

PHILCO CAR RADIO. 200-550 metres, for 6-volt operation. Valve line up : 2 of EF39, 1 of ECH35, 1 of EBC33, 1 of EL32, 1 of 6X5 and a 6-v. vibrator. Unusually powerful and selective as an R.F. stage is incorporated. A built-in 6½in. speaker is included. Our price **£10/10/-**, plus 5/- carriage and packing. IN PERFECT WORKING ORDER.



SHIPPING AND TOP BAND. Listeners to these bands will be pleased to hear that we can once again offer a Command Set with a frequency coverage of 1.5 to 3 Mc/s. (100-200 metres). These follow the same specification as the other types of Command Sets, and are complete with circuit diagram. Price (less Dynamotor), **£4/10/-**, carriage paid. In brand new condition and contained in black crackle cases.

RECEIVER TYPE 21. A battery operated superhet covering 4.2-7.5 Mc/s. and 19-31 Mc/s. Operates as a double superhet on the 10-metre band. Complete with nine 2 v. valves and circuit diagram. In new condition. Only **45/-**, carriage paid.

45 Mc/s. "PYE" STRIP. A ready-made vision receiver for London frequency. Uses 6 EF50 and an EA50. Circuit data provided. Less valves, **37/6**, with all valves, **57/6**, plus 1/6 post and packing.

24 v. EXTRACTOR FAN. For operation from 24 v. A.C./D.C., but will function from mains when fitted with a suitable dropper resistance. Has many uses—Ventilation purposes, as a hair dryer, etc. As new, only **12/6**, plus 1/6 post and packing.

EX-R.A.F. U.H.F. ANTENNA. This consists of an EA50 untuned detector stage mounted on a moulded streamlined base. The copper antenna measures 22.5 cm. All connections are brought out to a 3-pin screened connector. These units are brand new and boxed. Only **5/-**, post paid.

METAL RECTIFIERS. 12 v. 2 a. Full wave bridge, **12/6**, plus 6d. post Miniature H.T. Rectifiers, type R.M.2—125 v. 100 mA., 4/3 each, or two for 8/-. RM3—125 v. 120 mA., 5/- each, or two for **9/6**, plus 6d. post for one or two. Selenium 150 v. 40 mA., three for **10/-**, post paid.

EF50 (VR91) Red American Sylvania types at **8/6** each. Brand new. British types also available at 5/- each, tested.

SPECIAL PURPOSE VALVES. VT501 (TT11), 5/- ; 954, 2/6 ; VR136 (EF54), 6/6 ; E.1148, 2/6 ; VR65a (SP41), 3/- Hundreds of other types in stock. Post 6d. for 1 to 4 valves.

SPARE C.R.T.'s. For Erskine Oscilloscope. Type 1/B as advertised above. G.E.C. Type E4103/B/4. Brand new and boxed only **22/6**, post paid.

EX-GOVT. CHOKES. 20H 80 Ma 350 ohms, 6/6. 30H 100 Ma, **12/6**. Both types are upright mounting and very conservatively rated, **1/-** each postage.

6in. MAGNIFYING LENS. Super quality oil filled perspex. Enables you to have a large picture with VCR97, VCR517 and 5CP1 tubes etc., special price of only **22/6** each, plus 1/6 postage.

COSSOR DOUBLE BEAM OSCILLOSCOPES. 2 only in stock, Model 339A. As new and in perfect working order. Price **£40** each.

MOVING COIL METER. Consists of 500 micro-amp movement with 3in. scale contained in metal case, size 3½ x 2¾ x 2in. It is calibrated for 2 volts A.C. and incorporates a rectifier. Price **19/6**, post paid.

DIFFERENTIAL MILLIAMETER. Moving coil, 15-0-15 Ma centre zero 2½in. bakelite case. Brand new and boxed, **10/6**, post paid.

PERSONAL CALLERS SHOULD NOTE

that it is impossible to convey in this advert. the enormous range of components, valves, C.R.T.'s test equipment and other gear which we have in stock. We are stockists of Wharfedale Speakers, Connoisseur Pick-Ups, Quality Amplifiers and many, many other items of interest to Schools, Laboratories, Manufacturers and all others connected with the Electronic Industry. When in town pay us a visit and you will be surprised and delighted at the astonishing variety of goods we have to offer at keen competitive prices.

WANTED ! ! !

We require the motor and gearbox or gearbox only which was in R.3547 or R.3584 receivers also the relays and contact strips from these units. State your price.

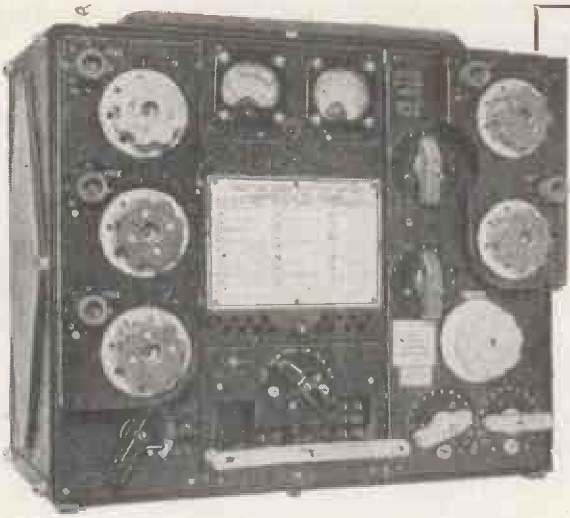
CBR LTD

CHARLES BRITAIN (Radio) Ltd.

11, UPPER SAINT MARTIN'S LANE, LONDON, W.C.2 TEM 0545

WANTED ! ! !

EXPERIENCED Radio Engineer, preferably "Ham," Write in first instance stating qualifications, salary required and whether driving licence is held.



T1154 TRANSMITTER

59/6

COMPLETE

Frequency Ranges: 200-500 kc/s., 3-5.5 Mc/s., 5.5-10 Mc/s. in switched bands. Frequency stability. V.F.O. control. Services provided include MCW, CW and RT. 70% modulation by suppressor grid on MCW and RT. Power output 50-80 watts. Quarter power on MCW and RT. Has two moving coil meters for measuring P.A. Anode current and Aerial current. Fitted with Auto-click mechanism for ease in re-setting frequencies. Complete with two valves Type ML6 and two valves Type PT15. D.C. Power supply required: 1,200 volts at 200 mA. and 6 volts at 6½ amps.

Circuit diagram and operating instructions included. Dispatched in maker's transit cases. 59/6. Packing and carriage 25/-. 12/6 refunded on return of case.

NOTE—Transmitters are complete as illustrated and described. All four valves supplied are filament checked before dispatch and the physical condition of the units is good. We do not necessarily guarantee that they are in working order.

CHARLES BRITAIN (Radio) Ltd.
11, UPPER SAINT MARTIN'S LANE
LONDON, W.C.2. *TEM 054*

(See our full page advertisement on page 85)

3 minutes from Leicester Square Station (up Cranbourn Street) *Shop Hours: 9-6 p.m. (9-1 p.m. Thursday) Open all day Saturday*

RADIO EXCHANGE CO.

MIDGET AMPLIFIERS with 1 12SJ7 and 2 12SH7s; a very compact unit. 12/6 (1/6 carr.).
BRAND NEW ACCUMULATORS. Multiplate, in transparent non-spillable plastic cases. 7 A.H. 2 v., 6/6. 21 A.H. 2 v. (ex 58 set), with built-in hydrometers, 15/-.
H.T. BATTERIES. 72 v. (layer), plus 1.5 v., 7/6.
RECEIVER P.40. Complete with valves, covering 85-95 Mc/s., this is ideal for Wrotham, or converting for "2." Contains 4 EF54s (RF, mixer, Xtal multipliers), EC32 (Xtal oscillator), 2 EF39s (2.9 Mc/s. IFs), EB34 (det.), 6J5 and 6V6 (audio). Housed in attractive grey cases. Only 69/6, in original cartons, complete with circuit: circuit only, 2/-.
POWER UNIT S441B. Separate individually controlled H.T. and L.T. transformers, jewelled indicator lights, attractive appearance and modest size (14in. x 7½in.) x 7in. Output from 200/250 v. 50 cps., is 300 v. at 200 m/A., 12v. at 3 a. and 5 v. D.C. ONLY 65/- (5/- carr.) in original cartons.
TRANSMITTER 21. Sending C.W., M.C.W., or speech on frequencies of 4.2-7.5 or 18-31 Mc/s. These are complete with valves, key, control box and front panel. Relays and wire from P.A. coils (formers are intact) have been stripped by the M.O.S., but may easily be replaced with the circuit and data supplied by us. In excellent condition, 25/-.
RECEIVER 1225. Complete with 5 EF50s, 2 EF39s and 1 EB34, these operate on four pre-set frequencies, L.O. being crystal controlled, and are ideal for two metres. ONLY 39/6 (1/6 post).
POWER UNIT S532. Containing 5Z4 rectifier, SU2150 (5KV) EHT rectifier, choke, relay, condensers, transformers, etc. Complete with our 50 cps E.H.T. and H.T. conversion data, 17/6 (2/3 post).
VIBRATOR UNIT 21. 6 v. input, approx. 160 v. at 40 m/A., D.C. smoothed output. Designed to supply the Trans/Rec. 21. ONLY 15/6.
THE NEW 1355 CONVERSION data for all five T.V. channels, 3/-.
We have a number of bargains for callers only; quantities held are too small to advertise, but prices are really low; soiled P40s, £2/5/-; P40 power packs, £1/19/6; transmitters, etc., etc.

9 CAULDWELL STREET, BEDFORD
'Phone 5568.

Dept. W.W.

ALEC Davis SUPPLIES Ltd.

18 TOTTENHAM COURT ROAD, LONDON, W.1
Tel.: MUSeum 2453/4539

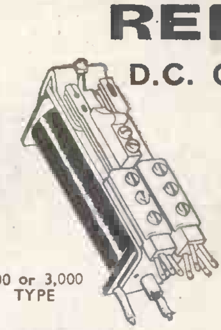
Shop hours: Monday - Friday 9—5.30 Saturday 9—1
FULL MAIL ORDER FACILITIES. Please add postage

RELAYS

D.C. COIL RESISTANCE

3,000 TYPES: 1.9Ω to 80,000Ω
600 TYPES: 0.4Ω to 9,200Ω

ALSO LARGE STOCKS OF DOUBLE & TRIPLE-WOUND AND SLUGGED COILS.



600 or 3,000 TYPE

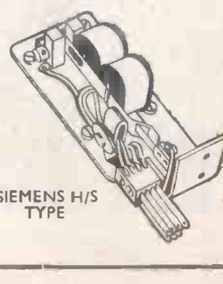
CONTACTS

3,000 TYPES: up to 8 sets.
600 TYPES: up to 4 sets.

3,000 TYPES: Make (M), Break (B), in Twin-silver, Twin-platinum, Dome-silver (2 amp.), Tungsten (5 amp.), and Flat-silver (8 amp.). Change-Over (C), in all but Tungsten: Make-Before-Break (K), in Twin-silver and Twin-platinum.

600 TYPES: (M), (B) and (C), in Twin-silver and Twin-platinum.

SPECIAL
3,000 type Relays with 80,000Ω coils operating on approx. 600 μA. with up to four sets of contacts.

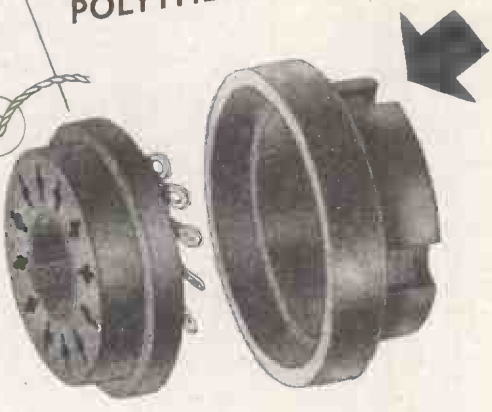


SIEMENS H/S TYPE

Recognised as the Most Reliable Valveholders

McMURDO Moulded Valveholders

POLYTHENE PUSH-ON COVER



B12A—Duodecal

FOR CATHODE RAY TUBES

Ref. No. B.12/U—moulded in **Phenol-Formaldehyde with Polythene Cover**
„ „ B.12/U.1— „ „ „ „ „ without cover

Wholesale Enquiries:—CYRIL FRENCH LTD., HIGH STREET, HAMPTON WICK, MIDDLESEX · KIN. 2240
Manufacturers' Enquiries:—THE McMURDO INSTRUMENT CO. LTD., VICTORIA WORKS, ASHTEAD, SURREY
ASHTEAD 3401

RADIO SUPPLY CO.

15, WELLINGTON ST., LEEDS, 1.

Post Terms C.W.O. or C.O.D. No C.O.D. under £1. Postage 1/3 charged on orders under £3. Open to callers 9 a.m. to 5.30 p.m. Saturdays until 1 p.m.

R.S.C. MAINS TRANSFORMERS

Fully Guaranteed, Interleaved, and Impregnated. Primaries 200-230-250v. 50 c/s. Screened.

DROP THROUGH TYPES, TOP SHROUDED
260-0-260 v. 70 ma., 6.3 v. 2 a., 5 v. 2a., Midget type, 2½-3-2½in. **12/11**
260-0-260 v. 80 ma., 6.3 v. 3 a., 5 v. 2a...... **14/11**
350-0-350 v. 80 ma., 6.3 v. 2 a., 5 v. 2a..... **14/11**
350-0-350 v. 80 ma., 0-4-6.3 v. 2 a., 0-4-5 v. 2 a.......... **18/9**
260-0-260 v. 90 ma., 6.3 v. 3 a., 5 v. 2a... **19/9**
350-0-350 v. 90 ma., 6.3 v. 3 a., 5 v. 2a... **19/9**
250-0-250 v. 100 ma., 6.3 v. 4 a., 5 v. 3 a.... **21/9**
250-0-250 v. 100 ma., 6.3 v. 6 a., 5 v. 3 a., for R1355 conversion.......... **23/11**
350-0-350 v. 100 ma., 6.3 v.-4 v. 4 a. C.T. 0-4-5 v. 3 a.......... **21/11**
350-0-350 v. 120 ma., 6.3 v. 4 a., 5 v. 3 a.... **25/9**
350-0-350 v. 150 ma., 6.3 v. 4 a., 5 v. 3 a.... **27/11**

FULLY SHROUDED, UPRIGHT
250-0-250 v. 60 ma., 6.3 v. 2 a., 5 v. 2a., Midget type 2½-3-3in.......... **16/9**
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.......... **23/9**
250-0-250 v. 100 ma., 6.3 v. 6 a., 5 v. 3 a., for 1355 conversion.......... **26/9**
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 v. 4 a. C.T., 0-4-5 v. 3 a.......... **23/9**
350-0-350 v. 120 ma., 6.3 v. 4 a., 5 v. 3 a.... **27/9**
350-0-350 v. 150 ma., 6.3 v. 4 a., 5 v. 3a... **29/11**
350-0-350 v. 150 ma., 6.3 v. 2 a., 6.3 v. 2 a., 5 v. 3 a.......... **31/-**
350-0-350 v. 250 ma., 6.3 v. 6 a., 4 v. 8 a., 0-2-6 v. 2 a., 4 v. 3 a., for Electronic Eng. Televisor **63/-**
425-0-425 v. 200 ma., 6.3 v.-4 v. 4 a. C.T., 6.3 v.-4 v. 4 a., C.T., 0-4-5 v. 3 a., suitable Williamson Amplifier.......... **48/9**
325-0-325 v. 20 ma., 6.3 v. 0.5 a., 6.3 v. 1.5 a. for Williamson Preamplifier......... **17/6**

FILAMENT TRANSFORMERS
All with 200-250 v. 50 c/s. primaries : 6.3 v. 2 a., **7/6** ; 0-4-6.3 v. 2 a., **7/9** ; 12 v. 1 a., **7/11** ; 6.3 v. 3 a., **10/11** ; 6.3 v. 6 a., **16/9** ; 0-2-4-5-6.3 v. 4 a., **16/9** ; 12 v. 3 a. or 24 v. 1.5 a.......... **16/9**

CHARGER TRANSFORMERS
All with 200-230-250 v. 50 c/s. Primaries : 0-9-15 v. 1.5 a., **12/9** ; 0-9-15 v. 3 a., **15/9** ; 0-9-15 v. 6 a., **21/9** ; 0-4-9-15-24 v. 3 a., **21/9** ; 0-9-15-30 v. 3 a.......... **22/9**

SMOOTHING CHOKES
200 ma. 5 h. 100 ohms.......... **7/6**
100 ma. 10 h. 100 ohms.......... **7/6**
90 ma. 10 h. 100 ohms.......... **6/6**
80 ma. 10 h. 350 ohms.......... **5/6**
60 ma. 10 h. 400 ohms.......... **4/6**
50 ma. 50 h. 1,500 ohms. (Williamson Amp.) **8/6**

AUTO TRANSFORMERS
100 watts 110-200-230-250 v.......... **19/9**

ELIMINATOR TRANSFORMERS
200-250 v, 50 c/s. input, 120 v. 40 ma. output **7/11**

OUTPUT TRANSFORMERS
Midget Battery, Pentode 66 : 1 for 3S4, etc. **3/6**
Small Pentode, 5,000 ohms to 3 ohms... **3/9**
Standard Pentode 8,000 ohms to 3 ohms **4/9**
Pentode 8,000 ohms tapped 5,000 ohms to 3 ohms (50 ma.).......... **4/11**
Multi ratio 40 ma., 30 : 1, 45 : 1, 60 : 1, 90 : 1 Class B Push-Pull.......... **5/3**
Push-Pull 8 watts 6V6 to 3 ohms.......... **9/6**
Push-Pull 10-12 watts 6V6 to 3 or 15 ohms **15/11**
Push-pull 10-12 watt to match 6L6, PX4, 6V6, etc., to 3-5-8 or 15 ohm speaker...... **15/11**
Push-pull 15-18 watts to match 6L6, etc., to 3 or 15 ohm speaker.......... **21/9**
Williamson type exact to author's spec. **75/-**

SPEAKERS P.M. 5in. 2-3 ohms......... **14/9**
M.E. 8in. 2-3 ohms (Field 600 ohms)...... **12/9**

RECEIVER CHASSIS, 16 s.w.g., aluminium 10-5¼-2in., **3/6** ; 11-6-2½in., **3/11** ; 12-8-2½in., **4/11** ; 16-8-2½in., **6/9** ; 20-8-2½in., **7/11**.

AMPLIFIER CHASSIS, 16 s.w.g. aluminium, 12-8-2½in., **7/11** ; 16-8-2½in., **10/11** ; 20-8-2½in., **13/6**.

MISC. ITEMS. Ex. Govt. chokes 100 ma., 10 h., 100 ohms. Tropicalised, **4/3**. Ex-Govt. Selenium rectifiers, 600 v. 30 ma., **6/9** ; 120 v. 40 ma., H.W., **3/6** ; (Ex. new equipment). New, 150 v. 60 ma., H.W., **3/9**. Vol. Controls, 200 k. long spindle, **1/3** ea., **12/6** doz. 0.1 mfd. 1,000 v. Tubulars, **4/11** doz. Ex-Govt. Receiver Units, type 71, less valves, **7/6**. E.H.T. Smoothers, 0.5 mfd., 3,500 v., **1/9** ; 4 mfd. 600 v. Blocks (ex new equip.), **2/9**. Ex-Govt. R1124 Units, less valves, **10/9**. New 2,000 mfd. 12 v. Blocks, **4/6**.

BAKELITE CABINETS
Premier type 12-6½-5½in. (Supplied complete with back). Brown or ivory, fully punched chassis, L and M, 3 colour glass dials, or L, M and S, Back Plates and Brackets S.M. Drum Drive, **28/6**.

SPECIAL OFFERS. Mains trans. (Mnfs. surplus). 200-250 v. Primary. Secs. 300-0-300 v. 70 ma., 6.3 v. 3 a. 5 v. 2 a., **10/11** ; 230 v. primary, 6.3 v. 1.5 a. sec. (small), **5/9**. Smoothing Chokes, 80 ma. 10 h. 250 ohms, **4/6**. Push-pull, 15 watt output, trans. 6V6 or 6L6 to 3 and 15 ohms, **15/6**.

FULL RANGE OF STANDARD COMPONENTS AVAILABLE AT KEEN PRICES. ALL GOODS GUARANTEED AND NEW, UNLESS OTHERWISE STATED. WE CAN QUOTE FOR ANY TYPE OF CHOKE OR TRANSFORMER S.A.E. PLEASE WITH ALL ENQUIRIES FULL STOCK LIST, 4d. SPECIAL LIST FOR TRADE, 4d.

CONSTRUCTORS!!

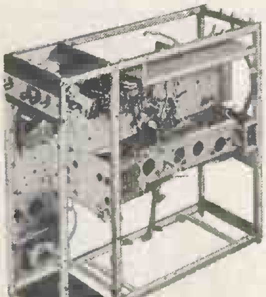
HERE'S A BARGAIN FOR YOU!

POUNDS WORTH OF COMPONENTS FOR ONLY 5/-

The home constructor should derive a lot of satisfaction from this chassis—it contains so much of value to him. It might even have the very component he has been looking for. The light but immensely strong steel framework, paxolin and aluminium panels, stand-off insulators and the innumerable lengths of high-quality, beautifully insulated leads are all worth far more than is being asked for the whole chassis.

HOW TO DESIGN 'NEAR UNIT' APPARATUS USING THIS CHASSIS AS A BASIS

as suggested by a satisfied technician



SIZE: 21½" x 7¾" x 19" high

1—Lower Section of Unit already fitted with 10-pin Plug Strip fitting sockets of the ex-U.S.A. TUB Tuning Units for conversion to Receiver.

2—This leaves room at right of panel to take the ex-R.A.F. RF Units 27 or 28 used as convertors feeding into receiver.

3—Centre Instrument Panel Strip will take English type M.A. and Voltage and other meters having 2¼in. flange, without further drilling.

4—When the internal aluminium chassis is removed, the top section of the frame will take another TUB unit for conversion to Transmitter.

5—Leaving the top right-hand Antennae Tuning Panel and space behind it ready made for this or for fitting other apparatus required.

Average Contents (all new and unused).

10 Pin Plug Strip
5 250 K. 1-watt Resistors.
4 100 ohm. 1-watt Resistors.
2 600 v. 1 mf. Condensers.
9 High-voltage Condensers .0001 to .01.
1 3-way Switch.
2 H.F. Chokes.
1 Relay Switch.
1 Ceramic Valve Holder.
Lamp fuse with holder.
Spring Terminals.
Paxolin Panel 6¼in. x 5in.
Aluminium Panel, black finished.
Large number Multi-coloured sleeved leads.
Very strong steel framing.
Innumerable Nuts and Bolts, Soldering points.
Stand-off Insulators, etc., etc.

The whole outfit, weight 18 lbs. sent to any address for only 5/-, plus 2/3 part cost of packing and carriage. *U.K. only*

SPECIAL OFFER: 4 for 22/6, carriage paid. *U.K. only*

Foreign and Colonial Orders are subject to overseas freightage
Satisfaction Guaranteed or Money Refunded in Full

The NEW LONDON ELECTRON WORKS Ltd.
92 EAST HAM LONDON.E.6
Telephone: Grangewood 0044-1363

THE 600 GROUP OF COMPANIES

NOVEMBER OFFERS

R.1155 COMMUNICATIONS RECEIVER. We have been fortunate in obtaining a quantity of BRAND NEW UNUSED SETS, which are now becoming scarce. This famous ex-R.A.F. Bomber Command receiver covers 5 wave ranges: 18.5-7.5 mcs., 7.5-3.0 mcs., 1,500-600 kcs., 500-200 kcs., 200-75 kcs., and is easily and simply modified for normal mains use, full details being supplied. All sets aerial tested before despatch. IN MAKER'S ORIGINAL TRANSIT CASES ONLY £11/19/6 (carriage 10/6). A factory-made power pack with output stage, which operates the R.1155 immediately, can be supplied for £5/5/-.

BATTERY SUPERSEDER. Will save battery users pounds. Operates from a 2-volt ACCUMULATOR and delivers constant H.T. of 67 volts at 4.7 mA., 130 volts at 13-25 mA. and 1.4 v. L.T. if required. American made, and originally intended for Walkie Talkie equipment, this unit is easily adapted for use with any battery set, and full illustrated details are supplied. ONLY 60/- (postage etc., 2/-).

I.F. STRIP TYPE 194. An easily modified I.F. Strip recommended for TV constructors who want good results at moderate cost, or for those who have built televisors but are having trouble in the vision or sound receivers. This 6-stage strip measures 18in. x 5in. x 5in. and contains 6 valves: VR65, 1 of VR92, and 1 of VR53 or VR56. Mod. data supplied. BRAND NEW. ONLY 45/- (postage etc., 2/6)

RECEIVER R.1355. The unit specified for "Inexpensive Television." Complete with 8 valves: VR65, and 1 each 5U4G, VU120, VR92, and a copy of "Inexpensive TV," which gives full constructional details.

RDF IDENTIFICATION UNIT ZC 13312. A very powerful 14-valve receiver with 4 I.F. stages of 12 mcs. with 4 mcs bandwidth. Will convert into a first-class T.V. receiver. Valve line up: 5 of SP61, 2 of P61, 3 of EA50, and 1 each CV63, EB34, EC52, 5Z4G. ONLY 49/6 (carriage, etc., 5/-).

10-VALVE 1½-METRE SUPERHET ZC8931. For long-distance T.V. results Valve line up is 6 of VR65, 2 of VR92, and 1 each VR136 and VR137, and the 12 mcs. 6-stage I.F. Strip gives tremendous amplification with ample bandwidth of 4 mcs. Easily modified. Full details supplied. BRAND NEW IN MAKER'S CARTONS. ONLY 59/6 (carriage 5/-).

6046/6050 AMPLIFIER. An ideal unit for conversion into a high gain T.V. pre-amplifier, full details being supplied. Complete with 2 valves EF50. ONLY 22/6 (postage, etc., 1/6).

R.F. UNIT TYPE 24. For use with the R.1355 Receiver for Sutton Coldfield T.V. (mod. data supplied) or as a pre-amplifier as per "Practical Television" December 1950. ONLY 17/6 (postage 1/6).

SECTIONAL TELESCOPIC AERIAL, comprising 16 sections each 16in. in length, and colour-coded for ease of assembly. Complete in web case. BRAND NEW. ONLY 9/6 (postage 1/-)

WALKIE TALKIE CHASSIS TYPE 38. A beautifully made chassis, ideal for the enthusiast, or as a source of components. As used by the Forces, with the exception of certain transmitting components removed by the Ministry of Supply. ONLY 9/6 (postage 1/6).

HEADPHONE AND MICROPHONE SET. A pair of 4,000 ohms phones, fitted with rubber noise excluders, and a high grade carbon microphone. BRAND NEW. ONLY 12/6 (postage 1/-)

HEADPHONES DLR NO. 2. Low resistance phones fitted with solid type head band, and 6ft. lead terminating in jack-plug. As used on type 18 receiver, etc. BRAND NEW. ONLY 6/6 (postage 1/-).

MUIRHEAD SLOW MOTION DRIVE. A really precision product of this famous maker. 3in. in diameter with edge marked 0-180. Complete with cursor. BRAND NEW IN MAKER'S CARTONS. ONLY 8/6 (postage 1/-).

CONDENSERS. Paper metal cased. .1 mfd 3,000 volts, 4/6; electrolytics (cans unless stated), 8 mfd. 450 v., 2/6; 8 x 8 500 v., 4/9; 8 x 16 450 v., 5/9; 16 500 v. cardboard, 6/-; 16 450 v. can, 5/6; 16 x 16 500 v., 7/-; 24 350 v. cardboard, 4/6; 25, 25 v., 1/6; 32 350 v., 2/9; 50 12 v. can or card, 1/-; 32 x 16 450 v., 6/9; Postage 1/- please on orders under £1.

PLESSEY P.M. SPEAKERS. 6½in. with trans., 14/6; 8in. less trans. 14/6 (postage 1/6). BRAND NEW.

CHOKES. 20 H.80/120 mA., 6/6; 5 H. 200/300 mA., 6/- (postage 1/-).

GERMANIUM CRYSTAL DIODES. 4/6.

VR91 (EF50) ex New Equipment, and tested, 6/6; American Red Sylvanias, 8/6.

MAINS TRANSFORMERS. Standard primaries. Universal mounting, 350-0-350 v. 80 mA., 0-4-6.3 v 4 a., and 0-4-5 v. 2 a., 18/6. Upright mounting, fully shrouded 250-0-250 v. 100 mA., 6.3 v. 6 a., 5 v. 3 a., 27/6 (postage 1/6 either trans.).

Cash with order please, and print name and address clearly. Amounts given for carriage refer to inland only.

U.E.I. CORPORATION

Radio Corner, 138 Gray's Inn Road, London, W.C.1. *Phone:* TERMINUS 7937.

(Open until 1 p.m. Saturdays We are 2 mins. from High Holborn (Chancery Lane Station) and 5 mins. by bus from King's Cross.)

OUTSTANDING OFFERS FOR EXPORT ONLY

U.S.A. RADIO & RADAR EQUIPMENT

RCA TRANSMITTERS, Type ET-4336-B, H, K, L.
Westinghouse AIRCRAFT TRANSMITTERS, Model GO-9.
TRANSMITTERS/RECEIVERS SCR-536
TEST EQUIPMENT IE-46 (Signal Generators I-196-B, Frequency Meters BC-906-D, Radio Receivers BC-1066-B).
AN/TRC EQUIPMENT.
SCR-399.
RADAR Mk.26 (Models 3 and 4).
INTERROGATORS-RESPONSORS BM-1 (and BN-1).
REPEATER-INDICATORS AN/APA-1
RADAR INDICATING EQUIPMENT, Model VF.
AIRCRAFT RADAR EQUIPMENT APS-3, 4 and 6.
TEST UNITS AN/UPM.
GISHOLT-BALANCING METERING UNITS (complete)

SPARES (RADIO & RADAR—U.S.A.)

Full range of spares for AN/APN-3.
Spares for most models of U.S.A. Naval and Aircraft RADAR UNITS.
Spares for most AMERICAN TRANSMITTERS.
Brand new Klystrons (RAYTHEON) 2 K-33.
CRYSTALS (for SCR-610, etc.)

COMPLETE OPERATIONS CENTRE AN/TTQ-1

(Full installation for Wing Filter or Operations Room, or Combined Filter-Fighter Control Area Operations Room.)

POWER UNITS, MOTOR GENERATORS DYNAMOTORS

and large quantities of various components.

AIRCRAFT INSTRUMENTS AND ACCESSORIES

Large selection of Bendix Instruments.
Aircraft Generators and Motor Assemblies.

Individual Test Certificates and A.I.D. Certificates can be supplied upon request.

ENQUIRIES TO

BRITISH SAROZAL LTD.
(Export Branch)
1 BRISTOL HOUSE, SOUTHAMPTON ROW, LONDON, W.C.1
Telephone: HOLborn 6763/4/5 *Cables: Sarozal, London*

OVERSEAS BUYERS ARE CORDIALLY INVITED TO VISIT OUR WAREHOUSES, SHOWROOMS AND LABORATORY

EXPORT & WHOLESALE

Valves Receiving ★ Valves Transmitting Tubes Cathode Ray

Both British and American makes. Govt. surplus and regular types, including special purpose tubes. No dollar expenditure involved. We can offer rapid delivery from our ample stocks. One of the largest in England.

Large stocks of:—
P.M. Speakers Transformers
Condensers, etc.

V.E.S. WHOLESALE SERVICES LTD.,
11, GUNNERSBURY LANE, W. ACTON, W.3.
Telephone: ACOrn 5027 (3 lines).

Make "PYROBIT"

ELECTRIC SOLDERING IRONS

Your CHOICE

THEY ARE USED BY EXPERTS ALL OVER THE WORLD!

Delivery from Stock, ask for Leaflet

The ACRU ELECTRIC TOOL MFG. Co. Ltd.
123 Hyde Road, ARDWICK, MANCHESTER

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: December 1951 issue, Thursday, November 1st. No responsibility accepted for errors.

WARNING

Readers are warned that Government surplus components which may be offered for sale through our columns carry no manufacturers' guarantee. Many of these components 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 components purchased.

NEW RECEIVERS AND AMPLIFIERS

BERNARD'S.—

BERNARD'S, manufacturers of television, radio and amplifying equipment, can now offer good deliveries of hand-built equipment; let us quote you and save yourself ££££s by buying direct from actual manufacturers: 12 months' written guarantee; we supply complete television receivers; time-bases, vision strips, amplifiers 5-1,000 watts, radio receivers; quotations by return post.

BERNARD'S.—295, Munster Rd., Fulham, S.W.6. [0097

UNIVERSAL ELECTRONIC PRODUCTS, 36, Marylebone High St., London, W.1. Welbeck 4058.

SPECIALISTS in the design and manufacture of high fidelity reproducing equipment from 5-100 watts for domestic or industrial purposes. Our new twin channel amplifier (type U.E.57), with independent bass and treble outputs, provides the most satisfying standard of reproduction we have yet experienced. It is now being demonstrated in our showrooms daily (we close Thursday 1 p.m., Saturday 4.30 p.m.), and we invite those who seek perfection from recorded music to hear this superb instrument. We also offer tuning units or complete chassis designed and constructed to individual requirements.

12-watt high quality amplifiers, bass and treble boost; £12/15; lists.—Broadcast & Acoustic Equipment Co., Ltd., Tombland, Norwich. [0065

MIDLAND RADIO COIL PRODUCTS offer a service for the production of high quality amplifiers and radio equipment to specification; list of standard products is available; suppliers of audio and radio equipment to the Northamptonshire Education Authority.—Enquiries to 28, Winstanly Rd., Wellingborough. [6336

C.J.R. ELECTRICAL & ELECTRONIC DEVELOPMENT, Ltd., Hubert St., Birmingham, 6 (Aston Cross 2440), the Midlands specialist manufacturers of high fidelity sound reproduction equipment, for the world-famous Williamson amplifier and associated accessories including tone control stages, loudspeaker crossover units, distortionless contrast expanders and radio feeders; send for details and prices. [0105

A GRAND job, our model SL35, a 5-valve 3-waveband superhet R/G chassis has everything, superb tone, knife-edge selectivity, extremely sensitive, above all, the price is very reasonable, handsome floodlit glass dial, this neat and attractive chassis, aligned and aerial tested complete with valves, supplied with 10in or 8in P.M. speaker; send 2½d stamp for literature, etc.; trade enquiries invited.—Bayly Bros., 46, Pavilion Drive, Leigh-on-Sea, Essex. [7581

TELRAD ELECTRONICS, 70, Church Rd., Upper Norwood, London, S.E.19.—Designers and manufacturers of Telrad quality amplifiers; established as the most outstanding value in high-quality amplifiers, thanks to faithful reproduction at unrivalled price, these unique amplifiers are the first choice of the enthusiast; built to satisfy the discriminating ear; bass and treble independent controls, providing widest possible variation to suit all recordings and varying acoustic properties of one room with another; full details on request.—Write, call or 'phone Livingstone 4879.

RECEIVERS, AMPLIFIERS—SURPLUS AND SECONDHAND

EDDYSTONE 504, as new, matching speaker; £29.—Box 4506. [7593

SALE: acoustical QA12/P amplifier, little used, overhauled by makers; £17.—Box 4439.

R.G.D. 746 radiogram; £85 o.n.o.—Jackson, Vicarage Cottage, Brockham Green, Betchworth, Surrey. [7529

CHARLES 4 valve, 3 waveband, R.C. tuning unit, superhet or T.R.F., little used, 12 months old; £9.—Box 4306. [7492

TELEVISION and radio receiver, H.M.V. table model 905; £25.—Darracott, 21, Lushington Rd., Eastbourne, Sussex. [7590

SHAFTESBURY 5 watt amplifier for sale, battery, two mikes and stand complete.—Lacey, "Garreg-Wen," Ystrad-Rhondda, Glam.

BUSH T91 (Alexandra Palace) Console television set; £35 or near offer; delivery arranged.—Morcom, Bargolva, Liskeard, Cornwall.

B.C. 221, £22; spare Xtal instruction book.—Rowland, 169, Devana Rd., Leicester.

PHILIPS 12v car radio, £14; Lexington Senior n/c pick-up and trans.; £3.—Box 4478.

DYNATRON "Ether Sovereign" combined radiogram and television, superb condition throughout; best offer over £375.—Fro. 3463.

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

ENTHUSIAST disposing commercial push pull amplifier, £10; Garrard 65A record changer, £15; Ruco VS feeder, £7 or offers, all as new.—Wilson, 4, Laird St., Birkenhead. [7528

EDDYSTONE 680, perfect condition, £75; Hallicrafters SP44 Panadaptor as new, £25; RCA AR77, £20; GEC miniscope, as new, £10.—Boards, 22, South St., Cottingham, E. Yorks.

TRIX B619 amp for sale, complete with batt. and mains units, hand mic., pr. re-entrant horn spkrs, used one week only, as new; £43.—Welchman, 46, London Rd., Chippenham, Wilts.

G.E.C. BT 1091 table model television set (Sutton Coldfield), with built-in pre-amplifier, suitable for "fringe" area; £50 or near offer; delivery arranged.—Morcom, Bargolva, Liskeard, Cornwall. [7612

RECORD changer, G.E.C., mixed 10in or 12in, metal base plate p.u., £5; Philco car radio, £10; Marconi 10in quality L.S. in immac. cabinet, £3; MCR1 mains with sep. o/p stage and L.S., £5 or offers.—Box 4477. [7579

RADIOVISION "Commander" receiver for sale; 10 to 160 mtrs., 11 valve double-superhet, all usual controls, complete with manual, in new condition; £38.—A. Simmons, 65, Bramcote Ave., Chilwell, Notts. [7562

H.M.V. model 1901 combined television receiver (London area) and auto-radiogram in figured walnut cabinet, 15in tube, little used, cost new over £335; disposal due move outside television reception area; available inspection in London.—M. W. Anderson, Ridgewood House, Almondsbury, Nr. Bristol, Glos. [7483

LOUDSPEAKERS—SURPLUS AND SECONDHAND

ACOUSTICAL "Quad" £18; Labyrinth speaker SL15 £12; perfect.—190, Oxford Rd., Calne.

FOR sale, Voigt domestic corner horn with Voigt energised unit and field supply; £55 or nearest.—Robinson, 20, The Dene, Wembley.

VOIGT loudspeaker with corner horn, finished oak, new light twin diaphragm, 200- and 400-volt field; £50 o.n.o.—Box 4520.

WHARFEDALE dual corner cabinet speaker, as new, medium oak, £36; Goodmans bass reflect cabinet, solid Italian walnut and mahogany, fitted Vitavox 12-20 speaker, new; £19/10.—Tyas, 50, Southwick Rd., Boscombe, Hants.

NEW TEST EQUIPMENT

TOROIDAL coils; your network problems at all frequencies can be solved by these versatile and increasingly popular inductors; harmonic selection and filtering, sideband suppression, admission; crossover networks; tele-metering; cuts of 50db within 1kcs at 50kcs possible; very high Q, low C allows tune over wide ranges; 25mH to 2.0H, many values from stock; decade boxes 0.1H to 0.4H for early delivery; also .05% silver mica condensers; on Govt. and G.P.O. lists. BEL SOUND PRODUCTS Co., Marlborough Yard, London Archway, N.19. Tel. Arc. 5078.

TEST EQUIPMENT—SURPLUS AND SECONDHAND

COSSOR D/B 339 scope, £30, nr. offer.—Boyle, 45, Fairbridge Rd., N.19. [7584

OSCILLOSCOPE G.E.C., £5.—Leeves, 216, High St., Bromley, Kent. [7442

COSSOR Oscilloscope model 1035, six months old, less than 12 hours' use; reason for sale.—Box 4435. [7544

METER movements, Weston linear, moving coil; 2 for 7/6; See Sept. "W.W."—Lucas, 22, Hengrove Rd., Bristol, 4. [7556

MODEL Seven, as new, overhauled by Avo's, case and leads, £15; offers.—Spooner, 7, Foxholes Rd., Southbourne, Bournemouth.

VALVE tester, cost £19/15; impedance bridge, cost £18/15; both good condition; £15 for quick sale.—W. D. M., 10, Harley Ave., Bebington, Cheshire. [7527

TAYLOR 65c Sig-gen. 100 kc/s-160 mc/s, as brand new, £13/10; Avometer, model 7, as new, in case, £14/10.—Peel, 64, Palace Rd., East Molesey, Surrey. (Molesey 3267.) [7432

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.

MARCONI TF144G, first-rate condition, £100; Evershed-Vignolles bridge megger with Varley loop test, £35; Ave electronic testmeter, £25; both very good condition, will accept offer for lot.—A. E. Cawkell, Electronic Engineers, Southall. Sou. 3702. [7519

MARCONI instruments, standard signal generator, TF144G, £75; universal impedance bridge, TF373D, £50; valve volmeter, TF428B, £30; output power meter, £12; the above instruments were purchased new direct from makers, and have had 100-300 hours use only; all in perfect order, untampered with, and immaculate as new; also Furzehill B.E.O., £20.—Box 4318. [7522

THOUGHTS AFTER THE RADIO SHOW

Quite simply we announced demonstrations after business hours during the period of the radio exhibition. A large number of musical enthusiasts took up that invitation, and their comments have interested us very much.

Knowing that good demonstrations have never been possible at any radio show held in this country we expected to be told that good equipment could only be seen, not heard, at the Show. That is why we gave up the idea of being an exhibitor, although we shall be at full strength in New York, where the public *can* hear the equipment.

But what did interest us were the comments of people who had never previously heard Hartley-Turner reproduction. We know it sounds different from the other man's but the public must decide which is best. We believe our equipment gives a very good approximation to the real thing, and having produced it we leave it to fight its own battle in the world of commerce.

That we *have* something saleable to music-lovers is proved by our having been in the business for over twenty years.

Is, then, Hartley-Turner reproduction better than the rest ?

The invariable comment of those who heard it for the first time was "I've never heard anything like this before"; and frequently "This is incredible—it doesn't sound like a gramophone at all."

That to us was a real compliment, because we don't think that a real high-fidelity instrument *should* sound like a gramophone, not even a very good one. It ought to sound like the real thing and that, we were told, was just what it did sound like. The tiny tinkle of a triangle brought raptures to listeners who usually heard it as a rather high-pitched metallic clang; the colossal horsepower of the sixteen tympani of the Berlioz Requiem shook them to their foundations. And so on . .

All we ask is that you do not compare our reproduction with any other—compare it with the original performance. If it fails in that respect, then we have failed. But we don't think you will think so.

Catalogue free on request.

We are sorry that some readers of our last advertisement thought we could sell American L.Ps. This is not permitted except against payment in dollars. Our collection is only available for your amusement and possible instruction.

H. A. HARTLEY Co. Ltd.,
152, HAMMERSMITH ROAD, LONDON, W.6
Phone: RIV. 7387

NEW DYNAMOS, MOTORS, ETC.

BATTERY chargers, 4 models, 2-6-12v, 1-2-4 amp D.C.; any mains voltage; also larger types special transformers, chokes, test gear, interior car heaters, etc.—The Banner Electric Co., Ltd., Hoddesdon, Herts. [0122

ALL types of rotating electrical machinery up to 20kva available, including rotary converters, rotary transformers, motors, petrol and diesel-engined generating plants, alternators and d.c. generators. We are also in a position to quote for power transformers; as actual manufacturers we will be glad to quote for any quantity for home or export.

DIESEL Electric generating plants, 3kva, 230v with push-button remote control, starting equipment, ready for use; £235.

ROTARY transformers, input 20v d.c., outputs 6.5v d.c. and 300v d.c., permanent magnet head, 20/-; ditto, input 28v d.c. and 1,200v 70ma d.c output; energised field, 35/-; ditto, input 12v d.c., output 500v, 90ma d.c., energised fields 35/-; reasonable delivery.

CHAS. F. WARD, Lordscroft Works Haverhill, Suffolk. Tel 253 [0039

DYNAMOS MOTORS, ETC.—SURPLUS AND SECONDHAND

GENTLEMEN.

I VERY much regret that my lighting plant department is now quite inadequate to deal with the ever-increasing demands made upon it by readers of "Wireless World," and customers from every continent.

IN the circumstances, though unwillingly, I find that I must close down this department as from November 1st, 1951. All outstanding orders will be dealt with up to this date.

ON re-opening with adequate premises, customers will again receive that high standard of service which with great difficulty I have tried to maintain.

I CAN only assure you that this is the "End of the beginning," and not "The Beginning of the end," and advertisements to announce the re-opening of the department will appear as soon as possible.

IN the meantime only the following new, current products of a well-known British manufacturer can be supplied.

DIESEL alternator plant, 230/1/50, 3 kva, belt driven by Petters latest type diesel A.V.I. engine, alternator self-energised, automatic voltage control, press-button and remote control, 1 press-button start and stop unit supplied complete with H. duty Exide starter battery and charger for starter battery, full load 4¼-5 hrs. on 1 gallon of cheap fuel; engine covered by Petters inspection service; delivered ready for use, £228, or packed f.o.b. London Docks, £235; fullest descriptive literature on request.

ALTERNATORS, 110/1/60 and 230/1/50, 3, also 6kva, 1,500rpm 50 cycles, 1,800rpm 60 cycles, self-energised, automatic, voltage control by winding on stator, with d.c. output of 32v 15amp for charging 24v starter battery which can be used for lighting when main plant is not in use, press-button start, state direction of rotation when ordering, fullest descriptive literature on request; 3 kva £61, 6 kva £81, delivered; 3 kva £66, 6 kva £87/10 f.o.b. London Docks.

PLEASE see displayed advert, page 102 for S.T.C. selenium rectifiers; terms, c.w.o., pro-forma invoice, c.o.d. (post goods only).

T. W. PEARCE, 66, Great Percy St, W.C.1 (near Angel). [0014

CONVERTOR Valradio 230/110 A, still guaranteed.—Offers 24, Clarendon St., Nottingham.

ROTARY convertor, 150 watt output, 230 volt 50 cycle A.C., input 220/240 volt D.C., £6 or offer.—PRO. 6561. [7537

FOR sale, converter by Lancs Dynamo, Ltd.; prim. 220-240v, sec. 220v, as new.—Ingrey, 4, St. Annes Rd., Harrow 0925. [7597

ROTARY convertor, 80 watt output, 230 volt 50 cycle A.C., input 24 volt D.C.; totally enclosed with volt meter; £6 or offer.—Pro. 6561.

TRANSMITTING EQUIPMENT

FREQUENCY meter model L.M. (Navy version BC221), unmodified and as new; £20 or near offer.—Box 4480. [7585

TR9 sets, complete with 9 valves, not guaranteed, 20/- post paid; trade enquiries invited.—Autorex, New Whittington, Chesterfield.

MAGSLIP transmitters from 10/-; ideal for remote control of radio apparatus, including Antenna direction indication; stamp for details.

ENGINEERING FACILITIES LTD., 29, Rea St., Birmingham, 5 [7507

NEW GRAMOPHONE AND SOUND EQUIPMENT

RECORDING and play-back platforms (tape), complete with tape, spools and heads; from £14/15.

RECORDING and play-back amplifiers, complete microphone and radio inputs and all switching; £13/15

RECORD hds., tape, motors, and any component for magnetic recordings, at prices that satisfy.

E. M. DEVELOPMENTS, 176, Grove Lane, Handsworth, Birmingham, 21. [7469

MAGNETIC tape new high coercivity Emitape 35/- 1,200ft. Type 65 25/- 1,200ft; blank recording discs 10in d/sided 3/- from stock; full trade terms.

SOUND DISCS (SUPPLIES), Ltd., 178, Bispham Rd., Southport, Lancs. Tel. 88153 [5335

BAIRD tape recorders, 55½gns; 8 watt O/P, no unlacing to rewind office retalker, £65 with foot pedal.—Alfred Rose, 134-136, Lewisham Way, S.E.14. Tideway 3696. [7510

TAPE recording amplifiers to suit any make of desk, from £8; the "Lane" and "Qualtape" desks, heads, tape, etc., supplied; demonstrations by appointment, s.a.e.—Harding Electronics, 120a Mora Rd., London, N.W 2

"AUTOMAT" HOME CHARGERS, SELENIUM RECTIFIERS, CHARGER KITS

All New Goods with Full Guarantee

"AUTOMAT" HEAVY DUTY HOME CHARGER, for car or radio cells. Virtually unwreckable. Selenium rectification. Impregnated transformer of large size. Fine workmanship and appearance. 12 months' guarantee. For A.C. mains only. Standard model 6 v./12 v. 2 amp. output, 8¼ lb. wt., 59/6, post 2/-. Minor 1 amp. model, wt. 7 lb., 50/-, post 2/-. 5 amp. truck or large car model, £6, carr. 5/-. Minor model for 6 v. only at 2 amp., 52/6, post 2/-.

ELIMINATOR KIT. Transformer, selenium h.t. rect., l.t. rect., 2×15 mfds. condensers for 120 v. 20/30 mA. eliminator with trickle charge, 35/-, or with handsome steel case, 43/-, post 1/2.

FOOLPROOF CHARGER KITS, standard model, 45 watts trans., triple tapped, large 12 v. 2 amp. selenium rectifier, ballast/indicator bulb for 2 v., 6 v., 12 v. charger, simple and foolproof, 38/6, post 1/4; or with handsome steel case, screws grommets, 52/6. Ditto kit, but 60-watt trans. and 12 v. 3 amp. rectifier, 45/-, weight 8 lb., or with case, 58/-; ditto kit but 4 amp. rectifier and 75-watt trans. for 3.5 to 4 amp. charge, 55/-, post 1/8. Charger kit as above for 6 v. 1.5 amp., 27/6, post 1/3. Heavy duty kit for 6 v./12 v. 6 amps. 120 watt trans., 12 v. 6 amp. rectifier, giant finned type, slider resistance 8 ohms, ammeter, £4/12/6, post 3/4, 16 lb. Ditto but 4 amp. output max., £3/12/6, post 1/8. Trickle charger kit, 2 v. 0.5 amp. rectifier and high-grade transformer with ballast resistor, 12/6, post 8d.

SELENIUM RECTIFIERS. New stock not surplus, 12/15 v. 2 amp., 13/6, 6 v. 2 amp., 9/-, post 8d. 12 v. 1 amp., 12/6; 12 v. 3 amp., 15/9; 6 v. 4 amp., 16/6; 12/15 v. 5 amp., 27/-, post 9d. Giant finned type, 12 v. 6 amp., 35/-, post 1/3; 24 v. 4 amp., 54/6; 24 v. 6 amp., 67/-; 24 v. 2 amp., 27/6. Small space H.T. rectifiers, selenium. 250 v. 60 m/a., 7/6; 110 v./135 v. 60 m/a., 6/6; 250 v. 100 m/a. bridge, 13/6. All 6d. extra postage. Small 40 m/a. type for relays, 2/10. "RENEWBAT," battery desulphater and conditioner 1/9, post 3d.

CHAMPION PRODUCTS
43 Uplands Way, London, N.21. Phone LAB 4457

SOUND SERVICE IN SCOTLAND

Sound Sales Tone Control Unit and A-Z Amplifier	£32 10 0
Sound Sales Cabinet Speaker	£12 10 0
Acoustical Q.U.A.D. Amplifier	£35 0 0
Acoustical Cabinet L.S. Demonstration Model	£30 0 0
Leak TL/12 Amplifier	£27 7 0
Leak Pre-Amplifier	£9 9 0
Savage & Parsons 45w Amplifier	£30 0 0
Reslo R.V.A. Microphone	£8 0 0
Reslo V.M.C. Microphone	£5 10 0
Reslo Directional Speaker	£14 0 0
Wright & Weaire Tape Deck	£35 0 0
Scophony-Baird Home Recorder	£58 5 6
Scophony-Baird Soundmaster, as new	£30 0 0
Soundmirror Table Model	£69 10 0
16 mm. and 35 mm. Soundheads from	£20 0 0
S.O.F. Pre-Amplifier	£15 0 0
Danson 16 mm. Sound Projector, new	£129 10 0
Carpenter 16 mm. Sound Projector, as new	£105 0 0
Victor 16 mm. Sound Projector	£90 0 0
S.O.F. 12 watt Amplifier	£25 0 0

Trade Enquiries Invited.

PRECISION SERVICES LTD.
8 HILL STREET, EDINBURGH 2
Telephone No. 34311/2

Surplus BARGAINS

MANUFACTURERS' & BANKRUPT STOCKS
LIMITED SUPPLIES ONLY

PRICES ARE RISING
SUPPLIES ARE GETTING SHORT

—BUY NOW—

ALWAYS SOMETHING NEW

VISIT OUR SHOWROOM
We can offer for immediate delivery

SPECIAL OFFER

NOW AVAILABLE

—DIRECT FROM M.O.S.

STORAGE AND STARTER BATTERIES

6 volt. 72 Amp. "ESE"
6 volt. 90 Amp. 15 plate "Reading" U.S.
6 volt. 100 Amp. 15 plate "Delco Remy"
6 volt. 140 Amp. 21 plate "Delco Remy"
12 volt. 9 plate.
12 volt. 14 Amp. In METAL CARRYING CASE.

All Brand New in original cases.

Receivers: R1155, 1355 and 184 Brand New in original cases. Dinghy Radio Transmitter SCR 578.

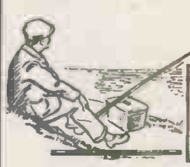
EX-W.D.

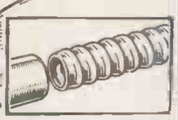
AERIALS

CAN ALSO BE USED AS

FISHING RODS

12ft. Light Steel Aerials in 3 screw-in sections of 4ft.





Charging Control Boards with Auto. cut out, 3 amp. 220 v.

Yaxley Type Switches, Mansbridge Condensers (Oil filled and Jelly), Burgoyne Solder Guns, Tannoy Handmikes, Dinghy Transmitter Sets. Adhesive Tape, Coaxial Cable, Magnifying Lenses, Rubber Masks. Speakers, Coaxial Plugs and Sockets, Belling Plugs and Sockets, Vibrators, Belling Fuseholders, Meters, Mica Condensers, Electrolytic Condensers, Volume Controls, Valve Holders, Output Transformers, Mains Transformers, Chokes, Headphones, Valves Type CV 101, etc., etc.

Your enquiries are invited

WHOLESALE AND EXPORT ONLY

For further bargains call at our Counter or write for NEW bulletin

RADIO MERCHANDISE
COMPANY LIMITED
65, Farringdon Road, London, E.C.1
Telephone: HOLborn 6377 Quote Dept. W.W.

TAPE recorder motors. 230v a.c., powerful, quiet, brand new, 13/11; post, etc., 1/1.—K. W. Logan, Westalley, Hitchin, Herts. [6469

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., 60, Aylward Rd London, S.W.20. (Liberty 2426.) Callers by appointment only. [6724

FRITH RADIOCRAFT, Ltd., recommend and can give immediate delivery from stock of the Scophony Baird magnetic tape recorder; completely portable and self-contained and weighing only 30 lbs. this instrument has a frequency response of 50-5.000 c/s at 7½in per second and push-pull output of 10 watts, a.c. only 200-250v 50 c/s; price complete in handsome case with mike, tape and spare reel, £58/5/6; carriage paid in U.K.; H.P. terms available.
TAPE and spools also available from stock; E.M.I., 65A, 25/-; G.E.C., 30/-; Durex (Scotch Boy), 35/-; all per 1,200ft reel; spare reels 4/- each.
RECORDING motors, BSR, SR1 32/-, SR2 25/-, FP10 38/-.
MEICO transverse current microphones; price £2/10 each.
RCA ribbon microphones on desk stand with switch, price £6/6; matching transformers to suit, 21/- each.
FRITH RADIOCRAFT, Ltd., 69-71, Church Gate, Leicester. Tel. 58927. [0024

GRAMOPHONE AND SOUND EQUIPMENT —SURPLUS AND SECONDHAND

CLIFTON tape recorder, cost £52/10 new; accept £48.—Box 4505. [7592

ACOS GP20 P.U., 2 std., 2 lp. heads, cond. guaranteed; £5/10.—Box 4183. [7441

FERROGRAPH tape recorder for hire; London; long or short periods.—Box 4189. [7459

COLLARD record changer, three sizes, 78 Rothermal head.—Rampton, 11, Liverpool Rd., Kingston. [7446

£190.—Wire recorder, substantial reduction accepted; urgent.—Vilela, 17, Wheatclose Rd., Barrow-in-Furness. [7434

GAYDON-B.B.C. groove-locating micrometer units, two, as new, fitted Decca pick-ups; pair best offer over £30.—Box 4436. [7558

B.S.R. DR33C recorder, in rexine case, Monitor speaker, less amp, perfect condition; £65.—Dean, 73, St. Mary's Rd., Oxford. [7618

CONNOISSEUR super lightweight, red spot, £4/10; Decca type C, £3; as new, post paid. —H. Dix, Martins Rd., Keevil, Trowbridge.

TAPE recorder with amplifier (less cabinet), can be seen working, used few times only; £27/10.—176, Grove Lane, Handsworth, B'ham.

SOUND magnet tape recorder, 3 speeds, 2 sound tracks, complete as portable unit, as new and unused; £45.—Ashworth, 6, New Barn Lane, Rochdale. [7468

H.M.V. disc recording equipment, complete in 3 portable cases, ribbon mic., new condition, including £38 accessories; bargain, £170; buyer collects (London).
REDER, Ltd., 223, Hackney Rd., E.2. Tel. Shoreditch 8842. [7523

FOR sale, radio gramophone, R.G.D. 296/356, chassis 5489, Garrard pick-up, fully overhauled by R.G.D. dealer; £50 or offers.—Green, Drummond Rd., Skegness. [7433

WILLIAMSON O.P. trans. to authors spec. (supplied by Ashworth), £3; Connoisseur pick-ups and trans, L/W £3, fibre £4; Rothermel Senior, £1.—Box 4481. [7586

M.S.S. Recorder, type CD.45, for disposal; this machine has been very little used and is in nearly new condition, complete with carrying case and handles; £35.—Apply Box 4178. [7421

WHARFEDALE W.10 C.S.B. speaker, as new, £6/10; 1/4 wave cabinet, £3; Decca transcription-quality dual-speed motor with X.M.S. pick-ups, £16/10.—170, Baginton Rd., Coventry, Warwickshire. [7580

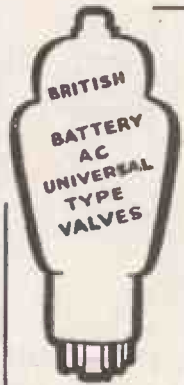
TABLE mikes with fully adjustable stand, and switch in base (self energising, no battery required), a snip at 7/6 plus 1/6 post; these are usually advertised at 12/6; moving coil hand mikes with switch in handle, 3/6; carbon hand mikes with switch in handle, lead and jack-plug, 2/6; self-energising mike or headphone units in moulded cases with lead and bracket, 3/-; low resistance headphones, very sensitive, 5/-; thousands of components in stock, s.a.e. for list; please add at least 9d p. and p. on all orders; money back if not satisfied.—Electrad Radio, 69, High St., Belfast, N.I. [7570

NEW COMPONENTS

YOU are bound to try an Osmor "Q" Coil-pack eventually and be delighted with the results; why not save time and money now? Send a stamp for free circuits and latest lists of coils, coilpacks, dials, etc., etc.
OSMOR RADIO PRODUCTS, Ltd. (Dept. W.C.A.), Borough Hill, Croydon, Surrey. (Tel. Croydon 1220.) [0046

EVERYTHING for home constructor, chassis, condensers, coils, valves, resistors, gram units, speakers, test gear, Viewmaster kits, etc., cash or H.P.; stamp for lists; quick service, no Govt. surplus offered.—BCM/EDHWA London, W.C.1. [6227

27/6.—The popular JB S.L.8 spinwheel dial, drive and tuning assembly, supplied complete with bronze escutcheon; wide range of dials and drives always in stock; set of components for building 2-wave plus gram superhet, coil pack, 18/-; send for our latest Home Constructor's Handbook, price 2/- only. See also our display advertisement in this issue.
SUPACOILS, 98, Greenway Ave., London, E.17



"DEMOBBED VALVES" MANUAL

2/9 POST FREE

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 PRE-BUDGET rates which actually sold at the old price. There is a space free for YOU on our mailing list.

EXPORT to all parts of the Commonwealth and beyond — safely packed, fully insured (no C.O.D.) and free of tax.

EX-W.D. CHASSIS with brand new valves, IR5, IS4, IS5, IT4 and circuit diagram showing conversion to excellent Personal Portable, 52/6, post 1/6.

CRYSTAL RECEIVER KITS and Construction Book complete and post free, 15/-.

RESISTOR COLOUR CODE INDICATORS, accurate, disc type, 1/3.

ADCOLA 3/16in. DIA. BIT SOLDERING INSTRUMENT. Miniature type to meet every requirement for Radio, Television etc., 22/6, post 1/4.

NEW EX-GOVERNMENT HEADPHONES
60 ohms.

High-grade Double Headphone Type Extremely sensitive. Balanced Armature. *Further applications:* **Miniature Speakers for Personal Radios or Teletalks, Microphones, Pick-ups, etc. Per pair, post free. 7/6**

SERVICE SHEETS. The one you require enclosed if available in a dozen, our choice 10/6.

"ACTIVETTE." Mains unit for Re-activating Dry Batteries. The sensation of Earl's Court Radio Show. Available Shortly.

MICRO DIALS. Fitted with Hair-Line and Cursor, 10/-.

PIFCO. All-in-one Radio Meters, 27/6, post 1/-.

QUIXO BATTERY TESTERS, 52/6

INSET. Telephone Balanced Armatures, Ex-Govt., 4/-.

EX-GOVT. 4 mfd. 450 v. Dry Electrotype Condensers, 4/-.

HYDROMETERS. Unbreakable, all plastic, correct for 60°F., 6/6.

TAYLOR 110B, £11. (Very rare).

TAYLOR 47 A/S. Brand new—old stock, £24.

AVO 7, £19.

FABRIC for speakers, 1 square foot, 4/-.

"ONE-VALVE RECEIVERS," 8 models, latest Book, 1/9.

"PRACTICAL RADIO" for Beginners 3/3.

CONDENSER TESTERS and Rectifier Units. Plugs straight into A.C. mains, 200/240 v., and is indispensable for examination of condensers. Very slight and intermittent leakages which cannot be discovered by conventional instruments can be traced by this unit. Complete, 39/6. Post 1/-.

(Kindly mark envelope W.W.11)

RADIO **BULLS** VALVES
246, HIGH ST. HARLESDEN NW10

HANNEY OF BATH. offers:—
EDDYSTONE 740 receiver, limited number, ex-stock, £35/10.
ACOS GP20 pick-ups, standard or LP, £3/11/5 tax paid; heads only, 43/4.
WB STENTORIAN speakers, complete range as advertised, 2½in to 10in.
OSMOR "Q" coilpacks, type HO 52/-; HF stage 21/8.
WEARITE type 705 packs, 37/10; Wearite "P" coils, all ranges, 3/- each; Denco type "C" TRF coils, 6/6 pair.
WILLIAMSON amplifier, 25 resistors and pots. for main amplifier, 33/9; 9 ditto fig. 13, 9/6; 23 ditto fig. 15, 24/-; 22 ditto fig. 19, 37/-; 6 condensers for fig. 13, 15/-; 15 ditto fig. 15, 47/-; 33 ditto fig. 19, 54/6; the above kits contain 1st-class components only by the best makers and are exactly to specification.
W.W. TV S'het. Receiver, coils are now available for all 5 channels; our TV list contains items for W.W., P.T., E.E., and Viewmaster Televisors.
SEND 3d stamp for our comprehensive lists, new goods only; no surplus; c.w.o. or c.o.d. (no c.o.d. under £1).
L. F. HANNEY, 77, Lower Bristol Rd., Bath. Tel. 3811. [7189

CRYSTAL microphone inserts (Cosmocord Mic-6) guaranteed brand new, 15/6 post free.
RADIO-AID LTD., (Retail Dept.) 29, Market St., Watford. [0036

TELEVISION; BEL manufacture many TV parts; inquiries from the trade and for special parts invited.
COIL sets for EE PT view/mast, all include Video choke; London 16/6, Midland 18/6, Holme Moss 21/-, Scotland 25/-.
COIL formers, canned and cored ⅜in, 2/-; 6mm iron-cored and 8mm, 7d and 10d, ⅜in, ½in Paxolin tube.
"WIRELESS WORLD" TV coils for all channels, prefab. copper RF strips, 52/6; Williamson tuner coils, 8/6 pair.
NOVEMBER bargain.—Few M.W. and L.W., or S.W. 2-band coilpacks, quite new, miniature size, guaranteed, 18/6.
BEL SOUND PRODUCTS Co., Marlborough Yard, London Archway, N.19. [0813

MINICOILS, midget size, 1in high, ¾in diam., high Q, iron-cored, two-hole fixing, all coils wound on polystyrene formers, fitted 4-way tag-panels; ranges, LW, MW, SW (16-48m); types, HF, AE, OSC; I.F. 465kc, 3/6 each; 465kc I.F. rejector, 4/3 each; each coil boxed, with connection data, etc.
SUPERHET coilpack kits, comprising LW, MW, SW, AE and OSC coils, 4P 4w w/c switch, all padders and trimmers, 465kc I.F. rejector, 35/-.
"HIGH Q" TRF coil, LW and MW with reaction, inc. circuits, 5/-; replacement P.U. bobbins, 4,000Ω, 7/6; other values stocked; midget TRF 3-station coilpack kits, 16/6; midget relays, 5,000Ω, coil, weight 1oz, 10/-; "Viewmaster" TV pre-amp kits, complete, inc. valve, 42/-; deliveries by return; all c.w.o.; trade supplied.
A. P. CRETTON (W), 349, Copnor Rd., Portsmouth. [7397

COMPONENTS—SURPLUS AND SECONDHAND

SUPREME RADIO, 746b, Romford Rd., Manor Park, London, E.12. Tel. Ilf. 1260. Est. 17 years. "Supreme" bargains at the right price.
JUST arrived! 4B.A. brass nickel-plated terminals, 2/3 doz; Westinghouse type metal rectrs., 250v R.M.S., 65ma, 5/6 ea.; L.T. heater trans., 0-200-230v, 6.3v 1.5 amp, 6/9 ea.; glass dials, 8¾in×4¾in, L.M.S. wave station, name for the new wavelengths, in 3 colours, 3/6 ea.; metal escutcheon for same, 2/6 ea.; pointer, 10½d ea.; 8mfd 350v wire-end tub. carboard cond., 2/6 ea.; 16+24mfd 350v tub card cond., with fixing clip, 3/- ea.; small metal can cond., 16mfd, 350v, 1/9 ea.; bias conds., 50 mfd, 50v, cardboard, or 50 mfd 12v metal, tag end conds., 1/- ea.
PERMANENT magnet focus units for triode or tetrode tubes, 16/6 ea.; drop-through type mains trans., tapped primary, 0-250v on voltage panel, sec. 275-0-275v, 80ma, 63.3v 3 amp, 5v 2 amp, with screen, 15/11 ea.; flat-type mains dropper, tapped for 200-250v, 630 ohm, 0.2 amp, 1/6 ea.; moulded B7G valveholders, 10d ea.; B9G ceramic v/hlds., 7d ea.; slate-type B9G v/hldrs., 6d ea.; int/octal amphinol v/holders, 7d ea.; 2-pole 2-way small rotary switches, 8d ea.; 4-pole 3-way small-type rotary switches, with medium spindle, 2/11 ea.; 3 meg vol. controls, 7½d ea.; 0.001 mfd, 600v tub. cardboard condensers, 2/6 per doz.; 0.1 mfd, 1 k/v tub cardboard cond., 1/- ea., 11/- doz.
MANY other bargain lines in stock. Latest list available.
TERMS c.w.o., no c.o.d. Send 6d extra for postage orders under £5. 2½d s.a.e. all enquiries and list. [0021

CAPACITORS, capacitors, capacitors, capacitors, for every use and occasion, including many high voltage types for television and transmitting.—It will pay you to send s.a.e. for lists to E. Lynch, 133, St. James Rd., Blackburn.

PUSH buttons, small pf conds, tub conds, valve holders, usw chokes 3d, case and chassis 2/-; 1/1kv Potms, sw coils, plugs, jacks, toggles, 6d; phones, 14-3, VR65, CV54, 3/-; 2B6 boxed, 3/6; s.a.e. lists, post extra.—Annakin, 25, Ashfield Place, Otley, Yorks. [7578

230/115v step-down transformers, 75-watt, 6/6; heavy duty output transformers, weight 3½lb, two primaries, one centre tapped and one secondary 4 taps, these can also be used as small mains transformers, delivering 150-0-150v at 100ma and 10-20-30 40v all at 65ma, 230v input only, 4/6.—Haynsons, 14, St. Mary's Bedford., Tel. 5568.

Come to Classic for

"The Classic Service"

Our Motto is: "Nothing is too much trouble"

We will ship to any part of the British Isles or abroad.

TAPE RECORDING EQUIPMENT:	Delivery	Price
Simon Simphonic, Model IA	Soon	
Sound Mirror, Table model	Stock	£69 10 0
Sound Mirror, portable model	Stock	£79 10 0
Scophony, portable mod.	Stock	£58 10 0
Bradmaster Tape Desks	Stock	£42 10 0
Microphones	Stock	£6 16 6
Tapes from stock		£1 5 0

AMPLIFIERS AND HI-FI EQUIPMENT		
Leak T12 Amplifiers, with control unit	Stock	£37 16 0
Williamson (Goodsell), with control unit	Stock	£40 15 0
Quad Amplifier with control unit	Stock	£35 0 0
Quad Radio Feeder Unit	Stock	£26 0 0
Leak Radio Feeder Unit	Stock	£37 2 4

MOTORS AND PICK-UPS		
Connoisseur 2-speed Motor and Pick-up	Stock	£22 18 8
Connoisseur Super light-weight Pick-up	Stock	£4 10 5
Garrard Auto-changer Unit and single-speed 8 record	Stock	£12 12 0
Plessey Auto-changer Unit, 3 speed, 7in., 10in. and 12in. mixed	Stock	£23 13 0
Collaro Auto-changer Unit, 3 speed, 8 record	Stock	£18 14 1
Decca 2-speed Motor and Pick-up	Stock	£9 19 6
Decca dual Head Pick-up	Stock	£3 10 0
Leak Pick-ups, standard or L/P	Stock	£8 8 0
Decca Deccalians 230 v. A.C.	Stock	£37 10 0

QUALITY SPEAKERS. UNITS		
Bakers, 12in. triple cone unit	Stock	£9 15 0
Barker's 148A Unit	Stock	£15 15 0
Barker's 150 Unit	Stock	£18 18 0
Tannoy Duo Concentric, 12in.	Stock	£27 10 0
W.B. 10in. Duo Concentric	Stock	£6 6 0
W.B. 12in. Series gap 15 watt	Stock	£8 10 0
Wharfedale Units, wide range from		£4 14 6

QUALITY SPEAKERS. CABINET TYPE		
Leak, 2 unit, 400 cyl. crossover, in walnut cabinet	Stock	£57 10 0
Decca Corner Speaker, 3 or 15 ohms.	Stock	£21 0 0
W.B. 10in. Duo Concentric Corner	Stock	£13 16 0

COMPONENT AND KITS		
Williamson Amplifier Kits Comp.		£20 10 0
Viewmaster Tele. Kits	Stock	£27 10 0
Germanium Crystals	Stock	3 9
16 ft. Portable Aerial		£1 12 6

All goods despatched by post or passenger train. Please include carriage.

Send Stamps for List. All Enquiries to

The Classic Electrical Co. Ltd.

"THE HI-FI TELEVISION SPECIALISTS"

352/364, Lower Addiscombe Road, Croydon, Surrey. Telephone: Addiscombe 4023

RADIO CLEARANCE, Ltd.

TELEVISION! Set of 3 components, comprising line output trans., with E.H.T. winding to give 7 kV, using EY51 (heater winding for EY51 also included), and fitted with width control scanning coils, low impedance line and frame, focus coil (res. 10,000Ω, current approx. 20 mA); the set of 3 for 42/- plus 1/6 post, diagram of line trans. supplied.

MINIATURE iron cored coils, former size 1⅜×⅜in adjustable core, set of 4 coils, M.W., AE and OSC, S.W., AE and OSC, 5/11, post 6d; mains dropping resistors for .15a valves, 920Ω, tapped at 850 and 700Ω, small size (3in×⅝in), 2/3.

A.C./D.C. amplifiers, complete kit for construction of 20w, 8v amplifier, by McMurdo, all first-class components by Partridge, Gardner, etc., valves 4×CL33, 2×EF37, 2×UR3C, black crackle, chassis and case, isolated from mains, and drilled, circuit diagram supplied, everything complete, £10/10/6, carr. paid.

PERSONAL receivers, 3 valve T.R.F. using IT4s, contained in handsome bakelite case with lift-up lid, size 7×6½×5in with lid closed, plastic carrying handle, fram AE in lid, these receivers cover the medium waveband and operate from self-contained dry batts., standard types, W1435 and U2, output to a pair of lightweight 'phones (H.R.) controls, SM tuning and reaction, opening lid switches on, supplied brand new, with valves, batteries, 'phones, an ideal set for invalids, hosp. patients, etc., these receivers are not Govt. surplus and are offered ready to play; carr. paid £4/4.

CHASSIS steel 5¼×5¼×1½in drilled 3 button base holes 1/9, 5×9×1½ drilled 5 button base holes, 2/3; ali. 17×9½×2½ drilled 7 int. octal and square, open ends 3/-, ali. 14½×10×2½ drilled 10-B8A, 5 int. octal, ex. T.V. 4/3; primary 0-110-210/240v 50c/s, secs 300-0-300v 80ma, 4v 2a, 6.3v 2.5a, 15/6, heater trans., auto. wound 200/250v 50c/s to 6.3v 3a, 8/-; smoothing chokes, 5H, 200ma 100Ω 5/6, 8H 250ma 50Ω size 4×5×5 potted 10/6 post paid; electrolytics 32mf 350v card 2/-, 32-350v can 2/6, 16-450v can 2/6, 8+4 450v can, small 2/9, 8+4 275v 2/-, 2-450v 1/6; switches standard Yaxley type, 2p 4w 1b with shorting wafer 2/-; superhet coils ½×1¾ formers M. wave H.F. AE. Osc, L, wave H.F., AE, Osc, 1/9 per coil; I.F. trans. 465kc/s 1½×1½×4in iron cored 8/- pair; meters 2in square bakelite cased, 0/5ma 6/6 0/50ma 7/6 0/300v d.c. with series res. 7/6, bakelite cased 2½in circular 0/200ma 9/6; Rotary power units type 104, p.m. rotary mounted on chassis with supp. input 12v d.c. output, 250v 60ma, 6.5v 2.5a d.c. 7/-, type 87 24v input, outputs as 104 6/6 post paid; plugs and sockets, bakelite with keyway 5, 7, 1/6 pair; extension speaker controls 10Ω wire wound, ¼in spindle 9d; "Pye Strips" the well-known 45mc/s vision strips, brand new, less EF50s, with EA50, perfect condition, 39/6, plus 1/6 post; focus coils, low res., 200Ω, standard TV 8/6, can be had as alternative with kit, if required; 6½in loudspeakers, p.m. less trans., boxed, 12/6 post paid; Mansbridge conds., 4mf 1,000v wkg. 3/-; v.c. with sp switch long spindle 25k, 50k, 100k, 2m 4/-.

SMALL size iron cored I.F.s. 465kc/s, size 1in×1¼in×2½in, 8/6 pair; frame aerials for personal sets, etc., medium wave, rectangular winding, size 6½×4½×1in, wound round 4 wooden bobbins mounted at the corners of an ali. plate, tabs for connections 2/6 post paid; output trans., 5,000/3,750, 2/11; valveholders, Amphenol, int. octal 7d, ceramic int octal 10d.

RADIO CLEARANCE, Ltd., 27, Tottenham Court Rd., London, W.1. Tel. Museum 9188. [0015

BENDIX BC.221 frequency meters complete; £30.

S.C.R. 522 frequency 100-156 mcs complete transmitter/receiver, in new condition, with all tubes; £30.

EIMAC 100th transmitting valves; 55/-.

TAYLOR T200 transmitting valves; £6.

THROAT microphones, new and boxed; 4/6.

PLUG and key assembly No. 3 with send/rec. switch; 5/6.

LEACH relay heavy duty 24 VDC, res. 250 ohms; 7/6.

CLARKE keying relays; 17/6.

PAPER condenser, 4mfd 300v wkg., 6/6; paper condenser, 0.25mfd 1,200v wkg., 4/-; paper condenser, 0.05 plus 0.05, 2,000v, 4/-.

SMALL porcelain jumbo, 4-pin bases; 4/- each.

LARGE porcelain jumbo, 4-in bases; 6/6 each.

McEIROY-ADAMS MFG. GROUP, Ltd., 46, Greyhound Rd., Fulham, W.6. Tel. Fulham 1802. Cables: Hallicraft, London. [0196

OUR latest clearance list now available; send s.a.e. today for your copy.

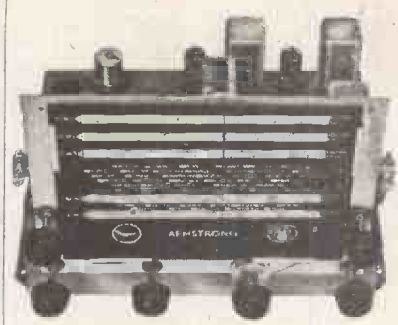
WALTON'S WIRELESS STORES, 48 Stafford St., Wolverhampton. [0061

SPEAKERS.—2½in 15ohm 12/6, 3in 5ohm 11/6, 5in 2-3ohms 12/6, 8in 14/6, 10in 28/6; condensers, 8-450v 2/6, 16-450v 2/8, 8×16 450v 4/3, 16×16 450v 4/6, 32×32 450v 5/9, 25-25v 1/6, 50-50v 2/3; co-ox cable 12/6 doz yds. V/controls, L/sp., L/sw 3/-, W sw 4/6; Amplion semi-midget L/sw 4/-, SP/sw 5/9, DP/sw 6/6; mains trans, 300-0-300, 6v-4a, 5v-2a, 100m/a, 23/-, post 2/-; 13,000 B.V.A. valves in stock; order c.o.d.—Radio Unlimited, Elm Rd., London, E.17.—Key. 4813.

ELECTROLYTIC condensers, tubular wire ends, 8mf 500v.w., 3/-; 16mf 500v.w., 4/-; aluminium can, 32mf 500v.w., 6/-; 8-8mf 350v.w. 4/-; 16-8mf 350v.w., 5/6; 16-16mf 500v.w., 6/9; 32-16mf 500v.w., 8/-; 32-8-8mf 350v.w., 6/-; 32-32mf 275v.w., 5/9; metal-cased tubular condensers neoprene end-seals, prices per doz, 1mf 250v 6/-, 25mf 350v 8/-, 0 1mf 350v 7/-, 0.05mf 500v 7/-, 0.02mf 750v 6/-, 0.01mf 1,000v 6/-, 0.001mf 1,000v 5/-; P.M. speakers, 10in less trans 24/6; add postage under £1; money-back guarantee if not satisfied.—Ward 9, West Cliff, Dawlish, Devon. [7553

Armstrong

THE CHASSIS PEOPLE



The prestige of Armstrong chassis is firmly based upon many years of constant endeavour to produce reliable and efficient receivers at an economical price. Our present range of chassis will even further advance the already high reputation enjoyed by our receivers. We are delighted to give demonstrations in our showroom and our illustrated catalogue will be sent on request.

MODEL EXP 125/3 14-VALVE ALL-WAVE RADIOGRAM CHASSIS

5 Wave Bands covering from 10.9 to 550m and 800 to 2,000m. R.F. Pre-Amplifier. Two I.F. Stages with Variable Selectivity. Bass and Treble Controls. 15-Watt Push-Pull Output. For A.C. Mains. £36.15.0. plus P.T.

MODEL RF 104 10-VALVE ALL-WAVE RADIO CHASSIS

4 Wave Bands. R.F. Pre-Amplifier. Two I.F. Stages with Variable Selectivity. 10-Watt Push-Pull Output. For A.C. Mains. £24.0.0. plus P.T.

MODEL EXP 73 8-STAGE ALL-WAVE RADIO CHASSIS

3 Wave Bands. Variable Selectivity. Fly-Wheel Tuning. 8-Watt Push-Pull Output with Negative Feed Back. For A.C. Mains. £17.15.0. plus P.T.

EXPORT MARKET

Overseas customers are cordially invited to write for details of Models BS 125 and EXP 119. Both these chassis have been designed in consultation with engineers from many parts of the world to ensure maximum performance under adverse conditions.

Sole Agents for:—

KENYA, UGANDA, TANGANYIKA, ZANZIBAR
Jennings & Fox (Mombasa) Ltd.; Kilindini Road, P.O. Box 56, Mombasa, Kenya.

EGYPT
Emmanuel Cokkinos & Co., P.O. Box 1720, Cairo.

URUGUAY
Arbesa, S.A., Jaime Zudanoz 2713, Montevideo.

ARMSTRONG WIRELESS & TELEVISION CO. LTD.

WARLTERS ROAD, HOLLOWAY, LONDON, N.7

Telephone: NORth 3213

MEISSNER de luxe signal shifter, £20; Hallicrafter Skyrider Model 23, perfect.
EDDYSTONE 640, 1145, transmitters, communication receivers in stock. Hammerlung Super Pro. H.R.O. Seniors, C.R.100, A.R.88D., A.R.88L.F., etc., all in perfect order; R.1155 receivers in new condition; your enquiries are invited for rotary convertors and electric motors, most sizes and types available from stock; motor alternators, 110v d.c. input 230v a.c., 50 cycles, 250 watt output, special clearance of F.H.P. electric motors, 35/-, 110v-250v a.c.
UNIVERSAL a.c./d.c. motors, suitable for sewing machines, 40/- each; 12v-15v a.c./d.c. motors with extended spindle, suitable for models, etc., 9/3; 20 watt P.A. rack mounting amplifier, new and complete, with heavy duty a.c. power pack, 200/250v, PX25 P.P. output, £5/10, less valves; new moving coil microphones, hand type, heavy duty and complete with 12yd screened cable, £3/15; 20ft telescopic tubular T/V mast, 18/6 each; large selection of test equipment; multi-range meters, valve testers, signal generators, oscilloscopes, bridge meggers and meggers, etc., all at reasonable prices; hand bearing prismatic compasses with provision for battery in handle, perfect, 40/- each; very large stocks of transmitting valves, Klystron, of all types, send us your requirements; special offer of new, not ex-W.D., mains transformer, semi-shrouded 200/250v tapped primary, 250-0-250, 100ma, 5v 3amp, 6v 4amp, 20/- each; large stocks of L.T. transformers, special sizes and ratings wound to specification; auto-record changers in stock from £10/15; switchboard mounting voltmeters, ampmeters, various ranges a.c. and d.c. available at cheap prices to clear; large stocks of enamelled wire, 28 s.w.g., 18 and 20 s.w.g., D.S.G. No. 15 U.X. base, American valves available. Special offer, H.R.O. coils, 48-96 m/s and 180-430 k/s, 45/- each,quantity of litz and nickel chrome wire available; type 74 indicator units, complete with tube, as new, £6 each; prices do not include postage; American Dinghy transmitter, type SCR578, 500 k/c M.C.W.; large stock electric exhaust fans, most types; Hallicrafter Super Skyrider 5×28 in stock. Evershed bridge megger, 500v 1½ kw, e.d.c. rotary converter, 220 d.c./230 a.c., complete with Igranic starter, £28. Large selection of American Pyranch high-voltage working condensers; 0-5 m/a meter rectifiers 6/3 ea.
SERVICE RADIO SPARES, 4, Lisle St., W.C.2. Gerrard 1734. [0188

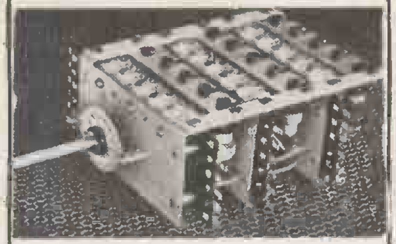
G. A. RYALL, "Utopia," Mayfield Rd., Herne Bay, Kent, offers post-free bargains, all unused and new or as new.
SWITCHES, standard Yaxley type SP. SB. 9w. 1/6; SP. 2B. 6w, 1/6; smaller type 3B. 2P. 6w, total 5P only, 2/4; miniature instrument SB. 2P, 1/6; one type 2B. 3w, 3P with coloured leads, 2/-; and one type soldered tags, 2B. 4w, total 5P having one double bank, 1/6; Paxolin quarter inch 12×12, 5/9; ditto 12×8, 4/6.
METERS, brand new in makers' boxes, British make, 2½in (3¼in overall) 0-30ma circular flush with front fixing bolts, 7/9 or best British make, 8/9; 2in ditto, best make, 8/9; voltmeter 0-300v, 2in square front, FSD 5ma front fixing, 7/9; ditto square front 0-5ma, 2in meter, fine open scale by best British maker, 7/9.
HIGH resistance headphones, with good type microphone, padded double headbands, sponge rubbers on earcaps, all wired into large 4-cleft plug as per R.A.F. adverts, as new, 8/9 per set.
CONDENSERS mica, 0.01mf 350v, six for 1/6; 0.001mf ditto; 0.004mf 1,200v. working, 6—1/6; 4mf Mansbridge 400v. wkg upright, terminals, feet, 2/3; 1mf ditto 500v wkg, 2—1/6; 250pf, silver mica, 6—1/6; Special note, insulation of all condensers perfect; four new resistance panels with thirty ¼-½-1-2 watt colour coded, best make carbon resistances at 4/6 lot; three 2in high stability vitreous resistances on Govt. grade panel with insert sockets and bolts for mtg sizes, 2-25,000 ohms and 1-130 ohm, 2/3 panel complete; pairs of 25mf 50v electrolitics, alni can, 2/3.
MINIATURE red lamp holders panel mtg with 12v bulb, cap cover brass, 2/3 complete; 7ft twin screened radio connector in two lengths, 1/8; 3yds light twin rubber cable, 1/3; triple ditto, 1/6; 2-way plug and jack, 1/6; single ditto, 1/3; bakelite toggle switches, 250v 2P. ST., 1/3, and 2P. DT change over, 2/-, and 2¼in pointer knobs, 1/3; four gang condensers, straight type, brand new, 3/10; .0004mf and 0.0004mf bar type, 3-gang, 5/10; twin gang ceramic butterfly type, 10mm non-standard spindle, 2/9; vitreous resistors, 500 ohm, with clips, about 15w, 1/3 each; L.T. type, 23 ohms, tapped, 1/3; and 3.59 tapped, and 4 ohms, no tap, both L.T. types, 1/3 each; 31 ohm miniature clip in type 2—1/3.
BOXES with five die cast plugs, wired, 12-18 points, 2/9; metal boxes, flat, 8×6×2, 2/6; Paxolin anchor blocks, 3-way, with bolts, 2—1/6; connector blocks, 2-way, with cover and fixing bolts, 2—1/6; 60mm variables ¼in spindle of 4¼in length, 1/9; television junction boxes, 2/9.

RESISTANCES, vitreous, wirewound, 30-watt 800 ohm tapped, 2/-, 2,000 1/3, 15-watt 1,500 10d, 6-watt 50 200, 3,000, 5d; 3-watt 25, 1000 1500 4d; 2-watt 45, 100, 3d; sliding rheostats, 12 amp 1 ohm, 6/-; 6 amp 4 ohm, 7/6; meters, 0-15v MI, 5/-; 0-250 micro A (temperature scale), 15/-; sturdy motors, 24v 3 ph 50c (run 1ph with condenser), 5/-; rectifiers, FW 12v 1a, 5/6; 12v 5a, 17/6; 12v 8a, 23/-; HW 250v 200 mA, 12/6; other sizes available; rectangular bicycle transformers, suitable audio 800/3 ohms, or set of 6 give multitapped 20v 4a from mains 2/6; 3kw 50c transformers, various outputs, £5; various converters; details on request; technical queries welcomed; terms c.w.o. or c.o.d.; orders over 3/- carriage paid U.K.
PARKER, 68, Station Rd., Petersfield. [7557

Introducing...

COIL PACK

Model 320



5-waveband coil unit.

A comprehensive pre-aligned assembly consisting of switch, complete set of aerial, H.F. and oscillator coils and all associated trimming and padding condensers for 5-waveband operation with tuned H.F. stage on all bands. All coils have dust iron cores for inductance adjustment. A six position switch is used with provision for pick up connections and H.F. muting on the sixth position. For use with any of the standard frequency changer valves (6K8, ECH35 etc.) and an I.F. frequency of 470 Kc.

Ranges : 1, 13—40. 2, 30—100 3, 80—200. 4, 200—550. 5, 900—2000 metres.

All parts for the above can be supplied separately if required.

TELEVISION COMPONENTS

"Electronic Engineering"—

Focus Coil
Deflector Coils
Line Output Transformer

Deflector Coils and Line Output Transformers suitable for other Kits are also available.

I.F. TRANSFORMERS Iron Core Tuned 472Kc. Per pair, 15/-

We also manufacture:—

3- and 6-BANK TRIMMERS
MAINS TRANSFORMERS
OUTPUT TRANSFORMERS

ALL COMPONENTS ARE MANUFACTURED IN OUR OWN WORKS

ALLEN

COMPONENTS LTD

1, SHREWSBURY ROAD, LONDON, N.W.10

Phone: WILlesden 3675 & 4901

MAGSLIPS at 1/10 to 1/20 of list prices. huge stocks. please state requirements. K LOGAN Westalley. Hitchin Herts [6369

SOUTHERN RADIO SUPPLY, Ltd., 11, Little Newport Street, London, W.C.2. See our displayed advertisement page 100. [0016

GENUINE bargain!—Numerous condensers, etc., for sale; all items as new; owner has gone abroad.—Tel. Hainault 2830. [7552

K. H EDE (late director of Chas. Britain) offers real bargains in used radio spares stripped from Ekco Radio chassis; all components are tested before despatch; mains transformers, 350-0-350v 80 m.a. 4v 4a, 4v 2a, 210-250v prims, with fixing feet, 10/6 inc. post; Rola energised speakers, 2,500 ohm field 8in. with trans and baffle, 10/6. inc. post; 2,000 and 5,000 ohm field less trans, 8in. 8/6, or with damaged cones, 3/6; 400 ohm with trans. 9/6; chokes, 400 ohm 60 m.a. 2/6; pentode speaker trans, 2/6; i.f. trans 110 K/cs, 3/6 pr; 110 K/cs osc. coils, with diag., 2/- ea.; 2 waveband pass aerial coils with switch, trimmer and diag., 4/- ea.; 3-gang 0005 tuning condenser with SM drive and drum, with trims, 4/6; 0005 tuning cond. with trims, SM drive, dial and large knob, 5/-; these tuning conds have one sect with cut away vanes for 110 K/cs. twin HF hum suppressor chokes, 2/- ea.; 0.2 amp mains droppers, 800 ohm with fixing rod and voltage tap, 2/-; knobs, ¼in spindle, one large, 1/- per set of 3; volume controls, ¼ meg with switch, 1/6; toggle switches DP on off, 1/-; resistors, ¼ and 1 watt, 1/6 per doz (our selection); round type Ekco cabinets, 10/-.

SPECIAL offers.—Reconditioned Ekco receivers, round type, ac. dc bakelite cabinets, 4 valve plus rec, covering medium and long wavebands, complete with valves and tested, only £3/17/6, plus 6/- carr.; Philco 5-valve superhet, completely reconditioned and tested, in light oak or dark oak cabinets, Cathedral model for ac or ac, dc mains, £4/10 plus 6/- carr.; Ekco ac 157, or ac 267, complete but less valves, 35/- plus 5/- carr.; Ekco ad 267 Universal, complete but less valves, 30/-, 5/- carr.; terms, c.w.o. or c.o.d. over £1; please add enough for post.—K. H. Ede, 255, Fulham Rd., Chelsea, S.W.3. Tel. Flaxman 5587. Nearest tube, Sth. Kensington. [7563

NOTICES

BRITISH SOUND RECORDING ASSOCIATION.

MEMBERSHIP of the Association is essential to all actively engaged or keenly interested in high-quality sound recording and reproduction. The 1951-52 Lecture Season has commenced and an exceedingly interesting series of papers and lectures, many with demonstrations, has been arranged for the benefit of members. Additions have again been made to the publications of the Association, and there are also the very special and exclusive test disks. Full information is contained in the latest Publications List, P.104, and this, together with the new brochure giving full information of the work of the Association and the benefits conferred by membership, with a Membership Application Form, may be obtained from the Membership Secretary at 48, Mount View Rd., North Chingford, London, E.4, England. [0119

WANTED, EXCHANGE, ETC.

WANTED, Siemens UCL11 valve.—Burtwell & Drew, Coxwell St., Faringdon, Berks.

WANTED, dynamometer, a.c. test set, also oscilloscope type 339A, also L050A oscillator.

LESLIE DIXON & Co., 214, Queenstown Rd., Battersea S.W.8 Macaulay 2159 [0176

WANTED, carbon pile voltage regulator.—Sander, "Beachside," East Beach, Selsey, Sussex. [7542

WANTED.—Two prop pitch motors, 24-volt D.C.—Andrew, 5, Southwood Gardens, Ramsgate. [7428

CAR radio, H.M.V. 4200 or Ecko CR61.—D. Stewart, Chalfont St. Peter. Bucks (Gerrards Cross 2683). [7453

SURPLUS laminations wanted; state types, quantities, and price required; cash on collection.—Box 4317. [7521

WANTED, HRO coils, Rxs, etc. AR88s BC348s, S27s, etc.—Details to R.T. & I. Service, 254, Grove Green Rd., London, E.11. Ley. 4986. [0163

WILLARD 2v accumulator type radio 25-2 with built-in hydrometer, new or unused, disposal.—Southey, R.A.F., Lyneham, Chippenham, Wilts. [7456

WANTED.—RCA speech amplifiers, type MI-11220 J or K.—Offers stating quantity and price to P.C.A. Radio, The Arches, Cambridge Grove, W.6. [0080

WANTED, laboratory test equipment, including standard signal generator, watt meter, oscilloscope, bridges, recorders; send price and details to:

HATFIELD INSTRUMENTS, 175, Uxbridge Rd., Hanwell, W.7. Tel. Ealing 0779. [0037

WANTED, all types of radio equipment, test instruments, radio receivers, personal sets, television, components, etc., etc.; call, write, send or 'phone.

MILLER'S RADIO, 38a, Newport Court, Charing Cross Rd., London. [7010

WANTED, set manufacturers' or ex-Government radio equipment, large or small quantities of valves, electrolytics, speakers, meters, also components.

LOWE BROS. 199 Mile End Rd., London, E.1. Ste. 2579. [6554

TRANSFORMERS wanted for immediate cash payment, all types.—W. G. Blake Linthouse Lane Works, Woodend, Wednesfield, Wolverhampton 31561. [7520

VALVES, surplus, following types wanted for cash, any quantity:—6K8, 6Q7, 6V6, 5Z4, EF39, EF36, EL32, or equivalents.—N. R. S., 16, Kings College Rd., London, N.W.3. [7242

JOHN FARMER

22. **MODULATOR UNITS,** Type 169, Contain CV-67 Klystron, 5U4G, EF50, B4101, 3 neon stabilizers, two 250 v. 100 m/a. selenium rectifiers, small motor with reduction gear, two transformers, oil and paper condensers, pots, resistors, etc., etc. In metal cases size 18in. x 8½in. x 7½in., packed in wooden cases, brand new condition. A bargain at 40/- each, carriage 7/6. 37. **TRANSMITTING VALVES VT90,** by Nat. Union. Brand new, boxed, 7/6 each, post 6d. 57. **PARMEKO RADIO TRANSFORMERS,** drop-through shrouded type. Input 110-225-245v. Output 250-0-250 v. at 90 m/a., 5 v. 2 amp., 6.3 v. 3 amp., screen. A first-class transformer, brand new, 20/- each, post 1/3. 90. **TOGGLE SWITCHES,** 250 v. 2 amp., single pole. Single hole panel mounting. 9d. each, post 3d. ; 72/- per gross, post 1/6. 124. **VOLTMETERS,** 0-100 v. A.C., moving coil, internal rectifier, 1 m/a. Scaled in 20-volt divs., with 1/10th sub-divs., 2½in. scale flush panel mounting. New, 20/- each, post 6d. 138. **"PYE" 45-MC/S. I.F. STRIPS.** A ready made vision unit for the London frequency. Complete with six EF50s and one EA50. New unused, 60/- each, post 1/6. 171. **TRANSMITTER TUNING UNITS, TU-9-B.** Freq. range 7,700-10,000 kc/s., complete with calibration charts. In aluminium housing size 15¼in. x 7in. x 6in., with black crackle front panel size 16¾in. x 7¾in. Unused condition, 12/6 each, post 1/6. 223. **VARIABLE RHEOSTATS,** "Zenith," 0.4 ohms, 25 amps., helical screw traverse, laminated contacts. Wire wound on vitreous steel former. Base mountings and brackets. Unused condition, 7/6 each, post 1/6. 225. **RELAYS, G.P.O. TYPE P3000.** (a) 200 ohms 3-pole, 2 make 1 break, 5/6 each, post 6d. (b) 200 ohms, 2-pole, 2 make, 5/- each, post 6d. 230 **TERMINALS,** nickel plated brass 4 B.A., shanks 1½in. long, fitted washers and locknuts, 5/- per doz., post 6d. 249. **AMPLIFIER UNITS TYPE 165.** Contain five valves : VT52 (2), VR56 (2) and VR55 ; various transformers, vol. control, resistors, resistors, condensers, etc. Chassis mounted with protection frame size 7¼in. x 7½in. x 4½in., 20/- each, post 1/8. Also amplifier units type 18, identical specification to type 165, and the same price. 250. **MIDGET U.S.A. RELAYS,** 20-32 v., coil res. 650 ohms, 2-pole changeover contacts, size 1½in. x 1⅛in. x 1in. Brand new, 5/- each, post 3d. 13. **RADIO TRANSFORMERS.** Primary 200-220-240 v. Secondary 350-0-350 v. at 80 m/a., 6.3 v. tapped at 4 v. at 5 amp., 5 v. tapped at 4 v. at 2 amp., screen, stout pressed plate clamps, with slots for chassis, mounting. Size 4in. x 3½in. x 2½in., 20/- each, post 1/5. 24. **AMMETERS,** 0-9 amps., hot wire, A.C./D.C., 3¼in. dia., 2¼in. scale, fit 2½in. dia. hole, flush panel mounting. Brand new, 10/- each, post 6d. 27. **CHOKES, L.F.,** 20 ohm, 180 m/a., in metal cases size 3¼in. x 2in. x 1½in. New, 1/6 each, post 10d. 36. **LONDEX RELAYS** Type 452. 9-12 v. operation, 150 ohm coil, 2-pole contacts. New, 2/6 each, post 4d. 24/- per doz., post 1/-. 71. **AMPLIFIERS, TYPE 1134.** Supplied less valves. (Two 10-LF and QP-21). Consist of three transformers (input, output and intervalve), 3-way key switch, each side 4-pole changeover, on/off toggle switch and the usual resistors, condensers, etc. In metal case., 7in. x 5in. x 4½in. New, unused, 7/6 each, post 1/3. In wooden transit cases, 8/6 each, post 1/6. 169. **ANTI-VIBRATION MOUNTINGS—REF. 10A/17621,** 10lb. centre parts float on 16 coiled springs, with hole to take up to ¼in. bolt, base 2⅜in. square, overall height 1⅛in., anodized steel. Ideal for all radio units. Our price, brand new, 2/6 for four, post 6d., 6/- per doz., post 10d 18. **TRANSFORMERS,** input 200-220-240 v., 50 cycles, single phase. Tapped secondary giving 3-4-5-6-8-9-10-12-15-18-20-24 and 30 volts at 2 amps. A first-class transformer with 101 uses, 22/6 each, post 1/5. 61.

The above are a few items from our latest lists obtainable now from

JOHN FARMER (DEPT. A.1.), 194 HARBORNE PARK RD., HARBORNE, B'HAM, 17

Tel.: HARborne 1309

THE
BRITISH NATIONAL RADIO SCHOOL
ESTD. 1940

NOW IN OUR TWELFTH YEAR AND STILL

NO B.N.R.S. STUDENT HAS EVER FAILED

to pass his examination (s) after completing our appropriate study course.

Put not your trust in Princes, or "WELFARE" States, but join the B. N. R. S. and do *YOURSELF* a BIT of GOOD!

A.M.Brit.I.R.E. and CITY and GUILDS Radio and Telecommunications Exams., etc., etc.

Introductory offer, six lessons with questions, model answers and full coaching services, 30/-

Please mention this advt. nd send for free booklet to :

STUDIES DIRECTOR
BRITISH NATIONAL RADIO SCHOOL
66, ADDISCOMBE ROAD, CROYDON
Phone : Addiscombe 3341

THE "FLUXITE QUINS" AT WORK

"Fixing our aerial's all right,
With solder and good old FLUXITE,
But why" EH cried,
"Should our lad decide
To fall down the chimney to-night?"

See that **FLUXITE** is always by you—in the house — garage — workshop — wherever speedy soldering is needed. Used for over 40 years in Government works and by leading engineers and manufacturers. Of all Ironmongers—in tins from 1/- upwards

TO CYCLISTS! For stronger wheels that will remain round and true, here's a time tested tip. Tie the spokes where they cross with fine wire AND SOLDER. It's simple — with FLUXITE — but IMPORTANT.

The **FLUXITE GUN** puts **FLUXITE** where you want it by simple pressure. Price 2/6. or filled, 3/6.

FLUXITE

SIMPLIFIES *ALL* SOLDERING

Write for Book on the Art of "SOFT" Soldering and for leaflet on CASE-HARDENING STEEL and TEMPERING TOOLS with FLUXITE. Price 1½d. ea.
FLUXITE LTD. (Dept. WW), BERMONDSEY STREET, LONDON, S.E.1.

WANTED.—BC1610 Hallicrafters, RCA FT-4336 transmitter, SX-28, AR-88, S-27; HRO receiver and spare parts for above; best price.—Write Box 864, c/o Spiers Service, 82, Centurion Rd., Brighton, Sussex. [0081

WANTED. AN/APR-4 receiver, any units; any other good quality U.S. surplus radio and radar, tubes, test sets; laboratory equipment, etc.; give condition and price in first letter.—Littell, Farhills, Box 26, Dayton 9, Ohio, U.S.A. [6346

REPAIRS AND SERVICE

BERNARD'S.

TELEVISION, radio and amplifier repairs, conversions and modifications; home-built receivers aligned; commercial radios rebuilt; send equipment with full instructions for quotation by return post; 12 months' guarantee on all work done.

BERNARD'S.—295, Munster Rd., Fulham, S.W.6. [0099

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. 3855.

LOUDSPEAKERS repaired promptly.—Model Loudspeaker Service, 34a, Bullingdon Rd., Oxford. [6919

SPEAKER repairs, cones fitted, fields and clock coils wound, prompt service, guaranteed satisfaction.

L. S. REPAIR SERVICE, Pluckley, Ashford, Kent. [0110

METROPOLITAN RADIO SERVICE regret to advise that their transformer rewind service is temporarily suspended.—75, Kilburn Lane, London, W.10. [0130

MAINS transformers rewound or constructed to any specification; prompt delivery.—Bede Transformer Co., Ltd., Bedesway, Bede Trading Estate, Jarrow. [3198

REPAIRS.—E.H.T., mains and O.P. transformers field coils and chokes; also armatures and motors; new transformers designed to any specification; all work fully guaranteed.

WILLESDEN TRANSFORMER Co., Ltd., 20a, Church Lane, Church Rd., N.W.10. Tel. Willesden 7093

RADIO MAINTENANCE SERVICE for guaranteed rewinds and repairs; armatures, F.H.P. motors, vac. units, portable tools, etc.; good deliveries.—139, Goldhurst Terrace, N.W.6. Mai. 6133. [9925

"SERVICE with a smile."—Repairers of all types of British and American receivers; coil rewinds; American valves, spares, line cord.—F.R.I. Ltd., 22, Howland St., W.1. Museum 5675. [0112

ELECTRICAL measuring instruments of every make, multi or single range, repaired and standardised; prompt attention.—The Electrical Instrument Repair Service, 329, Kilburn Lane, London, W 9. Tel. Lad. 4168. [3715

REWINDS and conversions to mains and output trans, pick-ups, fields, clock coils, chokes, etc., from 4/6. p.p equipment a speciality, all work guaranteed.—N.L. Rewinds, 32, Blackbird Hill, N.W.9. Tel. Wordsworth 7791. [7560

24-HOUR service, 6 months' guarantee, any transformer rewind, mains outputs and i.f.s., etc.; all types of new transf., etc., supplied to specification; business heading or service card for trade prices.—Majestic Winding Co., 180, Windham Rd., Bournemouth. [6520

MISCELLANEOUS

70 Copies W.W., 44-51, 13 QST, 8 E.E.; best offer secures.—Box 4508. [7595

METALWORK; all types cabinets, chassis, racks, etc., to your own specifications.

PHILPOTT'S METAL WORKS, Ltd. (G4BI), Chapman St., Loughborough. [0208

PROC. I.R.E., Jan. 1943 to Oct. 1948; April, June, July 1944 missing; offers.—Box 4479.

WALNUT radiogram cabinets, stamp leaflets.—Cabinetware, 1a, Heyes St., Blackburn.

WALNUT radiogram cabinet; stamp details.—E. Wisker, 501, Hale End Rd., Highams Park, E.4. [6942

46 swg Eureka wire, 30 ohms per ft. 29lb for disposal; would consider winding .5% resistors to order.

BEL SOUND PRODUCTS Co., Marlborough Yard, London, N.19. Arc 5078. [0190

FOR sale, 42, 44, 46 s.w.g. enamelled wire, 5lb minimum.—Champion, 43, Uplands Way, London, N.21. Lab. 4457. [0102

WALNUT radiogram and television cabinets, soundly constructed, stamp details.—R. Shaw, 69, Fairlop Rd., Leytonstone, E.11.

EUREKA, nichrome, silk and cotton covered copper wires wanted, top price paid.—Doyle, 144, St. John St., E.C.1. Cle. 7723.

NICKEL chrome wires, 65/15 quality gauges 32, 34, 35, 44, 46; 80/20 quality gauges 30, 31, 40.—Doyle, 144, St. John St., London, E.C.1. Cle. 7723. [7435

ENGRAVING, amateurs and trade could take the opportunity of engraving problems in the future by getting in touch with A. G. Engraving, 19a, Windmill Rd., London, S.W.18. Brass, bronze, erinoid, Perspex dials; one knob or repetition equally entertained. [0034

ALLSCREWS, Ltd., for B.A. screws, nuts, washers, studding, grub-screws, bolts, soldering tags, woodscrews, etc., plain or nickel or cadmium plated, one-gross packets or large quantities; stamp for lists.—270a, King St., Hammersmith, W.6. Riv. 7762. [5426

EX-W.D. unused fluorescent lighting sets for 12 and 24 volts d.c. input, 230 v a.c. output, rotary converter, choke, P.F. condenser, leak transformer for 85 watt sodium lamps; the whole enclosed in metal box, £5 to clear.—A. J. Philpott, Fountain Sq., Fenton, Stoke-on-Trent. [7496

IT'S WORTH WHILE

Sending for the

CANDLER BOOK OF FACTS

if you're interested in

MORSE CODE TRAINING

Read these extracts from letters which Candler students have sent us :

Re. JUNIOR COURSE
"I simply must congratulate you on having such an easy way of teaching code. Frankly, I'm amazed at the speed with which I've been able to progress with your course. I can now send at 15 w.p.m. and receive at 8 w.p.m. This was accomplished with only 4 hours study per week." J. S.

Re. SPECIAL COURSE
"So far I have found your Special Course for securing an Amateur Transmitting Licence very beneficial in learning the Morse code, since I am practising on my own. I am now able to copy at approximately 10-12 words per minute. My sending speed is approximately 13-15 words per minute with comfort." O. F. S.

Re. ADVANCED COURSE
"With regard to code work, I can send at a comfortable 30 w.p.m. and can read quite long sentences at a speed just under that. . . . I have a smoother sending action, and get off 'reversals' at a fairly high speed with good spacing and accuracy." J. C. B.

Send for the "Book of Facts"—it gives details of all the above Courses.

THE CANDLER SYSTEM CO.,
(55W) 52b, ABINGDON RD., LONDON, W.8
Candler System Company, Denver, Colorado, U.S.A.

MAGNETIC TAPE

Recording equipments and Components

MAGNETIC HEADS. A new series of ½-track totally enclosed heads are now offered having a wide frequency range and high efficiency. These heads are considered the best available today. The frequency response obtainable is better than 1 kc/s per inch of tape speed with simple correction equipment. Consistency is maintained by employing optical finishing techniques.

RECORD/REPRODUCE HEAD. Employs the smallest effective gap obtainable. Available in low impedance (2.4 mH. 15 ohms at 1 kc. approx.), and high impedance (200 mH. 1,250 ohms at 1 kc. approx.). **Price £3/3/-.**

ERASE HEAD. Available in medium impedance. **Price £3/-/-.**

TRANSFORMER. Suitable for low-impedance head to grid step-up. **Price £1/-/-.**

TRANSFORMER. As above, but enclosed in 16 s.w.g. mumetal can. **Price £2/-/-.**

OSCILLATOR COIL ASSEMBLY. Comprises high-'Q' coil and condenser tuned to 45 kcs. Specially designed to provide highly symmetrical sine wave output for low tape noise. **Price 10/6.**

OSCILLATOR UNIT. Constructed on small chassis suitable for sub-assembly, provides r.f. for erase and bias at 45 kcs. Requires 250 v. h.t. and 6.3 v. for operation. Complete with 6V6 valve. **Price £3/-/-.**

AMPLIFIERS. A range of amplifiers have been developed specifically for use with tape.

Please send for further details.

CABOT RADIO COMPANY LIMITED
Electronic Equipment Manufacturers
28, BEDMINSTER PARADE, BRISTOL.3.
Telephone 64314.

A WINDOW WORTH LOOKING INTO

Television Coil Formers. With iron dust cores, Polystrene, 1in. x ½in. with single hole 6ba fixing, 6d. each, 5/6 per dozen.
Television. Amplifiers, type 208a, 45 Mc/s, can be rewound for 56 Mc/s complete with 2 EF50 valves, 14/6 each.
Television. .1 mfd. high voltage Condensers, Mansbridge type, 5,000 volt, "NO TROUBLE," very limited number now left, 2/- each.
Television. EF50 (VR91). Boxed, brand new, 7/6 each.
Television. Diode Holders, 3d. each. Cradle type, 6d., ditto Polystrene, 8d. each.
Television. High voltage Pots. Ex-W.D., most sizes available, 1/9 each.
Television. Wire wound Pots., from 1 ohm to 50K, 2/- each.
Television Dural Aerial Masts. 7 feet long, ideal for making your own aerial, 4/6 each.
Television Transformers. 230 volt primary, secondary 1,800 volts, 20 M/a, 22/6 each. Ex-W.D., not rubbish.
Television. Chassis. 4 stage. EF50 and diode holders mounted with coils and coupling condensers and resistors, each stage separately screened, wonderful bargain, 8/6 each.
Aerial Coupling Units, with silver plated tank coil, 3in. in diameter with 37 turns of 12 SWG, complete with 0-1 amp. thermometer, brand new, 14/6 each. The coils have a variable selector with dial.
Meters. Thermo 0-350 M/as 2in. round flush mounting, brand new, 5/6 each.
Meters. 0-1½ M/a 2in. round flush mounting Brand new and boxed, 6/6 each.
Auto Transformer. Ex-W.D. 100/250 volt at 100 watts, 15/6 each.
Micro Switches. Several types available, large stocks, please let us have your requirements.
Ex-W.D. 2 Valve Battery Amplifiers. Complete with 2 volt driver and Q.P.P. output valve, brand new. Ideal for Mic. or Gramo, 12 6, valves alone are worth this.
Switch. Suitable for "Williamson," single pole 8 way 5 bank, 3/6 each. Limited number only.
Rectifiers. LT 12 volt 1½ amp., bridge, 10/6 each.
Rectifiers. LT 6 volt ½ amp., 4/6 each.
Cable. Heavy duty twin, ideal for garage extension. Ex-W.D., 1/- per yard, worth double, minimum 12 yards.
Special Offer. Condensers. 16 x 16 x 16 mfd., 450 volt working, brand new, 3/6 each.
Amplifiers Type A1271. With new VR56, also 400 ohm relay 4M 2B, with host of useful spare condensers, volume control and resistors, 9/6 each.

Open all day Saturday.

G. W. SMITH & CO.
(RADIO) LTD
3, LISLE STREET, LONDON, W.C.2
Telephone : GERrard 8204/9155

DRY battery charger, 230v mains, recharges all torch, cycle and radio cells up to 3 volts. 14 6; Christmas lights, set of 12 coloured with spare, boxed ready for use, 27/6; small rotary convertors, 12v d.c. to 250v at 50mA, 6.3v 2.5amp 8/9, post 1/2.—Malden Transformer Supplies, 200 Cambridge Rd., Kingston-on-Thames. [0038

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

WORK WANTED

ASSEMBLY, wiring, conversions carried out, one or quantity, trade or private.—Radiovizier, 377, High Rd., Finchley, N.2. [7401

SERVICING, modification and design of prototype electronic equipment, transmitters, receivers, etc., carried out to meet individual requirements; specialised light mechanical engineering also undertaken.—Enquiries to Box 4188.

DRAUGHTING, tracing and photoprinting services; estimates free; contractors to the Ministry of Supply and the Admiralty for drawing and tracing work to their requirements and specifications; sub-contracting work of this nature undertaken.
DRAWING & TRACING, Ltd., 456a, Ewell Rd., Tolworth, Surbiton. Tel. Elmbridge 7406. [5975

J. MORT, M.Sc., A.M.I.E.E., offers to the trade and amateur a service of technical advice, design and construction of special test gear, receivers and other apparatus, including correction of faults in home-built apparatus.—J. Mort, 13, Heath St, Golborne, Lancs. [5752

INSTRUMENT company, established, with 4,000 sq ft space, male and female labour, experienced supervision, own machine shop and sheet-metal dept., seek assembly, repair or manufacture radio or electrical work, A.I.D. standard; conversant commercial radio service Radar, v.h.f. systems, etc.—Box 4316. [7518

SITUATIONS VACANT

ADMIRALTY.
APPLICATIONS are invited from engineering electrical and ship draughtsmen for temporary service in Admiralty Departments at Bath.
CANDIDATES must be British subjects of 21 years of age and upwards, who have had practical workshop and drawing office experience.
SALARY will be assessed according to age qualifications and experience within the range £320-£545 per annum.
APPLICATIONS, giving age and details of technical qualifications, apprenticeship (or equivalents), workshop and drawing office experience, should be sent to Admiralty (C.E. II, Room 88), Empire Hotel, Bath. Candidates required for interview will be advised within two weeks of receipt of application. [6952

ULTRASONICS.
DEVELOPMENT Engineer required to explore a new industrial application of ultrasonic vibrational techniques; must have previous laboratory experience in similar fields; interesting permanent post for right man; location Slough.—Box 4180. [7430

METEOROLOGICAL Office.
AIR Ministry invites applications for appointment as Radio (Meteorological) Mechanics at a number of locations in the British Isles. Duties comprise the maintenance and operation of radar and radio equipment used in the Meteorological Office, mainly for the determination of upper winds. Candidates must be prepared to serve at any of the locations and also to undertake tours of duty overseas, mainly in the Mediterranean and the Middle East area. Candidates must possess a knowledge of the fundamental principles of radio and radar and have had practical experience in the maintenance and use of radar equipment, including cathode ray oscilloscopes.
COMMENCING basic weekly wage is £7/3 at age 25 or over rising annually by 5/- a week to £8/13. Commencing wage is decreased by 3/- for each year below age 25. The wages quoted are London rates and in the Provinces are from 4/- to 8/- a week lower. Additional allowances are payable for shift work, for service at remote stations and service abroad.
A PROPORTION of the posts are permanent and pensionable and there are also opportunities for promotion to higher grades in the Technical Class.
Applications giving details of qualifications and experience should be addressed to The Borough Employment Exchange, 236, Walworth Rd., London, S.E.17. Suitable candidates will be invited for interview by Air Ministry; travelling expenses, if over 7/6, will be refunded.

ESSEX EDUCATION COMMITTEE.
SOUTH-EAST ESSEX TECHNICAL COLLEGE AND SCHOOL OF ART, Longbridge Rd., Dagenham.
LABORATORY Steward required in Physics laboratories, mainly for radio-communications and electronics; applicant should be over 21 years of age and able to undertake maintenance and repair of wide range of test gear.
SALARY £310×£15 to £415, plus London "weighting." For form of application apply to the Clerk to the Governors. [7516

SERVICE engineer required in the London area for valve hearing aids; radio or L.F. experience —Apply Box 4312. [7508

RADIO testers required, good rates, 5-day week.—Write or apply, The Dulci Co., Ltd., 97, Villiers Rd., London, N.W.2. [7460

TELEVISION service engineer wanted, 5-day week, N.W.3; good position offered to capable, experienced man.—Box 4509 [7596

GALPINS

ELECTRICAL STORES

408 HIGH ST., LEWISHAM, LONDON, S.E.13
Tel.: Lee Green 0309 *Near Lewisham Hospital*

TERMS : CASH WITH ORDER. NO C.O.D.
All goods sent on 7 days' approval against cash.

EARLY CLOSING DAY THURSDAY

MAINS TRANSFORMERS. (New.) Input 200/250 volts in steps of 10 volts. Output 350-0-350 volts, 300 m/amps., 6.3 volts 8 amps. twice, 4 volts 4 amps , 5 volts 4 amps., 65/- each, carriage 3/6. Ditto, 450-0-450 volts 250 m/amps., 6.3 volts 8 amps. twice, 4 volts 4 amps., 5 volts 4 amps., 65/- each, carriage 3/6. Another, input as above. Output 500-0-500 volts 250 m/amps., 6.3 volts 8 amps. twice, 6.3 volts 4 amps., 4 volts 4 amps., 5 volts 4 amps., 70/-, carriage 3/6. Another, wound to (electronic) specifications, 350-0-350 volts 250 m/amps., 4 volts 8 amps., 4 volts 4 amps., 6.3 volts 8 amps., 0-2-6.3 volts 2 amps., 63/6 each carriage paid. Another, input as above. Output 500-350-0-350-500 volts 250 m/amps., 6.3 volts 6 amps., 0-2-6.3 volts 2 amps., 0-4-5 volts 4 amps. twice, 67/6 each, carriage 3/6.
PRE-PAYMENT 1/- SLOT METERS. 200-250 volts A.C., 50 cycles, 1 phase, set at 3d. per unit, 60/- each, carriage 5/-. Ditto for D.C. mains, 45/- each, carriage 5/- (all 20 amp. load). **SWITCHBOARD METERS.** 4in. scale, moving coil (D.C.) only, 0 to 14 amps., 17/6 each, post 1/6. Ditto, A.C./D.C., 22/6 each, post 1/6. Another 0 to 30 amps., A.C./D.C., 25/-., post 1/6. **MAINS TRANSFORMERS** (new). Input 200-250 volts in steps of 10 volts, output 350-0-350 volts 180 m/amps., 4 volts, 4 amps., 5 volts 3 amps., 6.3 volts 4 amps., 39/6 each, post 1/6. Another, 350-0-350 volts 180 m/amps., 6.3 volts 8 amps., 0-4-5 volts 4 amps., 39/6 each, post 1/6. Another, 500-0-500 volts 150 m/a., 4 volts 4 amps. C.T., 6.3 volts 4 amps. C.T., 5 volts 3 amps., 42/6 each, post 1/6. Another, 425-0-425 volts 160 m/amps., 6.3 volts 4 amps., C.T. twice, 5 v. 3 amps. 42/6 each, post 1/6. **DOUBLE-WOUND VOLTAGE CHANGER TRANSFORMERS.** 3,000 watt, 110 to 240 volts or vice versa, weight 100 lb., £10/10/- each, carriage 10/-. **EX-W.D. SURPLUS METERS.** 2in. scale ,0 to 20 volts, 6 6 each, post 6d. ; 0 to 40 volts, 7/6 each, post 6d. (both moving coil). Thermo coupled 0 to 350 m amp., 7/6 each, post 6d. **SWITCH-BOARD.** 4in. scale Amp. meters, moving coil meters, 100 to 250 amps., complete with shunt, 30 - each, post 1/6. **EX-RADAR MAINS TRANSFORMERS.** 230 volts input, 50 cycles, 1 phase. Output 4,500-5,500 volts approx., 30 m/amps., 6.3 volts 2 amps., 4 volts 1¾ amps., 2 volts 2 amps., these transformers are new, immersed in oil. Can be taken out of the oil and used as television transformers, giving an output of 10 m/amps. ; overall size of transformers, separately, 5½ x 4½ x 4in. and 3 x 3 x 2½in., price £3/10/- each carriage paid. **ROTARY CONVERTORS.** 24-28 volts D.C. input, 1,200 volts 70 m/amps. D.C. output. 10/- each. Post free. **AUTO-WOUND VOLTAGE CHANGER TRANSFORMERS.** Tapped 0-110-200-230 volts 350 watts, 48/6 each, post 1/6. As above, but 500 watts, 62/6 each, carriage 3/6. As above, 200 watts, 35/- each, post 1/6. 1,600 watts, tapped 0-110-150-190-230 volts, £5/5/- each, carriage 5/-. **TYPE 101 R.F. UNITS** (new). Containing 6 valves, including grounded grid triode F.H.P., 24 volt universal motor, numerous resistances and condensers, etc., 35/- each, carriage 3/6. **RECTIFIERS** (new). D.C. output 36 volts at 50 amps complete with mains transformer, 230 volts A.C. Input 50 cycles, 1 phase. Output to match the required voltage for the rectifier, £15 per set, carriage 10/-. **MAINS TRANSFORMERS** (new). Suitable for spot welding. Input 200-250 volts in steps of 10 volts. Output suitably tapped for a combination of either 2-4-6-8-10 or 12 volts at 50-70 amps., 87/6 each, carriage 7/6. **EX-NAVAL ROTARY CONVERTORS.** 110 volts D.C. input. Output 230 volts A.C., 50 cycles, 1 phase, 250 watts, capable of 50 per cent., overload, weight 100 lb. price £10/10/- each, carriage forward. **ELECTRIC LIGHT QUARTERLY TYPE CHECK METERS.** All for 200-250 volts A.C., 50 cycles, 1 phase, 5 amp. load, 17/6 each, post 1/6 ; 10 amp., 21/- each, post 1/6 ; 20 amp. load, 25/- each, post 1/6. **MAINS TRANSFORMERS** (new). 200-250 volts input, in steps of 10 volts. Output 0, 6, 12, 24 volts 6 amps., 37/6 each, post 1/6. Another as above, but 10-12 amps., 48/6 each, post 1/6. Another as above, but 25-30 amps., 70/- each, carriage 1/6. Another, input as above, output 0.3, 18. 30, 36 volts 6 amps., 42/6 each, post 1/6. **PRE-PAYMENT 1/- SLOT METERS,** by well-known makers, 200/250 volt A.C., 50 cycles 1 phase, 20 amp. load. Set rating of 8d. or 9d. per unit, bakelite case, 37/6 each (for shop clients only).

QUALITY ENTHUSIASTS

Always consult

HOLLEY'S RADIO STORES

285 CAMBERWELL ROAD, S.E.5

Now in Stock

SOUND SALES A-Z AMPLIFIER and TONE COLOUR UNIT and DX RADIO TUNERS
LEAK TL12 AMPLIFIER RCPA/U PRE-AMP. and SUPER-HET RADIO TUNER
NEW ACOUSTICAL Q.U.A.D. RADIO TUNER AND AMPLIFIER
WILLIAMSON AMPLIFIERS AND TUNER BY GOODSELL & ROGERS
NEW TONEMASTER AMPLIFIER WITH TONE COLOUR UNIT
ARMSTRONG MODEL 73 and 104 ALL-WAVE CHASSIS
AMPLIFIERS BY ROGERS DEVELOPMENT CO. AND VORTEXION
NEW McMICHAEL HIGH FIDELITY RECEIVERS
Recommended SPEAKERS
VOIGT DOMESTIC CORNER
TANNOY DUAL CONCENTRIC
WHARFEDALE NEW FIVE AND CORNER
BARKER 150
GOODMANS AUDIOM 60
DECCA CORNER SPEAKER and LONG PLAYING RECORD EQUIPMENT
TAPEDECKS, TWO SPEED MOTORS and THREE HEAD PICK-UPS
RADIO-GRAM AND CORNER SPEAKER CABINETS
CONNOISSEUR TWO SPEED MOTORS

Open all day Saturday. Callers only.

'Phone: ROD 4988

SOUTHERN RADIO'S WIRELESS BARGAINS

WALKIE-TALKIE (TRANSMITTER-RECEIVER). Type 38 Mark II. Complete with 5 valves, Throat Microphone, Headphones and Aerial. 7 mc/s Amateur Band suitable for field use. Powerful Superhet Receiver. Modulated Transmitter. Guaranteed ready for the Air, less batteries, £3/10/-.
R.3515 TELEVISION UNITS. Complete with 21 valves. 6 Stage 14 mc/s I.F. Strip. Ideal for T.V. Conversion. Brand new in original wooden cases, £3/10/-.
LUFBRA HOLE CUTTERS. Adjustable from ¾in. to 3½in. for use on Wood, Metal, Plastic, etc., 5/9. LUFBRA FLY CUTTERS, 14/6.
LIONEL "BUG" KEYS. Genuine U.S.A. Automatic Morse Key, Type J36. Few only, £3/7/6.
THROAT MICROPHONES. Magnetic type complete with long lead and plug, 4/6.
HAND GENERATORS. 6 volts at 5 amps. With Crank, 21/-.
PLASTIC TRANSPARENT MAP CASES, 14 inches by 10¾ inches. Ideal for Maps, Charts, Display, Photographs, etc., 5/6.
STAR IDENTIFIERS. With Hydrographic Office Modifications A-N Type 1. Complete in case, 5/6.
MOVING COIL D/C METERS. Brand new, 2in. 0-2 mA., 0-5 mA., 0-30 mA., 0-20 volts, 9/6 ea.
WESTECTORS. Type WX6 and W112, 1/- ea., 11/- doz.
VALVES. Brand new 805 U.S.A. in original cartons, each 32/6. A.T.P.4 for use on Transmitting section of Type "38" Walkie-Talkie, 7/6, 6K7, 7/6. All brand new.
MARCONI AERIAL FILTER UNITS. Type "916" in conformity with P.O. Specification. Full instructions for fixing, 4/-.
CONTACTOR TIME SWITCHES. 10-hour movement, 2 impulses per second. Thermostatic Control in soundproof Cases, 11/6.
VISUAL INDICATOR UNIT Type 3 (10Q/4). Contains two Moving Coil movements, two Neons, etc. Easily convertible to very efficient M.C. Meters, 11/-. Conversion fully described in "W.W." Sept. 1951.

Full list of Radio Publications, 2½d.

SOUTHERN RADIO SUPPLY LTD., 11, LITTLE NEWPORT STREET, LONDON W.C.2. GERrard 6653

CROWN Agents for the Colonies.
(A) DIESEL-ELECTRIC mechanic and
(B) WIRELESS operator mechanic required for the Falkland Islands Dependencies Survey for one tour of 18 or 30 months in the first instance. Salary according to qualifications and experience in scale £250, rising to £400 a year. Duty allowance £50 a year. Quarters, subsistence, clothing and routine canteen stores are provided free of charge while serving in Dependencies. Liberal leave on full salary. For both posts candidates should preferably be single. For post (A) they must possess a general working knowledge of electricity, and be capable of running and maintaining small diesel generating sets with associated switchboards, accumulators, etc. For post (B) candidates must be able to transmit and receive morse at 25 words a minute (plain language or code) and be capable of elementary maintenance of wireless transmitting and receiving equipment.
CANDIDATES should apply at once by letter, stating age, full names in block letters, and full particulars of qualifications and experience, and mentioning this paper to the Crown Agents for the Colonies, 4, Millbank, London, S.W.1, quoting for post (A) M.28660.B. and for post (B) M.28666.B. on both letter and envelope. The Crown Agents cannot undertake to acknowledge all applications and will communicate only with applicants selected for further consideration.

LONDON County Council Education Service.
LABORATORY technician required immediately at Poplar Technical College, Poplar High St., E.14, in electrical and physics laboratories. SCALE 57/6 weekly at 16 to 80/- at 19; at age 20 or over £225×£15—£315 a year, additional increments for special qualifications; these rates are subject to a 10% addition; further particulars with application forms obtainable from the secretary of the college returnable within 14 days of appearance of this advertisement. (1176.)

NORTHERN POLYTECHNIC, Holloway, N.7.
THE governing body invite immediate applications for appointment as full-time teacher of telecommunications engineering for the three-year full-time course in preparation for the Full technological certificate of the City and Guilds of London Institute in telecommunications engineering; Burnham technical salary scale, grade B. plus London allowance; forms of application, together with full particulars, will be forwarded on receipt of a stamped addressed foolscap envelope.
R. H. CURRELL, Clerk. [7574

THE QUEEN'S UNIVERSITY OF BELFAST.
SENIOR Technician (Electronics).
REQUIRED for the Department of Chemistry, a Senior Technician with wide experience in constructing electronic apparatus. Salary scale £450 rising by increments of £20 to a maximum of £530 per annum. Letters of application stating age, education and experience, together with two testimonials, should reach the undersigned by November 13th, 1951.
G. R. COWIE, M.A., LL.B., Secretary. [7493

NO. 4 Central Workshops R.E.M.E., Donnington, Shropshire.
APPLICATIONS are required from candidates for technical electrical and electronic engineering grade appointments (salary scale up to approximately £800 per annum).
APPLICANTS must have experience of either design, manufacture or repair in one or more of the following branches: (a) electronic servo or computing equipment; (b) modern communication equipment; (c) electrical and electronic test equipment and measuring devices; (d) service radar equipment.
APPLICATIONS are also invited for other vacancies with prospects to transfer to technical grades for persons—male or female, age 18 upwards—having the following academic qualifications but little or no practical experience: national engineering certificate, higher national engineering certificate, higher school certificate.
ASSISTED travel facilities available in approximately a 40-mile radius of Donnington; staff midday meal service; 5-day week; annual entitlement of leave on starting, lower grades 16 days per annum, higher grades 20 days per annum, for the technical vacancies.
APPLICANTS can apply in person or in writing in the first instance to C.E.P.O., No. 4 Central Workshops R.E.M.E., C.O.D., Donnington, Shropshire. [7576

DEVELOPMENT engineers required for work on the following:—
(a) CIRCUIT development and design on a wide range of electronic instruments: degree in Physics or Electrical Engineering essential and some industrial experience desirable.
(b) DEVELOPMENT of pressure pick-ups and electro-mechanical transducers; candidates should have Degree in Mechanical and Electrical Engineering and an interest in both fields.—Southern Instruments, Ltd., Fernhill, Hawley, Camberley, Surrey. [7530

SERVICE engineers required by Bromley, Kent dealer.—Box 4184. [7443

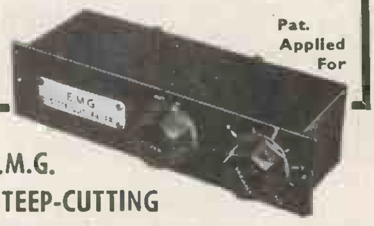
REQUIRED, radio tester for N.W. London area; 3/9 per hr., 44-hr. week.—Box 4315.

A VACANCY exists for a radio mechanic, preferably licensed and an aircraft electrician.
APPLY:—Starways, Ltd., Liverpool Airport, Liverpool 19. [7440

ELECTRONIC instrument makers require test engineers, please apply stating experience and salary required.—Write, Box 4309. [7503

YOUNG man (20-25), with good A.F. and mech. knowledge, for mobile projectionist/service engineer; clean licence; perm. post. JOHN KING (FILMS), Ltd., 7-9, Glentworth St., 1 min Baker St. Stn., Welbeck 1157. [7524

A REMARKABLE ACHIEVEMENT IN FILTER DESIGN



Pat. Applied For

E.M.G. STEEP-CUTTING INFINITELY VARIABLE FILTER

- Cuts at any selected frequency between 4,000 and 8,000 c.p.s.
- Average steepness of cut 30 db. per octave.
- Connects between secondary of output transformer and speaker (15 ohms. rated impedance)
- Specially valuable for use with new microgroove records.
- Greatly reduces needle-hiss on ordinary records with minimum high note loss, and suppresses high pitched interferences on radio.
- No distortion, and no appreciable loss of volume.
- Leaflet available from the manufacturers.
- *Novel circuit, patents pending.*

£4 - 10 - 0

Trade Enquiries invited

E.M.G. HANDMADE GRAMOPHONES, LTD.
Newman St., Oxford St., W.1.
Telephone: Museum 9971-2-3

WANTED

End equipment, tubes and component parts.

Will pay highest prices.

END EQUIPMENT

APN-9	HS-23
ARC-1	T-17D
APN-4	American made ARC-3
SCR-522	R-5A/ARN-7
BC-640	BC-453
ART-13	SCR-720
BC-639	APR-4
BC-221	AT-4/ARN-1 Antenna
RTA-1B	TN-16, 17, 18, 19 and 54
HS-33	

TEST EQUIPMENT

TS-13	TS-174
TS-34	TS-182
TS-35	TS-203
TS-45	TS-235
TS-70	TS-251
TS-89	TS-270
TS-118	TS-263
TS-120	TS-268
TS-142	IE-19

ARROW SALES, INC.
1712 S. MICHIGAN AVENUE, CHICAGO 16, ILL., U.S.A.
Phone: WEbster 9-7454

THE following vacancies exist in the design department of a company operating a large number of wire broadcasting systems:—
1. SENIOR engineer to take charge of radio frequency section; must have a degree and have had at least three years' practical experience of television design.
SALARY: £800 to £1,000 per annum, according to experience.
2. JUNIOR engineers age 20 to 25 with degree or graduateship of I.E.E. or I.R.E.
SALARY: £400 to £500 per annum.
3. LABORATORY assistants capable of wiring and testing radio equipment under supervision. SALARY: £8 per week.—Please send full particulars to Box 4314. [7511

APPLICATIONS are invited by the Ministry of Supply for the following appointments at the Atomic Energy Research Establishment, Harwell, Berks.
1. PHYSICISTS (Ref. A266/51/A).—Senior experimental officer to take charge of, and experimental officer to assist in the industrial applications of radio-active isotopes, involving complex techniques. Electronics, vacuum and/or radio-activity experience would be an advantage.
2. CHEMICAL engineers (Ref. F670/51/A).—Experimental officers and assistant experimental officers with experience in erection and operation of chemical plant on the pilot or semi-technical scale or in process development on the laboratory or larger scales.
3. CHEMICAL and metallurgical analysts (Ref. F.670/51/A). E.M.—Experimental officers and assistant experimental officers for analytical work. Two of the posts are connected with the analysis of heavy metals, rare elements and their alloys. Experience of metal analysis desirable.
4. METALLURGISTS (Ref. F.669/51/A).—Experimental officer or assistant experimental officer with experience in heat treatment to operate small vacuum melting and precision heat-treatment furnaces. A good working knowledge of normal types of temperate controllers and pyrometers is essential, and ability to use and construct vacuum systems would be an advantage.
5. DEVELOPMENT engineers (Ref. C565/51/A).—Senior experimental officer or experimental officer for development of special types of plant and instruments requiring remote control or for operation under onerous conditions of temperature, pressure and corrosion, e.g., pumps, valves, filters, etc. Suitable experience would be that obtained in plant development in a chemical works.
MINIMUM acceptable qualifications include Higher School Certificate with a science subject as principal subject, Higher National Certificate etc.; higher qualifications, e.g., a University degree in an appropriate subject would be an advantage.
SALARY will be determined on age, qualifications and experience within the ranges: senior experimental officer (minimum age 35). £742-£960; experimental officer (minimum age 28), £545-£695; assistant experimental officer, £240 (at age 18)-£505. Rates for women somewhat lower. Posts are unestablished.
APPLICATION forms obtainable from the Ministry of Labour and National Service, Technical and Scientific Register (K), York House, Kingsway, London, W.C.2, quoting appropriate reference number. Closing date 12 November, 1951.

SERVICE engineer required, radio preferably with television experience and able to drive, permanent post for efficient engineer; N.W. London.—Box 4311. [7505

RADIO and television service engineer required for Forest Gate area of East London; must be able to drive, write stating salary required.—Box 4187. [7451

BUSH RADIO, Ltd., require a number of engineers and physicists for new research and development laboratories which are being formed at Plymouth.
(a) A QUALIFIED senior engineer for a responsible position. The applicant should have a university degree in physics or electrical engineering, or have passed the graduateship examination of the I.E.E. He will be required to make preliminary theoretical investigations to initiate experimental work, and to direct assistants.
(b) A SENIOR enginer—preferably with a good theoretical background. A successful applicant will be required to carry through to the production stage, design and development of radar and similar equipment.
(c) A TRANSFORMER designer. The applicant should be experienced in the design of small power transformers (less than 0.5 kva), chokes, audio transformers and pulse transformers, and will be expected to carry through to the production stage the design of power supplies and other associated equipment. Experience of servo-motors and generators would be useful, but is not essential.
(d) A RESEARCH physicist or engineer. The applicant should have a university degree in physics or electrical engineering. Ability to apply mathematics to electrical problems is required, as well as a flair for experimental work in the field of electronics. Previous experience is not essential.
CANDIDATES for posts (a) and (b) above should have had at least five years' experience in the design of electronic equipment, especially in the following fields: Pulse techniques, C.R.T. displays, telemetering equipment, microwave equipment and aerials, servo-mechanisms.
THE laboratory is situated in pleasant surroundings on the outskirts of Plymouth, and there is a pension scheme in operation. Candidates should write giving full details and salary required to the Chief Engineer, Bush Radio, Ltd., Power Rd., Chiswick, W.4. [7489

A WELL-KNOWN company invites applications for the following positions in its Midland industrial electronics department:—
(1) R.F. HEATER design engineer, for design and circuits work on induction and di-electric heaters; a senior man is required, able to control a section; applicants should have experience of this type of work or of radio transmitters; preference given to those with university degree (ref. CEG).
(2) ELECTRONIC control gear design engineer, for design of motor controllers, automatic control and servomechanisms; experience essential, and degree or H.N.C. an advantage (ref. GBH).
(3) ELECTRONIC instrument design engineer, for design of instruments and sensing and control devices; experience essential and a degree or H.N.C. an advantage (ref. ICI).
ALL these positions offer excellent scope for keen electronic engineers on work of considerable interest.—Please apply, giving full details and appropriate reference No., to Box 4440.

CHIEF engineer (radar) required for new branch of London firm; managerial experience and highest qualifications required; unusual opportunities for right applicant.—Apply Box 4320. [7532

DEVELOPMENT engineer required for well-known firm of electrical instrument makers situated North London. Man with good technical and mechanical knowledge for experimental work. —Box 4512. [7614

RADAR engineers and mechanics required for new branch of London firm; experience in reconditioning and modification of British and U.S.A. radar equipment essential; good salaries. —Apply Box 4319. [7531

OVERSEAS.—Design and production engineer required to supervise installation of plant, and take full charge of production of electrical power factor correction condensers in South Africa.—Box 4193. [7481

FERRANTI, Ltd., Moston Works, Manchester, have staff vacancies in connection with special electronic valve development and manufacture in association with an important radio tele-control project.
(1) SENIOR valve engineers to take charge of research and development work.
QUALIFICATIONS include a good degree in physics or electrical engineering and extensive experience in charge of development work.
SALARY according to qualifications and experience in the range of £1,100—£1,600 per annum; please quote Ref. S.V.E.
THE company has a staff pension scheme, and will give housing assistance in special cases.—Application forms from Mr. R. J. Hebbert, Staff Manager, Ferranti, Ltd., Hollinwood, Lancs.

INSTRUMENT assemblers with some electrical knowledge required, also test room assistants, for well-known instrument company situated in North London, good working conditions and canteen.—Apply Box 4511. [7613

FIRST-CLASS wiremen required by electronic instrument manufacturers, producing high grade instruments, only efficient men need apply, top rate paid and if suitable, house will be provided.—Apply Box 4310. [7504

ASSISTANT to W.M., to take charge test, development, with small firm specialised equipment manufacturers.—Write details, education, experience, salary, to S.S. Electronics, Ltd., 8a, Byron Rd., Harrow, Middlesex. [7577

SENIOR T/V engineer to take charge of television development of large manufacturing co., in S.E. London area; applicants should write giving particulars of age, qualifications, experience and salary required to Box 4308.

RADIO mechanic required for radio service work at S. Smith & Sons (England), Ltd., Great West Road Factory, Brentford; experience essential; high starting wage.—Apply in person to Personnel Manager or Tel. Ealing 8071, ext. 25. [7454

TELEVISION and radio service engineers required immediately; good terms of employment with progressive company; write or telephone Mr. D. Howell for interview.—Northern Lights, Ltd., 370, Cricklewood Lane, N.W.2 Tel. Speedwell 4262. [7465

ADMIRALTY.—Vacancies exist for electrical and/or mechanical engineering draughtsmen in Admiralty Research and Development Establishments located in the vicinity of Weymouth, Portsmouth, Teddington (Middlesex) and Baldock, Herts.
DRAUGHTSMEN experienced in light current, electro-mechanical, precision mechanical and electronic equipment are particularly needed.
CANDIDATES must be British subjects of 21 years of age and upwards who have had practical workshop experience (preferably an apprenticeship) together with drawing office experience.
APPOINTMENTS will be in an unestablished capacity, but opportunities may occur for qualified staff to compete for established posts.
THE salaries offered, depending on age, experience, ability and place of duty, will be within the range £320—£560 p.a.
HOSTEL accommodation is available at some establishments.
APPLICATIONS, stating age and details of technical qualifications, apprenticeship (or equivalents) workshop and drawing office experience, should be sent to Admiralty (C.E.II. Room 88), Empire Hotel, Bath, quoting DM/R.D. Original testimonials should not be forwarded with application. Candidates required for interview (at London or Bath whichever is nearer) will be advised within two weeks of receipt of application. [7367

JUNIOR engineers required for interesting work on a V.H.F. radio-link system in the field; experience desirable but not essential; headquarters near London; salary according to qualifications.—Write giving full details, quoting ref. ICD, to Box 4196. [7487

Use SOLONS for the jobs that matter—this modern precision tool makes soldering speedier, simpler and more reliable. 5 models: 65 watt with oval tapered and round pencil bit; 125 watt with oval tapered and round pencil bit; 240 watt with oval tapered bit; each with 6 feet 3-core Henley flexible. Voltage ranges from 100 to 250.

W. T. HENLEY'S TELEGRAPH WORKS CO. LTD
51-53 Hatton Garden London, E.C.1

Write for Folder Y 10

HENLEY SOLON ELECTRIC SOLDERING IRONS

FOR INDUSTRIAL USE

THE HOUSE FOR QUICK DELIVERY

The following Goods Ex-Stock.

Cash with Order, or C.O.D.

LEAK TL/12 watt "Point One" Feedback Amplifier	£28 7 0
LEAK New RC/PA/U Remote Control Pre-Amplifier	£9 9 0
LEAK VS Superhet Tuner Unit, complete with valves	£37 2 4
DECCA 3-speed motors with turntable ready for mounting	£7 3 4
ACOS GP20 complete with either standard or L.P. Head	£3 11 5
ACOS Heads Standard or L.P.	£2 3 4
GARRARD Standard Playing Unit with Pick-Up	£6 3 2
COLLARO Standard Playing Unit with Pick-Up	£6 10 6

Send me your order for all your:

Wharfedale Speakers. Test Meters—Avo, Taylor, Advance. Valves. Components. Please note these prices are subject to any increase by the makers due to rises in costs.

A. ERNEST BUCHAN

(M.O. Dept.)

28, BELMONT ST., ABERDEEN

Telephone 23579

TRANSFORMER designer/engineer required to take charge of small manufacturing plant in Glasgow area.—Full particulars to Box 4194.

NUMBER of vacancies exist for draughtsmen and designer draughtsmen in various sections of the Pye group of companies.—Please reply giving details of age, experience and salary required to Personnel Department, St. Andrew's Rd., Cambridge. [7437

EXPERIENCED electronic wiremen required immediately for top priority Government contracts, excellent wages, working conditions and prospects for the right type of applicant.—Apply, Peto Scott Electrical Instruments, Addlestone Rd., Weybridge, Surrey. [7265

RADIO engineer required, television experience and ability to drive an advantage, for service dept., handling Murphy, H.M.V., Pye, Philips, Ekco, etc., where ambition and ability will be recognised.—Barnes & Avis, Ltd., 140-141, Friar St., Reading, Berks. [7475

ELECTRONIC engineers and experienced radio mechanics required for developing and maintaining equipment for measuring vibrations and stress analysis in connection with gas turbine engine development.—Apply Armstrong Siddeley Motors, Ltd., Coventry. [7497

APPLICATIONS are invited by a Government Department for high-grade W.T. operators; salary, according to qualifications and experience, within the region of £375-£450 p.a.; living allowances in addition to salary at overseas posts.—Write W/T.O. Box 4190. [7473

E. K. COLE, Ltd., have vacancies for testers at their Electronics Division; experience in the testing of radar, communications or electronics equipments to Ministry specifications essential.—Full details in writing to the Personnel Manager, Malmesbury, Wilts. [7340

DRAUGHTSMEN, senior, required with electrical or radio experience and knowledge of Ministry specifications; salary up to £600 per annum; location, Bedfordshire.—Write, giving full details of qualifications and experience and mentioning ref. ADD. to Box 4197. [7488

DEVELOPMENT engineers for electronic and electrical instruments required, high priority work; location South Wales; pension scheme; salary £500 to £700 p.a.; technical qualifications and industrial experience to Box 191, C.R.C., 29, Hertford St., London, W.1. [7549

INTERNATIONAL AERADIO, Ltd. require radar specialist in Army equipment, preferably staff officer experience for senior post in Pakistan; good salary and pension scheme, passages provided.—Write quoting SRS(3), Senior Admin. Officer, 40, Park St., London, W.1. [7571

TELEVISION and radio service engineers are required by London's leading retailer; the necessary qualifications are good theoretical and practical technical knowledge and able to drive light vans.—Apply Service Manager, Imhof's Retail, Ltd., 112, New Oxford St., W.C.1. [7464

EXPERIENCED radio/television engineer required to work on outside service and in service department, also to carry out special investigations; please write to service department manager stating age, experience and salary required.—Regentone Products, Ltd., Eastern Ave., Romford, Essex. [7479

INTERNATIONAL AERADIA, Ltd., require ground radio operators overseas; candidates preferably licensed should have experience air radio operating and D/F work; pension fund, good salary and allowance, tax free.—Write quoting GRO, Senior Admin. Officer, 40 Park St., London, W.1. [7447

UNIVERSITY College, London (Gower St., W.C.1), has vacancies in Department of Physics for young men for constructing electronic and general physical research apparatus; scale £221×£13—£338 p.a.; plus London weighting of £20.—Application forms from the Secretary, quoting Physice/6. [7555

SENIOR draughtsman required for interesting work on electronic equipment, design and small quantity production; experience an advantage, also ability to work on own initiative; good prospects and 5-day week.—Apply Personnel Manager, Dynatron Radio, Ltd., Ray Lea Rd., Maidenhead, Berks. [7472

BERRY'S (SHORT WAVE), Ltd., have vacancies for counter sales staff and engineers with experience of: (a) Amateur radio; (b) Quality amplifiers; (c) Recording equipment; applications in writing, give full particulars of past experience, etc., salary required to 25, High Holborn, W.C.1. [7506

DESIGNER draughtsmen required, radio and television, able to work on own initiative and to develop own ideas, willing to take responsibility, interesting work, above A.E.S.D. rates for suitable applicants, 5-day week, pension scheme.—Apply in writing to Vidor, Ltd., West St., Erith, Kent. [7498

ELECTRICAL instrument maker required for small quantity production of specialised instruments; must be capable of light assembly, wiring, testing and calibration and able to work on own initiative; technical background desirable to H.N.C. standard; good opportunity and prospects for right man.
APPLY in writing to Personnel Officer, W. Edwards & Co. (London), Ltd., Worsley Bridge Rd., Sydenham, London, S.E.26. [7495

ELECTRONIC assistant required for construction and wiring of test-gear in engineering laboratory; interesting work, 5-day week.—Write, stating age and giving full details of previous experience and salary required, to the Personnel Officer, The de Havilland Engine Co., Ltd., Stag Lane, Edgware, Middlesex. [7550

PHYSICIST, age 30 to 40, required by valve manufacturer in home counties; progressive post for man with experience in valve development and production, who should possess a degree; staff pension fund; house available for suitable applicant.—Write fully, state age, qualifications and experience, to Box 4482. [7587

SUPACOILS

OFFER

THE LATEST EDITION OF THE

HOME CONSTRUCTOR'S HANDBOOK

If you wish to build Superhets, Feeder Units, Amplifiers, etc., etc., you MUST have this Handbook. In addition to a considerable number of reliable and tested circuits it contains:

- Pages of servicing and constructional information which will assist you in YOUR radio problem.
- Complete resistance colour code.
- A considerable amount of invaluable general Radio information.
- A comprehensive catalogue.
- Above all it is profusely illustrated with half tone blocks and costs 2/- only or a copy will be given **FREE** with every order for £1 or more.

We also offer the following selection from our stocks of quality components:

- **COILS.** Our standard High Q variable iron dust cored coils (as recommended for the P.W. 9 valver) in wavelengths 10-30, 16-50, 30-75, 75-200, 190-550 and 800-2,000 metres; Aerial, H.F. or Oscillator 3/- each.
- **COIL GROUPS.** Our very popular coil groups are being used by more and more constructors for set building. Coil Group "A" consists of 6 of the above coils (your own selection), 1 Miniature 4p. 3w. rotary switch, 2 fixed padders (to suit coils selected), 6 variable trimmers. Complete group. £1 9 0
  Coil Group "B" consists of 9 of the above coils (your own selection), 1 rotary 7p 4w switch (3 w/bands and gram.), 2 fixed padders (to suit coils selected), 9 variable trimmers. Complete group. £2 7 6
- **SPECIAL.** We have recently introduced a new range of miniature iron-dust cored coils, waveband coverage as for our standard coils. Price 3/6 each (full descriptive leaflet and quantity terms on application).
- **I.F. TRANSFORMERS.** Iron dust cored, pre-aligned to 465 Kc/s. 16/6 pair.
- **T.R.F. COILS.** Iron cored. Medium Wave only, grid coil Litz-wound, Aerial and H.F. 7/- pair.
- **T.R.F. COILS.** Air cored. Long and Medium Wave on one former with coupling coil. Aerial and H.F. (M.W. Grid Coils Litz-wound). 8/- pair.
- Large stock of coil packs and all components. Stamp for complete catalogue. Export enquiries for all our products cordially invited.

SUPACOILS MAIL ORDER OFFICE
98, Greenway Ave., London, E.17

THREE in ONE TRANSFORMER 6/- each Post 1/5

1. Use as Push/Pull Modulation Transformer Push/Pull 211's to single 211-100 watts. Makes ideal Output Transformer P/p 6L6 or 807 to match High Impedance Relay Speakers And as,
2. 230 volts 50 cycles Input 150-0-150 at 100 m/A. Output. Useful for H.T. Eliminators and Low Voltage Power Supply. Can also be used 300 volts Half-Wave at Lower Current. And as,
3. 230-115 volt AUTO Step/Up or Step/Down Mains Transformer 75 watts rating.

U.S.A. Manufacture—Fully Shrouded.
SIMPLE : EFFICIENT : GUARANTEED.

NORMAN H. FIELD
68 HURST STREET, BIRMINGHAM 5
Mail Order Dept.
64-65 CHURCH LANE, WOLVERHAMPTON

RADIO engineer required accustomed to layout and design of chassis.—Apply to Employment Manager, Vickers-Armstrongs, Ltd. (Aircraft Section), Weybridge, Surrey. [7426

BOYD, Ltd., require radio & T/V engineers for their central service depot, 18, Crown Place, N.W.5, top wages, own car an advantage.—Apply Service Supervisor, 256, Edgware Rd., W.2.

VACANCIES exist for men with qualifications in electrical engineering or physics for interesting development work of national importance; these positions are permanent and pensionable.—Apply Personnel Manager, Standard Telephones & Cables, Ltd., North Woolwich, E.16, quoting reference 2371. [7547

STOCK-KEEPER.—Competent man required as valve stock-keeper, must be fully conversant with current makes and types of valves and equivalents and able to take charge of stores, ordering, etc.—Apply J. & F. Stone Lighting & Radio, Ltd., Edgware Rd., The Hyde, Hendon, N.W.9 (corner Colindale Avenue). [7616

A NEW defence project of National importance being undertaken by a well-known aircraft company located in the northern outskirts of London, offers highly paid and interesting posts for suitably qualified applicants; vacancies exist in senior (salaried grades) and for junior engineers in various categories:—
(a) PHYSICISTS with experience in electronic problems.
(b) PHYSICISTS with experience in optical work.
(c) ELECTRONIC engineers with Servo-mechanism experience.
(d) ELECTRONIC engineers with experience of low frequency work and measuring systems.
(e) ELECTRICAL engineers with experience in small motor design and development.
APPLICANTS for senior posts should possess a good University degree and preferably should have some industrial experience.
APPLICANTS for junior posts should have a good industrial experience, be qualified either by City & Guilds Certificate or by Inter B.Sc.
WRITE full details, qualifications, experience, age, salary sought, to—Box A.C.65488, Samson Clarks, 57/61 Mortimer St., W.1. [7409

A VACANCY exists for a senior wireless engineer to control a team engaged on research, development and engineering new low-power equipments in the 400-600megacycle band; salaries up to £1,200 per annum offered to suitable candidates; please write, giving full details and quoting Ref. HHE to Box 4181. [7438

A NUMBER of senior and junior vacancies for radio, radar, electronic, television, etc., development, service engineers, draughtsmen, wiremen, testers, inspectors, etc.; urgently required 30 television service engineers.—Write in confidence, Technical Employment Agency, 179, Clapham Rd., S.W.9. (Brixton 3487.) [0103

TECHNICAL assistants required for interesting laboratory and field work connected with guided missiles project; applicants to be between 20 and 35 years of age, with at least National Certificate (Electrical) or equivalent; experience of R.F. technique up to 500mc would be an advantage.—Full particulars to Box 4322. [7540

RADIO engineer to take charge of low power transmitting station in U.K.; applicants should be between ages 28-38 years and preferably married and prepared to live on site; possession of own car would be an advantage; salary £500 per anum plus free accommodation; excellent superannuation scheme.—Box 4192. [7480

LABORATORY assistants for development on cathode ray photo-electric and other types of television vacuum tubes; preference given to applicants with Inter-B.Sc. or equivalent, and with completed National Service; good canteen, 5-day week, pension scheme; write, giving age, experience and salary required to CINEMA-TELEVISION, Ltd., Worsley Bridge Rd., Lower Sydenham, S.E.26. [7450

RADIO manufacturer requires man with own facilities to design, develop and preferably manufacture test gear for factory use; any individual or small firms who are fully competent in this field should reply giving full details of their facilities and experiences together with any other relevant informtion to Box 4307.

A COST estimator is required by the Midland industrial electronics dept. of a well-known company; applicants should be of H.N.C. standard and able to draw up equipment schedules and pre-costs; previous experience in the electronic engineering field essential.—Please write, giving full details, quoting ref. IBC to Box 4441.

RADIO mechanics required for work on centimetre equipments at Stanmore; previous experience essential; progressive staff positions; 5-day week.—Write, giving full details of age, experience and qualifications, to the Staff Manager (Ref. GBLC/G/43), Research Laboratories of the General Electric Co., Ltd., N. Wembley.

ENGLISH ELECTRIC VALVE Co., Ltd., Chelmsford require a young engineer for testing and development work on Microwave Klystrons; suitably experienced and qualified applicants should write giving full details and quoting ref. 419B to—Central Personnel Services, English Electric Co., Ltd., 24/30, Gillingham St., London, S.W.1. [7444

ELECTRONIC and radio engineers.—Applications are invited for the position of field trials engineer to lead a team engaged in the usage and application of V.H.F. radio-link systems; practical experience desirable, but not essential; salary according to qualifications.—Write, giving full details and quoting ref. D.H.G., to Box 4191. [7477

COMPETENT Technicians with experience of testing, servicing or installing radio and electronic equipment generally required by well-known firm; ex-Service personnel with radio or radar experience particularly suitable; good salaries are offered according to age and experience.—Write, giving full details and quoting ref. DGF to Box 4437. [7564

POTENTIOMETERS

Wire-wound and Composition types. Single, Ganged, Tandem Units. Characteristics : linear, log., semi-log., non-inductive. etc. Full details on request.

RELIANCE

RELIANCE MNFG., CO. (SOUTHWARK), LTD.
SUTHERLAND ROAD, HIGHAM HILL, WALTHAMSTOW, E.17.
Telephone : Larkswood 3245

Excellent Bargains by ELECTRADIX

LABORATORY AND TEST GEAR. Galvanometers, Tinsley moving coil Ballistic, mirror reflection type, 100 ohm. coil, 2½ microamps per 1in. of scale at 1 metre in pol. wood case with glass front and levelling feet, £8/10/-. Cambridge Ironclad Indicators, mirror scale 0-100 edgeways model, £12/10/-. Sullivan Marine type Galvo in lacquered brass case on pol. wood base, £15. Ohmmeter by Evershed, in wood case, scaled 0-0.1 ohms., £8/10/-. Galvanic Detectors, G.P.O. type, scaled 60-0-60, in mahog. case, 35/-.

Watt-meter, Met.-Vic., 5 to 30 kW., full circular scale, 6½in. dia., 230 volts 3-ph. 50 c/s., with compensator box, £10.

Frequency Meters, 5in. Crompton, flush panel, 40/60 c/s, 230 volts, calibrated, and as new, £9. **Meters.** Ammeters, 2in. D.C. moving coil 0-20 with shunt, 9/6, post 9d. D.C. moving iron voltmeters, 2½in. flush panel, 0-9 volts, 6/6, post 9d. D.C. moving iron ammeters, 2½in. flush, 0-25 amps., 12/6, post 9d.

Electrostatic Voltmeters, Everett Edgcumbe 2½in. flush, 1,500 volts, 65/-.

Hydraulic Pumps, high pressure, for Bakelite press, etc., ¼in. inlet and outlet, spline shaft 2in. long, flange mounting, weight 5 lb., 45/-, packing and postage 2/-.

Rotary Converters, D.C./A.C., 24 volts/230 volts 100 watts, 75/-, carr. 5/- ; 110/230 volts 200 watts, £10/10/-, carr. 10/- ; 230/230 v lts 200 watts, £12/12/-, carr. 10/- ; starters for larger sizes, 25/-. extra. Send for leaflet

The Dem Continuity Tester, in wood box, 6½in. x 3¾in. x 2½in., new, totally enclosed, with carrying strap and contact switch, a portable testing set for all electrical circuits, 7/6, post 1/-.

ELECTRADIX RADIOS
214 Queenstown Road, London, S.W.8
Telephone · MACaulay 2159

RADAR mechanic; a vacancy is open for a radar mechanic in our Wembley factory; must be ex-Serviceman; please write in the first instance to: Mr. Dow, Claude-General Neon Lights, Ltd., Wembley Exhibition Grounds.

TRANSFORMER tester, inspector required by low-power transformer manufacturers, Ealing district, must have some technical knowledge; ability to construct test gear under direction an advantage; write stating previous experience, age and salary required.—Box 4186.

A LABORATORY assistant required, capable of taking charge of electrical and electronic equipment for a guided missiles project; duties will include calibration and minor repairs of instruments; applicant with the necessary experience will also control sub-standard room and undertake design of laboratory equipment.—Full particulars to Box 4321. [7539

ENGINEER for transformer design work, used to small power audio and pulse transformer work, required by prominent aircraft firm in the London area; highest technical ability and experience of miniaturisation required.—Write full details, qualifications, experience, age, salary sought, to Box A.C. 64418, Samson Clarks, 57-61 Mortimer St., W.1. [7238

V.H.F. communications, progressive and rapidly expanding London company has vacancies for an engineer-in-charge (working) and V.H.F. service engineers; technicians wishing to join an organisation offering a sound future in the communications field should apply at once stating full details of past experience, salary required, etc. to—Box 4182. [7439

MURPHY RADIO, Ltd., have vacancies for senior mechanical designers in their electronics division; a full and varied programme ensures opportunity of widening experience with excellent prospects; application giving particulars of training and experience should be made immediately to—Personnel Dept., Murphy Radio, Ltd., Welwyn Garden City. [7408

MULLARD EQUIPMENT, Ltd., S.W.18. Designers.—Electro-mechanical designers of Degree standard required for interpreting laboratory electronic devices into production designs; permanent, pensionable posts; salary according to qualifications and experience.—Apply Personnel Department, Mullard Equipment, Ltd., Brathway Rd., Wandsworth, S.W.18. [7525

PERSONNEL experienced in the maintenance and repair of electronic control and radar equipment are required for civilian appointments in North West, Midlands and South Wales; salary £435×£20 to £550 to technical assistants Grade III with opportunities for promotion to higher grades; married accommodation may become available for selected personnel.
VACANCIES exist also for telecommunications and radar mechanics with general experience at £6/16 per week, training facilities available.
FORM of application from A.D.M.E. 4 A.A. Group, Peninsular Barracks, Warrington, Lancs. [7455

ROLLS-ROYCE, Ltd., Derby, have vacancies for graduates to work on the study of vibration characteristics of Rolls-Royce gas turbine and piston type aero engines, under laboratory conditions, on the test bed and in flight; some knowledge of electrical measurements is an advantage but extensive electronic knowledge is not essential; salary according to age, qualifications and experience. [7345

RADIO testers and fault finders required for work of national importance; men with experience of domestic radio, television or V.H.F. communications, can be offered attractive posts according to their ability.—Applicants, who must be prepared to reside in the Midland area, should write giving full details of experience and present salary, to the Personnel Officer. Ref. (Radio Test). Box 3233. [7270

SEVERAL electronic engineers or physicists are required, who have graduated in physics or telecommunications and have two or three years radar experience, to take charge of the development of particular sections of a project involving radar, the work includes design of pulse generators, timing wave form oscillators, electronic computors, V.H.F. transmitters and receivers, and serve systems.
IN addition, technical assistants are needed with H.N.C. or equivalent qualifications.
ALL the positions available are for work of high interest in a new and expanding field.
APPLICATIONS, which will receive prompt attention, should give the fullest details of education and professional experience with appropriate dates.
APPLY Employment Manager, Vickers-Armstrongs Ltd. (Aircraft Section), Weybridge.

BRITISH OVERSEAS AIRWAYS CORPORATION have vacancies for radio mechanics experienced in radio maintenance and/or overhaul; rates of pay 2/10 per hour plus 4¼d per hour provisional bonus; attracting proficiency pay up to 3d per hour; 5-day, 44-hour week; possible shift work; good pension, sick pay and holiday facilities.—Write or call, Staff Manager, Hut 29, London Airport. [7315

WRITER required, experience essential in compilation of technical literature and service manuals dealing with electronic communication and measuring apparatus; excellent opportunity for qualified man to join staff of well-known company.—Write, telephone (St. Albans 6161) or call; Saturday interviews if necessary. Marconi Instruments, Ltd., Longacres, Hatfield Rd., St. Albans. [7445

EXPERIENCED telecommunications draughtsmen required by the Plessey Co., Ltd.; permanent and progressive positions are offered to men having experience of line communications equipment or radio communications equipment; positions offer varied and interesting jobs with usual staff privileges.—Applicants should state full details to Personnel Manager, The Plessey Co., Ltd., Ilford, Essex. [7533

"DEFINITELY IN STOCK NOW"

COLLARO AC3/514 3-speed Gram. Units, with Pick-up taking 2 Acos GP27 plug-in heads for Std. and L.P. Fitted auto-stop. Price complete £14/8/9 and carr. 2/6. Above mounted in de Luxe rexine covered portable case, 17 gns., plus carr 2/6.

DECCA THREE-SPEED GRAM. MOTOR and substantial turntable, fitted precision switch, giving 33⅓, 45 and 78 r.p.m Our special offer, £7/3/9, plus 2/6 post.

DECCA LIGHTWEIGHT PICK-UP to match, complete with Acos GP19 (78) and GP19LP (33⅓) plug-in cartridges with permanent sapphires £4/4/6, or with either one head only, £2/13/0, post 1/6. Spare heads 32/6.

ABOVE MOTOR AND PICK-UP with 2 heads fitted in de Luxe leatherette-covered portable case, 15 gns.

GP20 PICK-UP with standard or micro-groove head, £3/11/5, post 1/6. Either head separately, 43/4, post 8d.

SYMPHONY NO. 1 (AMPLIFIER) by N.R.S. The most versatile domestic Audio Amplifier on the market to-day. Independent control of Bass, Middle and Top, separate Scratch Cut, negative feedback. For A.C. 200-250 v., input for magnetic crystal and hi-fi pick-ups, also Tuner 5-watt output. Price : 3 ohm model, 9½ gns. ; 15 ohm model, £10/7/6, carriage 5/-.

SYMPHONY NO. 2 MARK II. New model with 10 watts push-pull triode output, breathtaking realism, hum level negligible—90 db down. Woden mains transformer, choke and output transformer for 3, 7.5 and 15 ohms. Input for ordinary and hi-fidelity pick-ups. Tone control system same as No. 1. A truly magnificent instrument for only 15 gns., carriage 5/-.

RECORD PLAYER CASES, well made, measure 15½in x 13½in. x 7in., beautifully covered in brown leatherette, fitted hinged lid, clasp and sprung carrying handle. Price complete with uncut motorboard, 57/6. Post 2/6.

RADIOGRAM CABINETS, table model, finished in french polished figured walnut, overall : 15in. wide, 14in. deep and 9½in. high. Int height above motorboard 2½in., depth below 6in. Also ideal for making de Luxe microgram or record player. New, perfect. Price (cost double to make) £3, carr. and packing 5/-.

BASS-REFLEX CABINET KITS give superb bass response and top (¾in. patent timber). Full instructions supplied. 8in. speaker model 2ft. 6in. high x 1ft. 3in. x 1ft. deep. Price 85/- ; 10in speaker model, 30in. x 16in. x 13½in., 97/6 12in. speaker model, 30in. x 17½in. x 16in., 107/6. Any of above ready built for 7/6 extra. Carr. in any case 7/6.

Send 5d. for latest bargain catalogue and supplement, indispensable to all Quality Enthusiasts. TERMS : c.w.o. or c.o.d. Callers welcome. Demonstrations Monday to Saturday (inclusive). 9 a.m. to 6 p.m.

NORTHERN RADIO SERVICES
16 Kings College Road, London, N.W.3
Phone PRImrose 8314.

YOUR METER DAMAGED?

Leading Electrical Instrument Repairers to the Industry.

Contractors to The Ministry of Supply.

Repairs by skilled craftsmen to all makes and types of Voltmeters Ammeters, Microammeters Multirange Test meters Electrical Thermometers. Recording Instruments Synchronous Clocks, etc. Quick deliveries—for speedy estimate send defective instrument by registered post to :—

L. GLASER
Electrical Instrument Repairers
341 CITY ROAD, E.C.1
Tel. Terminus 2489

RADIO technical sales engineer for East Africa required by important firm representing well-known British manufacturers; applicants must have good experience of V.H.F. communication equipment; leave and pension schemes.—Write Box SP/55, c/o 95, Bishopsgate, E.C.2.

DEVELOPMENT engineer. — International Aeradio, Ltd., specialists radio equipment design for aviation services, are expanding development section Bovington Airport, nr. Watford, to deal with interesting new prospects; salary according to experience; single quarters provided; pension scheme; 5-day week; canteen facilities.—Write, quoting Ref. D.E.B., Senior Admin. Officer, 40, Park St., London, W.1. [7466

JUNIOR engineers to assist in the design, construction and test of laboratory models of special electronic circuits; some experience of similar work desirable and a knowledge of radar circuits, design and operation an advantage; salary up to £600 per annum.—Please write, giving full details and quoting ref. 815c, to Central Personnel Services, English Electric Co., Ltd., 24-30, Gillingham St., London, S.W.1.

JUNIOR radio engineer required for installation and testing of aircraft radio equipment; duties will involve test flying; current M.C.A. operator's licence an advantage, but consideration will be given to suitable applicant prepared to obtain licence during probationary period.—Application should be made in writing, giving details of experience and salary required, to the Personnel Manager, The de Havilland Aircraft Co., Ltd., Hatfield. [7600

EX-RADIO and radar personnel, civilian or ex-Service, urgently required for interesting work West Middlesex area. Well-paid jobs await those accepted for preliminary training in central London. Three-quarters full union rate paid during three months' training. Contracts offered suitable applicants. This is a genuine offer of employment by one of the largest electronic organisations. Write for particulars and application form.—Box 4195. [7486

LABORATORY assistant required for instrument section; previous experience in making and repairing, indicating and electronic instruments essential; Higher National Certificate or equivalent qualification would be an advantage, but is not essential.—Apply in writing to the Staff Manager (Ref. GBLC/G/17), Research Laboratories of the General Electric Co., Ltd., Wembley, Middx., giving full details of age, qualifications and experience. [7517

REQUIRED by an old-established firm at their research laboratories, Borehamwood, senior draughtsmen for design of specialised electronic equipment or mechanical and electrical precision devices; sound general engineering and practical experience, Higher National Certificate standard preferred; must be capable of undertaking design work calling for originality and initiative; salary up to £625; five-day week of 39½ hours. Apply—Box 4185. [7448

BELLING & LEE, Ltd., Cambridge Arterial Rd., Enfield, Middlesex, require research assistants in connection with work on electronic components, fuses, interference suppressors and television aerials; applicants must be graduates of the I.E.E. or possess equivalent qualifications together with similar laboratory experience; salary will be commensurate with previous experience; applications must be detailed and concise, and will be treated as confidential.

A SENIOR engineer is required by the Industrial Electronics Dept. of the English Electric Co., Ltd., for design and circuit work on valve type H.F. heating generators; applicants should have good experience in this type of work or on radio transmitters; a University degree is desirable but not essential.—Please write, giving full details and quoting ref. 357, to Central Personnel Services, English Electric Co., Ltd., 24-30, Gillingham St., London, S.W.1.

REPRESENTATIVE wanted, retainer or commission basis; British importing firm starting in America wishes appoint part-time representative with technical knowledge, experience of radio industry, business experience and discernment to advise on British products and assist negotiations with manufacturers; little time required.—Write, stating qualifications, references, age, retainer wanted, to British Radio Industries Importing Agency, 1, Thomas Circle, Washington 5, D.C. [7420

SENIOR draughtsmen; Metropolitan-Vickers Electrical Co., Ltd., require for their Trafford Park works a number of senior draughtsmen, preferably with experience in radio and radar equipment; for qualified men these jobs are permanent, five-day week under good conditions.—Apply in writing stating age, experience, qualifications, salary required, etc., marking envelopes "Radio D.O.," to Personnel Manager, Metropolitan-Vickers Electrical Co., Ltd., Trafford Park, Manchester, 17. [7424

LIBRARIAN (female) required for E.M.I. technical library; qualifications: good general scientific background with practical experience, preferably in the field of light electrical engineering, coupled with a keen interest in librarianship, though actual experience of this work is not essential; knowledge of technical German and French would be an advantage; age over 24 years; please write, giving full details of experience and salary reqd., etc., to—ED/36, E.M.I. Engineering Development, Ltd., Hayes, Middx.

NORTHUMBERLAND company manufacturing electronic components requires experienced Electronic Technician immediately for development and construction, under technical supervision, of specialised electronic equipment for internal laboratory and factory use; age 24 to 35. O.N.C. or preferably H.N.C. or equivalent qualifications; experience of general workshop practice and electronic instruments, including A.C. and D.C. amplifiers and bridges, CRO, etc. Salary according to age and experience.—Apply Box 4438. [7565

THE MODERN BOOK CO.

The De Luxe Home-built Televisor and Radiogram. By W. I. Flack. 6s. 6d. Postage 4d.

Reference Data for Radio Engineers. Edited by W. L. McPherson. 7s. Postage 6d.

Amplifiers. By N. H. Crowhurst. 3s. 6d. Postage 3d.

Resistance Strain Gauges. By J. Yarnell. 12s. 6d. Postage 6d.

Handbook of Line Communication, Vol. I. The Royal Signals. 20s. Postage 1s.

Theory and Design of Valve Oscillators, Vol. 7. By H. A. Thomas. 2nd rev. edn. 36s. Potage 9d.

The Radio Amateur's Handbook. By The American Radio Relay League. 28th edn. 22s. 6d. Postage 1s.

Theory and Design of Television Receivers. By S. Deutsch. 55s. 6d. Postage 9d.

Telecommunications Principles. By R. N. Renton. 37s. 6d. Postage 9d.

Time Bases (Scanning Generators). By O. S. Puckle. 2nd rev. edn. 30s. Postage 9d.

Television Receiving Equipment. By W. T. Cocking. 3rd edition. 18s. Postage 6d.

Radio Servicing: Theory and Practice. By A. Marcus. 35s. Postage 9d.

Radio Valve Data. Compiled by "Wireless World." 2nd edn. 3s. 6d. Postage 4d.

Radio Installations. By W. E. Pannett. 45s. Postage 9d.

We have the finest selection of British and American radio books in the Country. Complete list on application.

19-23 PRAED STREET
(Dept. W.11)
LONDON, W.2.
PADdington 4185

DECCA RADAR LIMITED

Decca Radar Limited have established themselves in a position of pre-eminence in the field of marine radar. New programmes of research and development are proceeding on projects of outstanding interest and importance, for which well equipped laboratories have been acquired at Tolworth, Surrey, and vacancies exist for senior and junior physicists, engineers and mechanical designers with experience in centimetric radar, display systems and associated electronic equipment.

The vacancies to be filled will appeal to ambitious men who wish to join a young progressive company where ability, initiative and hard work will be recognised and rewarded.

All those with suitable qualifications who wish to be considered for the positions available are invited to write in confidence to the Managing Director, Ref. T, Decca Radar Limited, 1-3, Brixton Road, London, S.W.9.

THE General Post Office has vacancies for radio operators at its coast radio stations and applications are invited from men between 21 and 28 years of age who hold the Postmaster-General's First and Second Class Certificate of Proficiency in Radiotelegraphy. Selected candidates who hold or obtain the First Class Certificate will be considered later for permanent pensionable posts.—Early application should be made to the Inspector of Wireless Telegraphy, G.P.O. Headquarters, London, E.C.1, who will supply particulars. [7476

WAYNE KERR require several draughtsmen for design and development work on electronic equipment for the Armed Forces; the work is interesting and offers considerable scope for men with initiative and design ability; the projects at present involved are of high priority and form part of the Defence Programme; attractive salaries in excess of the revised A.E.S.D. rates will be offered to suitable applicants.—Write giving details of past experience, to Wayne Kerr Laboratories, Ltd., Sycamore Grove, New Malden, Surrey. [7463

ENGINEERS are required by Marconi's Wireless Telegraph Co., Ltd., Chelmsford, for the development and design of sound studio apparatus; applicants should have B.Sc. or equivalent qualifications and experience in the design of studio equipment, amplifiers and associated circuits, operational studio control experience also an advantage; salaries in the range of £500 to £750 are offered depending upon qualifications and experience.—Please apply, quoting reference 936, to Central Personnel Services, The English Electric Co., Ltd., 24-30, Gillingham St., S.W.1.

PROJECT Engineers required for assisting in the development and production of highest grade Television transmission and other equipment. Applicants must be capable of taking charge of a complete project which includes supervision, progressing, testing and installation. Qualifications are desirable up to degree standard, but lower grade qualifications and comprehensive practical experience will be considered; 5-day week; pension scheme.—Write, stating age, experience and salary required to Cinema-Television, Ltd., Worsley Bridge Rd., Lower Sydenham, S.E.26. [7567

LEADING television equipment manufacturer has a vacancy for an experienced electronic circuit engineer to work on a special development of unusual interest now in its early stages; the applicant should have practical experience of electronic equipment development; an understanding of the principles underlying modern television cameras is essential and practical experience on such equipment would be most desirable; an interest, preferably combined with experience, in the allied fields of optics and photography would be considered a great advantage.—Apply to Box 4483. [7588

PLANNING engineer required to assist in the planning of development of prototype electronic equipment; duties will include preparation of estimates and schedules and the checking of progress; experience in a similar capacity is desirable, and tact in handling people is of great importance; the post offers considerable prospects.—Applicants should write in confidence, giving full details of experience, salary required and when free for interview and appointment, to the Personnel Department, E.M.I. Engineering Development, Ltd., Hayes, Middlesex, quoting ED/49. [7526

RESEARCH Laboratories of The General Electric Co., Ltd., Wembley, Middlesex, have vacancies on a major guided weapon project at their Stanmore Laboratories for engineers and physicists with at least three and preferably five years' experience in the generation and handling of waveforms for radar computers or pulse multiplex systems. These openings will offer good prospects in experimental teams and attractive starting salaries will be paid.—All applications should be sent to the Staff Manager (Ref. GBLC/14), stating age, qualifications and experience. [7485

FERRANTI, Ltd., have vacancies for engineers with experience or interest in work connected with electro-mechanical gunnery predictors, gyroscopic instruments and allied projects; preference given to holders of degrees or equivalent qualifications, but aptitude and practical ability in light mechanical or electrical engineering is essential; salary according to age and experience in the range of £350-£650 per annum; the company has a staff pension scheme.—Forms of application from Mr. R. J. Hebbert, Staff Manager, Ferranti, Ltd., Hollinwood, Lancs. Please quote Ref. E.E.M. [7241

PRODUCTION manager required with considerable experience in the assembly of light electrical and mechanical apparatus covering a wide range of products, such as specialised electronic equipment, sound recording apparatus, etc.; previous experience essential in production line working and engagement and control of mixed labour; the position offers scope, is progressive and is situated on the South Coast near Southampton; assistance given to obtain suitable accommodation.—Write giving full details of experience in chronological order, stating age and salary required, to Box 4179.

A NUMBER of vacancies exist for electro-mechanical designers with a good degree in mechanical and electrical engineering, or similar qualification, and several years experience in a laboratory or factory design department; successful candidates will be expected to work in laboratory teams or in laboratory factory teams on interesting and varied projects, and to be responsible for the mechanical design of equipment; the posts are permanent and pensionable; salary according to qualifications and experience and consistent with present day levels.—Application form from Personnel Officer, Mullard Research Laboratory, Cross Oak Lane, Salfords, nr Redhill, Surrey. [7378

NUSOUND PRODUCTS

136 WARDOUR STREET, LONDON, W.1

(Oxford Street End)
Tel: GERrard 8845

NUSOUND FIDELITY-TEN. The latest super quality Amplifier. All Triode line up. P-Pull PX4 output. Frequency response 20-25 kcs. ± .6 d.b. and continuing up to 50 kcs. ± .9 d.b. Sensitivity 120 mv for max 10 w. output. Total harmonic distortion .1 per cent. at 1,000 c.p.s. at 6 watts. 20 d.b. neg. feedback. Independent Treble and Bass controls. Chassis size: 14 x 9 x 7¾in. high. A.C. model only. £26 (send for leaflet).

A NEW FEEDER UNIT. This is our latest addition to our range, and employs a s/het c.c.t. with two I.F. stages and variable selectivity controls giving bandwidths of 7-10 and 14 kcs. The unit covers the medium-long and short wavebands and has a large illuminated dial. Price 17 gns. inc. (We hope this unit will be available in November).

NUSOUND QUALITY AMPLIFIERS. 8½-WATT OUTPUT.—PP 6V6s—independent bass and treble boost and cut—switch for L.P. records—neg. feedback—provision for radio feeder unit—freq. response 23 to 20,000 c.p.s. ± ½ d.b.—hum 80 d.b. down at 6.5 watts—feedback 14 d.b.—sensitivity .05 volt. Price only £15/17/6. Also available with remote control unit. Price £17/10/-.

NUSOUND REMOTE CONTROL AND PRE-AMP. UNIT.—Bass boost—Treble boost and cut—V/C and switch—L.P. correction switch—Gives a gain of 10 : 1 in voltage—Ideal for Williamson and W.W. Amplifiers Price £5/7/6.

NUSOUND REFLEX CABINETS.—For Wharfedale speakers—10in. £9/9/—12in. £10/10/-. Veneered polish finish mahogany or oak.

Please send stamp for list of all our products. Our other products inc. 4½ watt Amp.—A.C. Model £11/10/- ; A.C./D.C. £12 ; T.R.F. Preset Feeder, 3 station £7/12/6 ; 3 station Preset S/Het £8/18/- ; two band variably tuned S/Het £11/5/-.

GRAMOPHONE EQUIPMENT. Connoisseur P/ups, Stnd. L/weight £4/11/8. Trans. 13/-. Super L/weight, one head £6/9/-. LP Head 71/8. Trans. 15/-. Fibre P/up £4/3/2. Trans. 25/-. Two speed Stroboscope 3/11. Garrard Heads: Standard 25/3. Miniature 50/11. HiFi 56/-. Type A Adaptor 7/7. Decca Mag. Heads 59/2. Decca XMS P/up £7 complete. Chancery Attachment 72/6. Decca 3-speed motor £7/3/4. Connoisseur 2-speed motor £22/18/8. Chancery Xtal P/up (LP20 insert) 53/-. Spare insert, LP 31/6. Garrard AC6 motor, speed controlled, 12in. table £6/15/10. Collaro A.C. 514MB motor and P/up £6/10/5. Collaro A.C./D.C. motor, 12in table £12/2/7.

(We stock a full range of Wharfedale & Goodmans speakers and accessories). TV and Gram. list 4d. (Please Add Postage).

CRYSTALS

of OUTSTANDING QUALITY

TYPE "S"

Frequency range: 100 Kc/s to 15 Mc/s. Black bakelite case, 1¾" high, 1$\frac{3}{16}$" wide, ½" thick, with two ⅛" diameter pins spaced ½" apart.

BROOKES CRYSTALS LTD.

10, Stockwell St., Greenwich, London, S.E.10
Phone: GREenwich 1828. Cables: Xtals London. Grams: Xtals Green London

RESEARCH Engineers, age 25-35, applicants should be of degree standard, preferably with communications training and sound mathematical background; the work is experimental and is concerned with various problems in electronics and acoustics; application stating technical qualifications, practical experience and salary required should be addressed to the Personnel Department, Kelvin & Hughes, Ltd., New North Rd., Barkingside, Essex. [7566

THE GENERAL ELECTRIC Co., Ltd., Brown's Lane, Coventry, have vacancies for development engineers, senior development engineers, mechanical and electronic, for their development laboratories on work of national importance; fields include microwave and pulse applications; salary range £400—£1,250 per annum; vacancies also exist for specialist engineers in component design, valve applications, electro-mechanical devices and small mechanisms; the company's laboratories provide excellent working conditions with social and welfare facilities, superannuation scheme; assistance with housing in special cases.—Apply by letter, stating age and experience, to The Personnel Manager (Ref. CHC). [7217

RADIO service technician required to do the more difficult repairs at the works of accredited dealers in North-east England (Yorks, Northumberland and Durham, with occasional visits to Cumberland, Westmorland and Carlisle); experience in repair of radios in general and car radios in particular essential; personality and technical knowledge important; directly responsible to area manager; starting salary £416-£494 p.a., according to qualifications, plus profit sharing; good prospects of advancement, pension scheme; interview in London or, by special appointment, in Wakefield area.—Apply, quoting ref. RDM, to Staff Personnel Manager, S. Smith & Sons (England), Ltd., Cricklewood Works, N.W.2. [7478

ELECTRONIC engineers; attractive positions are available in the organization of a large manufacturing company located in Lancashire; three engineers are required with scientific and fundamental knowledge of electronic component parts and their functional circuits with application to storage principles and binary system; three other engineers wanted with knowledge and experience of electronics which will enable them to reduce to practice developments resulting from research carried out by first three engineers, to provide signalling storing and transmitting systems for telecommunicating purposes.—Applicants should reply, stating age, experience and salary required, to Box 262, Dorland Advertising, Ltd., 18-20, Regent St., London, S.W.1. [7534

WORKS study engineer required by Marconi's Wireless Telegraph Co., Ltd., Chelmsford; applicants should be familiar with all aspects of light engineering as applied to jobbing and batch production of radio and radar equipment; practical experience of planning, time study, and motion economy technique essential, together with a general knowledge of incentive schemes applicable to the above type of work; applicants must be capable of conducting investigations into conditions of work surrounding both direct and indirect workers and presenting data in a logical form for management consideration; salary will be by arrangement and dependent upon the applicants' qualifications and experience.—Please apply, giving full details and quoting reference number 930 to Central Personnel Services, The English Electric Co., Ltd., 24-30, Gillingham St., London, S.W.1. [7554

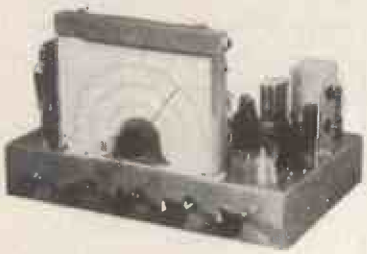
MINISTRY OF CIVIL AVIATION, Telecommunications Technical Officers. The Civil Service Commissioners invite applications from men for pensionable posts. Candidates must be at least 23 and under 28 years of age on August 1st, 1951, with extension for regular service in H.M. Forces. They must possess (a) the Ordinary National Certificate in Electrical Engineering, or (b) City and Guilds Intermediate Certificate in Telecommunications Engineering, plus City and Guilds Certificate Radio III, or (c) City and Guilds Certificates Telecommunications Principles III and Radio III, or (d) produce evidence of an equivalent standard of technical education. Candidates must also have had not less than 8 years' experience in an appropriate telecommunications field, including manufacturing or maintenance or operating in industry or a Government Department or the Armed Forces.

THE London salary scale is £400-£575 (rather less in the provinces), but to the minimum will be added £20 for each year above 23, but not exceeding age 28. Prospects of promotion.

FURTHER particulars and application forms from Civil Service Commission, Scientific Branch, Trinidad House, Old Burlington St., London, W.1, quoting No. S207/51. Completed application forms must be returned by November 10th, 1951. [7512

AN attractive engineering career in The English Electric Group of Companies will be available to a number of young engineers who have completed recognised apprenticeship in electrical or mechanical engineering, preferably with manufacturing firms; some of the vacancies call for a minimum academic standard of Higher National Certificate, while others will require a good honours degree in engineering; applicants are asked to state (1) their own preference for the type of equipments in which they are most interested, and (2) whether their interests lie in the commercial, design, development, production or research departments; previous experience in these fields is not essential; it is the company's policy wherever possible to place suitable men in the type of work which they themselves prefer and preliminary interviews will be arranged to discuss possible openings.—Please apply, quoting ref. 454, to Central Personnel Services, English Electric Co., Ltd., 24-30, Gillingham St., London, S.W.1. [7423

FIDELIA *De luxe*



Luxury 9 valve Radiogram chassis with 20-20,000 cycles audio response and triode push-pull output stage, £28/5/-.

Our range of Fidelia chassis will shortly include a new 10 valve model—the Major. This model has increased R.F. sensitivity over our popular "de luxe" model. The Major will be built in two sections, all controls being mounted on the R.F. section. The audio and mains components, being rather heavy, will be mounted on a separate chassis. The price will be £31/10/-.

Our range also includes
Fidelia Standard 7 valve model, £21/15/-.
Fidelia Plus 8 valve model, £24/5/-.
Technical data sheets willingly sent on request.

Owing to the very difficult raw materials position we suggest that, should you propose buying one of our chassis in the future, you send us a provisional order at once, and so avoid disappointment.

ELECTRO Acoustic DEVELOPMENTS

18 Broad Road, Willingdon, Eastbourne

WILCO ELECTRONICS

METAL RECTIFIERS.—12 v. 1 amp., 12/6; 6 v. 1 amp., 10/6; 48 v. 150 m/a., 10/-; All Bridge type. Post 1/-.

ACCUMULATOR CHARGERS in black crackle case with fuses and meter. 6 and 12 volts at 4 amps. Bargain Price, £4/19/6. Pkg. and carr., 5/-

SLOW-MOTION DIALS. 6in. Scaled 0-100, reduction 200 to 1 or direct, ideal for wavemeters, signal generators, etc. Our price, while they last, 5/6 each, post 1/-.

POWER PACKS. Input 110-230 volt A.C. Output 250 volt, 80 m/a., 6.3 volt 1 amp., 6.3 volt .5 amp. Complete with 5Z4G valve, in steel case. Only a few left at the amazing price, 50/-. Carriage and packing, 2/6.

CONDENSERS. Block type. 8 Mfd. 750 v. D.C., 10/6 ea.; 10 Mfd. 1,000 v. D.C. 15/- ea.; 10 Mfd. 1,500 v. D.C., 23/- ea.; 1.5 mfd. 4,000 v. D.C., 25/- each.

0/50 MICROAMMETER 2½in. Flush type contained in Test Set 28. A very sensitive meter only 50/-.

GERMANIUM CRYSTAL DIODES. Midget size wire ends, 4/6 each.

AIRCRAFT CLOCKS with splendid 8-day jewelled movement. Flange type, made to stringent Govt. specification. Brand new, guaranteed. Ideal for car, study, bedroom, etc., Special offer, 65/- each. Post free.

SLOW MOTION DRIVE. Muirhead, Ratio 50-1. 8/6. Post 1/-.

AMPLIFIERS. 50 watt "Tannoy" Rack mounting, less valves, only £8/10/- to clear. Carriage 7/6.

The transformers and chokes are guaranteed O.K. but some small components may require replacing, and wiring renewed. 4 amplifiers on one P.O Rack for £25.

AMPLIFIERS. 15 watts, Marconi Type 6, using 2-PX25, MHL4, rack mounting, complete with power pack, 200 to 250 volts 50 cycles, meter, etc., with valves, £8/10/-, less valves, £6. Carriage 7/6.

204 LOWER ADDISCOMBE ROAD, CROYDON.

JUNIOR engineers required for assisting in the development and production of highest grade television transmissions and other equipment; applicants should possess sound fundamental knowledge of both radio and television practice, be capable of wiring to a high standard and of producing own component layouts; City & Guilds, Higher Nat. or similar qualifications an advantage, but comprehensive practical experience may be acceptable; 5-day week, pension scheme.—Write, stating age, experience and salary required, to Cinema-Television, Ltd., Worsley Bridge Rd., Lower Sydenham, S.E.26.

ELECTRONIC engineers are invited to apply for an appointment in the research laboratories of the English Electric Valve Co., Ltd., at Chelmsford, to work on the development of experimental television circuits; applicants should have considerable experience of this type of work, with particular reference to camera tubes, together with a Science Degree or equivalent qualifications; remuneration will be dependent on qualifications and experience and the position will offer ample scope for advancement.—Please write, giving full particulars and quoting Ref. 440B, to Central Personnel Services, The English Electric Co., Ltd., 24-30, Gillingham St., S.W.1.

PRODUCTION Inspectors are required at a number of Admiralty Establishments and in shipbuilding and industrial centres in various parts of the country. The duties involve work in connection with the manufacture, inspection, test and installation of a wide variety of mechanical, electrical and electronic equipment for H.M. Ships. Candidates, who must be at least 25, should have served a recognisable engineering apprenticeship or have had equivalent training, followed by at least three years' relevant experience in industry or Government service. They should preferably be in possession of Higher National Certificate or equivalent; a lower qualification such as Ordinary National Certificate might however be considered. Ex-Service personnel with appropriate training and experience are eligible to apply. Appointments will be unestablished, but successful candidates will have opportunities at a later date of competing for permanent posts. The salary scale is £570×£20—£675 per annum and entry will be at the minimum, subject to a deduction of £20 for each year by which the age at entry falls short of 30. Rates outside London are a little lower. Write quoting D.33/51-A to the Ministry of Labour and National Service, Technical and Scientific Register (K), York House, Kingsway, London, W.C.2, for application form which must be returned completed by November 8, 1951.

ELECTRICAL and electronic engineers required by Ministry of Supply in London; Malvern, Worcs; Chertsey, Surrey; Bromley and Sevenoaks, Kent; with some posts elsewhere (including Bucks and Berks); qualifications: British, of British parents; engineering apprenticeship or equivalent training and either corporate member of Institution of Civil, Mechanical or Electrical Engineers or associate fellow Royal Aeronautical Society, or appropriate professional attainments or experience; duties: design and development of equipment and installations or standardisation, or planning and progressing, or control of production or inspection of radio, radar and general electrical apparatus for airborne equipment, navigational aids, test and measuring equipment, flight instruments, air and ground communications, guided weapons, fighting vehicles, electro mechanical and servo systems, weapons and fire control; also general installation and maintenance of electrical equipment, plant and factory services; salaries: between £575 and £1,200 (London) with a few posts up to £1,450 a year, dependent on qualifications and experience; rates in provinces and for women slightly lower; posts are unestablished, but periodical opportunities arise to compete for established pensionable posts; paid sick leave, annual leave initially 25 days (30 in London) plus public holidays, normal working week 44 hours; candidates' preference for a particular area will be met if possible.

APPLICATIONS on form from Ministry of Labour and National Service, Technical and Scientific Register (K), York House, Kingsway, W.C.2, quoting reference No. D408/51-AEO.

SITUATIONS WANTED

RADIO engineer, aged 36, accustomed to responsibility, desires post as test equipment engineer or development engineer.—Box 4507.

EXECUTIVE (36), A.M.I.E.E., 16 years' exp. for all spheres electronics industry, also TV aerial design, production, seeks change.—Box 4604. [7589

ADVERTISER, 37, first-class P.M.G., ten years' marine experience, plus servicing, amateur transmitter building.—Write BM/TBGK, London, W.C.1. [7568

SENIOR television engineer, specialising television since 1934, radio 1925 experience television development, technical sales, service supervision and organisation, aerial installations, television distribution equipment, technical advertising and service literature, technical correspondence, conference work, car; desires post West London or west country.—Box 4313

BUSINESSES FOR SALE AND WANTED

WIRELESS college, old established and flourishing business for sale as a going concern, owner retiring; sale can include freehold buildings or these can be leased to purchaser.—Write first instance, Box 1951, Glovers Advtg., Ltd., 30, Bouverie St., London, E.C.4.

LONDON, N.W.7.—Magnificently situated wireless and television business for disposal as a going concern advantageous terms on lease and excellent annual turnover; price for lease, equipment and goodwill, £3,000; s.a.v.—Gladding, Son & Wing, Chartered Surveyors, 8-11, Pavilion Buildings, Brighton. [7548

PITMAN
Radio Books

★

AC/DC Test Meters

By W. H. Cazaly and Thomas Roddam. Describes the principles, circuit design and construction of multi-range test instruments of workshop grade used for measuring voltage, current, resistance and capacitance, and low power at audio frequencies. With 112 illustrations. 18s. net.

The Principles of Television Reception

By A. W. Keen, M.I.R.E., A.M.BRIT.I.R.E. A systematic treatment, including a stage-by-stage examination of the receiver, and a review of the problem of natural-colour television. Illustrated. 30s. net.

"A very readable account . . . should find a place on the shelves of every television technician or student."—*JOURNAL OF THE BRITISH INSTITUTION OF RADIO ENGINEERS.*

Echo Sounding at Sea

By H. Galway. A guide to basic principles and present-day techniques, with a detailed account of the Hughes and Marconi types of equipment. Illustrated. 35s. net.

PITMAN
Parker Street, Kingsway, London, W.C.2

MODERN ELECTRICS LTD.

164, CHARING CROSS RD., LONDON, W.C.2

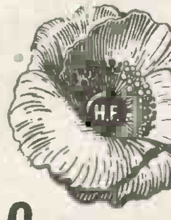
Phone: TEMple Bar 7587

Export Enquiries Welcomed

STILL IN STOCK—
ALL GOODS ADVERTISED IN LAST ISSUE

IT WILL BE WORTH YOUR WHILE
to watch for our space in December issue

Remember



Generously

SAT-NOV 10

ELECTRONICS
DUPLEY
LTD.
CRANMER AV. EALING.W 13.

Transformer and Coil Manufacturers to the Trade
Telephone: EALing 5688

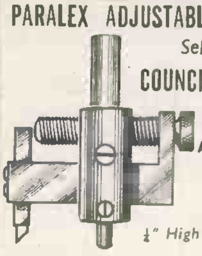
RELAYS 10 ohm to 42,000 ohm. Aerials 12ft. screw-in type 7/6, reduction quantity. **EVERSHED OHMMETERS.** Ex-Govt. twin scale, 0-1,000 and 0-200,000 with prods, complete in leather case, price £5.10.0. Yaxleys, Key Switches, many other bargains.

Send for Catalogue

L. C. NORTHALL
16 Holly Road, Quinton, Birmingham, 32
Retail: 416 High Street, Smethwick Phone: WOO 3166

PARALEX ADJUSTABLE HOLE CUTTER

Selected by the
COUNCIL of INDUSTRIAL DESIGN



A PRECISION TOOL

Capacity 1" to 4"

Vernier adjustment

¼" High Speed 18% Tungsten Toolbit

P.L. round parallel shank **16/-** each (incl. post) essential parts case-hardened

Wholesale and Export Enquiries solicited

ALFA PRECISE INSTRUMENT CO.,
111, Greencroft Gardens, London, N.W.6

RECTIFIERS

IMMEDIATE DELIVERY.
NEW METAL RECTIFIERS (Selenium)
All ratings from ½ Amp. to 200 Amp.

A few examples :-

Full wave bridge, Input 18 V. Output 14 V ½A 7/6, 1A 11/-, 2A 16/-, 5A 28/-, 10A 51/-, 20A 96/-. Input 36 V Output 28 V ½A 13/6, 1A 20/-, 2A 29/-, 5A 51/-, 10A 89/-, 20A 162/-. All post free.

Special rectifiers at short notice.

Trade enquiries also invited.

MOON METAL LABORATORY
16, Montague Road, Sale, Manchester
Tel. Sale 5851

PAINTS, CELLULOSE, ETC.

PAINT spraying handbook 3/6, post free; cellulose and synthetic paints and all spraying requisites supplied; catalogue free.—Leonard Brooks, 53, Harold Wood, Romford. [0207

TECHNICAL TRAINING

TELEVISION

THE GOTHIC TELEVISION SCHOOL, devoted exclusively to training in television, prepares students to Brit.I.R.E., and R.T.E.B. examination standards; correspondence course prospectus from the Principal, Gothic Television School, 13, North Avenue, London, W.13. [0651

CITY & GUILDS (Electrical, etc.), on "No Pass—No Fees" terms. Over 95% successes. For full details of modern courses in all branches of Electrical Technology send for our 144-page handbook, free and post free.—B.I.E.T. (Dept. 388A), 17, Stratford Place, London, W.1.

TUITION

RADIO training.—P.M.G. exams. and I.E.E. Diploma; prospectus free.—Technical College, Hull. [0111

WIRELESS operating; attendance and postal courses.—Stamp for reply to Manager, The Wireless School, Manor Gdns., London, N.7.

NOTHING succeeds like success! What we have done a thousand times we can do again, for you.—See the B.N.R.S. advt., page 98.

SEE the world, 600 Radio Officers required; send 2d stamp for prospectus to Britain's leading college; we train most, in shortest period, at lowest cost.—Wireless College, Colwyn Bay.

A.M.I.Mech.E., A.M.Brit.I.R.E., City and Guilds, etc., on "no pass—no fee" terms; over 95% successes. For details of exams and courses in all branches of engineering, building, etc., write for 144-page handbook—free—B.I.E.T. (Dept. 387B), 17, Stratford Place, London, W.1. [0118

TELEVISION postal course for radio trades Examination Board's diploma; also postal courses for P.M.G. 2nd and 1st class Certificates and Amateur Radio Transmitting licence.—Apply British School of Telegraphy, Ltd., 179, Clapham Rd. London, S.W.9. (40 years' experience in coaching students in wireless telegraphy and allied subjects.) [0124

THE 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

FREE! Brochure giving details of home study training in radio, television, and all branches of electronics, courses for the hobby enthusiast or for those aiming at the A.M.Brit.I.R.E., City and Guilds Telecommunications, R.T.E.B., and other professional examinations; train with the college operated by Britain's largest electronic organisation, moderate fees.—Write to E.M.I. Institutes, Postal Division, Dept. W.W.28, 43, Grove Park Rd., London, W.4. Chiswick 4417. (Associated with H.M.V.) [0001

BOOKS, INSTRUCTIONS, ETC.

I.P.R.E. Technical Publications: 5,000 alignment peaks for superheterodynes, 4/9 post free; The Practical Radio Engineer, quarterly publication of the Institute, sample copy 2/- post free; membership and examination data 1/- post free.—Secretary, I.P.R.E., 20, Fairfield Rd., London, N.8. [0089

CHAFFEY-CONSOLE

Designers & Manufacturers of

CABINETS

6, SEFTON RD., PETTS WOOD, KENT
Tel.: Orpington 3559

BOROUGH OF SOUTHGATE

SUPPLY OF MOBILE PUBLIC ADDRESS EQUIPMENT.

The Southgate Borough Council invite Tenders for the supply of 100 watt Mobile Public Address Equipment.

Contract Documents and Instructions for tendering may be obtained on written application to the Borough Engineer and Surveyor, Town Hall, Palmers Green, N.13.

GORDON H. TAYLOR
Town Clerk.

Town Hall,
Palmers Green, N.13.
26th September, 1951.

B. & H. RADIO
EAST STREET, DARLINGTON

BASS & TREBLE SEPARATOR
Enables the use of separate speakers for Bass and Treble. Permits adjustment of treble and matches up speakers of different impedance. Kit of Parts £1 13 6

SCRATCH FILTER
Easily fitted to pick-up and gives marked reduction of scratch 17 6

WHISTLE FILTER
is very simply inserted in speaker wiring and completely eliminates 9 Kc/s. whistle £1 15 0

A.F. and R.F. COILS rewound or wound to specification.

EXCEL SOUND SERVICES LTD.

are pleased to announce that they are now accepting orders for their Tape Recorders.

Trade enquiries invited

49, BRADFORD ROAD, SHIPLEY, YORKS.
Telephone: Shipley 55779 & 51291

—AUTOMATIC SWITCHES—
(RECONDITIONED)

ELECTRIC 1 to 100 AMPS.
CLOCKWORK 7 to 35 DAYS

From **35/-** EACH

All guaranteed for a year.

Write for illustrated list:

DONOHOE'S (Timers), 6, GEORGE ST., NORTH SHIELDS, NORTHUMBERLAND.

HIFI LTD., 150, HIGH STREET, LYE, STOURBRIDGE, WORCS. Telephone: LYE 261

TRANSFORMERS

FOR ALL PURPOSES
SINGLY OR IN QUANTITIES
FROM OUR STANDARD RANGE
OR TO YOUR SPECIFICATIONS

GOOD DELIVERIES
REASONABLE PRICES

We have also a department for rewinds giving you a 24 hour service and a better job. Please label all burnt-outs with your name and address when despatching

P. HOWORTH
51 POLLARD LANE · BRADFORD
Tel.: 37030

RELAYS AND KEY SWITCHES

LARGEST EX-GOVT. STOCK IN GT. BRITAIN

Types 600-3000 Relays—Siemens High Speed
Also A.C. 400 volts 50 cycles

Uniselector Switches, Telephone Switch-boards, Telephone Components, Plugs, Jacks, Handsets — Government Contractors.

JACK DAVIS (RELAYS) LTD. (DEPT. W.)
36 PERCY STREET, LONDON, W.1
Phones: MUSeum 7960 LANgham 4821

WILKINSON'S OF CROYDON

SIGNAL AND NOISE GENERATOR. Test Set 210. Range 20 to 88 Mc/s in 4 Bands. Crystal Controlled, 2 Crystals, Vernier adjustment, Brand New. Input 80 and 115 Volts 1,000 Cycles, £20, or 230 Volts 50 Cycles, £25.
ELECTRONIC IGNITION TESTER. Type U.E.D. English Electric. Incorporating Cathode Ray Tube giving a visual trace of the complete ignition cycle enabling the electrical performance of the entire system to be observed whilst the engine is running. Operates on 230 Volts A.C. also 6, 12 and 24 volts D.C. Brand New. £35.
SIGNAL GENERATOR. No. 1-222a with Range Calibrator 1-223a H.F. Range 150 to 230 M.C. L.F. range 8 to 15 M.C. Crystal Controlled. For 117.5 Volts Operation. Supplied in Chest with lead, plugs and sockets, £45.
TEST SET 205. Wavemeter range. 3.05 to 3.35 centimetres, built-in oscillator with 9 valves including Klystron type CV.129, etc., in good condition. £20.
PHOTOMULTIPLIER NO. 931A. With network Contained in transmitting unit APQ9. £5. Cge. and pkg. 10/-.
We hold very large stocks of RELAYS, CONDENSERS, RACKS FOR 19in. PANELS, SLYDLOK FUSES, SANTON AND ARROW SWITCHES,

19 LANSDOWNE ROAD, CROYDON CRO 0839

POLYTHENE H. F. EQUIPMENT

(AMBYTHENE BRAND)

COIL FORMERS
CHOKES
STAND-OFFS
FEED-THROUGHS

Send for Particulars and Samples

AMPLEX APPLIANCES (KENT) LTD.
19, DARTMOUTH ROAD, HAYES, BROMLEY, KENT
(RAVensbourne 5531)

COILS • COILS • COILS

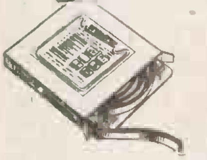
T.R.F. • SUPERHET • FILTERS • PACKS
TELEVISION COILS • I.F. TRANSFORMERS

FOR DEPENDABLE COMPONENTS CONTACT

OLYMPIC RADIO COMPONENTS
COIL WINDING SPECIALISTS & MANUFACTURERS
224, HORNSEY RD., N.7. NORTH 2914

STIKASTRIP

A CLATONRITE PRODUCT



STIKASTRIP, the adhesive sponge-rubber sealing strip, sticks to wood, metal, glass and other surfaces, and has hundreds of practical uses. For car ventilators, bonnets, headlamp gaskets, and in many other places where cushioning or weather-stripping is required.

STIKASTRIP stops draughts, rattles, and absorbs vibration.
Supplied in 10 ft. rolls in carton ; in several sizes, from 3s.6d. per carton

HOWARD CLAYTON - WRIGHT LTD.
WELLESBOURNE, WARWICKSHIRE. Tel.: Wellesbourne 316/7/8

DEALERS & SERVICE ENGINEERS

HOME AND OVERSEAS TRADE

Large stock of servicing accessories for Radio and Television Receivers.

COILS — POTENTIOMETERS — RESISTORS — LOUDSPEAKERS
CONDENSERS — MAINS TRANSFORMERS — CHOKES

Many other useful, low-priced items.

Send for our monthly bulletin, which always announces special bargain lines.

Trade only supplied.

V.E.S. WHOLESALE SERVICES LTD.,
11, GUNNERSBURY LANE, W. ACTON, W.3.
Telephone: ACOrn 5027.

CONDENSERS	Silver Mica · Tubular · Mansbridge
CRYSTALS	American · British
HEADPHONES	High and Low Impedance
METERS	Thermo · Moving Coil · Moving Iron
PLUG & SOCKETS	All Types
RESISTORS	Carbon and wire wound
VOLUME CONTROLS	Carbon and wire wound

We hold large and comprehensive stocks of new components and units, both Government and Manufacturers' Surplus

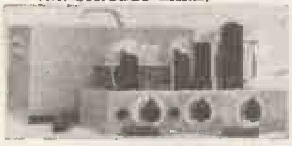
No. 19 Set, Equipment Available.

Wholesale and Export Only.

ANDERS RADIO LTD.
167, HAMPSTEAD ROAD, LONDON, N.W.1
EUS.: 1639 EST. 1928

PRATTS RADIO

1070 Harrow Road, London, N.W.10
(Nr. SCRUBBS LANE) Tel. LADbroke 1734



MODEL AC10E £9/18/6

AMPLIFIERS. College general purpose units. MODEL AC10E. 4 valve 10 watts. Neg. feedback, £9/18/6. MODEL AC18E, 6 valve; 18½ watt P/P output. Feedback over 3 stages, £14/14/-. MODEL AC32E, 32 watts P/P output. Feedback over 3 stages, £18/18/-. MODEL U10E, for DC/AC mains, 6 valve 10 watt P/P output. Feedback over 3 stages. £12/12/-. All are complete with cases and chrome handles. They have a separate microphone stage. Separate inputs for mike and gram., allowing individual mixing, etc. Outputs match 3, 8 or 15 ohm speakers. Max. input volts required for full stated output average Mike .003, Gram. .3 v. MODEL AC8C, 5 valve P/P 8-10 watt unit for records, radio, etc. Feedback over 3 stages. Output to 3, 8, 15 ohms. £9/18/6. MODEL AC4C, 3 valve record/radio amplifier, 4 watts to .3 ohms, £5/9/6. Ditto U4C for DC/AC mains, £5/9/6. Stamp for list. Full range of accessories available, including: Rothermel Crystal Mikes, 105/-; Goodmans 12in. P.M. speaker, £8/12/6: Collaro A.C. Record Players, rim drive, magnetic model, £6/9/-. Crystal, £6/15/-. Jack plugs 1/6 each extra.
Nearest Station: Kensal Green.

INDEX TO ADVERTISERS

Printed in Great Britain for the Publishers, ILIFFE & SONS, LTD., Dorset House, Stamford St., London, S.E.1, by THE 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. INDIA: A. R. 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.

Condenser leadership —from the inside!

★Terminal hermetically sealed: two pronged soldering tag.

★Robust bakelite case: maximum path between terminals to avoid possible flash-over.

★Series wound element: conservatively rated to provide ample safety margin.

★"Visconol" impregnation and filling for safe H.V. working; prevents arcing or brushing.

★Hermetic sealing on to special gasket avoids reliance on soldered joints.

★Sturdy one-hole fixing.

★Suitable for use in conditions of tropical humidity.

The unique design of these chassis-mounting Condensers renders them eminently suitable for television and allied high voltage applications up to 50,000 v. where exceptionally stringent conditions are likely to be encountered. They are processed with the newly developed impregnant "Visconol," which affords the advantages of adequate voltage rating and low power factor, whilst improving the stability of the dielectric and its power to withstand sharp-front short-time surges. Wide range of working temperature, −40°C. to +71°C., ensures reliable operation under most stringent conditions.

Anti-Corona Rings are now available for the higher voltage ratings throughout the range.

TCC

'VISCONOL (REGISTERED) CATHODRAY' CONDENSERS

THE TELEGRAPH CONDENSER CO. LTD · *RADIO DIVISION* · LONDON · W.3 · Tel: Acorn 0061 (9 lines)