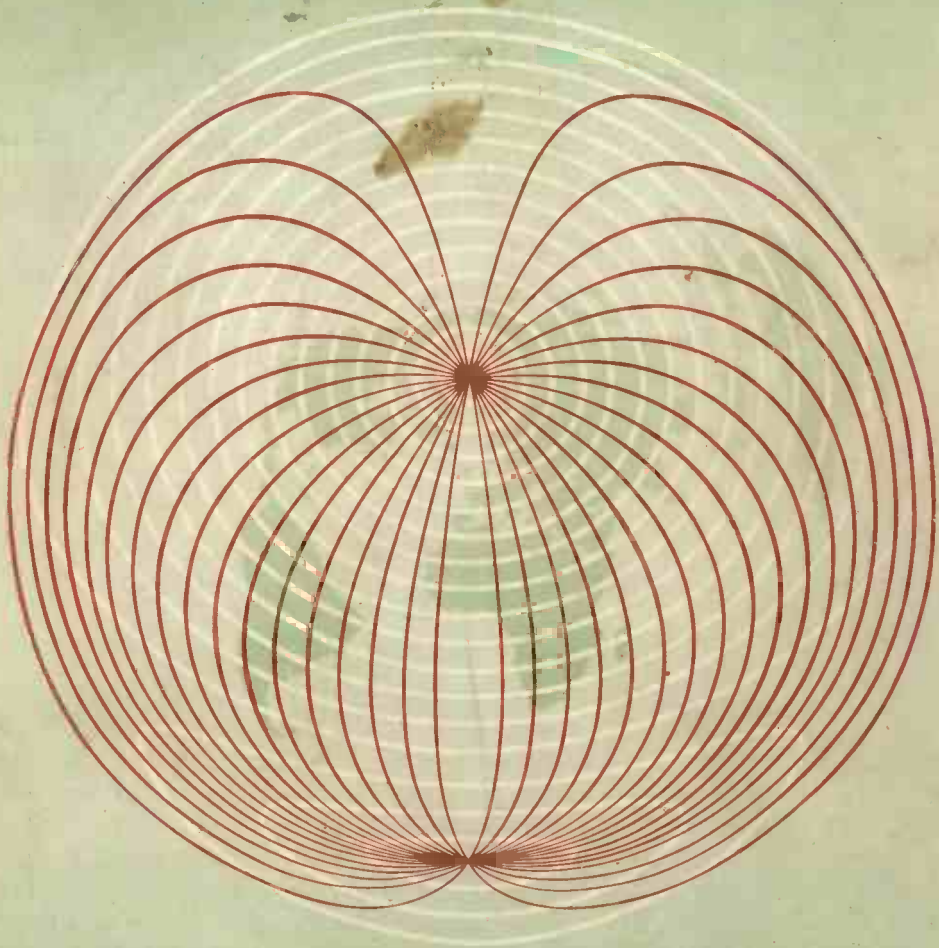


Wireless World

DECEMBER 1953

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Wireless World

RADIO, TELEVISION
AND ELECTRONICS

43rd YEAR OF PUBLICATION

Managing Editor: HUGH S. POCOCK, M.I.E.E.
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DECEMBER 1953

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DECEMBER 1953

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Home Recording and the Law

UNTIL the domestic tape recorder became commonplace, the legality or otherwise of making recordings from broadcast transmissions was largely an academic question. The number of people capable of cutting a good disc was never significant, but now, with the help of a modern tape machine, almost anyone living in an area served with a good signal can, by choosing the best of the B.B.C. transmissions, make a recording that compares well with the average long-playing disc. The small amount of skill needed is easily acquired by many ordinary listeners, and the gear needed is neither highly complex nor unduly costly. Is there any legal barrier in the way of making recordings "off the air" in this way?

The question of copyright as it affects home recording has already been discussed in this journal. But there are other considerations, and the whole matter has been revived by a B.B.C. statement published in *Radio Times* of October 23. The statement reads:—

"We have been asked to remind listeners to B.B.C. programmes that in view of the provisions of the Dramatic and Musical Performers' Protection Act, 1925, it is, in certain circumstances, an offence to make recordings by means of tape equipment or otherwise of any dramatic or musical work broadcast by the Corporation without the consent in writing of the performers. Moreover, the making of unauthorized recordings of any copyright material included in B.B.C. programmes may also constitute an infringement of the provisions of the Copyright Act, 1911.

"The Corporation cannot undertake to secure the consent of performers and owners of copyright material on behalf of parties wishing to record programmes broadcast by the Corporation."

That statement, though strictly accurate so far as it goes, tells only a part of the story, and is liable to confuse the great body of listeners and potential home recordists.

Let us first consider the effect of the Dramatic and Musical Performers' Protection Act. True, that Act makes it an offence to record directly or "indirectly" (e.g., through broadcasting) or to sell, hire

or use for public performance any recording made without authority. What the B.B.C. statement does not mention is the highly relevant proviso that the home recordist has a valid defence if he can prove that the recording was not made for "purposes of trade." Thus it is quite clear that the private individual who makes a recording for his private use—and not for gain—does not commit any offence under the Act.

The ordinary home recordist's position under the Copyright Act is almost equally clear. The essence of the matter is that, for an infringement to be committed, the recording must be played back in circumstances that introduce some element of "public performance." In defining the word "public" the law takes quite a narrow view; for instance, performance in a club to which members only were admitted would almost certainly be ruled to be in public. Also it is not necessary for an admission charge to be made in order to bring the performance into the "public" category. What seems quite certain is that playback of a recording made "off the air" is not an infringement if done in the recorder's own home, with an audience limited to his family or intimate circle of friends.

All this seems to be in accordance with common-sense, and we believe that neither performers or copyright holders are likely to suffer in the long run through the growth of home recording. Indeed, it may stimulate public interest in what they have to offer, just as broadcasting stimulated the sale of gramophone records.

There remains the possibility that the law of copyright may soon be altered, but that seems unlikely to affect the position. The present Act is overdue for revision, but the Report of the Copyright Committee 1952, on whose recommendations the revision will presumably be based, did not touch on the subject of recording "off the air."

Finally, it should be emphasized that those who use the B.B.C. transmissions without authority to make recordings for sale or public performance do most certainly infringe the law, and no doubt the B.B.C. warning was directed against those who are "pirating" the Corporation's transmissions in this reprehensible way.

Pocket Reactance and Resonance Calculator

By

V. J. TYLER,
B.Sc., A.M.I.E.E.

Covering Twelve Decades Without Ambiguity

LIFE is too short to calculate every minor value in an electronic circuit design; such things as bypass capacitances and stray inductances are often assessed by experience or intuition. But where a quick and reliable aid to calculation is available it is possible to be more meticulous in design and leave less to be determined by trial and error. I say "reliable" rather than "accurate," because normal tolerances do not permit of accurate design where valves are concerned; but it is of vital importance that one should, for instance, be sure of the position of the decimal point in a calculated value.

The calculator (Fig. 1) is intended as such an aid and deals comprehensively with the quantities capacitance (C), inductance (L), frequency (f), capacitive reactance (X_C) and inductive reactance (X_L), under conditions of resonance or otherwise.

Where two of the quantities C, f and X_C are known, the third can be found directly; similarly the quantities L, f and X_L can be dealt with. Where a resonant circuit is involved (i.e., where $X_C = X_L = X$) the fixing of any two of the quantities C, L, f and X automatically fixes the other two, and both can be found directly.

The calculator consists (Fig. 2) of three Perspex discs, calibrated with logarithmic scales, interleaved with three cursor discs. The outer "C" disc and middle ("f") disc form a circular slide rule connecting

C, f via the fixed cursor lines. X_C is read on the middle scale against an index mark on the outer one. The middle and inner discs form a similar slide rule connecting L, f and X_L .

Since a common " f " scale is used for both rules, the X_C and X_L scales increase in opposite directions and cannot be replaced by a common scale. Where resonance is considered, X_L and X_C are made to have equal values by balancing the "resonance diagram" in the centre of the calculator. The diagram is a combination of lines engraved on the various transparent discs. The design on the "C" disc consists of a ring of diagonal lines one of which terminates in an approximately "equi-angular" spiral. The "L" disc diagram is the exact mirror-image of the "C"

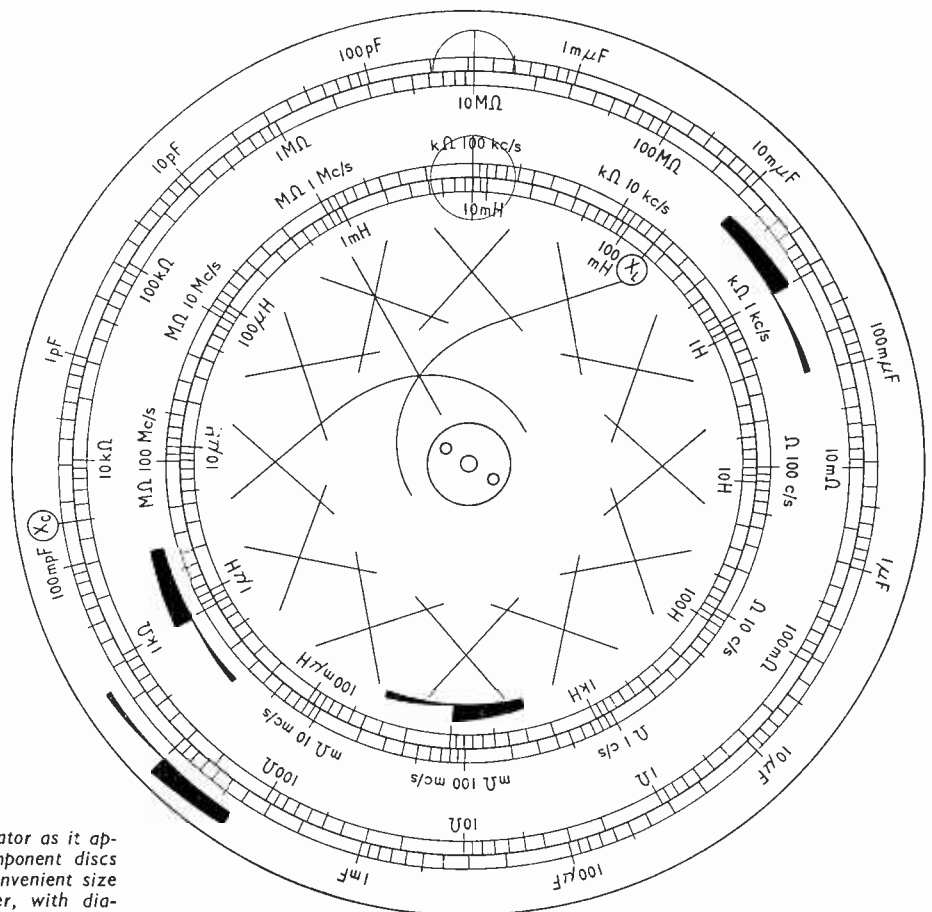


Fig. 1. Complete calculator as it appears when the six component discs are superimposed. A convenient size is $4\frac{3}{4}$ in outside diameter, with diameters of $4\frac{1}{4}$ in and 3in for the other discs.

disc diagram. The radial line on the "f" disc is engraved on both sides of the Perspex to minimize parallax error. "Balancing" the diagram consists of making the radial line pass through the intersection of the two spiral lines. This can be done by moving any one of the three discs, e.g., by moving the "L" disc to position (a), the "f" disc to position (b) or the "C" disc to position (c) (see Fig. 3). Since the spirals cut at a shallow angle, the initial accuracy of balancing is not high, but is sufficient to indicate with certainty which of the many intersections of the diagonal lines should be used to refine the balance and to achieve an accurate "cut" as shown at (d).

In actual use this process is quick and straightforward. The illustration of the "complete calculator" shows a worked example. Assuming, for instance, that the values given are $f = 100$ kc/s and $L = 7.9$ mH, the inner and middle discs are set to bring these values over the cursor line. The outer disc is then rotated until its spiral line passes through the intersection of the radial line and the other spiral line, and the "cut" refined on the outer diagonal lines. The capacitance can then be read off as 320 pF, and the reactance (either X_C or X_L) as 5 kΩ.

If greater accuracy is required the answer can be checked by calculation, using the appropriate simplified formula given in the table.

The positions of decimal points can be ignored when using the formulae to check results obtained by the

Resonant-Circuit Relationships			
Unknown Quantity	Equivalent in Terms of Known Quantities. Units either c/s, μF, H, ohms or Mc/s, pF, μH, ohms.		
X	$\frac{159020}{f \cdot C}$	$6.283 \cdot f \cdot L$	$10^3 \cdot \frac{L}{\sqrt{C}}$
f	$\frac{159020}{X \cdot C}$	$\frac{0.15902 \cdot X}{L}$	$\frac{159.02}{\sqrt{LC}}$
C	$\frac{159020}{X \cdot f}$	$10^6 \cdot \frac{L}{X^2}$	$\frac{25287}{f^2 \cdot L}$
L	$\frac{0.15902 \cdot X}{f}$	$10^{-6} \cdot X^2 \cdot C$	$\frac{25287}{f^2 \cdot C}$

calculator,* since the decimal position given by the calculator is quite unambiguous and cannot be in error by less than a million to one, which would be immediately obvious. Applying these formulae to the worked example above, we obtain 32009 and 49638 as more exact evaluations of C and X, giving final answers of 320.09 pF and 4963.8 ohms. In most cases, however, electronic circuit design does not justify such accuracy.

The core of the calculator is an assembly of metal

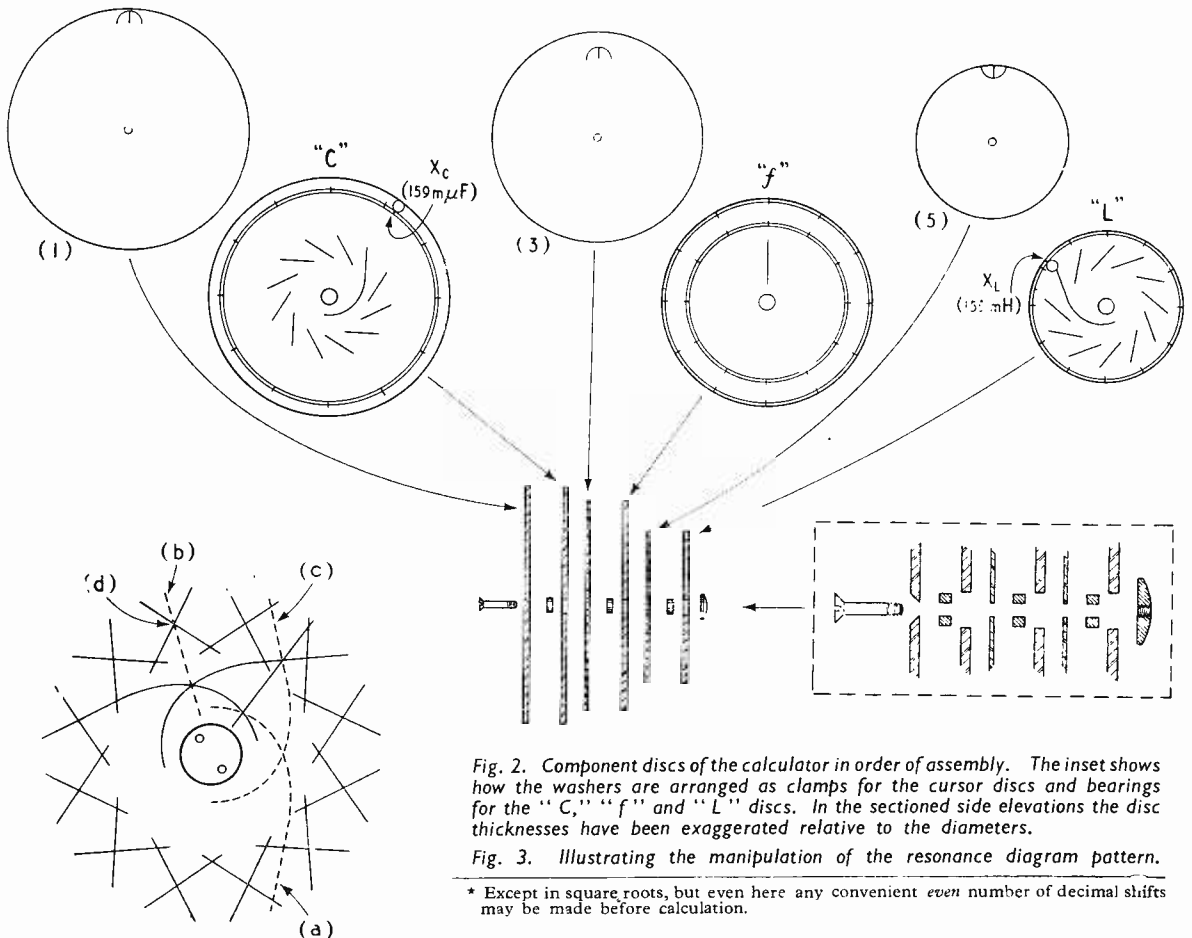


Fig. 2. Component discs of the calculator in order of assembly. The inset shows how the washers are arranged as clamps for the cursor discs and bearings for the "C," "f" and "L" discs. In the sectioned side elevations the disc thicknesses have been exaggerated relative to the diameters.

Fig. 3. Illustrating the manipulation of the resonance diagram pattern.

* Except in square roots, but even here any convenient even number of decimal shifts may be made before calculation.

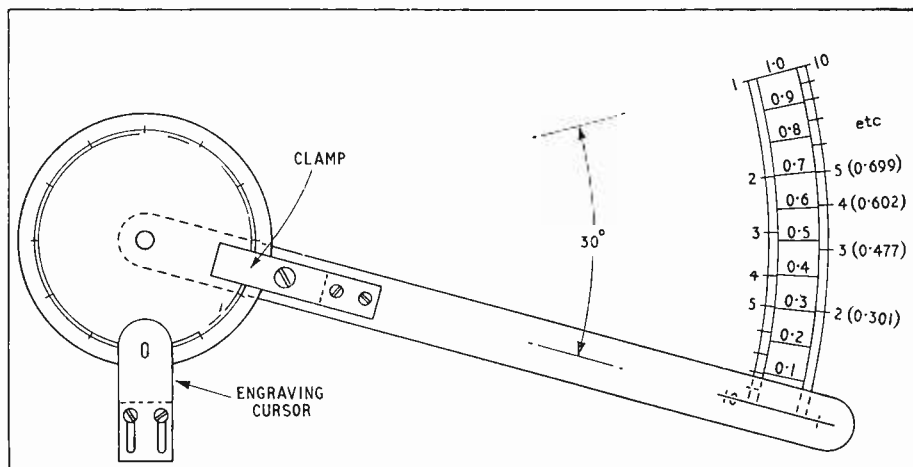


Fig. 4. Suggested method of dividing the scales. A radius of 19cm will give 10 mm per division (3 deg. of arc) on the centre scale.

spacers bolted solidly together with the cursor discs (1), (3) and (5). Disc (1) may be of aluminium, or, like the calibrated discs, of $\frac{1}{8}$ in thick Perspex. Most transparent materials other than Perspex warp to a saucer-shape in use. Discs (3) and (5) are of any transparent material, but are as thin as possible. Each of these discs has on it a cursor design consisting of a semicircle and radial line, the lines being accurately registered with each other when the assembly is bolted together. The spacers are dimensioned so that the calibrated discs turn freely upon them. When one calibrated disc is turned, the fixed cursor discs prevent it from disturbing the settings of the others. A calibrated disc is easily adjusted, using one or both thumbs on the scale surface, the fingers resting on the back of cursor disc (1).

Engraving the Scale

Although neater scales result from machine engraving, the scales can easily be made by hand using the arrangement shown in Fig. 4. The scale to be engraved is first divided into twelve equal parts by ordinary geometrical means, but using more than ordinary care. It is then set up on a board on a well-fitting pivot together with a Perspex arm which can be clamped to it by a simple friction device. An engraving cursor is also fitted to the board, having a slot in it which exactly fits either an engraving stylus or a set of punches (for various line lengths).

In use the engraved line on the Perspex arm is set to the appropriate end of the enlarged scale shown, and simultaneously the corresponding decade mark on the calculator scale is set up directly under the cursor slot. The clamp is then tightened up and the arm moved to the "2" position on the enlarged scale. A corresponding mark is made on the calculator scale by scratching through the slot with a stylus, or lightly tapping through with a punch. The arm is then moved to "3" and so on. All decades are marked in this way.

The enlarged scale is made by constructing geometrically a thirty-degree arc and dividing it up into ten equal divisions (which are themselves subdivided where necessary). On either side of this linear scale two logarithmic scales are drawn increasing in opposite senses. The value for each unit on the log scale is taken directly from a table of common

logarithms in the manner indicated. The log scale can be usefully subdivided, further than is shown, by making dots (not lines) on the calculator scale corresponding to 1.2, 1.4, 1.6, 1.8 and 2.5, but further subdivision is not recommended in a twelve-decade, pocket size calculator.

The spiral lines are engraved by marking out a thin template with a spiral more or less as shown (the exact shape not being important), cutting it along the marked line and smoothing it with a file. It is then used, after the fashion of a French curve, to engrave one scale, and is turned over to engrave the other.

The diagonal lines are made by marking out two rings of twelve dots each. The diameters of the rings are not important, but the dots must be exactly equally spaced, and one dot in each ring must lie exactly on the radius passing through the X_L or X_C mark. The appropriate dots are then joined by straight lines as illustrated. Unlike the spiral lines, the diagonal lines must be engraved as accurately as possible.

To minimize parallax, the engraving should be as follows:

- "C" disc (rear): "C" scale.
- " " (front): Resonance diagram and X_C index mark.
- "f" disc (rear): X_C scale and radial line.
- " " (front): f and X_L scale and radial line.
- "L" disc (rear): L scale, resonance diagram and X_L index mark.

The front of cursor disc (1) is sprayed white as a background for the scales and diagrams. The reactance scales and index marks are filled in red as a reminder that they are not read against the cursors. All other engraving is filled in black.

In practice the calculator has proved quicker, more certain and more convenient than either a reactance chart or an abac. A reactance chart demands a high degree of concentration if one is not to lose one's way among four mutually intersecting logarithmic scales. An abac gives sensible answers only to sensible questions, and is apt to exclude from the latter category queries concerning, for instance, the reactance of a microfarad at a megacycle, although such values are common in the design of decoupling networks. Moreover, neither kind of chart may safely be left to bang about a bench among soldering irons and flux pots, nor can either be carried in a pocket ready for immediate use.

Tape Recorder For Home Construction

Parts for Assembling Tape Mechanism and Amplifier

IT has been suggested, and is accepted in many quarters, that whereas the electrical side of a tape recorder is within the capabilities of the home constructor, the mechanical side is not. The sponsors of the "Sound Master" tape recorder have challenged this view with a kit of parts which includes the components for building the tape mechanism as well as the associated amplifier. True, the role of the constructor is limited to the assembly of parts which have been accurately machined for him by the Brenell Engineering Company, but is this very different from accepting ready-made valves as components for the amplifier?

Designed by W. I. Slack, who was also responsible for the "View Master" television kit, the "Sound Master" follows the best practice both in mechanical and electrical design. Three motors (by Collaro) are used in the tape drive, and the magnetic heads are made by Wright and Weaire; other firms collaborating in the supply of components are Bulgin, Mullard, N.S.F., Radio Resistor Company, T.C.C., and Whiteley Electrical Radio.

Three tape speeds are provided, $3\frac{1}{2}$, $7\frac{1}{2}$ and 15 in/sec. Speeds are changed by altering the position of the capstan flywheel driving belt under the top plate, or by fitting or removing a sleeve which increases

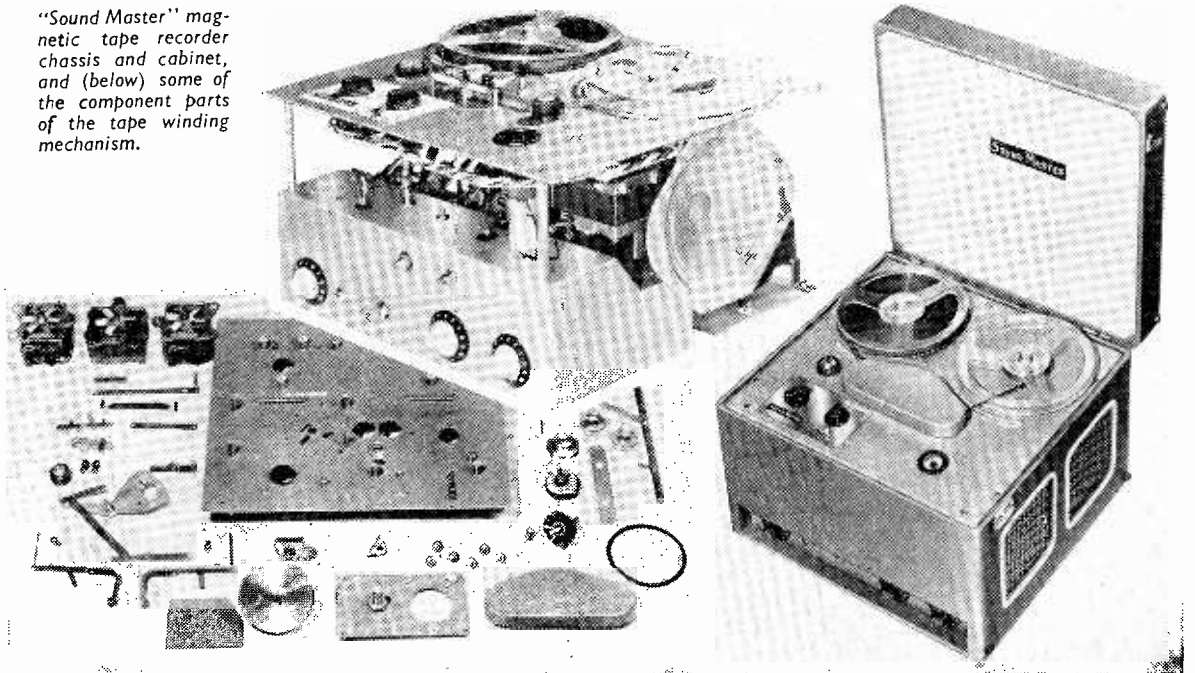
the diameter of the driving capstan. Either method is arranged to give a 2:1 change in tape speed.

Switching has been reduced to the practicable minimum, and a mechanical interlock is provided to prevent accidental erasure of recorded tape. In addition, a three-colour indicator lamp shows when the equipment is set for recording (red), rewinding (amber) or playback (green).

The performance of the complete equipment is very good, even when set up without the aid of special test instruments. The speed constancy of the tape is excellent and passes critical listening tests, both on recorded music and with constant-frequency inputs. Quality of reproduction depends upon the skill with which the bias and volume indicator circuits have been adjusted, but there is no reason why professional standards should not be reached with a little practice and a critical ear, or, better still, by the aid of a cathode-ray oscilloscope and an audio oscillator, as described in the instruction manual.

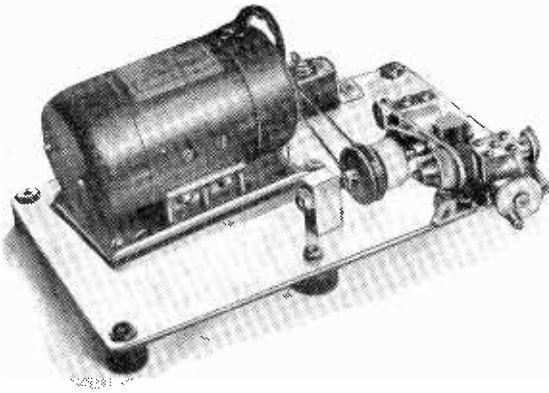
A kit of parts, excluding cabinet and microphone, costs £56 5s 10d. The W.B. cabinet costs £6 6s and the recommended Lustraphone microphone £5 15s 6d for the table model or £6 6s for the hand model. The instruction manual can be purchased separately for 6s 6d.

"Sound Master" magnetic tape recorder chassis and cabinet, and (below) some of the component parts of the tape winding mechanism.



Sharpening

Simple Machine Giving Well-shaped and Burnished Points



General view of sharpener with needle chuck locked in the grinding position.

IN the course of giving gramophone recitals in the North for over 20 years, the writer has met many owners of valuable record collections who have tried, with varying results, to use thorn or fibre needles, but who have given them up in favour of steel or sapphire, since they were unable to make a thorn last more than one side or less. Often these people had not the patience or the time, sometimes not even the inclination, to look for the cause.

So the general condemnation of thorn needles goes on. In reality the "object" used can hardly be termed a needle, and when highly magnified looks more like a poker than anything else. One would have thought that with a smooth groove surface finish, the thorn point also would be made smooth and without flats, yet some sharpeners depend on the use of glass paper with practically no surface speed. No wonder the point soon goes, and also the user's patience.

Many discussions, in print and otherwise, have taken place regarding the use of thorn needles, but little indication is given as to their shape or smoothness, or as to how they are sharpened. The articles

by A. M. Pollock¹ and S. Kelly², also the excellent photomicrographs of C. E. Watts, are perhaps the only instances in print of serious study given to the subject; and only in Mr. Pollock's article is any sharpening process mentioned.

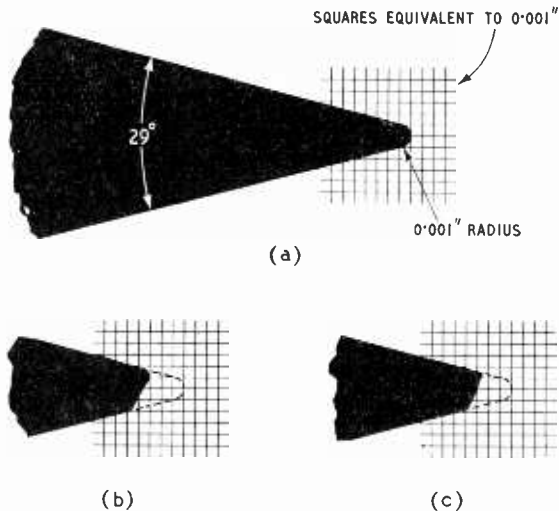
The Machine.—In 1933 the writer made a needle sharpener for B.C.N. fibre needles, driven by a Meccano spring motor, which gave fairly good results, and was exhibited at the Liverpool Gramophone Society's "Coming of Age" meeting in January, 1934. Breakage of springs and low peripheral wheel speed caused it to be redesigned in 1948, and the writer has since used it regularly both at home and at recitals elsewhere. Since that date it has had no replacements, nor has the wheel become glazed or needed retreating.

A series-wound, 15-watt universal motor runs at 7,000 r.p.m. and is mounted on a brass baseplate 6 in \times 9 in \times $\frac{1}{2}$ in, with rubber feet. The white grinding wheel, 1 in diameter, $\frac{1}{2}$ in wide, $\frac{1}{4}$ in hole, Grade A 46R, is made by the Carborundum Company. This is mounted on a hardened silver-steel spindle, with adjustable silver-steel needle point bearings, almost frictionless. Silver steel, which is stocked by most large tool shops, is a carbon tool steel containing nickel. Water-hardened at 780 deg C, it gives a Brinell hardness of 700, which is ideal for the purpose. Lubricant for the points should be graphite grease, sold by cycle dealers. The point angle of thorn needles, usually 29 degrees, can be varied by a small screw at the bottom of the "headstock," which acts as a stop for the pivoted slide plate carrying the needle chuck. A quick-acting clamp keeps the slide against the stop while the needle is being ground.

The wheel speed of 7,000 r.p.m. is, of course, much lower than the specified wheel speed of 22,000 r.p.m. for a 1-in diameter wheel, but it gives a very smooth finish and does not glaze. Some may question the apparently coarse wheel used, but a wide experience of micro-finishes has shown the writer that a finer wheel does not necessarily produce a smooth surface, whereas a suitable grit, grade and bond, though somewhat coarse, with a high surface speed will give the best result.

The thorn needle, of any diameter, is held by a small, three-jaw drill chuck. One elastic belt drives the wheel, while another elastic belt drives the chuck and needle by vee pulley on the spindle, and by the knurled portion of the chuck. An idler pulley at the back maintains the belt tension. Three needles per minute, ground and burnished, is the normal production rate.

Thorn Points.—The operating surface of a needle



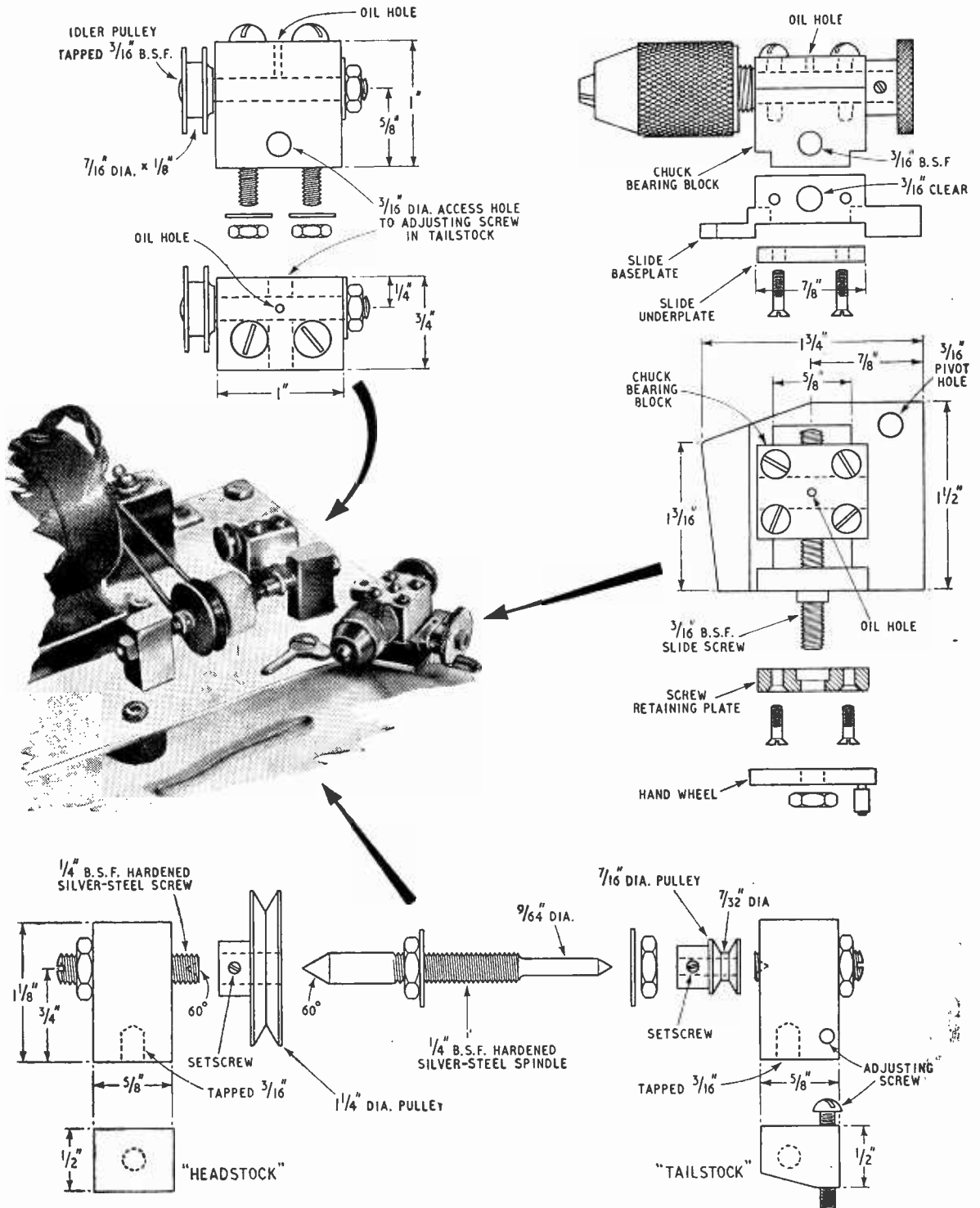
Shadowgraph tracings of Davey miniature thorn needle profile, (a) as sharpened, with a 0.001-in point radius, (b) after playing two sides of H.M.V. DB6965 ("Faust"), and (c) after playing six sides of Decca K1574-8 ("Firebird") 78 r.p.m. records.

¹ *Wireless World*, December, 1950.

² *Wireless World*, June, 1952.

Thorn Needles

By E. F. FOSTER



These constructional details of the machine used by the author may suggest the lines along which readers can construct their own needle sharpening and burnishing equipment

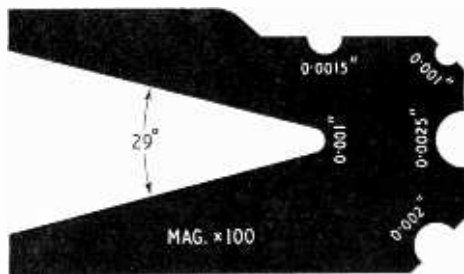
should have a surface finish equal to that of the record groove, in order to minimize the risk of retaining abrasive dust particles.

The needle points shown have been checked by shadowgraph on an optical projector, with a glass screen 15in×12in, having ruled squares of 0.1in which, with a magnification of 100, correspond to spaces of 0.001in. This projection by light is accurate to 0.0005in all over the screen. By using the scaled-up radius gauge shown, the shape and radius of any needle can be compared, and wear quickly discerned, by turning the needle round, in a small fixture, during examination. It is remarkable how large dust appears under these conditions.

Performance.—The pickup used in the tests with high-quality equipment was the Connoisseur Fibre Pickup with balance weight giving 14 grams playing weight. It will be noticed from the profiles shown that the wear is almost equal after playing either two sides of "Faust" (H.M.V. DB6965), or six sides of "Firebird" (Decca K1574-8). Another splendid record is Toccata and Fugue, Germani (organ) (H.M.V. C3781). Here is tremendous volume, clarity and sense of space and vastness. A miniature thorn needle plays this six times without loss of quality even on the high notes.

All these records have been played only with thorns, as one should not expect a thorn to function correctly on surfaces previously operated with steel or sapphire, or on bad pressings, of which there are many. I have heard many record recitals utterly spoiled by playing, with thorns, discs which have been used, and well worn, with sapphire styli.

Conclusion.—The purpose of this article is not to reopen the thorn or semi-permanent needle controversy, but instead to underline the fact that thorns seldom get a fair chance, are rarely correctly sharpened, and are used under conditions which are not good for needle, record or sound. The extra trouble taken in forming a good point will be well



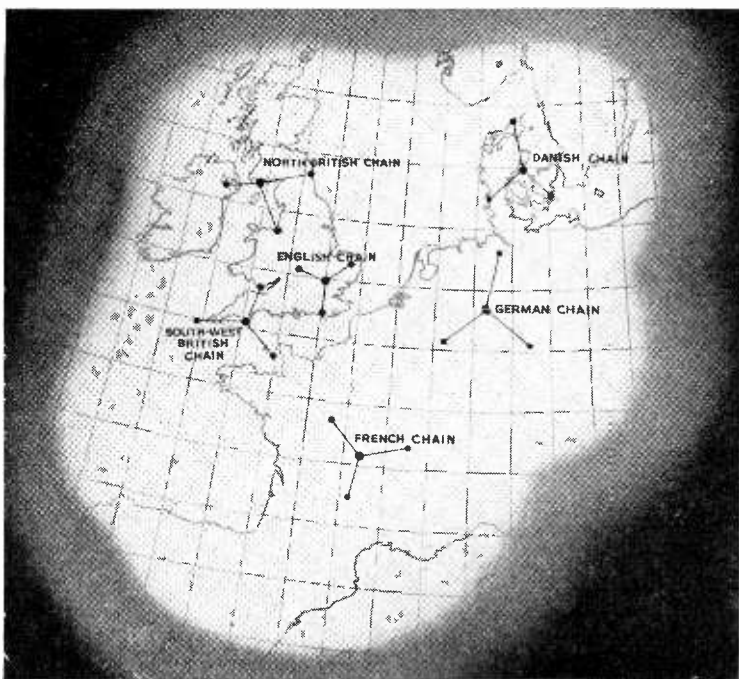
Scaled-up template used to check the profiles of gramophone needles on the screen of a projection microscope.

repaid by reduced record wear, and an extended frequency response can be achieved with suitable reproducing equipment. Quite recently the writer heard Mr. Pollock demonstrate in public, on his own instrument, the relative merits of sapphire and miniature thorn by playing a fine orchestral record with both types of needle, and none of the critical audience could detect any serious difference. He also played most successfully an L.P. disc with a thorn.

The main difference between the sharpening described and simpler types of machine is that it not only grinds, but burnishes a thorn needle and also produces a truly conic surface. These results are not obtained by commercial sharpeners with axial wobble and low peripheral speed.

Thorns, sapphire and diamond needles all have their merits and demerits and although the latter are probably the best, except for cost, there are still a large number of record collections in existence whose value depends on their not having been played with other than fibre needles, and for which improved thorns may be an advantage.

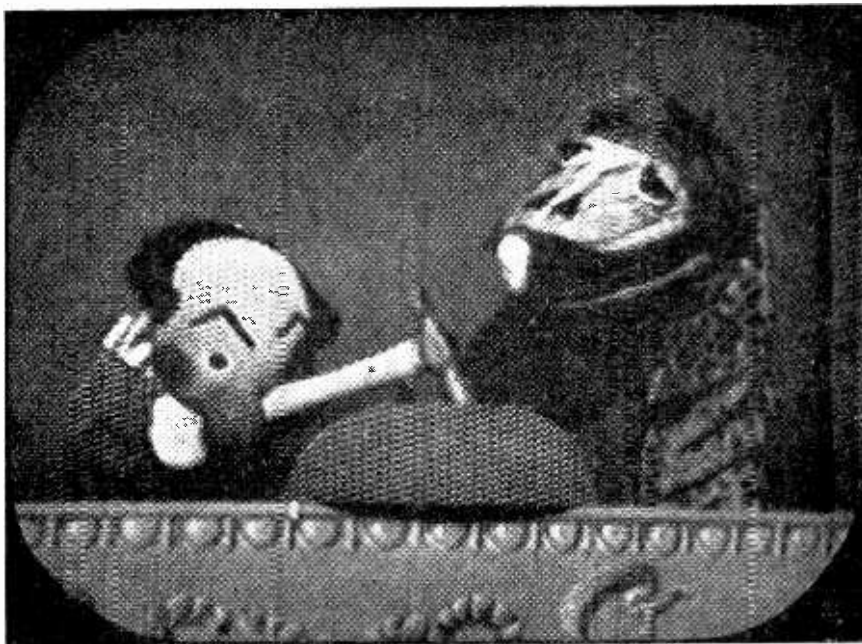
To test the matter finally the author will gladly, without obligation, sharpen any thorns sent to him at 29, Charlestown Road, Manchester, 9.



Decca Navigator

THE French chain of Decca Navigator stations, the sixth to be brought into service since this continuous-wave hyperbolic navigational system was introduced in 1946, was officially opened towards the end of October. With the master transmitter at Montluçon, the siting of the three slave stations follows the usual "star" formation; the red, green and purple slaves being, respectively, near Amboise, Chalon-sur-Saone and Aurillac. The complete service area of the six chains is indicated on this map. Variations in the day and night coverage are shown approximately by the shaded fringe area. Equipment for the French chain was manufactured under licence and installed by the Société Française Radioélectrique of Paris. The number of British and foreign ships equipped with Decca Navigators is now over 2,000.

Picture taken from the screen of a black-and-white television receiver in New York during a demonstration of N.T.S.C. colour television standards to the F.C.C. Parts of the picture appear to carry a rather bad interference pattern, possibly from the colour sub-carrier in the vision signal. This may be unduly emphasized by the camera, which does not have persistence of vision like the eye—a phenomenon on which the system relies for cancelling out the pattern.



N.T.S.C. Colour Pictures

BBRITISH observers who have seen recent demonstrations of N.T.S.C. colour television in America all seem to have been greatly impressed by the quality of the pictures. One engineer tells us that the colour pictures at their best were very good indeed, and certainly better than anything he had seen before, irrespective of the bandwidth used. There was a surprising amount of uniformity in colour rendering between receivers of different makes, but this was probably because 10 out of the 13 colour sets he saw together were using the same RCA tri-colour c.r. tube. Another engineer, who saw demonstrations on closed circuits, says that definition, brightness and colour rendering were all excellent. Moreover, there was no colour fringing (spurious colour at the boundaries of differently coloured areas) and a complete absence of the colour break-up seen on frame-sequential systems with moving subjects.

As for the various methods of displaying the colour pictures, it was generally agreed that the RCA tri-colour tube is the most suitable one for domestic receivers, though considerable skill is needed in adjusting it to obtain correct convergence of the three beams. Rather more faithful colour reproduction is given by another device using three separate c.r. tubes, but this is too cumbersome for the home and is likely to be more useful as a studio monitor.

On the question of compatibility the observers were a little more guarded. One said he thought the black-and-white pictures were perfectly acceptable, and he could not detect any interference pattern (from the colour signal) on them. At the same time he pointed out that at this particular demonstration there were only three monochrome receivers to 13 colour sets, and he was obliged to view them from behind a rope at a distance of about 12-15ft. Those who saw the

closed-circuit demonstrations were particularly impressed by the "beautiful quality" of the monochrome pictures. On this occasion, however, the pictures were displayed on control-room monitors and there was no colour sub-carrier present in the vision signal. They later saw the pictures on a typical American receiver, and here the colour-signal interference pattern could be distinguished, but only by very close inspection. On a special receiver with a frequency response well maintained to 4 Mc/s the pattern was visible as a background of crawling white dots.

Apart from these reservations, the general opinion seems to be that the N.T.S.C. have made out a good case for the adoption of their system in America, and that there is no reason why a similar one, compatible with 405-line standards, should not be developed in this country.

Meanwhile, in America the F.C.C. are continuing their examination of the system, and demonstrations have been arranged to cover all possible operating conditions. Tests have been done with various light levels, with close-ups and rapidly moving subjects and with indoor and outdoor scenes.

According to *Electronics*, it is almost certain that the F.C.C. will formally accept the N.T.S.C. standards before the end of the year, and interest is now centred around the availability and prices of receivers. One firm estimates that it can produce up to 75,000 sets next year at 800 dollars each, while another has promised a price for 1955 only 25 per cent above that of monochrome receivers. The Columbia Broadcasting System thinks that the first receivers will be about 1,000 dollars. Of course, the cost of the picture tube is a big item. *Electronics* says that the R.C.A. tri-colour tube has been quoted at various figures between 175 and 250 dollars and the Lawrence at 100 dollars.

TRANSISTORS

By THOMAS RODDAM

II.—Conclusion: Frequency Response in Transistor Circuits

SO this is the last of the present series of discursive articles on transistors, unless you hastily sign the petition at your local newsagent—no, not that one, that's for c.p.t.t.v. t...v.... The object of the series has been to describe what has happened, so that future articles on what is happening will find *Wireless World* readers already well informed.

One topic which must be dealt with before we come to the end of the series is that of frequency response in transistor circuits. This is a question which seems to lead to a certain amount of confusion: since the frequency-response limitations are the controlling features of transistor use in linear circuitry, it is obviously necessary that this confusion should be cleared away. It is not merely that I want a transistorized television receiver: I want to see transistors in such large production for home receivers that I can afford to use them for more serious applications. Those of you who remember doing design work with LS 7 and LS 8 repeater valves, or even earlier with the LS 5's, will appreciate this point.

The confusion, as I have met it, is something like this: A, who makes transistors, says that the current amplification factor is 3db down at, say, 1 Mc/s; B, who has used this particular type in a video amplifier, says that it starts to cut off at, perhaps, 100 kc/s. C, having talked to both, either damns A as a rogue or condemns transistors as only suitable for low-frequency working. In fact, A and B are telling consistent stories: C's trouble is that he has failed to realize that they are talking about two different things.

The discrepancy is especially marked in the case of the best junction transistors, so that the cleverer A is in this manufacturing process, the less C likes him. Justice, and even Cambridge mathematicians deserve justice, according to Heaviside, demands that we should deal with this matter.

Let us follow D. E. Thomas, in *Proc. I.R.E.* Nov. 1952, and consider the elementary transistor amplifier shown in Fig. 1, with its equivalent circuit. Using the notation given, which I rather dislike, since it seems more logical to make i_2 clockwise, we have the following linear equations, which we have already encountered in an earlier article:

$$R_E i_1 + r_b i_2 = v_g$$

$$(r_m + r_b) i_1 - (r_c + r_b + R_L) i_2 = 0$$

with

$$R_E = R_G + r_e + r_b$$

Solving these equations for i_2 , we have

$$i_2 = - \frac{r_m + r_b}{r_c + r_b + R_L} \cdot i_1 = - \frac{r_m + r_b}{r_c + r_b + R_L} \cdot \frac{v_g - r_b i_2}{R_E}$$

$$= - \frac{r_m + r_b}{r_c + r_b + R_L} \cdot \frac{v_g}{R_E} \cdot \frac{1}{1 - \frac{r_b}{R_E} \cdot \frac{r_m + r_b}{r_c + r_b + R_L}}$$

Now provided that R_L is small compared with r_c , which will be the case for an amplifier with extended frequency response, and r_b is small compared with r_m ,

which is true for any useful transistor, this cumbersome expression reduces to

$$i_2 = - \frac{\alpha}{R_E \left(1 - \frac{\alpha r_b}{R_E}\right)} \cdot v_g = -m v_g$$

where α is the current amplification factor and equals $(r_m + r_b)/(r_c + r_b)$

In the special, and purely theoretical, case where $r_b = 0$ this is simply

$$i_2 = -\alpha v_g / R_E$$

The additional term, $1/(1 - \alpha r_b / R_E)$, is obviously greater than unity. It is, indeed, the gain enhancement due to positive feedback produced by the base resistance, and in the special case where $R_E = \alpha r_b$ the gain will be infinite and the amplifier unstable.

Now consider a resistive generator working into a capacitive load. The voltage V_2 across the capacitance is given by

$$\frac{V_2}{V_1} = \frac{1}{1 + j\omega CR} \quad \text{or, writing } CR = 1/\omega_0$$

$$\frac{V_2}{V_1} = \frac{1}{1 + j(\omega/\omega_0)} = \frac{1}{1 + j(f/f_0)}$$

This is the general form for a 6db per octave high-frequency droop, 3db down at f_0 . It is the simplest form of physical response we encounter, and corresponds to an elementary minimum-phase-shift network. Let us assume that α , which we know falls off at high frequencies, falls off in just this way. For many transistors, this form has been found to be appropriate. We therefore write

$$\alpha = \alpha_0 / [1 + j(f/f_0)]$$

and substitute this in our equation for i_2 above. After quite a deal of manipulation we reach the following equation:

$$i_2 = - \frac{\alpha_0 v_g}{R_E \left(1 - \frac{\alpha_0 r_b}{R_E}\right) \left[1 + j \frac{f}{f_0 \left(1 - \frac{\alpha_0 r_b}{R_E}\right)}\right]}$$

$$= - \frac{m_0 v_g}{1 + j[f/f_0(1 - \alpha_0 r_b / R_E)]}$$

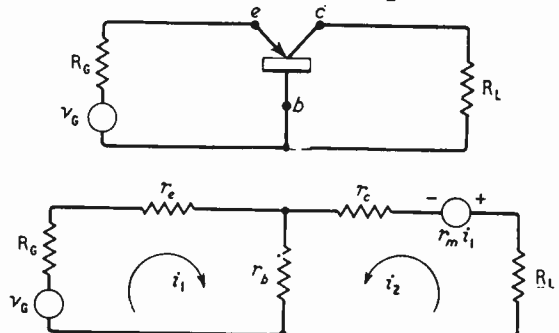


Fig. 1. Elementary earthed-base transmitter amplifier and its equivalent circuit

At very low frequencies the equation is just $i_2 = -m_0 v_g$ with m_0 the value of m introduced earlier, writing α_0 in place of α .

The second term, the frequency response term, is just $1/[1 + j(f/f_0)]$ when $r_b = 0$. When r_b is not equal to 0 the frequency response term can be written as

$1/[1 + j(f/f_0)']$ where $f_0' = f_0 \left(1 - \frac{\alpha_0 r_b}{R_E}\right)$. This means that the characteristic frequency, at which the response is 3db below the zero frequency value, has been reduced by a factor $\left(1 - \frac{\alpha_0 r_b}{R_E}\right)$.

Looking back we see that this is just the factor by which the low-frequency gain was increased as a result of the positive feedback through the base resistance. This is, indeed, merely another example of the trading balance which we so often encounter in feedback circuits: gain swings, bandwidth roundabouts, "you pays your penny and you takes your choice".

The earthed emitter amplifier, which is a very important form, can be treated in the same way. The circuit and its equivalent are shown in Fig. 2. From Thomas (*loc. cit.*) the equations for this system are

$$R_E i_1 + r_e i_2 = v_g$$

$$(r_e - r_m) i_1 + (r_e + r_c + R_L - r_m) i_2 = 0$$

with $R_E = R_G + r_e + r_b$
Assuming $R_L \ll r_c$ and $r_b \ll r_m$ we have

$$i_2 = \alpha v_g / \left[R_E \left(1 - \frac{\alpha (r_b + R_G)}{R_E}\right) \right]$$

We can now perform the same analysis as before, to find that the gain increases and the characteristic frequency decreases by a factor $\left(1 - \frac{\alpha (r_b + R_G)}{R_E}\right)$.

This will, of course, be a more serious effect than before, because we now have R_G added to the feedback resistance r_b .

For the junction transistor earthed-emitter amplifier, it is easier to consider only the current gain equation

$$i_2 = \frac{\alpha}{1 - \alpha} i_1$$

which applies when the load is very small compared with the collector resistance. Remembering the very high collector resistances obtained with the *n-p-n* junction transistors, this is always a reasonable approximation in a wide-band case. Now if we put

$$\alpha = \alpha_0 / [1 + j(f/f_0)]$$

we shall get

$$\frac{i_2}{i_1} = \frac{\alpha_0}{1 - \alpha_0} \left[\frac{1}{1 + j \frac{f}{(1 - \alpha_0) f_0}} \right]$$

The earthed-emitter amplifier has its current gain pushed up from α_0 to $\alpha_0 \left(\frac{1}{1 - \alpha_0}\right)$: at the same time the characteristic frequency is brought down by the factor $(1 - \alpha_0)$.

Type	α	α cut-off	Earthed-emitter cut-off
1	0.93	1.5 Mc/s	105 kc/s
2	0.98	3.0 Mc/s	60 kc/s
3	0.995	5.0 Mc/s	25 kc/s

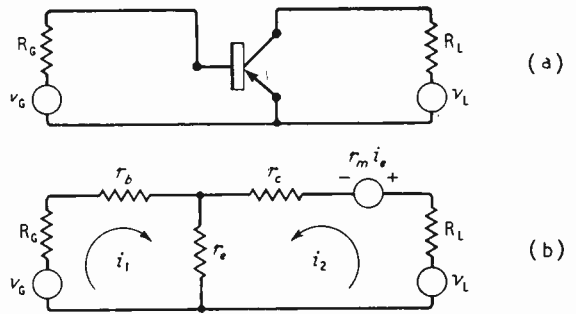


Fig. 2. (a) Earthed-emitter amplifier and its equivalent circuit (b).

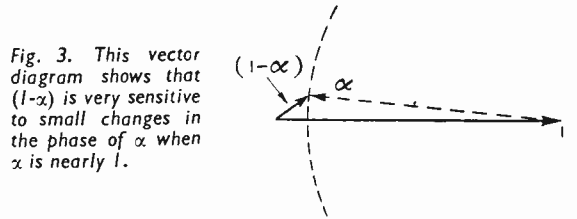


Fig. 3. This vector diagram shows that $(1 - \alpha)$ is very sensitive to small changes in the phase of α when α is nearly 1.

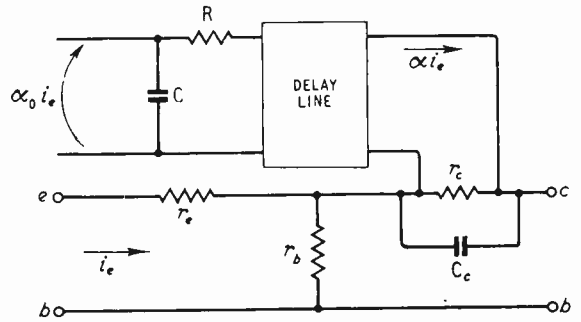


Fig. 4. Delay-line equivalent circuit of a junction transistor.

Let us take a numerical example of what happens in practice. One manufacturer advertises a range of transistors, of different α 's and different α cut-off frequencies. I have tabulated these at the foot of the previous column, together with the earthed-emitter cut-off frequency.

The more successful a manufacturer is in his effort to bring α up to 0.999, the worse the frequency response to the earthed-emitter amplifier using a junction transistor.

It is fairly easy to see why the cut-off frequency falls so much if we draw a vector diagram for $(1 - \alpha)$. This is given as Fig. 3, where it can be seen that a very small phase shift in α produces a large change in $(1 - \alpha)$. Long before the falling off of α is apparent, there is enough phase shift to produce the falling of the earthed emitter gain.

The simple expression for α as a function of frequency is rather misleading: it suggests that the cause of the dropping response at high frequencies may be a capacitance somewhere in the circuit. Examination puts this capacitance across r_c , and we hope blithely that it is just a problem in circuitry to get the same gain-bandwidth product, at any convenient centre frequency. As you already know, life contains one order of complication higher than you expected. The falling of α at high frequencies is a transit time effect, as we indicated when describing

the junction tetrodes, and there is in consequence a real time delay, not just a phase shift. (I agree that two are interrelated, but I am sure that the meaning of this phrase will be clear). The equivalent circuit of a transistor turns out to be of the approximate form shown in Fig. 4; the delay line is the stumbling stone. It is not possible to shift the frequency band sideways by a simple tuning operation, any more than the corresponding transit time effects in a valve can be avoided by purely circuit means. The junction tetrode, and the production of welded-junction triodes with very thin centre layers, are the only immediate solutions to the problem of good frequency response in the junction transistor.

To conclude the series we may look again on the history of the transistor. It is now just about five years since we first heard of it, and only half that time since the junction transistor appeared. Already there are some serious large-scale applications. A new system for setting up telephone calls has been introduced making use of punched cards, photo-transistors, transistor amplifiers, and cold-cathode valves. It would be possible, though not economic, to make this elaborate machine work with conventional valves and an enormous amount of cooling plant to deal with the heat dissipated. Looking back on the history of the valve we see a very much slower time scale, and yet, in less than 50 years, the world production of valves is probably nearing a thousand million a year. In the last 15 years, valves have been moving out of the ordinary wireless and long-distance telephone field into other, more complex, applications. Electronic computers, in the broadest sense, operate on information: they do not just transmit it. From the relatively simple gunnery predictors to the most advanced calculating devices, from photocell door-openers to complex servo-mechanisms, valves are doing the "thinking" for machines. Here, because of the complexity of the systems, the transistor has an immediate application, to which its price is no barrier. Because the signal to be handled at any stage usually originates with another transistor, the relatively low rating is unimportant. Working with microwatts, the saving of the heater power, at least one watt per stage, makes the transistor enormously superior to the valve.

The bread-and-butter of the valve industry is still, however, the home receiver. Receiving valves have been made smaller and better, but their life is relatively short, and even to amplify a few microvolts you will normally need to draw watts from the supply mains. Power means space for cooling: short life means a valveholder for easy replacement. The overall cost of a valve is higher than you think. It looks like 10s, perhaps, but if it lasts 5,000 hours it will have used at least 10 kWh of power, and at 5d. a unit, which is what I pay, that means an additional 4s. Your transistors should last 50,000 hours, or ten times as long as the valve, and use very little power. Even at £7 each, therefore, transistors are competitive.

The detailed cost analysis is more complicated, because with a transistor receiver, broadcast or television, the actual works will be much smaller. Remove the cathode-ray tube and loudspeaker and the remainder of the set becomes a really simple package which imposes few demands on the cabinet designer. As a rash prediction, we can expect to see a really attractive piece of radio furniture, one day.

Looking further into the future of the transistor in

the home, the use of time division multiplex seems more likely. Present systems of transmission rely on the approximate linearity of the ordinary valve, and cross-modulation and distortion are the price of the approximation. The transistor provides an extremely simple switching circuit, immediately applicable to the push-button receiver in the v.h.f. band. Frequency modulation may be only a digression, the last flourish of a decaying technique.

Weathering of Polythene

Advantages of Adding Carbon Black

IT is generally known that finely divided carbon black has almost magical properties in increasing the toughness and abrasion resistance of rubber; it is in fact at the very foundation of the pneumatic tyre industry.

One would hesitate to add a substance of potentially high electrical conductivity to a dielectric of such low power factor as polythene in the hope of improving its performance as an insulator, but that in fact is what has been done with success in the rather special conditions of exposure to extreme tropical conditions in the jungle, on the beach and in the desert.

It has been established that under these conditions, and particularly of intense ultra-violet radiation, the power factor (at 10 Mc/s) of polythene without carbon black can deteriorate in 12 months from 0.00022 to 0.0056. The addition of 0.1 per cent of carbon black, widely dispersed, of course, throughout the material, increases the initial power factor to 0.00028, but inhibits the increase after 12 months' exposure to about 0.0022. The deterioration under the worst conditions is thus only one-third of what may be expected without the use of carbon black.

Nevertheless, the deterioration in power factor after six months, even with the addition of carbon black, is regarded as prohibitive under semi-desert and surf-beach conditions and if protection from sunlight cannot be provided, a limited service life must be accepted.

Detailed descriptions of the test sites in Nigeria and figures for the changes in physical as well as electrical properties obtained over a period of 12 months are contained in Ministry of Supply "Reports on Plastics in the Tropics. 2.—Polythene," obtainable from Her Majesty's Stationery Office, price 2s net.



This new electrostatic storage tube made by E.M.I. (type VCRX350) has a storage time of 5-10 minutes and can be used for producing semi-permanent displays of transient images. In one half of the tube a cathode-ray "writing" beam builds up a charge pattern on a central grid corresponding to the incoming signals, while in the other half a "reading" beam scans the stored pattern and converts it back into signals.

Some Coaxial Problems

Transformer Effects Between the "Inner" and the "Outer"

By "CATHODE RAY"

AS I believe I mentioned before, anyone can become a "radio engineer," or consultant, or serviceman, at least in the sphere of receivers for sound broadcasting, on a course consisting of one lesson, duration 10 seconds. I give the entire course absolutely free of charge. It is the method I myself have used for many years with consistent success. Even my non-technical wife can confidently deputise, without having to refer the details of each problem to me. All you have to do, on receiving a complaint of bad reception, without even waiting to hear the nature of the trouble (though it generally makes a better impression if you do listen to that first) is to say "Use a decent aerial." Possibly 10 per cent of all cases of bad reception have nothing to do with aerials, but any consultant ought to be able to get by with that margin of error.

When I was at college we had a lecturer in electrical engineering who similarly believed in one master-key to fit (nearly) every problem. No matter what we were working on, when he moved around the class to rescue those who were completely stuck he almost invariably transfixed the victim with a hypnotic glare and hissed—"Magnetomotive force is point four pi times the current enclosed," at the same time suiting the action to the words by scribbling violently round and round a large piece of paper and then stabbing it repeatedly with his pencil inside the coil, presumably to suggest lines of force. (This was in the days when c.g.s. units were universal; nowadays his successor, who is an exponent of m.k.s. units, is no doubt endlessly repeating the liturgy "Magnetomotive force is numerically equal to the current enclosed.") There must have been many students who, floundering in the troublous ocean of a final exam, clutched gratefully at this ineffaceable classroom memory and were saved. More years later than I care to think, even, it comes in useful when thinking up these meditations. As recently as last month, skin effect—often regarded as one of the obscure phenomena of radio—turned out to be a fairly obvious consequence of the old magnetomotive force principle.

In the meanwhile, by a remarkable coincidence, a reader has submitted a problem that fits on to that story as if it were made to measure. The problem is as shown in Fig. 1, where (to use my correspondent's description) a short piece of coaxial cable is used as a 1:1 transformer. When an e.m.f. is maintained between the ends of the inner conductor, as at (a), an equal e.m.f. will appear between the ends of the outer conductor or sheath. (If you don't understand this, don't give up; just take it as a fact until the principle of the thing is explained in a very few moments.) Next, the generator and infinite-impedance voltmeter are transposed as at (b). Granting that the piece of cable is a 1:1 transformer, we are invited to explain how, since the current flowing through the sheath produces no magnetic flux where the inner conductor is, an e.m.f. is nevertheless induced in it. What flux

is cutting the "secondary" to induce such an e.m.f.?

My first reaction, on being confronted with this as a suggestion for these pages, was to wonder how many readers would get past the very first statement, that the "short length of coaxial cable" is a 1:1 transformer. Unless the teaching of electrical principles has recently undergone a profound change—and comparing present-day elementary books with those of years ago gives little ground for thinking that it has—I suppose most people still learn about inductance and induction as something to do with coils, in which case any problem which begins by taking for granted that a short piece of coaxial cable is a 1:1 transformer may tend to be dismissed as something too recondite for elementary students. Yet transformers and other devices which at low frequencies are made up of coils will in future increasingly be made up of rods and tubes, especially when the higher-frequency television bands are opened up; so it seemed to me that there was a case for dealing with that aspect in general, before considering the finer points of any trick problems arising. And as it happens, by the aforementioned coincidence, all the spade work has already been done. Anybody who followed last month's explanation of skin effect—and that was basically simple, in spite of the number of words I wove around it—should find this coaxial transformer a piece of cake.

I suppose a transformer could be defined as a device making use of the principle that an e.m.f. can be magnetically induced in one circuit by varying the current in another. The necessary condition is that at least some of the magnetic flux caused by the current in one circuit is linked with the other circuit. To be 100 per cent coupled, all the flux would have to be linked with both circuits.

Just in case anyone is not *quite* sure what "linked" means in this connection, the term signifies the same relationship as exists between links in a chain. If a

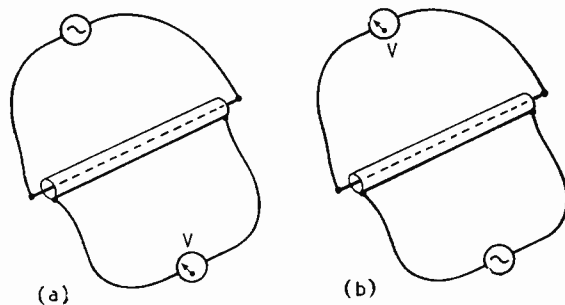


Fig. 1. In (a) the inner wire of a piece of coaxial cable is connected to a v.h.f. generator, and the outer sheath to an infinite-impedance voltmeter; in (b) the generator and voltmeter have changed places. The leads are supposed to be far enough away from the cable for their influence to be negligible.

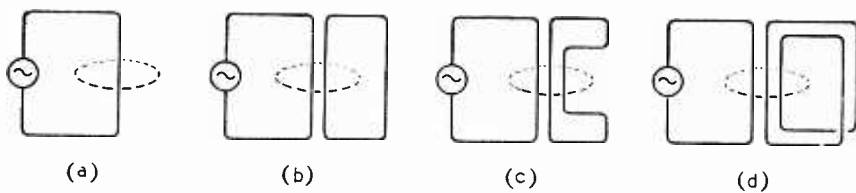


Fig. 2. Showing the meaning of flux linkages. At (a) the flux linkage causes self-inductance in the generator circuit; at (b) there is mutual inductance with a secondary circuit; at (c) there is no linkage with the secondary circuit; and at (d) there are two linkages.

generator is connected up to a closed circuit, as in Fig. 2(a), a current flows, and the current sets up magnetic flux which is linked with the circuit—or rather with the current, for as we saw last June a magnetic field of flux links a current even when it flows through space as a capacitive displacement, without any conducting circuit. However, there is no need to worry about that, for this month all our currents will flow through visible circuits. In Fig. 2(a) the flux is shown as one dotted loop, like a link on a chain, whereas of course it fills the space around the circuit. But (disregarding the flux inside the metal of the wire itself—see last month) it is all linked with all the current. If now any other circuit is linked with this flux, as in Fig. 2(b), the system is potentially a transformer. For it to be so at least some of the flux must pass around both circuits—and not in the sense shown at (c), where the secondary circuit is not linked with that particular flux loop at all; it could be pulled out without cutting the flux. On the other hand, in (d) it is linked twice, giving a voltage step-up as compared with (b). Too elementary? Yes, I thought so; let us move on.

Now this is where our pass-key comes in. So as not to raise any questions about units, let us put it in these words: magnetomotive force is proportional to the current linked. If the same current is linked n times, it counts n times, so the “current linked” (and therefore the m.m.f.) can be reckoned in ampere-turns. For low-frequency purposes, and even for fairly high frequencies, it is nearly always necessary to use quite a number of turns to gain the desired result, hence one becomes accustomed from the start to think of all this in connection with coils and to disregard as a mere stray effect any magnetic field set up by single wires. It is the purpose of the present argument to try to correct this.

Simple Equation

The great merit of the magnetomotive force equation is that it is so simple. It is one of the very few things to do with magnetism that are simple. For directly we start to find out what the field strength and flux density are, we are faced with the problem of reluctance. It is rather like Ohm's law would be if the resistance of a circuit were a very difficult thing to calculate or measure. We were only able to go as far as we did last month with skin effect because the only kind of circuit we went into in detail was the completely unpractical one of an infinitely long, straight cylindrical wire with no return. In that special case it is known that the flux paths are coaxial circles around the wire, and so their lengths are known; dividing the m.m.f. by the length gives the strength of the field (H) around that path; and multiplying H by the permeability of the stuff the path is in gives the flux density (B); and multiplying the average B through any cross-section by the area of that cross-section gives the total flux (Φ) through it. The trouble with most practical circuits is that the flux paths—and

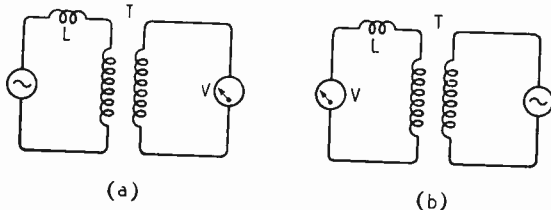


Fig. 3. The Fig. 1 situation shown in conventional symbols.

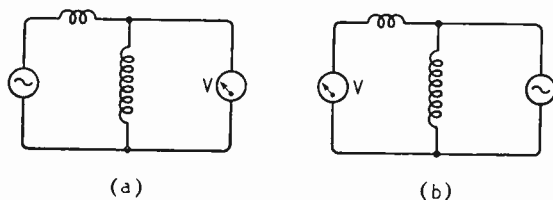


Fig. 4. As T in Fig. 3 is a 1:1 transformer with 100% coupling it can be replaced by a single coil.

hence their lengths—are difficult to determine; and if more than one permeability is involved that complicates matters still further.

In Fig. 1 these difficulties do not arise. The only part of the circuit (a) we are considering is a straight wire, and the sheath is presumably copper or some other material whose permeability does not differ appreciably from that of air. So the flux, which makes rings round the wire, is not significantly affected by the presence of the sheath, for there is supposed to be no current in it (the voltmeter being assumed to have an infinite impedance). The m.m.f. everywhere around the wire is the same—proportional to the current flowing, multiplied by one (turn). The field strength and flux are greatest where closest to the wire—because there the path is shortest—and fall off in inverse proportion to the distance from the wire. So the most intense field is inside the sheath and does not link with it at all. But all flux outside the inner surface of the sheath (except what passes outside the voltmeter circuit altogether, and that is supposed to be too far away to matter) links the voltmeter circuit, so produces an e.m.f. whenever the primary current is varying. But because some of the flux does not link the secondary circuit, the secondary voltage, even on open circuit, must be less than the primary voltage.

We have already begun to use familiar transformer terms. Continuing in the same vein, we would say that although this transformer has a nominal 1:1 ratio there is a good deal of leakage inductance, corresponding to the flux inside the sheath. It can be reduced by reducing the space between wire and sheath, but can only be eliminated altogether by reducing the space to zero, making wire and sheath one. The separately “wound” transformer then becomes a 1:1 auto-transformer, and primary current can pass straight through to the secondary circuit—all except the “mag-

netizing current" that is needed to maintain the voltage across the erstwhile cable.

Now look at Fig. 1(b). All the flux due to current in the primary (the sheath) inevitably links with the secondary, too. (In case experts at wire puzzles are tempted to claim that they could remove a ring linking the sheath without cutting the voltmeter circuit, let me recall at once that the voltmeter leads are assumed to be "infinitely" far away, and solutions that depend on bringing them close in and folding them back along the sheath will not be entertained.) Therefore, far from there being any doubt about whether this arrangement can work as a transformer, it is the only genuine 100 per cent transformer I can think of, and much better than Fig. 1(a).

For the sake of anyone who likes to see it in the familiar circuit symbols, Fig. 3 is specially provided.

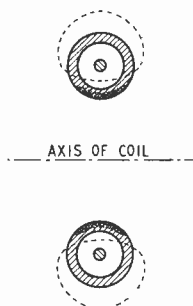
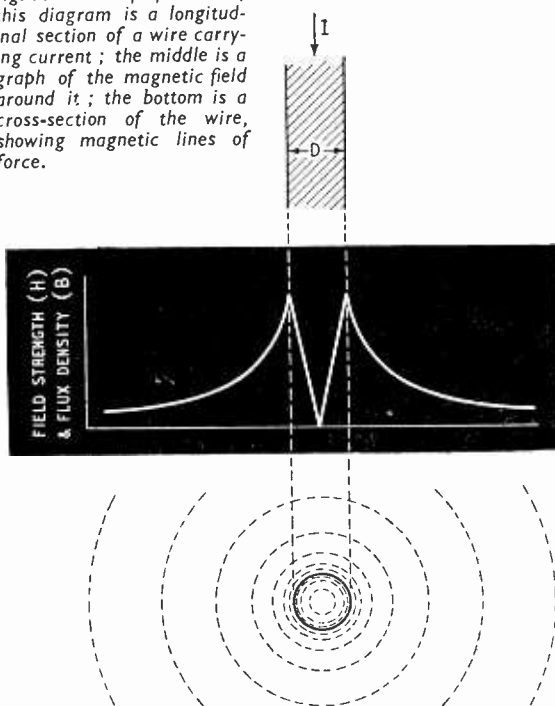


Fig. 5. If the coaxial cable is wound into a coil, "proximity effect" causes the sheath current to crowd to the inner parts, as shown shaded darkly, for these parts escape some of the flux linkages and so have less inductance.



Fig. 6. The capacitance between fully-coupled parallel conductors has no effect at the frequency of the current flowing therein, because both have identical voltages.

Fig. 7. The top portion of this diagram is a longitudinal section of a wire carrying current; the middle is a graph of the magnetic field around it; the bottom is a cross-section of the wire, showing magnetic lines of force.



Here, L stands for the inductance corresponding to flux *inside* the sheath when the wire is carrying current.

In case you have a momentary uncomfortable feeling that a 1:1 transformer ought to give the same voltage either way round, it may be worth pointing out that whereas in Fig. 3(a) the coil L takes some of the generator voltage, because every transformer requires some magnetizing current, even when the secondary is open-circuited, in Fig. 3(b) it takes no voltage, because the voltmeter is assumed to take no current. This is perhaps easier to see when we replace—as we may—the perfect 1:1 transformer T by its equivalent, a single coil, as in Fig. 4.

But to get back to the original problem, Fig. 1; why was it a problem at all? Simply because so many of us were taught electromagnetic induction in terms of "flux-cutting." As I said in the June issue, it is much better to think of variation of flux linkages. When one does—as we have with this problem—there is no problem.

You may remember that I said Fig. 1 (b) was a transformer with 100% coupling. Except at very high frequencies—or with an absurdly large length of cable—its impedance is too low to be practical, so supposing one has a requirement for a coil-wound air-core transformer with as nearly 100% coupling as possible, one might think it could be done to perfection by winding it with coaxial line, using the outer as the primary and the inner as the secondary. Well, certainly the coupling would be very close—probably as close as one could reasonably get it—but it would not be quite 100%. The reason is that the statement that the flux set up by the outer conductor completely encircles that conductor—and therefore the inner as well—only holds good for a straight run, with no other conductors anywhere near. Directly one starts winding the line into a coil this condition is broken and one has to take account of the m.m.f. of adjacent turns. When we did so, last month, we found that the current no longer flowed uniformly all round the circumference but crowded to one side; this being called *proximity effect*. The general principle is that the current tends to flow where it makes the inductance least. So in a coil it flows on the *inside* (because that makes the effective diameter of the turns least), as in Fig. 5. Obviously some of the flux encircling this will fail to link with the wire; our coil is, in effect, wound with parallel-wire line, and the coupling is slightly less than 100%.

Capacitance between Windings

One thing that may tend to worry anyone requiring a very tight-coupled transformer is the thought of the large capacitance between the windings. To obtain the desired closeness of coupling, the windings must be very close together, whether side-by-side or one inside the other. The capacitance between a short length of the twin winding can be shown conventionally as in Fig. 6. But one result of the close coupling is that practically all the flux that links one wire links the other, so the voltages induced are the same in both. Now if the potentials of two points are the same, it doesn't matter how much capacitance there is between them—there can be no capacitive current. The same is true if there is a constant difference of potential (and the purpose of a double-wound 1:1 transformer is usually to enable two circuits to have a constant p.d. between them). It is only when there

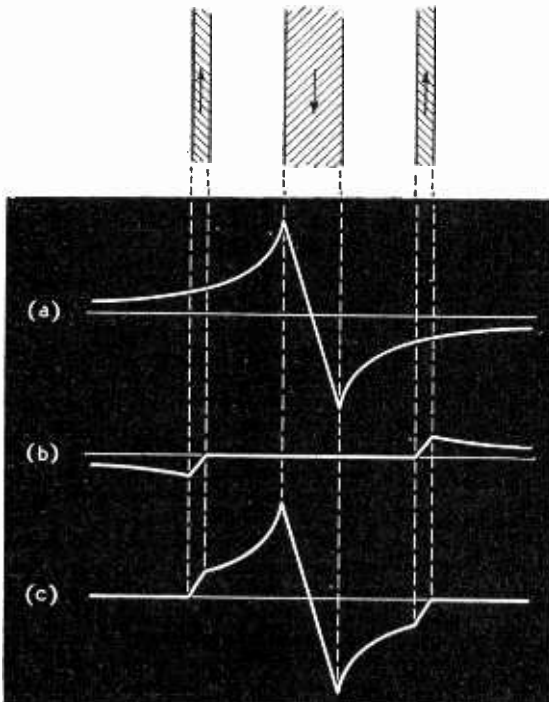
has to be a signal voltage between the two windings that the capacitance may be a difficulty.

Magnetic Field Distribution

Our study of skin effect last month was based mainly on calculating the field strength around and inside a wire and plotting it as a graph such as the middle part of Fig. 7. The top part is a longitudinal section of the wire, shown on a large scale for clearness, its diameter being D . We know that the magnetomotive force anywhere around the outside of the wire is the same, because the same current is enclosed. The field strength is equal to this divided by the length of the "lines of force," so is greatest where the length is least, i.e., at the surface of the wire, and falls off in proportion to the distance from the wire, as shown by the graph. Inside the wire, decreasing length of field path is more than offset by decreasing m.m.f., the current enclosed being less and less till right at the centre it is zero. Hence the V-shaped portion of the graph. The same graph does for flux density, for B is H multiplied by the constant μ . The total flux is represented by the area between the curve and the zero line. Note that although the flux density at the centre of the wire is zero, current flowing there has *all* the flux outside it; that is to say, linked with it.

Another way of showing the same thing is in cross-section, as in the lowest part of Fig. 7, where, of course, the wire appears as a circle. The relative field strength and flux density is indicated—rather crudely—by the relative density of the dotted rings,

Fig. 8. This diagram shows the distribution of field around a coaxial cable carrying equal go-and-return currents: (a) field due to current down inner wire alone; (b) due to current in outer sheath; and (c) both together. Unlike Fig. 7, it shows sign of field (+ and -) as well as magnitude.



the imaginary lines of force. According to the "corkscrew" rule, a clockwise direction of the lines of force would indicate that the direction of current was into the paper. In the upper parts of the diagram the lines of force would have to be represented in cross-section, as points, aimed away from one on the left of the wire axis and towards one on the right. The graph as shown takes no account of direction, both halves of it being "above the line," so conventionally positive. But when finding the total effect of more than one current, it is essential to distinguish the directions of the flux.

I admit that last month, dealing rather briefly with skin effect in a coaxial line, I drew its diagram without going through the process of combining the separate diagrams of the inner and outer conductors. That was because it was such an easy case. But anyone who did not find it obvious is recommended to trace the process through Fig. 8, where (a) is the diagram for the current in the central wire, (b) for the equal return current in the sheath, and (c) is obtained by adding the two together. Except for the distinction between positive and negative it is the same as last month's Fig. 7. The important feature, of course, is that there is no field anywhere outside the cable, so no inductive pick-up from the currents flowing therein. Remembering, too, that the sheath (if earthed, as it usually is) forms an electric screen around the inner wire, one might imagine that this wire was completely protected from external coupling.

But it is not. Fig. 9 shows an aerial, with its downlead screened by earthing the outer conductor of the coaxial cable of which it is composed. The idea is to

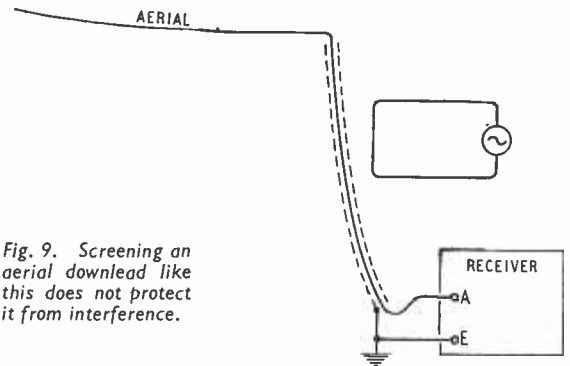


Fig. 9. Screening an aerial downlead like this does not protect it from interference.

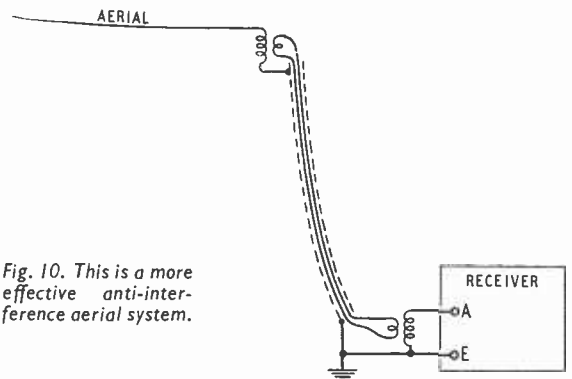


Fig. 10. This is a more effective anti-interference aerial system.

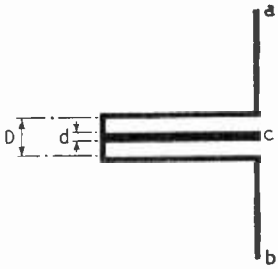


Fig. 11. Section of a coaxial inductor.

screen it from interference, represented by the generator driving current through adjacent wiring. But in so far as this wiring is parallel to the aerial, there is nothing to stop its magnetic flux from linking with the aerial wire and inducing interference in it. The "screening" does not even give complete immunity from electric fields, for if they affect the upper part of the cable they cause currents to flow to earth through its sheath, and their flux links 100% with the aerial wire.

A way out of this disappointing situation is to rearrange things as in Fig. 10. Here the cable is a screened parallel-wire type, connected so that any interference coupling with one wire affects the other practically equally, so does not drive current through the coupling coils. Since any cable of this kind has a comparatively low impedance, the impedance-

matching transformers are necessary for satisfactory efficiency.

Reverting to coaxial cable and Fig. 8, the complete absence of external field is strictly on condition that the go and return currents are equal. If there is any surplus in either direction along the cable, it produces an external field.

A useful application of coaxial line is for providing an accurately calculable amount of inductance without external coupling. For this, one end is completely stopped up by a short-circuiting disk, and the terminals are the other ends of inner and outer. Supposing *ab* in Fig. 11 is the screening panel of some apparatus, a convenient form of known inductance between it and *c* is as shown. The go and return currents being equal, there is no external field, and the inductance can be calculated from basic principles. (Actually it is very nearly $0.0046 \log_{10}(D/d)$ microhenries per centimetre length.) There is, of course, the complication of parallel capacitance, if the length of the line is appreciable compared with quarter of a wavelength of the signal used. But this, too, is quite easily calculated and allowed for. When the line is a quarter-wavelength long, the capacitance is enough to tune the inductance to resonance, and one obtains a highly efficient resonator or "rejector circuit." By a happy coincidence, any variation of inductance caused by varying the dimensions *D* and *d* is exactly compensated by the change of capacitance, so all that affects the tuning is length.

Mapping Magnetron Fields

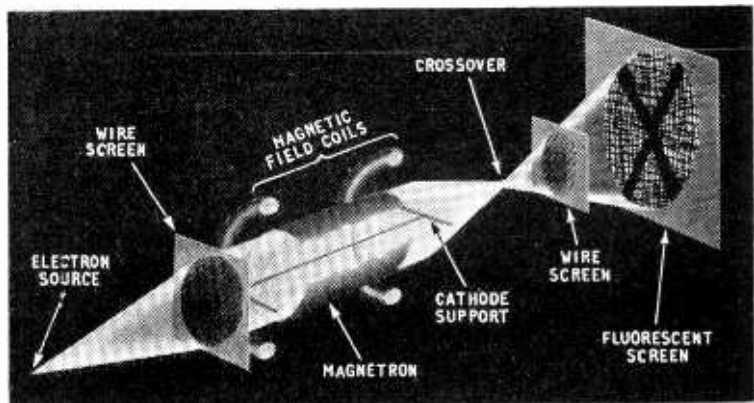
By MICHAEL LORANT

New Method for Studying Electric-Field and Space-Charge Configurations

AN accurate and sensitive technique for experimentally determining the electric-field distribution and space-charge density within a magnetron has recently been developed by D. L. Reverdin at the U.S. National Bureau of Standards. The new method, which is also well suited to investigations of electron-optical lenses, gas discharge, and other space-charge problems, is a modification of an electron-optical shadow technique recently developed at the Bureau for the quantitative study of minute electric and magnetic fields. A magnetic lens is used to produce shadow images of two fine wire screens placed at either end of the magnetron in the path of an electron beam. Then, from the distortion in the shadow network caused by deflection of the electrons as they pass through the magnetron field, the radial electric field is computed. These results are used to obtain the space-charge distribution.

The high space-charge density within a magnetron is known to have an important bearing on performance. However, very little is actually known

about the electric-field distribution and space-charge configuration within the valve. Although the problem has been investigated theoretically by many workers, the formidable mathematics involved have not permitted an exact solution, and the various simplifications of the theory that have been suggested have led to widely divergent results. Attempts at direct measurement have also proved unsuccessful because



the very critical symmetry of the field under study was disturbed.

The Bureau's new method uses an electron beam as a probe but keeps the charge density of the beam small compared with the space charge in the magnetron. Thus, the field under study is undisturbed. An electron gun sends the beam axially through the valve. Coaxial coils surrounding it provide a homogeneous magnetic field for the operation of the magnetron and at the same time act upon the beam as a convergent magnetic lens, bringing it to a focus beyond the valve. Two fine wire screens are placed in the path of the electrons, one just in front of the magnetron, the other just beyond the back focus of the beam. A complex shadow pattern of the two wire screens is then formed on a fluorescent screen. When the d.c. potential across the magnetron is zero, the pattern is undistorted. When an electric field is applied to the magnetron, however, the shadow network on the fluorescent screen becomes quite distorted, and theoretical analysis of this effect has related the distortion of a given part of the pattern to the intensity of the electric and space-charge fields in the corresponding region of the magnetron.

The actual apparatus takes the form of a cathode ray tube with a very long neck, inside which the magnetron

and wire screens are mounted. The electron beam comes from the cathode of the tube in the usual way, while the magnetic-field coils are mounted externally on a wooden former. Photographs are taken of the shadow network formed on the screen of the tube, both in the undistorted and distorted form. The changes in the paths of the electrons as they pass through the magnetron are then determined from measurements of the shadow patterns and the geometrical constants of the system, such as the positions of the wire screens, the magnetron, and the electron source and the number of meshes per unit length of the wire screens. From the deflection of an electron entering the magnetron at a given radial distance from the centre the strength of the electric field in the corresponding region of the magnetron is computed.

The Bureau's study of the field within a steady-state magnetron indicates that the actual space-charge distribution differs considerably from that predicted by the theorists. A number of different shapes of space-charge configuration were observed which are closely related to the symmetry of the magnetron. A certain lack of sharpness noted in the patterns gave a visual indication of the noise in the valve. This suggests further extension of the method to learn more about the problem of noise in the oscillating magnetron.

Transistor Radio-Telephone Transmitter

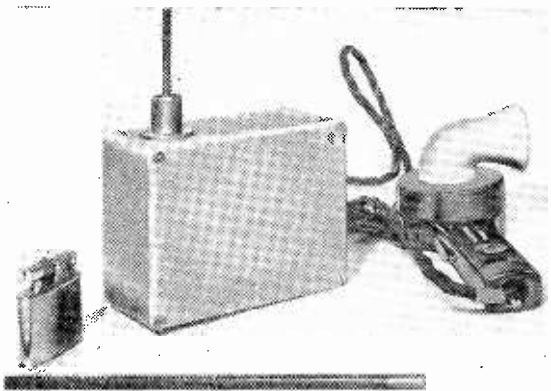
WHILE there is no real difficulty in making a transistor oscillate at the high radio frequencies there does appear to be a great deal of difficulty in finding the right kind of circuit in which they can be used for both the r.f. oscillator and the modulator.

It is claimed that these obstacles have been successfully overcome in a small experimental radio-telephone transmitter evolved by Douglas Walters and which is being operated as a portable station under the call G5CV/P.

As at present designed the transmitter consists of a G.E.C. germanium triode, Type GET1, functioning as a quartz crystal controlled r.f. oscillator on 3,608 kc/s (83 metres approx.) with a similar germanium triode for the modulator. With the few capacitors and resistors needed and a small 22½-volt dry battery the whole is housed in a metal box measuring 6 in × 4 in × 2 in. By substituting a

really miniature hearing-aid battery it is claimed that it could be reduced to about one-third this size.

When used as a "personal" transmitter it employs a two-section copper rod aerial about 4 ft long, and under these conditions, which are most unfavourable for this frequency, a confirmed range of about one mile has been obtained so far, but from indirect reports it is suspected that the actual range is much greater, as with a non-resonant long-wire aerial at a fixed station, several miles have been covered. It is for this reason that reports of reception of the portable station would be welcomed by Mr. Walters, at "Greenfield," The Drive, Godalming, Surrey.



The crystal controlled radio-telephone transmitter described in the text. The cigarette lighter gives some idea of the size. Part of one section of the collapsible aerial is included.

CLUB NEWS

Cleckheaton.—At the meeting of the Spen Valley and District Radio and Television Society on December 16th, J. E. Church (G2BMC) will describe a "Poor Man's BC221 (communications receiver)." The club meets on alternate Wednesdays at 7.30 in the Temperance Hall, Cleckheaton. Sec.: N. Pride, 100, Raikes Lane, Birstall, Nr. Leeds.

Derby.—December's meetings of the Derby and District Amateur Radio Society include a demonstrated talk on valve characteristics by C. M. Swift on the 2nd. The club meets on Wednesdays at the School of Arts and Crafts, Green Lane, Derby. Sec.: F. C. Ward (G2CVV), 5, Uplands Avenue, Littleover, Derby.

Wellingborough.—A member of the Post Office Engineering Department, Northampton (A. C. Homer), will address the Wellingborough and District Radio and Television Society on December 18th on "Some Problems Affecting Reception of Radio and Television in this Area." Meetings are held each Thursday at 7.30 at the Co-operative Society, Silver Street, Wellingborough. Throughout the session lectures are being given on television theory and practice. Sec.: N. M. Seabrooke, 85, The Drive, Wellingborough.

Seventh Amateur Radio Show

Preview of Commercial Equipment at this Year's Exhibition

THE amateur radio exhibition opening at the Royal Hotel, Woburn Place, London, on Wednesday next, November 25th, is the seventh of its kind held by the Radio Society of Great Britain.

While its primary purpose is to foster interest in amateur radio and provide an opportunity for exchange of ideas and a general get-together in a congenial atmosphere it also provides an opportunity for firms manufacturing parts and equipment especially suited to the occasion to exhibit their latest products.

A new development is a limited range of small units described as transmitter foundation units which are intended to provide the basis for a home-built band-switched transmitter covering the 3.5- to 28-Mc/s bands. They can be used in conjunction with most existing modulators and power units if required. The two main items consist of a VFO unit (Miniciter) embodying a buffer amplifier and frequency multipliers and a power amplifier unit (Minipa) with a pair of parallel-connected tetrodes and a band-switched aerial coupling circuit for matching to a wide range of aerials. These will be shown by David Godwin.

The once much-favoured open rack for transmitters and other apparatus is now largely replaced by closed cabinets in most amateur stations. Examples of modern metal cabinet-work of this kind will be shown by Philpotts Metalworks. Brighter colours are finding favour in modern station design and some good examples will be shown together with a new style described as "hammer finish." Supply of cabinets to users' requirements, generally at no greater cost than for stock sizes, is a speciality of this firm.

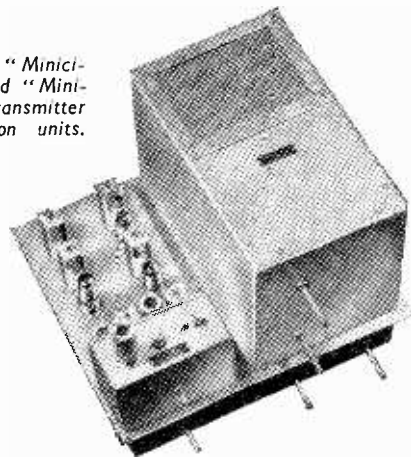
Tailor-made chassis will be found also on Denco's stand and here visitors interested in components for radio and television sets will find much to hold their attention. Some new Denco products include f.m. discriminator units and an inexpensive modulated test oscillator. Two complete transmitters will be shown

this year by Panda Radio: one is the 1954 version of their PR120V 150-watt table-top transmitter which includes a number of refinements, the other is a moderately priced 25-watt model appropriately called the Panda "Cub." It is band-switched for operation on 1.7 to 28 Mc/s with automatic reduction of power on the top band.

Quartz crystals for fundamental and overtone operation and in a variety of plug-in mounts will be the main feature of the Salford Electrical exhibit. Among other items G.E.C. will have two new ribbon microphone heads, one (costing £10) being particularly suitable for the amateur transmitting station. It is a high-quality microphone, with long-range pick-up characteristics and a very even response over 200 to 1,400 c/s. The impedance is 600 ohms. Other interesting G.E.C. products will be a range of new "Q" valves for industrial purposes where ruggedness is essential such as for mobile equipment of all kinds, metal cone loudspeakers and some audio amplifiers.

In addition to the existing range of piezo-electric products Cosmocord will have a range of reasonably priced microphones recently introduced for high-

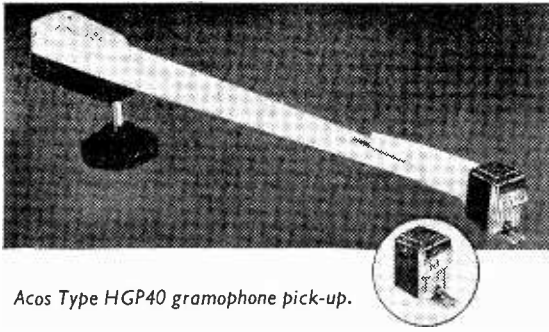
Godwin "Miniciter" and "Minipa" transmitter foundation units.



Avo model 8 wide range test meter and (right) G.E.C. Type BS2374/77 ribbon microphone head.



Panda 1954 model of the PR120V transmitter.



Acos Type HGP40 gramophone pick-up.

quality recording; these are equally suitable for transmitting purposes.

One of the latest Acos developments is the HGP40 high-fidelity pickup designed to track easily on standard and long-playing records. It has a compensated tone arm bringing the tracking weight to 8 grammes only.

Visitors interested in tape recording will find something of more than passing interest on the Grundig stand. Apart from the recorders themselves this firm

have a "Stethoscope" head-set for private listening to recording and a mixer unit enabling up to four different inputs to be mixed, faded in or out and controlled quite independently.

Measuring apparatus is all-important in the amateur station so the comprehensive display of equipment by Avo and by Taylor should not be missed.

Aerials will be the feature of the Telecraft exhibit where in addition to some television models there will be various industrial v.h.f. aerials and arrays.

Next month we hope to review the amateur and non-commercial exhibits in the show.

FIRMS SHOWING

- Automatic Coil Winder and Electrical Equipment Co., Ltd., Douglas Street, London, S.W.1.
- Cosmocord, Ltd., Great Cambridge Road, Enfield, Middlesex.
- David Godwin, 37, Dollis Hill Avenue, London, N.W.2.
- Denco (Clacton), Ltd., 357-9, Old Road, Clacton-on-Sea, Essex.
- General Electric Co., Ltd., Kingsway, London, W.C.2.
- Grundig (Gt. Britain), Ltd., Kidbrook Pk. Rd., London, S.E.3.
- Panda Radio Co., 58, School Lane, Rochdale, Lancs.
- Philpotts Metalworks, Ltd., Chapman Street, Loughborough.
- Salford Electrical Instruments, Ltd., Silk Street, Salford, 3.
- Siemens Electric Lamps and Supplies, Ltd., 38-39, Upper Thames Street, London, E.C.4.
- Taylor Electrical Instruments, Ltd., 419-424, Montrose Avenue, Slough, Bucks.
- Telecraft, Ltd., 64, Brigstock Road, Thornton Heath, Surrey.

Precision Two-speed Drive

AN ingenious slow-motion tuning control primarily for use in precision equipment has been produced by Transradio Ltd., 138a, Cromwell Road, London, S.W.7, but present production is restricted to manufacturers only.

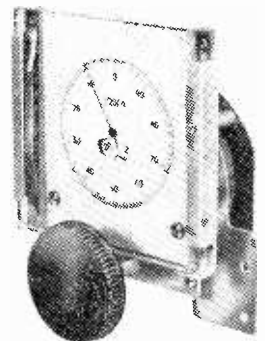
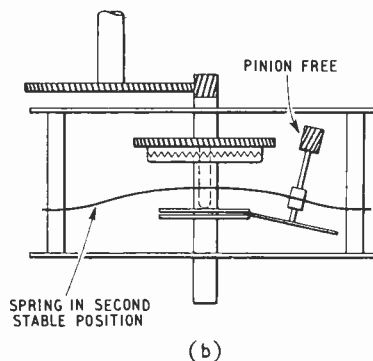
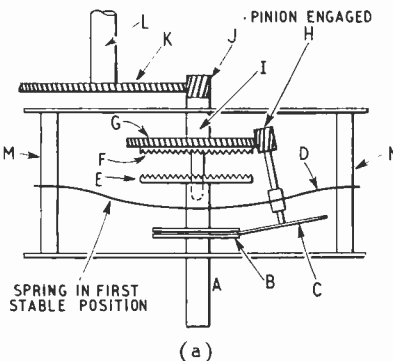
It utilizes a combination of friction drive and spring-tensioned gearing and provides two speeds, one for coarse and the other for fine control. In some models these are 8 and 100 to 1 respectively, while in others they are 15 and 200 to 1. Change from one speed to the other is effected by pulling out or pushing in the control knob spindle.

How this operates the change-over mechanism is best explained by means of the two drawings shown here. In (a), which shows the highest reduction arrangement (knob out), the sequence of drive is from control spindle A via friction discs B and C, thence through gears H, G, J and K, the latter being fixed to the output spindle L.

With the control knob "in" (fast drive), the spring D bows inwards and as it carries the bearing for the

lay-shaft, the pinion H disengages from G and at the same time the two crown-wheel type gears E and F lock together and provide a direct drive between spindles A and I. The gears J and K remain operative as before. The drawing (b) shows this change.

There are several models of this Microdual drive as it is called and all utilize the same basic principle. The latest addition is the Type 57/360 giving a 360-deg rotation of the output spindle L for one complete rotation of the coarse tuning scale, whereas 180 deg is normal. This is marked 0-20 with no subdivisions; the larger clock-face dial is engraved 0-100 with half-divisions marked. Its ratios are 15 and 200 to 1 and it is possible on fine control to record accurately 1/4,000th of a revolution of spindle L. Actually the dial can be read to a quarter of a division so that a movement of 1/8,000th of a revolution can be determined. The mechanism of the drive is such that no backlash in the gearing is transmitted to the scales. In point of fact we were unable to detect the slightest backlash in any part of this mechanism.



Mechanism of the Transradio Microdual drive, (a) showing gear train for high and (b) for low ratios. (Right) The latest version of the Transradio Microdual drive Type 57/360 giving a full rotation of the output spindle.

"Wow" Measurement

*An Oscillographic Method Suitable
for Use With Tape Recorders*

By D. W. THOMASSON, A.M.Brit.I.R.E.

THE kind of wow that is found in tape recorder apparatus is much more unacceptable to the ear than the kind commonly experienced with disc recording. It has a higher variational frequency, and the waveform of the variation is often much more complex, so that the audible effect of a given error is far more obvious. The effect is so obvious, in fact, that an extremely low degree of wow must be sought if it is intended to record music.

The first essential to such a search is a satisfactory method of measuring wow. Several possible techniques exist, but many are unsuitable because they are quite incapable of detecting the small frequency variations concerned. According to Shower and Biddulph (*J. Acoust. Soc. Amer.*, Vol. 3, p. 275, 1931) the human ear can detect a frequency variation of 0.17 per cent under favourable conditions. This figure applies to a 2,000-c/s tone varied sinusoidally at 2 c/s, the sensation level being 70 db. If the wow meter is to be of any practical value it must be able to detect much smaller variations.

Laboratory Technique.—A technique which has been found of value for laboratory work is based on a "strobe" type of oscilloscope display. A test recording is first made with a suitable signal (e.g. a 1 kc/s sine wave) and the output on replay is observed on an oscilloscope with an accurate frequency standard time base. The trace will waver from side to side as the frequency varies, and the lateral movement gives the deviation of the tape from its proper position in terms of time. The tape speed being known, this can be interpreted in terms of distance along the tape, and the frequency variation can then be calculated.

For very precise work it is necessary to determine both the waveform and frequency of the wow variation, but it is generally sufficient to assume that the waveform is approximately sinusoidal and that the frequency is the rotational frequency of the capstan, as it often is.

If the recording is made at a tape speed S_1 inches per second, with a signal frequency f_1 , and the frequency on replay is f_2 , then the speed on replay is equal to $S_1 f_2 / f_1$. If, further, the capstan is d inches in diameter, the rotational frequency will be $S_1 f_2 / \pi d f_1$. The time error can be observed as a fraction K of the cyclic period of the replayed signal, and this will represent a distance of KS_1 / f_1 inches along the tape.

This is the peak-to-peak range over which the tape position is varying from the nominal mean, and the variation is assumed to be at the capstan rotational frequency, so the maximum error velocity will be $KS_1^2 f_2 / d f_1^2$. This is equal to $KS_1 / d f_1$ times the tape velocity on replay.

The percentage error velocity can thus be found

without measuring either the tape speed or signal frequency on replay, and is directly proportional to K , so that a calibrated speed error scale can be used.

A Practical Case.—This method has been used to check the wow on many types of tape recorder, but the case of most interest is that which made the greatest demands in respect of accuracy and capability of showing small degrees of wow. The recorder in question was the "Reflectograph," and, as this recorder is fitted with a continuously variable speed control, observation was rather more simple than usual, the control being used to eliminate long term speed variations that must otherwise be checked by using a variable time-base frequency.

At $7\frac{1}{2}$ in per second, the value of K was found to be 0.1, and as the capstan diameter is 0.3 in the peak speed error is seen to be 0.25 per cent. This is greater than the minimum audible level under favourable conditions, and on this particular machine—which had been in use under domestic conditions for several months—a trace of variation could be heard on a 1 kc/s reproduced note, but there was no sign of wow on normal recordings.

The trace was "clean," showing that higher frequency flutter components were entirely absent.

The reference signal frequency must be chosen to suit the particular recorder in question. If the capstan diameter is small (say of the order of 0.15 in) a higher frequency may be needed to keep K in a convenient range, but as such small capstans tend to produce more percentage wow, especially after a short period of use, this tends to balance matters up. With large capstans the use of a lower frequency is advisable, and where the wow performance is very bad a lower frequency is essential. In one very bad case it was found necessary to go down to 200 c/s to bring K below unity. (Wow percentage was about 5.)

Interpretation.—A careful study of the strobe display will provide much useful information on the performance of the tape drive mechanism. A smooth movement across the screen is preferable, and an irregular movement warns that the wow is non-sinusoidal and may have a high peak velocity error. If the trace is "fuzzy" there is some high frequency flutter, and the "distance error" can be estimated by the width of the trace.

One particularly interesting effect observed was due to a faulty tape that had become excessively sticky. The machine had a slight tendency to wow, but the tape exaggerated this violently, as it stretched to a remarkable degree as the capstan tried to accelerate it, suddenly became free-moving, caught up with a jerk, and then slowed down again. This was traced by using a modified strobe display in which the trace

moved from top to bottom of the screen for the main scan, and slowly from left to right as well. The position of the tape was indicated by using the replayed signal to brighten the trace at a given point in the cycle, and this produced a graph of the varying positional error (Fig. 1). This technique allows both waveform and frequency of the wow to be observed and measured.

The figures themselves also need careful interpretation. It may not be enough to say that one machine has less percentage wow than another, and is therefore better. Comparisons of test figures with auditory tests indicate that the percentage peak frequency variation may not be as important as the rate of change of frequency in terms of the frequency itself.

($\frac{df}{dr}$ compared with f as a percentage.) This accords

with common experience, for when a note changes in pitch very slowly (e.g., the horn note that ends Britten's setting of Blake's *Elegy*) it is sometimes difficult to detect the change, whereas a more rapid slur over a much smaller interval is readily apparent.

The relevant information may be obtained from the test described without difficulty. The maximum frequency error is KS_1/d , and the maximum rate of change of frequency is thus $KS_1^2 f_2/d^2 f_1$ cycles per second per second. Numerically, this is $KS_1^2/d^2 f_1$ times the reproduced frequency.

In the case of the "Reflectograph," taking $f_1 = f_2$ the maximum rate of change of frequency is about 6 per cent of the frequency. With the small-diameter capstan recorders the higher capstan speed gives a much higher rate of change for the same wow percentage, and with slow speed capstans the figure is much lower. It may be noted in passing that this "figure of merit" permits a much more reasonable, comparison of the relative audible effects of wow in tape and disc recordings.

Peak Velocity Display.—It should be noted that the simple strobe technique actually measures the peak time displacement of the wow, and the peak velocity is deduced on the basis of an assumption. In cases where this is not considered a sufficiently reliable technique, the modified two-dimensional display illustrated in Fig. 1 may be used to measure the peak velocity error directly.

For this purpose the arrangement shown in Fig. 2 is used. The vertical scan frequency is adjusted to be equal to the mean frequency of the signal from the tape recorder, and the horizontal scan frequency is derived from the vertical scan by a frequency divider chain having an overall counting ratio of 1000:1. Using the same symbols as before, the vertical scan period will be $S_1/S_2 f_1$ and the horizontal scan period will be $1000 S_1/S_2 f_1$.

The maximum slope of the displayed wow curve may be defined as dV/dH , where dV and dH are expressed as fractions of the vertical and horizontal dimensions of the raster respectively. Then the time error involved is $dV S_1/S_2 f_1$ seconds, during which the tape moves $dV S_1/f_1$ inches. This error occurs during a period of $1000 dH S_1/S_2 f_1$ seconds, at a rate of

$\frac{dV}{dH} S_2 \times 10^{-3}$ inches per second, which, expressed

as a percentage of the replay speed S_2 is a peak velocity error of 0.1 dV/dH per cent. Once again, no separate measurements are required other than the direct determination of the slope in an appropriate manner. If the amplitudes of the horizontal and vertical scans are equal, a 45-degree slope indicates a peak wow of 0.1 per cent.

Values used in practice have been $f_1 = 1000$ c/s, for $S_1 = 7\frac{1}{2}$ in/sec. These have been found to be capable, especially with suitable variations in the frequency ratio of the scans, of dealing with extreme cases. Being an "absolute" method of measurement involving neither assumptions nor approximations, this technique might be useful for establishing a standard method of wow specification, which appears to be a rather urgent necessity.

Production Wow Testing.—For many purposes it is enough to use a standard tape in the same test set-up for production testing, but since this may not detect all types of fault in respect of tape transit mechanisms a further kind of wow test may be mentioned. This uses a frequency measuring circuit of the type in which a capacitor is alternately charged and discharged during each signal cycle, the average discharge current being proportional to the signal frequency. The magnitude of the current is first measured by a bridge circuit to determine the actual tape speed in terms of replayed signal frequency, and the a.c. component is then passed to a meter circuit which can measure both the true r.m.s. value and the peak value of the wow signal, so that the form factor can be estimated.

This instrument is somewhat limited in its present form by the difficulty of observing very small variations of frequency with high accuracy, but some apparatus of this sort must inevitably appear on the test benches of all tape recorder manufacturers before long.

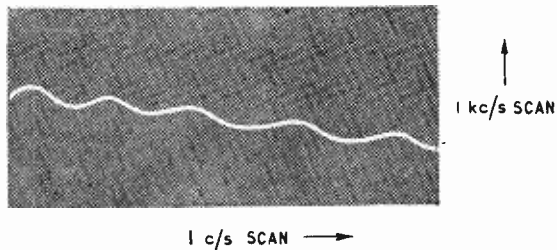


Fig. 1. Waveform of "wow," displayed by the technique indicated in Fig. 2.

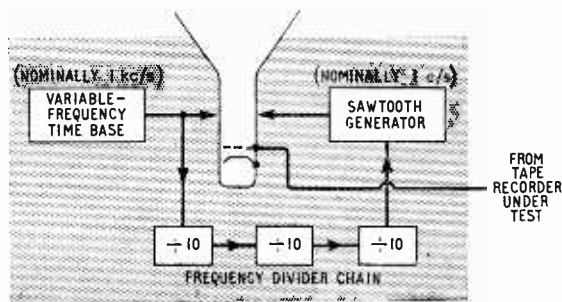


Fig. 2. Block diagram of modified two-dimensional display.

"Television Aerials of the Future": A Correction.

The last sentence of para. 2 on p. 508 should read: The characteristic impedance is 300 ohms and the loss at 450 Mc/s (when dry) is about 3db per 100ft.

LETTERS TO THE EDITOR

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

Ignition Interference in U.S.A.

THE LETTER from Malcolm S. Morse, published in your October issue, rallies me to "Diallist's" support on the subject of ignition interference.

If Mr. Morse has never seen or heard of a case of ignition interference on television in this country I am moved to question where he has been spending his time since television operations commenced here. I live about four miles closer to the four Washington television stations than he does and I have an antenna installation of average performance. However, under certain conditions some automobiles and trucks do cause ignition interference which can be seen as well as heard on my receiver. This is no isolated case and I am certain that most viewers have at one time or another seen the series of black dots followed by trailing whites produced by the adjacent passage of some internal-combustion-propelled device.

Even in the canyons of New York City where the modern cliff-dwellers exist in apartments ten or more storeys above ground level and literally within the shadow of seven television stations (not more than two or three miles distant) I have seen and heard ignition interference. Therefore I would take issue with your correspondent on behalf of the British manufacturers who turn out "poorly designed television sets that are subject to interference from automobile ignition." On the other hand, I will willingly join hands with him in condemning the short-sighted bureaucratic monopoly of the B.B.C. which deliberately selected positive modulation which tends to emphasize interference rather than the negative system which in most cases reduces interfering pulses to black level.

The car radio is as integral a part of the American automobile as a windshield wiper or a horn (and is used as much!). As of January 1, 1953, at least 25,000,000 auto receivers were in use, and 3,500,000 were produced in 1953 in the first seven months. This latter figure works out very closely to one per car produced this year. Most of these car radio installations use either resistor suppressors, resistive ignition leads (which have the same effect as suppressors), or shielded harness.

Possibly this letter is a little long, but I feel that its length is justified in defence of the sweeping indictment of British manufacturers presented by Mr. Morse.

Bethesda, Md., U.S.A. JOHN S. BATTISON.

THERE'S none so blind as those who will not see, they say. Or perhaps Malcolm S. Morse (your October issue) lives in the backwoods and rarely sees a car. I am an Englishman working over here as a TV serviceman, and one of our biggest problems is ignition interference. My workshop is on one of the main roads out of New York, and despite a 1000 μ V signal and a directional 5-element aerial with its back to the road we have plenty of reason to wish for the legislation "Diallist" was asking for—suppression of motor vehicle ignition systems.

As to the "penalizing" of British motorists, I suppressed my car in England for 1s 6d, and for 21 cents in U.S.A. That is some penalty, is it not!

There is absolutely no doubt that satisfactory suppression of any interference must be done at the source, and not in the set.

Hillsdale, N.Y., U.S.A. L. JOHN WHEATLEY.

IGNITION interference with television reception has been a dire complaint of your contributor "Diallist" for some time and no doubt you, too, feel strongly on the subject, but I do think that the letter of Malcolm S. Morse in the October number is deserving of more broadminded

consideration than you, Sir, appear to have accorded to it.

It appears to have become axiomatic with most of the technical Press and *Wireless World* in particular, that the policy of the B.B.C. is the correct one, regardless of what evidence may appear to show the contrary. Strenuous efforts have been made to convince the non-technical viewer that the nuisance caused to him by ignition interference is due only to the thoughtlessness or, indeed, malice, of the motorist.

Mr. Morse takes the view that ignition interference in the United States is practically negligible, and this view has been expressed previously by both technical and administrative spokesmen of the American TV industry.

Perhaps, then, the B.B.C.'s peak white modulation may be a contributory cause of our sufferings in this country?

No doubt the big guns are already loaded to disprove this, just as no doubt very soon they will "prove" that the American colour (and 3D?) TV is, in fact, inferior to our black-and-white picture with its 405 very noticeable lines.

Malvern, Worcs.

P. J. ATKINS.

Identifying Receiver Controls

A RADIO (or television) set is far from the "amateur" stage where function was everything, and both are now accepted as items of domestic furniture. While a regular user has no difficulty in knowing the controls and can operate the set without difficulty, this is not the case with occasional users, as in semi-public rooms, hotels, clubs, canteens and so on with a floating population. It is frequently a matter of some difficulty to determine if a receiver is correctly set when it has been switched on. With a panel light the fact that the set is on is obvious, but an associated volume or tone control may lead to indeterminate reception, particularly owing to the warming-up time. Further, the position of a wave-change switch may not be obvious, leading to possible delay in receiving a wanted programme.

Is there not a case for some degree of standardization of the location and/or appearance of these controls? I hasten to add that I am not proposing an arrangement of prominently labelled control knobs which would spoil the appearance of a set; but where there are three knobs, as is commonly found, these might well be standardized in their sequence, with some addition for ready identification. An on-off switch which is obviously on or off by its appearance would be an advantage, especially where there is a wall switch. Some form of indication such as an up-down motion similar to a lighting switch would be obvious to all, and could be made to match the other control knobs. The wave-change switch needs some marking and this is already provided on many sets. It is frequently on the right, and might well be standardized there. The tuning dial control need only be marked in some way to indicate which it is, since its real indication is on the main dial. It might usefully be located nearest to the dial or scale.

Finally the volume control. For a given case it is often left indefinitely; on the other hand it may be frequently reset by various users to suit themselves, and it may be altered when reception in another room is required. A volume control set at a high level and the set then switched on can result in a startling blare, and on the other hand the control may be left so low that the set is not heard and considered faulty. A simple marking on the knob or fixed near it would overcome this, so that on switching on and leaving the receiver to warm up the volume control could be set at the same time. A very unobtrusive marking is essential, such as lightly embossed or engraved radial lines. A convenient number might be six, needing no figures, or alternatively ten, with the fifth mark longer.

The volume control marking is, of course, a very controversial one: makers may claim that users would tend to compare receivers on the grounds that "my set gives me all the volume I want at 2, but the so-and-so set needs 4." Further, an ageing receiver would need a progressively increasing setting, although this might be turned to advantage by the maker pointing out that a given increase in setting is an indication that certain valves need renewing.

Bexley, Kent.

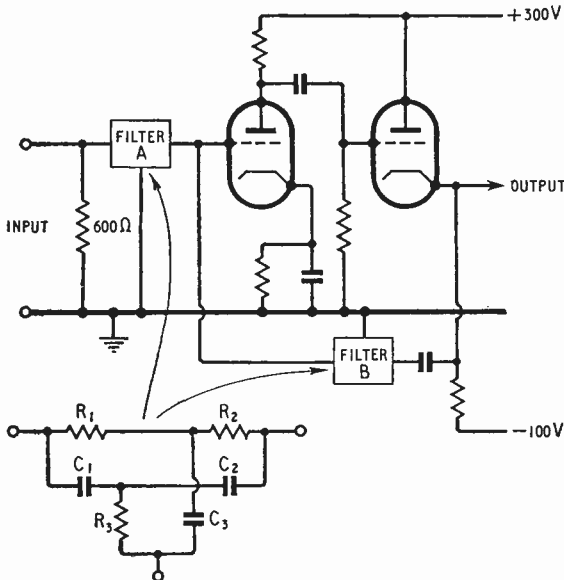
E. H. W. BANNER.

"Simple Distortion Meter"

THE advantages of the parallel T network for the removal of the fundamental in distortion measurements are noted by V. J. Tyler in the September issue. The disadvantage of the very low selectivity ($Q=1/2$) may be overcome quite simply by including a similar network in a feedback loop of the following amplifier.

The loss of harmonics in the input filter is greatest for the second, amounting to about 9 db. The loop gain must be substantially the inverse of the input filter response, except near the fundamental. For instance, with a loop gain of 30 at high harmonics, the second harmonic is in error by 0.4 per cent in amplitude and 5 deg in phase; with a loop gain of 10 the errors are 4.4 per cent and 16.5 deg.

The filtering of the fundamental will be offset to the



extent of the loop gain, so that the rejection of the input filter is greater by that much. For instance, suppose it is required to measure a distortion of 1 per cent to an accuracy of 10 per cent; using a loop gain of 10, there will be the response error of 4.4 per cent so a further 5.6 per cent error due to fundamental may be allowed, corresponding to 0.056 per cent of fundamental in the output; thus the input filter must give a rejection of 85 db.

Now the rejection of the filter itself may be made very high with ordinary components. It is not necessary for the components to have any precise relationship, provided there are two variables. The limit to the overall rejection is set by the stability of the test oscillator and by the feedback amplifier noise at fundamental frequency.

Measurements have been made in the range 10 c/s to

40 kc/s of distortions down to 0.1 per cent using loop gains of more than 30 so that 120 db rejection, at least, can be obtained.

The circuit is shown in outline in the figure. Each filter works from a low impedance into the other filter so that their responses are the same. High-stability components are used. In the filter, R_1 and R_2 are 160 kΩ and R_3 is 80 kΩ. The capacitances C_1 and C_2 are equal and C_3 is twice C_1 . The filters are similar in values but R_3 of A is made variable—68 kΩ fixed with 20 kΩ and 500 Ω coarse and fine variables.

Adjustment of A for a null is by variation of R_3 and the frequency of the test oscillator. The latter is a better adjustment than that of R_1 and R_2 . (In either case the two adjustments are not independent.)

From the two conditions for a null, viz.,

$$\frac{R_1 R_2}{X_1 X_2} = (X_1 + X_2) X_3 \text{ where } X = \frac{1}{\omega C}$$

it can be seen that the only independent variables are R_3 and C_3 . However, adjustment of R_3 and ω is not difficult in practice.

G. H. ASKEW, R. MATCHELL.

Cinema-Television, Ltd.,
London, S.E.26.

"Meter Overload Protection"

I AM obliged to T. H. Francis for pointing out (your November issue) that the circuit resistance was not specified in the "Overload Factor Test." In point of fact the tests reported were carried out with a circuit resistance of more than ten times the instrument resistance.

Perusal of the curve of Fig. 1 shows that the resistance of the rectifier disc shunting the movement under overload conditions approaches 10 ohms (<1 per cent of coil resistance). When used in a multi-range meter this device will give full protection on the low-voltage and high-resistance ranges when the indicator is not shunted at all.

I regret that no reference was made to M. G. Scroggie's work on this subject (*Wireless World*, 11.1.35 and 2.6.38). Although the circuit elements are similar, the linear scale shape and negligible temperature error were not a part of the earlier design.

Rickmansworth, Herts.

J. de GRUCHY.

Technical Qualifications

WHILST being in full agreement with Mr. Squires' letter and the last paragraph of Mr. Barton's letter (both October issue), I cannot agree with Mr. Barton's remarks on the mathematical standards of the City and Guilds of London Institute, nor on the question of the syllabus as applied to Post Office engineers.

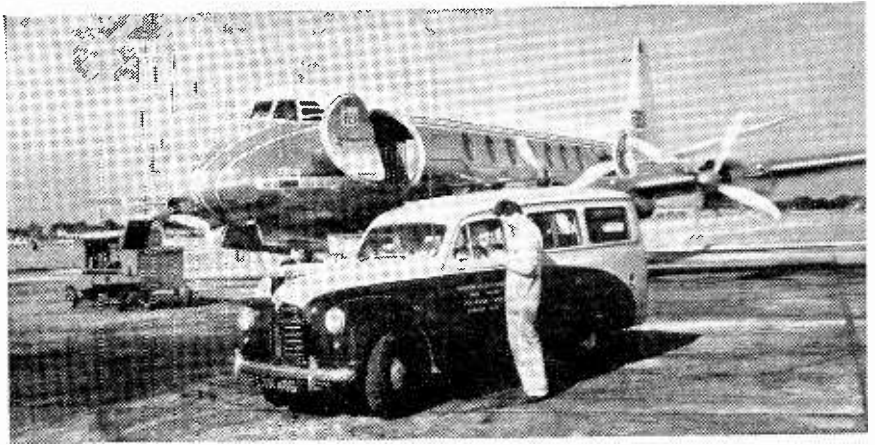
The City and Guilds technologist is not intended to be a mathematical genius, but a first-class technologist with a good working background of mathematics. If an employer wants a mental giant then he asks for and gets someone with a good degree from a University. The degree man is the theoretician in the main, and the technologist the man who interprets (or tries to interpret) these theories in practical form. In any case I fail to see how any City and Guilds student can pass Grades 4 and 5 Telecommunication Principles without having done the necessary mathematics for these grades.

Naturally the present City and Guilds syllabus places emphasis on telecommunications as understood by Post Office engineers, who are in the very wide field of telecommunication engineering for which this course was designed, as its name implies. So are B.B.C. engineers, cable wireless engineers, relay engineers, etc.

Willenhall, Staffs.

"GRADE IV STUDENT."

*Experimental V.H.F.
Radio Extension to
G.P.O. Telephone
System at
London Airport*

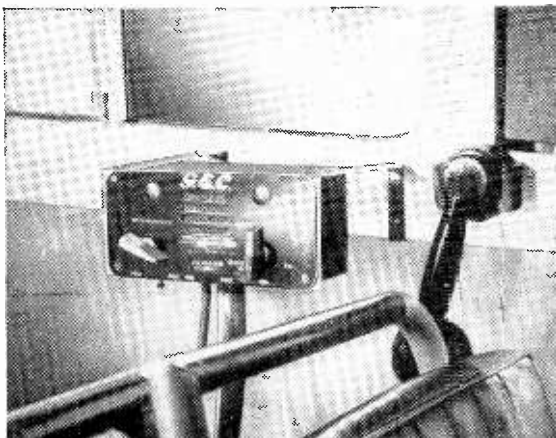


AIRPORT GROUND COMMUNICATIONS

A v.h.f. radio extension to the ordinary telephone system is being tried out at London Airport by the Ministry of Civil Aviation, using the General Electric Company's equipment. The idea is to provide means of direct communication between the offices and depots of the various air transport firms using the airport and their staffs in the more inaccessible parts of the aerodrome. Anyone familiar with London Airport and knowing the amount of ground it covers must know that one can be right out of reach of a telephone for very long periods.

The permanent adoption of this scheme would enable the driver of a vehicle towing an aircraft from its hangar to inform his company's duty officer of any mishap which would be likely to cause considerable delay in its arrival on the loading apron; or permission might be required to cross an intersection or duty runway. Staff loading aircraft may have an urgent message for the company's office or vice versa, or airport officials may wish to notify some last-

Above: Radio equipped vehicle passing on a message to mechanics working on the aircraft seen in the background at London Airport. Below: The G.E.C. remote control unit is very compact and easily accommodated in any type of vehicle. Here it is mounted just behind and to the left of the passenger's seat.



minute changes in the departure schedule to staff scattered about the airfield.

All this can be, and is, carried through by messengers or someone seeking the nearest fixed telephone, but how much simpler and speedier it could be by radio telephone!

The experimental v.h.f. equipment installed in the various vehicles is of 10 to 12 watts rating, is amplitude modulated and can operate on any spot frequency between 70 and 180 Mc/s. Duplex working is employed, without a change-over switch. The sets are remotely controlled and the main items can be stowed away in any convenient part of the vehicle. They operate entirely from the car's battery.

TAPE *versus* DISC

DEVELOPMENTS in tape recording, and the possibility of providing good quality at economical tape speeds, has brought the tape machine into the picture as a possible competitor with the disc for domestic sound reproduction. A recent discussion on this topic, staged by the Radio Section of the I.E.E., started with the assumption that both methods were capable of giving better than acceptable quality for domestic use. Relative cost and convenience were thought to be the most important considerations.

Though some disagreement arose as to comparative basic costs of component parts for the two systems, there was no strong suggestion that the price of a simple tape reproducer need be significantly greater than that of a disc machine of comparable performance. On the other hand, it was not contested that the present price of magnetic tape was such as to give an economic advantage to the disc, though the margin could be reduced by using slower speeds and multi-track recording. Existing methods of duplicating tapes by "dubbing" or "printing" might be no more costly than the pressing of discs, but it was stated some difficulty has been experienced in duplication on a really large scale. Inspection, too, is a problem, as tapes cannot be examined visually for flaws.

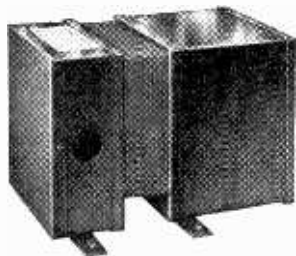
Both tape and disc had their supporters on the score of ease of handling and susceptibility to accidental damage. Tape was said to give a greater number of playings without deterioration, but to suffer from deterioration in storage (which might be prevented by re-spooling).

Manufacturers' Products

NEW EQUIPMENT AND ACCESSORIES FOR RADIO AND ELECTRONICS

Automatic Boost Transformers

SINGLE-STEP voltage booster transformers designed for use with equipment which might fail to operate satisfactorily or even suffer



Advance "Advolt" Type N2A automatic booster for 230-V a.c. supplies.

damage from a substantial fall in mains voltage have been introduced by Advance Components, Back Road, Shernhall Street, London, E.17.

Known as the "Advolt," it is completely automatic in operation and when the mains supply falls to a predetermined voltage a 12% boost voltage is immediately added to the output. When the supply reverts to normal boost is removed.

The equipment consists of a boost transformer switched by means of relays operated by a voltage-sensitive circuit. The Type N2A transformer,

which measures $8\frac{1}{2} \times 7\frac{1}{2} \times 5\frac{1}{2}$ in., weighs 16 lb, is for a nominal a.c.-supply of 230 V and a load capacity of 2 kVA, costs £16 15s. A 110-V model (N2B) is available and two for 5 kVA loading are in course of development.

Anti-interference Aerial

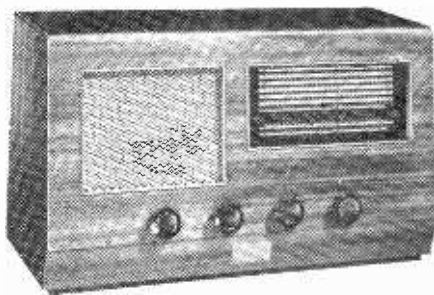
IT has been established that a frame aerial is less susceptible than an open aerial to locally generated electrical interference, particularly in the zone where the interfering field has not yet established itself as a self-propagating wave. The directional properties of a frame can also contribute materially to the reduction of interference when the desired signal is coming from a different direction. The superiority of a frame aerial over indoor "picture rail" aerials is most marked on long waves and at the top end of the medium-wave range, but its use has been restricted because conventional frames are thought to be incongruous in the living-room.

This objection has been overcome in the "Klerecep" aerial, distributed by A.B. Metal Products, 16, Berkeley Street, London, W.1. The windings are enclosed in an attractive picture frame which can be placed anywhere adjacent to the set, and are tuned by a small variable capacitor at the back. Switching is arranged to preserve the symmetry of the windings on both medium and long waves, and

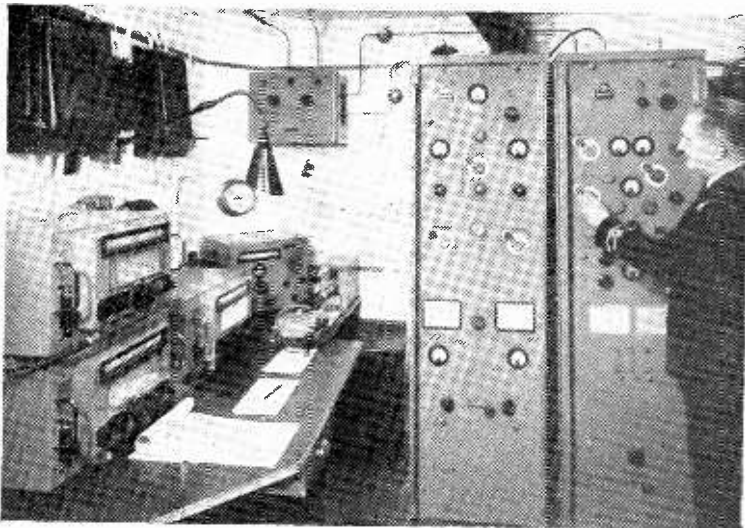
tappings are adjusted to match the input impedance of the average receiver. The selectivity conferred by the additional tuned circuit is worth having, and has proved useful in receiving Continental long-wave stations free from a background from Droitwich. The price of the "Klerecep" aerial is 47s 6d.

Cabin Broadcast Set

THE Cameo Senior Model RMI marine broadcast receiver marketed by Rees Mace Marine, 11 Hinde Street, Manchester Square, London, W.1, which was briefly described in our November 1952 issue, is now available in a wooden cabinet with either a walnut finish or covered in light blue rexine. No circuit changes have been made and both sets have nine wavebands, seven of which are on the short waves. It is a superhet for a.c. or d.c. operation. A point of interest is that fitting instructions, circuit diagram, list of components and a list of service agents throughout the world are packed with each receiver.



Rees Mace marine broadcast receiver fitted in a walnut cabinet.



RADIO ON THE ROYAL TOUR

SPECIAL radio equipment has been installed in the s.s. *Gothic* for the Royal tour of the Commonwealth. Apart from a heavy volume of State, Naval and Press messages, provision has been made for transmitting material for "live" B.B.C. broadcasts, for picture transmission and distribution of radio and recorded programmes throughout the ship.

The main transmitter is a Marconi SWB11X, giving 7 kW output on radio telephony and telegraphy in the band 4 to 22 Mc/s. Its installation gave rise to numerous difficulties from stray r.f. currents in rigging, poorly earthed metalwork and such-like. Thorough bonding cured these troubles. The supporting transmitter is a 600-W "Worldspan" (shown in the photograph) modified for high-speed telegraphy.

Special aerial equipment enables any of the receivers to be operated during transmission, provided a frequency separation of 1 Mc/s is allowed.

The ship carries also Marconi radar, direction finder and echo sounder.

WORLD OF WIRELESS

International, Organizational, Personal
and Industrial Notes and News

Interference: International Agreement

DETAILS have now been issued by the British Standards Institution of the recommendations on radio interference to be made to the International Electrotechnical Commission as a result of the recent London conference of the International Special Committee on Radio Interference (C.I.S.P.R.), to which we referred last month.

It was agreed to recommend that all countries should adopt the following limits of noise voltages measured at the terminals of appliances: 150-200kc/s, 1,500 μ V; 200-285kc/s and 525-1,605kc/s, 1,000 μ V. It was also recommended that the 1,000 μ V limit should, as far as practicable, be applied from 1,605kc/s to 25Mc/s.

These limits are applicable to domestic, industrial and commercial appliances rated up to 1kW, and intended for direct connection to a distribution system operating at not higher than 750 volts between conductors, or 375 volts between one conductor and earth.

It was recommended that all countries should consider the adoption of the 50 μ V/m limit at a distance of ten metres for Band 1 (41—68Mc/s) as now applied in both the U.K. and the U.S.A.

A considerable measure of agreement was also reached on the capacitor currents (at mains frequency) to frame or earth which could be accepted for various classes of domestic appliances without danger of shock to the user.

The countries represented at the meeting were Belgium, Czechoslovakia, Denmark, Finland, France, Germany, Italy, Netherlands, Norway, Sweden, Switzerland, U.K. and U.S.A.

Transmitting Licences

THE MORSE TEST for prospective amateur licensees will not in future be taken at any Head Post Office as in the past. From January 1st the test will be conducted on request at G.P.O. Headquarters, St. Martins-le-Grand, London, E.C.1; Post Office Coast Stations (Burnham, Cullercoats, Humber, Land's End, Niton, North Foreland, Oban, Port Patrick, Seaforth, Stonehaven and Wick) and Radio Surveyor's Offices in Belfast, Cardiff, Falmouth, Glasgow, Hull, Leith, Liverpool, London (E.C.3), Newcastle-upon-Tyne and Southampton.

In order to meet the need of applicants who cannot conveniently reach the above places, tests will also be held, provided there are sufficient candidates, twice a year (January and September) at the Head Post Offices in Birmingham, Cambridge, Derby, Leeds and Manchester. Applications for the January test must be received by O.T.D., Radio Branch, G.P.O. Headquarters, London, E.C.4, by December 20th.

We understand that the P.M.G. is still considering the question of issuing vision-only licences to those who do not hold the normal amateur licence but wish to experiment in vision transmission. The whole question of amateur licences is under consideration and there will probably be considerable changes when the new regulations are made known.

Audio Shows

THE SIXTH annual exhibition of sound recording and reproducing equipment sponsored by the British Sound Recording Association has been arranged for May 22nd and 23rd at the Waldorf Hotel, Aldwych, London, W.C.2.

The fifth exhibition of audio equipment to be organized by the Association of Public Address Engineers will be held on April 28th and 29th at the Horseshoe Hotel, Tottenham Court Road, London, W.1.

Alternative Television Proposals

NEW GOVERNMENT ideas for an alternative television service were set out in a White Paper (Cmd. 9005; H.M.S.O.; 4d) issued on November 13th. The scheme is for a network owned and operated by a public corporation like the B.B.C., but station time would be leased to private programme companies deriving their revenue solely from advertisements. The programmes would be under the control of the corporation, which in turn would be responsible to the Postmaster General.

The White Paper discusses the problem of finding frequencies for the proposed new stations. After pointing out the difficulties of working on Bands 4 and 5 it goes on to say that there are two, or possibly three, channels in Band 3 which could be used almost at once. This does not mean, though, that only two or three stations could be set up. "The number of stations that there can be on each channel without causing interference with one another depends on the power and range of the stations and their distance apart, and many different combinations of power and distance are technically possible." It would not, however, be possible to run a service of local independent stations, each leased to a different programme company. The programmes could only be produced economically if local stations were linked up into a network for the purpose of putting out the same programme for the bulk of the time, with something approaching national coverage.

For some years, says the White Paper, it will be impossible to set up more than one such network. Using two channels in Band 3, it would begin with stations in London and possibly in two other large centres of population.

Student Exchange

DURING the 1953 summer vacation 3,783 students participated in the international exchange organized by the International Association for the Exchange of Students for Technical Experience; more than double the 1950 figure. Of this number 623 came to this country and 544 went from the United Kingdom to other countries.

The statistics given in the annual report of the Association do not indicate how many students were studying radio and telecommunications—they are included under the general heading of electrical engineering. However, from the list of firms in the U.K. who received students it is apparent that a considerable number of the 117 listed as spending part of their vacation in the electrical industry, went into radio.

Eighteen countries participated in the scheme, particulars of which are obtainable from J. Newby, Imperial College, South Kensington, London, S.W.7.

PERSONALITIES

Dr. S. Whitehead, director of the British Electrical and Allied Industries Research Association, has relinquished the chairmanship of the International Special Committee on Radio Interference (C.I.S.P.R.) as he is no longer concerned so intimately with the problems before the committee. He had been chairman for seven years. Dr. Whitehead is succeeded by O. W. Humphreys, director of the G.E.C. Research Laboratories.

Commander (L) C. V. Robinson, O.B.E., R.N., this year's chairman of the Southern Centre of the I.E.E. has specialized in radio throughout his 40 years in the Royal Navy. He was for many years on the experimental staff of H.M. Signal School and at A.S.R.E. Haslemere. For three years from

1935 he was lent to the R.A.F. and was in charge of the radio gear for the operation of the radio-controlled *Queen Bee* aircraft. Throughout the war Commander Robinson was in charge of a department he formed which was responsible for the testing and adjustment of all W/T and radar equipment fitted in H.M. ships. He is now serving in H.M.S. *Collingwood*, the Navy's main electrical school.

Horace Freeman, exhibition manager of the R.S.G.B. Amateur Radio Show, which opens at the Royal Hotel, Woburn Place, London, W.C.1, on November 25th, has also organized each of the six previous shows. He has in fact been associated with radio publicity since the early 1920s and has been advertisement manager of R.S.G.B. publications since 1925. He was instrumental in the staging of the first All-British Wireless Exhibition at the Royal Horticultural Hall, London, in 1922. Mr. Freeman is now with the National Publicity Co. with which his own agency was merged in 1951. The portrait reproduced here was painted this year by Brigadier A. L. Harris, M.C., Royal Signals (Retd.).



Dr. A. Rosen, who was formerly chief engineer (telecommunications cables) with Siemens Brothers, has been appointed telecommunications consultant in the engineering organization of British Insulated Callender's Cables in succession to the late Dr. Hans Carsten.

S. Erickson, for the past four years officer-in-charge of the Technical Branch Drawing Office of Government Communications Headquarters at Cheltenham, has joined A. T. and E. (Bridgnorth), Ltd., as chief draughtsman. Before going to Cheltenham, Mr. Erickson was with Burndep and previously for many years at the radio and television works of the General Electric Co.

Walter Newman, chief designer of Salford Electrical Instruments, Ltd., has retired after 45 years' service with the company.

OUR AUTHORS

G. P. Anderson, who describes an amateur transmitter-receiver in this issue, joined the Post Office from school in 1934 and for the past 11 years has been in the Radio Branch Laboratory at the Post Office Research Station. He has held an amateur transmitting licence (G2QY) since 1934 and is particularly interested in u.h.f. and low-power low-frequency portable work.

D. W. Thomasson, author of the article on "wow" measurement in tape recorders, was test gear designer at Cossor's until 1947, when he became an independent consultant and operated his own prototype workshop (Earl Services) in Exeter. He joined Cossor's in 1937, but throughout the war was in the R.A.F., latterly on loan to the Armament Division of R.A.E., Farnborough.

OBITUARY

William A. Jackson, O.B.E., M.I.E.E., sales director of the Telephone Manufacturing Company died on October 25th at the age of 68. He had been associated with the company since 1916—a year after its formation. Mr. Jackson had been a director since 1939 and was also a member of the boards of Telephone Rentals, Ltd., T.M.C. Harwell (Sales), Ltd., and Carrington Manufacturing Co., Ltd. He was a past-chairman of the Radio and Electronic Component Manufacturers' Federation.

Lewis Marcus Lyons, chairman of the board of Claude Lyons, Ltd., died on September 1st at the age of 59. He had been with the company for 33 years. Claude Lyons also suffered earlier this year the loss of another director, **Louis Cedric Smith**, who was also chief engineer. He was 65 years old.

IN BRIEF

Thirteen Million broadcast receiving licences were current in the United Kingdom at the end of September. Sound licences totalled 10,278,157, television 2,615,259, and car sets 197,574. The month's increase in television licences was 76,156.

"Gothic" Radio-Telephones.—In addition to the installation described on page 584 the *Gothic* has been equipped for the Royal Tour with Pye v.h.f. radio-telephone gear to provide short-range communication between the ship and ports of call. Terminal equipment has been flown to some ports but at others a portable station will be landed from the *Gothic* for connection into the land telephone system.

Longest direct radio-telephone link in the world—linking New Zealand with the U.K.—was recently opened. The equipment for the New Zealand station at Himatangi, 75 miles north of Wellington, was supplied by Standard Telephones and Cables, and includes a 40-kW and three 4-kW single side-band transmitters. The equipment will be used to relay the Queen's Christmas Day broadcast from New Zealand for recording and retransmission by the B.B.C. The station is also equipped with phototelegraphy apparatus.

New B.B.C. Transmitter.—A permanent 2-kW station at Bexhill was brought into service by the B.B.C. on November 8th to replace the temporary station which has been in use at Hastings. This 206-metre Home Service transmitter will serve the coastal area between Rye and Beachy Head.

Transistor Lectures.—The course of eight lectures on "Crystal Valves and Transistors," which ends at the Borough Polytechnic, London, S.E.1, on December 8th, has created so much interest that it is being repeated. The lectures, which are by members of the G.E.C. Research Laboratories' staff, will be given at 3.0 and repeated at 7.0 on Tuesdays from January 19th until March 9th. The fee for the course is £1 10s, and intending students should apply for an enrolment form from the secretary.

Radar Association.—Originally formed as a social club for ex-wartime members of the R.A.F. who had been associated with radar, the Radar Association is to expand the technical side of its activities by the formation of a Technical Division. Membership is open to those who are or have been engaged in this field of radar in the Forces or in industry. The winter programme includes "The Exploration of Space" by Arthur C. Clark (at 7.30 on December 7th in the Anatomy Theatre, University College, Gower Street, London, W.1), "The Future of Secondary Radar" and "Radar in Meteorology." Particulars of the Association are obtainable from the Secretary, 83, Portland Place, London, W.1.

Canadian Approval.—The British Standards Institution has compiled a list of electrical equipment which has been approved for export to Canada. A number of electronic manufacturers appear in the miscellaneous section of the list, which is obtainable free of charge from the B.S.I., 2, Park Street, London, W.1. They include: Advance (test instruments and signal generators), B.S.R. (record changers and motor units), Cossor (twin-beam c.r.o.), Dawe (industrial electronic test equipment, pulse generator and Q meters), Garrard (record playing equipment and record changers) and Plessey (record changers).

Bibliographies on a variety of subjects are being produced by the Library Association and No. 22 of the series (issued under the general title of "Readers' Guide to Books") covers radio and television. The 240 or more books listed in this 20-page booklet are classified under 30 headings. The booklet is obtainable from the Library Association, County Library, Widemarsh Street, Hereford, price 10d (postage 2d).

French TV.—The third 819-line transmitter was brought into service in France on October 15th. This 20-kW transmitter at Strasbourg radiates on 175.15 Mc/s sound and 164 Mc/s vision. Two other transmitters are in course of construction at Lyons and Marseilles and are scheduled to be brought into service during the latter half of next year.

Belgium.—Experimental bi-lingual two-standard television transmissions began in Belgium at the end of October. The two transmitters, one radiating a Flemish programme on 625 lines and the other a French programme on 819 lines, are in the Brussels area. The equipment for the studios was provided by Pye.

Radio Stamp.—One of the three Swedish postage stamps issued to mark the centenary of the opening of the first public telegraph service in Sweden bears a symbolic radio design enclosed in a frame with *Radio Suedois* in morse.

PUBLICATION DATE

The January issue will be published on January 5th, the delay of a few days being due to the Christmas holidays.

Radio Show 1954.—H.M. The Queen has consented to be patron of next year's National Radio Show which will be held at Earls Court, London, from August 25th to September 4th, with a pre-view for overseas and other special visitors on August 24th.

MSF.—Bona fide users of the standard frequency transmissions from the Rugby station, MSF, can obtain a leaflet from the National Physical Laboratory, Teddington, Middlesex, giving details of the service, which, since May, has been radiated continuously on 2.5, 5 and 10 Mc/s.

Juvenile Lectures.—"The Uses of Radio Waves" is the title of the course of six lectures to be given by J. A. Ratcliffe, F.R.S., Reader in Physics, University of Cambridge, at the Royal Institution, 21, Albemarle Street, London, W.1, on December 29th and 31st, and January 2nd, 5th, 7th and 9th, at 3.0. It is the 124th course of R.I. Christmas Lectures "adapted to a juvenile auditory." The fee for children between 10 and 17 is £1.

Institute of Navigation.—The annual report of the Institute of Navigation records that the membership at the end of June was 1,349; an increase of 95 during the year.

Moroccan TV.—It is expected that the television station now being built at Casablanca will start transmissions next March. It will employ the French 819-line standard.

International Telecommunication Union.—Léon Mulatier, who has been secretary-general of the International Telecommunication Union for some years, is retiring at the end of the year and will be succeeded by Dr. Marco Aurelio Andrada, who is at present secretary-general of the Argentinian Posts and Telecommunications Administration.

Telecommunications Advisor.—The office of Telecommunications Advisor to the United States President, created by ex-President Truman in 1951, has been ended on the resignation of the holder, Haraden Pratt.

Plastics in the field of telecommunication cables is among the specialized uses of plastics covered by the papers included in "Plastics Progress, 1953" recently published by *British Plastics*. The text of the 439-page volume is based on the papers and discussions at the Convention held during the British Plastics Exhibition in June. It costs 50s.

Radio Control of a crane is a feature of the documentary sound film "Mechanical Handling on Show" which covers last year's Mechanical Handling Exhibition. It can be borrowed by societies, clubs, trade organizations, colleges, etc., free of charge from *Mechanical Handling*, Dorset House, Stamford Street, London, S.E.1.

Yachtsmen among our readers may like to know that the "Yachting World Diary 1954" includes in its 52-page reference section, details of Consol stations, radio beacons, times of B.B.C. weather forecasts and the Beaufort scale used in these. It costs 8s 9d (blue morocco leather) or 7s (rexine) including purchase tax.

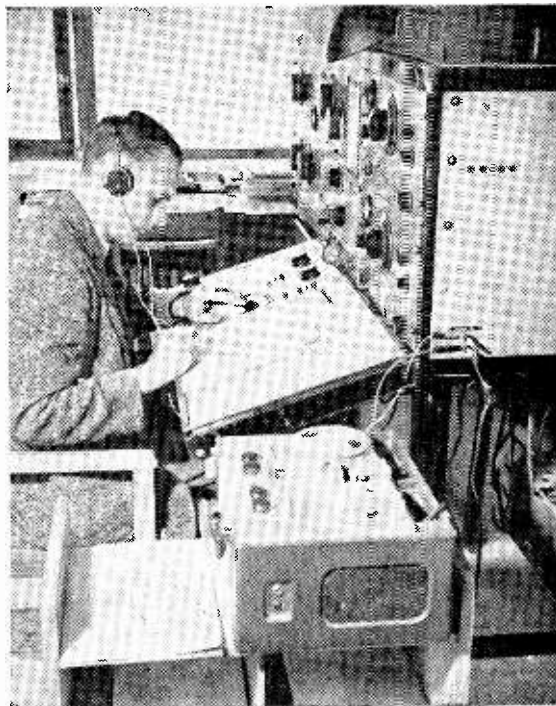
Exporting to Canada.—The 1954 edition of the CABMA Register of British Products and Canadian Distributors, which is sponsored by the Canadian Association of British Manufacturers and Agencies, is in course of preparation. The first edition was issued by our Publishers and Kelly's Directories last June, and included a number of radio and electronic manufacturers and exporters whose products and services are available in Canada. Any British manufacturer exporting to Canada whose name was not included in the 1953 edition should communicate with Kelly's Directories, Ltd., 186, Strand, London, W.C.2.

BUSINESS NOTES

Pye Industrial TV Equipment has been supplied to the recently opened National College of Rubber Technology, Holloway, London, which has been wired to enable large audiences in the lecture theatre to see televised details of processes and machinery in the comparatively small laboratories and workshops. The lecture theatre is equipped with a 27-inch monitor and a talk-back system permits students to ask questions of the lecturer or demonstrator in the laboratory.

Marconi's are to supply, through their Berne agents, Hasler S/A, a v.h.f. omni-directional radio range (VOR) beacon to the Swiss civil aviation authorities. VOR, which is an internationally approved system, enables an aircraft within range of a beacon to take an immediate bearing without having to carry complicated equipment.

Kelvin Hughes, echo-sounders have been installed in the trawler *Sarsia* which will carry out marine biological research in the Western Approaches on behalf of the Marine Biological Association of the United Kingdom. The two sounders, one recording soundings to a depth of 2,250 fathoms, use Tele-deltos dry recording paper.



E.B.U. RECEIVING STATION. One of the short-wave receiving positions at the recently opened Jurbise-Masny (Belgium) operating station of the European Broadcasting Union (see September issue). The magnetic-tape recorder in the foreground is used as an aid to identifying stations.

Winston Electronics, Ltd., of Hampton Hill, Middlesex, of which F. Winston Reynolds is managing director, have acquired the metal engineering firm of Goswell and Co., of Alpha Road, Teddington, which will in future be known as Winston Metal Fabrications, Ltd.

Rewound TV Transformers.—Direct TV Replacements, of 134-136, Lewisham Way, London, S.E.14, have introduced a "24-hour replacement rewind service" for television time-base and line output transformers. They state that they have a stock of some 700 different rewind transformers.

International Aeradio is to provide further radio stations for use at the Yugoslav aerodromes at Belgrade, Zagreb and Skopje.

Philco (Great Britain), Ltd., have supplied 150 short-wave universal portable receivers (Type A3214) for British troops in Korea. These tropicalized sets incorporate a 5-ft telescopic aerial.

Decca Radar announces that L. J. Dennett, who was previously in charge of the company's service division, has been appointed general manager of its Canadian associated company, Decca Radar (Canada), Ltd.

Ekco Electronics, Ltd., announce the appointment of E. B. Thompson as sales manager and R. Y. Parry as technical manager, nucleonics. Mr. Thompson joined the parent firm, E. K. Cole, Ltd., in 1937 and in recent years has been responsible for the export sales of Ekco communication and electronic equipment. Mr. Parry, who has been with E. K. Cole since 1936, has been associated with the development of Ekco nucleonic equipment.

Sir Robert Renwick, Bart., K.B.E., has been elected chairman of the board of **Reliance-Clifton Cables and Industrial Products, Ltd.**, which reaches its centenary in a few months. The operating company is Reliance Electrical Wire Co., Ltd., Staffa Road, Leyton, London, E.10.

Mervyn W. Shorter, a director and the general sales manager of **Westinghouse Brake and Signal Co., Ltd.**, has been appointed managing director.

Hallicrafters in Great Britain.—The recent announcement in the *London Gazette* that Hallicrafters, Great Britain, Ltd., had gone into liquidation has caused some misunderstanding. H. R. Adams, who was responsible for floating the company

in 1946, points out that, because of the dollar restrictions the company never traded and that the liquidation in no way affects McElroy-Adams Manufacturing Group, Ltd., who continue as the sole U.K. distributors of Hallicrafters communication equipment.



RHODESIAN RADIO. J. R. D. Sainsbury, who was with *Ultra Electric* and is now with *Chassay Bros. (Pvt.) Ltd.*, Bulawayo, sends us this photograph of part of the works of the company, which concentrates on the production of portable and car sets and is the only one manufacturing receivers in Central Africa.

From Canada.—R. H. Tanner, who was in the B.B.C. Research Department before going to Canada to join the Northern Electric Co., of Belleville, Ontario, has notified us of the installation by N.E.C. of the master control equipment in the new C.B.C. studios in Winnipeg, Manitoba.

Rees Mace Marine are to supply Pye v.h.f. radio-telephone equipment for eight cross-channel vessels operated by British Railways from Dover.

Solartron Laboratory Instruments has taken over a factory in Queen's Road, Thames Ditton, Surrey, into which it is also planned to transfer the administrative staff from the offices in High Street, Kingston-upon-Thames.

MEETINGS

Institution of Electrical Engineers

"Technical Arrangements for the Sound and Television Broadcasts of the Coronation Ceremonies on 2nd June, 1953" by W. S. Procter, M. J. L. Pulling, M.A., and F. Williams, on December 3rd.

Radio Section.—"Telegraph Codes and Code Converters" by T. Hayton, B.Sc., C. J. Hughes, B.Sc., and R. L. Saunders, B.Sc. (Eng.), and "Code Converters for the Interconnection of Morse and Teleprinter Systems" by R. O. Carter, M.Sc. (Eng.), and L. K. Wheeler, B.Sc. (Eng.), on December 2nd.

Discussion on "Will Transistors Oust Receiving Valves?" opener E. H. Cooke-Yarborough, on December 14th.

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

Cambridge Radio Group.—"Electronics in Aircraft" by R. W. Chandler, at 8.15 on December 1st at the Cavendish Laboratory, Cambridge.

North Midland Centre.—"Some Applications of Electronics" by T. G. Bridgwood, Ph.D., B.Sc., at 6.0 on December 8th at the University of Leeds.

Discussion on "Some Criticisms of Technical Education," opener G. A. Haigh and G. Auton, at 6.30 on December 15th at the British Electricity Authority, 1, Whitehall Road, Leeds.

East Midland Centre.—Faraday lecture, "Electric Process Heating—an Aid to Productivity" by O. W. Humphreys, B.Sc., at 7.15 on December 3rd at the De Montfort Hall, Leicester.

South-East Scotland Sub-Centre.—"Special Effects for Television Studio Productions" by A. M. Spooner, B.Sc. (Eng.), and T. Worswick, M.Sc., at 7.0 on December 1st at the Heriot-Watt College, Edinburgh.

South-West Scotland Sub-Centre.—"Special Effects for Television Studio Productions" by A. M. Spooner, B.Sc. (Eng.), and T. Worswick, M.Sc., at 7.0 on December 2nd at

the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, Glasgow, C.2.

South Midland Radio Group.—"Radio Aids for Airport Control" by E. J. Dickie, at 6.0 on December 7th at the James Watt Memorial Institute, Great Charles Street, Birmingham.

Southern Centre.—"Colour Perception and Colour Television" by J. H. Mole, Ph.D., at 7.30 on December 9th at the R.A.E. Technical College, Farnborough, Hants.

"Receiving Aerials for British Television" by I. A. Davidson, B.Sc., at 6.30 on December 11th at the South Dorset Technical College, Weymouth.

Maidstone District.—"Electronics in Industry" by B. Keller and E. R. Davies, at 7.30 on December 7th at the "Wig and Gown," Maidstone.

Norwich District.—"The Basic Principles of Electronic Digital Computing Machines and their Uses" by R. L. Grimdale, M.Sc., at 7.30 on December 7th at the Royal Hotel, Norwich.

British Institution of Radio Engineers

London Section.—A symposium on Vibration Methods of Testing: "Vibration Generators" by H. Moore (Goodmans), "Stroboscopes" by F. M. Savage (Dawe Instruments), "Strain Gauges" by P. Jackson (Saunders-Roe), and "Electronic Aids to Vibration Measurement" by R. K. Vinycomb, B.Sc., (Southern Instruments), at 6.30 on December 9th at the London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C.1.

Scottish Section.—"The B.B.C. Television O.B. Unit" by a member of B.B.C. Glasgow staff, at 7.0 on December 3rd, at the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, Glasgow, C.2.

North-Eastern Section.—"The Effects of Aural Disturbances on Audio Production" by Dr. M. Anderson, at 6.0 on December 9th at the Neville Hall, Westgate Road, Newcastle-upon-Tyne.

West Midlands Section.—"Printed Circuits: Some General Principles and Applications of the Foil Technique" by P. Eisler, Dr. Ing., (Technograph Electronic Products), at 7.15 on December 15th at the Wolverhampton and Staffordshire Technical College, Wulfruna Street, Wolverhampton.

Merseyside Section.—Discussion on "Training for the Radio and Electronics Industry" at 7.0 on December 3rd at the Electricity Service Centre, Whitechapel, Liverpool, 1.

North-Western Section.—"The Monitoring of High Speed Waveforms, using a Sampling Technique" by J. G. MacQueen (Metrovick), at 7.0 on December 3rd at the College of Technology, Manchester.

British Sound Recording Association

London.—"Problems of Magnetic Tape Reproduction" by P. E. Axon, O.B.E., at 7.0 on December 18th at the Royal Society of Arts, John Adam Street, London, W.C.2.

Manchester Centre.—"Some Records of 25 years ago," conversation opened by C. C. Blyton, at 7.30 on December 14th at the Engineers' Club, Albert Square, Manchester.

Television Society

London.—"Information Theory and Television" by Dr. E. C. Cherry (Imperial College), at 7.0 on December 17th at the Cinematograph Exhibitors' Association, 164, Shaftesbury Avenue, London, W.C.2.

Radio Society of Great Britain

Annual General Meeting at 6.30 on December 18th at the Institution of Electrical Engineers, Savoy Place, London, W.C.2.

Institute of Navigation

Developments in Radio Aids to Surface Navigation: "The Reduction of Sea and Rain Clutter in Marine Radars" by J. Croney, "A Racon Beacon for Reception by Civil Marine Radars" by C. Randall-Cook, and "A Portable Beacon for Identifying Ships on Harbour Radars" by A. L. P. Milwright, at 5.0 on December 18th at the Royal Geographical Society, 1, Kensington Gore, London, S.W.7.

Society of Instrument Technology

London.—"Sectional Paper Machine Drives with Electronic Control" by T. E. Barany, M.A., at 7.0 on December 15th at Manson House, Portland Place, London, W.1.

Tees-Side Section.—"Some Factors Influencing the Design of New Types of Instrument" by A. J. Philpot, C.B.E., M.A., at 7.30 on December 17th at the Cleveland Scientific and Technical Institution, Corporation Road, Middlesbrough.

Cardiff Section.—"Electronic Motor Control" by L. Babad, at 6.45 on December 2nd in the Physics Lecture Theatre, College of Technology, Cardiff.

Institute of Practical Radio Engineers

Midlands Section.—"Modern Industrial Metal Finishing" by F. Wild (Cruickshanks, Ltd.), at 7.30 on December 7th at the Crown Hotel, Broad Street, Birmingham.

Amateur Television Progress

More Pick-up Tubes Available for Home-Built Cameras

By M. BARLOW, * (G3CVO)



JUST over a year ago a report on progress in the field of amateur television transmission was given in the pages of *Wireless World*. Since then, several interesting developments have taken place; some 250 experimenters are on the lists of the British Amateur Television Club and active clubs have sprung up in ten overseas countries. The total number of active experimenters is probably around the 500 mark, but it will be appreciated that the majority of these are running closed-circuit transmission systems. It is unlikely that more than 25 amateur television stations exist in the world at the moment, owing to the severe difficulties to be overcome, but we may be proud of the fact that some of the leading stations are in the United Kingdom.

As mentioned before, the flying-spot scanning method of picture generation finds great favour on account of its simplicity and economy in cost and components. There is still a lack of suitable photocells—the ubiquitous RCA type 931A having disappeared from the surplus market—although the scanning c.r. tube position has improved now that some blue-trace tubes are on the commercial market.

In the main, however, these have not a flat face, which in turn introduces optical distortions into the picture, but it is becoming more general to use some form of lens system to improve definition and signal-to-noise ratio. The Club has standardized on 2-in x 2-in (35mm double frame) slides for captions, and a series of suitable slides is being turned out for the benefit of members. 16mm has been adopted as the standard for telecine working, either silent, sound-on-film or

The title picture shows an Image iconoscope camera constructed by I. Waters.

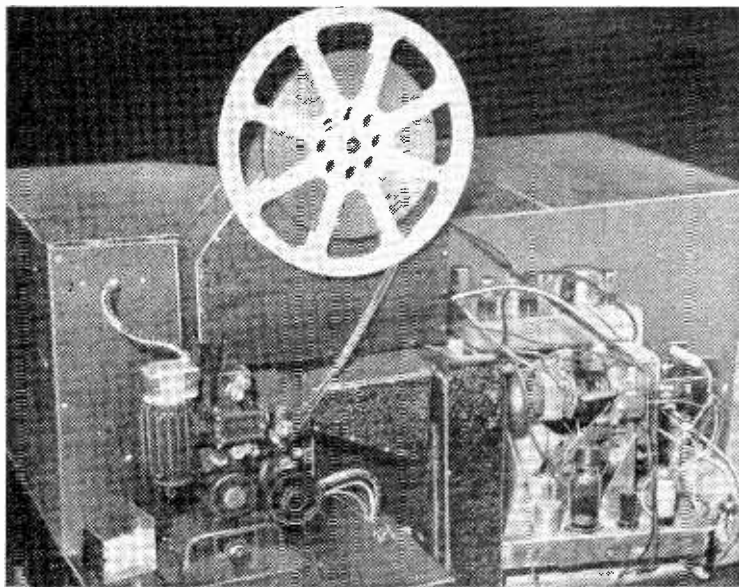
Right: Film scanning equipment built by D. Shepperd on board the "Balaena" whaling factory. The 16-mm film (left) is scanned by a flying-spot scanner (right) and the 405-line picture is transmitted to attendant whaling vessels. At the back of the equipment is a control position and monitoring screen.

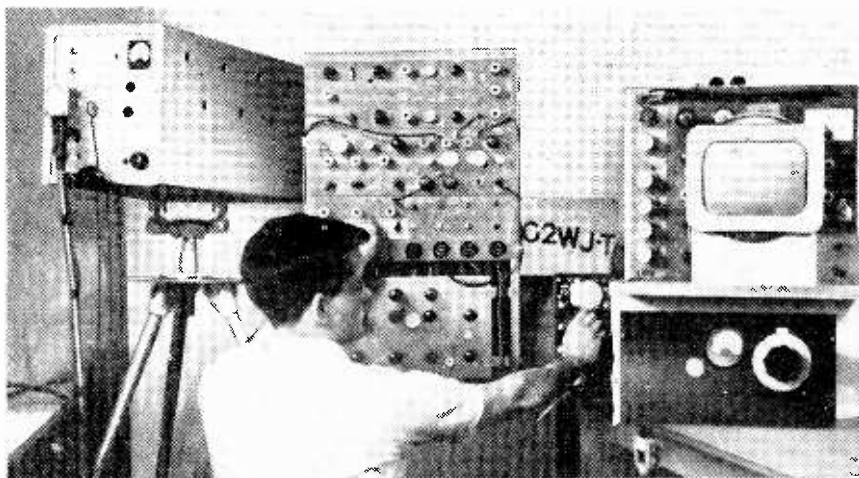
with the sound on tape. The normal means of scanning is to use two 25-c/s rasters (three at 16 $\frac{1}{2}$ c/s for silent film) scanning the film in the opposite direction to the film motion. The film moves through the gate continuously, not intermittently, so that the mechanical drive requirements are considerably eased, and a tape recorder type of drive is often employed. It may interest readers to learn that a home-made equipment of this nature is used experimentally on board the whaling factory *Balaena* to relay films to its attendant whaling vessels in the Antarctic!

Circuitry for these units has been recently improved by a design due to J. Mason, ZL1QS, of Auckland, New Zealand. Mr. Mason's video amplifier breaks away from the traditional by employing a cathode-coupled input stage after the photocell, followed by a frequency-correcting stage and a feed-back-pair video amplifier. The amplifier is designed to pass 4Mc/s, but, with a 5FP7 scanning tube, it is not possible to exceed 3Mc/s on normal subjects.

Since the last article was written the supply situa-

* Hon. Secretary, British Amateur Television Club.





Transmitting equipment at G2WJ/T, from which pictures have been received by G3GDR some 30 miles away. Constructed by J. Royle, it includes an image iconoscope camera (left), waveform generators (centre) and a monitor and 436-Mc s converter (right).

tion with camera tubes has improved considerably. At first a few reject studio-type tubes were made available through the kindness of various manufacturers, but, as readers will appreciate, the circuitry and coil-winding involved is rather formidable for an amateur to undertake. Nevertheless, two of the tubes were in action within four months of delivery of the bare tube, and there are now six studio-type tubes giving reasonable pictures. Unfortunately, it is not permitted to give public demonstrations with these cameras, but a good deal of research into economical circuits has been done, for the average amateur is not particularly interested in getting the last ounce out of his camera as long as the picture is satisfactory; this is, after all, the aim of any television system. In view of the relative disadvantages of using the large studio-type tubes, it is good news that a supply of reject Vidicon-type camera tubes has been made available at a reasonable price. Although none is in action yet, no fewer than 22 are on order, and our overseas friends are offering most tempting swaps—including a pair of image orthicons!—for the chance of obtaining one of these tubes. Unfortunately, it is not possible at the moment to supply overseas. The addition of these tubes will bring up the total number of cameras in this country to 39, including eight RCA type 5527s, up to now the standby of amateur and industrial television apparatus. These tubes are now being consistently run at a much higher definition and at much lower light levels than RCA stipulate in the data. Careful attention to shielding and focusing, together with such unlikely tricks as attaching very small magnets near the camera, have improved results out of all belief. Similar unorthodox short-cuts with the studio cameras have produced good results with about half the specified scanning power, although the use of milk-bottle tops instead of an adjustable iris diaphragm may be frowned upon by the purists!

A few monoscopes have also been supplied for experimental purposes, although it is difficult to judge how popular these will be compared with the flying-spot scanner. As a good picture source, of course, they are unsurpassed, and serve to remove one of the largest unknowns in the entire vision system, the output from the camera.

Many experimenters are still using very simple scanning equipment, wiring the scanning and monitor

c.r. tubes in parallel so that no synchronizing problem arises. However, more advanced pulse generators are now being more generally used, and the advantages of interlacing—relatively few in amateur work—are being exploited by some of the more advanced workers. Conventional circuits vie for popularity with some highly unconventional ones. These all use a minimum number of valves, perhaps at the expense of long-term reliability, but perform the functions for which they were designed. One such unit, giving a complete B.B.C.-type waveform, uses just nine valves, whilst a conventional circuit employs fourteen. The use of a B.B.C. standard waveform is universal amongst the transmitting members, but some closed-circuit enthusiasts have been using a very short frame synchronizing pulse to eliminate the need for inserted pulses in the frame interval. Current development is to find a count-down circuit using still fewer valves; for amateur purposes it does not matter greatly if the counter has to be reset occasionally, and with this in mind great economies can be made. On the other hand, some readers may have seen the pulse generator exhibited by the R.E.M.E. amateur radio club at the past Radio Show at Earls Court; this used binary counters and a servo correcting system, in all some 26 valves.

Transmission Experiments

The transmitters continue to be handicapped by lack of suitable valves, and by the fact that they are blazing a new trail all the time. The present transmitting licence is shortly to be replaced by a new one, at, it is earnestly hoped, considerably less cost. As an example of what can be done, it may be mentioned that G2WJ/T near Dunmow has repeatedly put a television signal into G3GDR at Kings Langley, some 30 miles distant, with just 2 watts peak white. The transmitter uses a conventional driver to 210Mc/s employing two QV04/7s and an 832; the power amplifier unit uses a CV53 doubler driving a CV53 power amplifier in a coaxial line circuit. This valve, by the way, is actually a receiving type, but is the only suitable one easily and cheaply available. At G2WJ modulation is on the grid from a cathode follower; the picture source is an image iconoscope camera and the pulse generator gives a standard B.B.C. output. The aerial consists of eight stacked full-wave elements

with a wire netting reflector about 30ft off the ground in a reasonably flat location. At G3GDR a trough mixer using a CV102 diode and a cascode head amplifier is used, output being at 45Mc/s to a standard B.B.C. television set. It is found that pictures can be resolved whenever the signal strength is S9 or greater. Contact at this range, although an everyday occurrence with telephony or morse, is the result of months of painstaking tests and adjustments by the station concerned.

Other power amplifier stages being tried are coaxial units with Det24 disc seal triodes, and trough circuits with QQEO6/40 and QQEO3/20 types. Unfortunately, these valves are extremely scarce and very expensive, and in most cases not too easy to modulate with television signals. Modulation is normally either on the grid, as above, or with a bootstrap modulator feeding both power amplifier and driver stages. It must be remembered that most of these 70-cm transmitters are using earthed-grid techniques, which can make wide-band modulation very difficult. A d.c. restorer is usually used on the modulator chassis in preference to a d.c. clamp so that only composite video need be fed to the transmitter rack. A simple audio amplifier has to be included so that the call-sign can be sent by telephony on the vision channel, in accordance with Post Office regulations!

Aerials form a fascinating branch for experiment; stacks, Yagis, helical arrays and fan aerials all have their adherents, but in general highly directive arrays are in use owing to the low transmitter power available. On the 430-Mc/s amateur band, where most of the experimental transmissions take place, bandwidth restriction in the aerials is not a limiting factor. Very little work has been done on the higher frequencies, again because of the shortage of suitable valves.

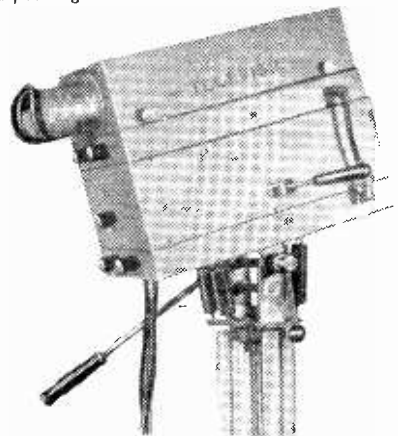
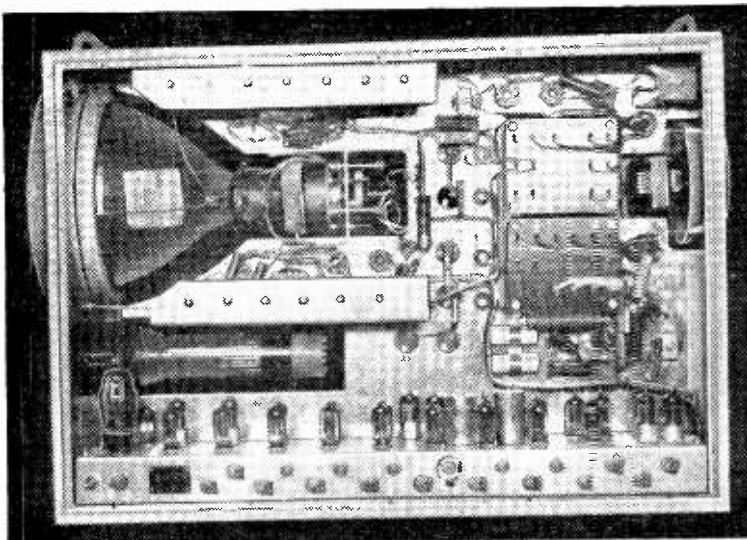
70-cm receiver design has improved considerably in the last year, several very good designs having appeared in the literature. The sensitivity and noise figures obtained are much superior to any obtained with commercial equipment. Most of these designs are for communications-type equipment, but can be adapted to the needs of amateur television; typical figures are 95 db below 30mV for the sensitivity and 12 db for noise, under wide-band television conditions. Careful attention to the head amplifier of the i.f. chain

makes for a low noise figure, and a cascode stage is almost a necessity.

A considerable amount of ingenuity has been expended in the construction of mechanical parts; a camera dolly made out of two bicycles; a camera crane weighing several hundredweight consisting of parts of a mangle and a bedstead; camera-tube racking devices made out of toy railway track. Dexion and Gascoigne fittings plus Woolworths towel rail have



Mobile camera unit built by Dr. de Waard, of Groningen, Netherlands. The 625-line interlaced picture from the iconoscope camera is sent by a 70-cm transmitter to the main transmitter working on 145 Mc/s. Sound is conveyed by f.m. on a 5.5-Mc/s sub-carrier. Power (about 700 watts) is supplied by a petrol generator in a trailer.



Camera built by W. G. Storm, of The Hague, Netherlands, with home-made panning and tilting head, and (left) camera control and monitoring unit designed for a Vidicon-type camera by K. A. J. Russell.

turned up in the most unlikely situations. Post Office-type construction, with valves at the front and circuitry at the rear of the racks, is very popular. To ease matters generally, and to permit any units to be used together, a standard output of 5 volts across 75 ohms has been adopted. This is larger than B.B.C. level, but means that just one video amplifier is all that is required to feed a monitor tube.

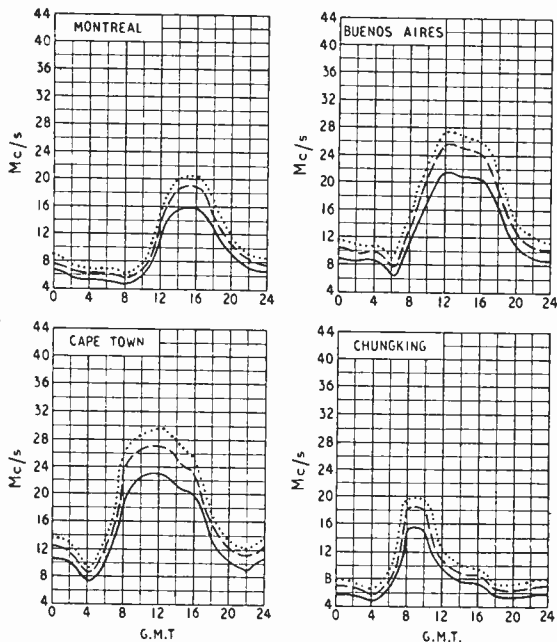
Five people are actively engaged in experiments with colour television. These experiments are confined to the transmitter mainly, since tri-colour tubes and the like are quite out of the question. A complete three-colour rotating-disc camera running 100 frames 150-line sequential has been built and is under test. A colour flying-spot scanner is under construction now that a flat-faced white-trace scanning c.r. tube has been found. Although it is not likely that any great discoveries will be made, the fascination of producing live colour television pictures is likely to draw more adherents as time goes on. In the meantime black and white television offers plenty of opportunity for experiment!

Short-wave Conditions

Predictions for December

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

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



- 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

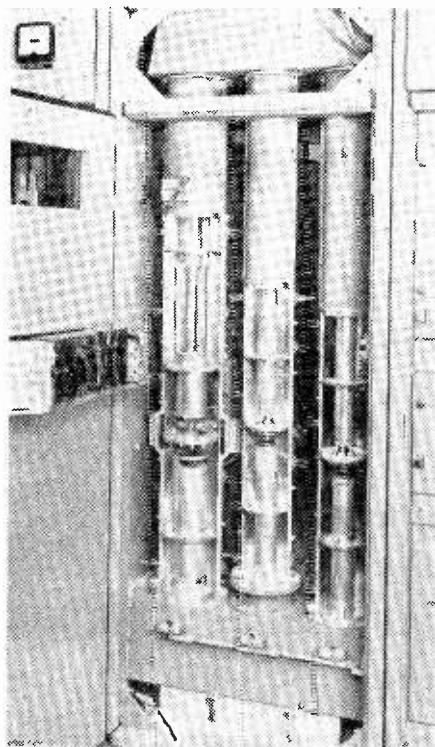
BAND 3 TELEVISION TRANSMITTERS

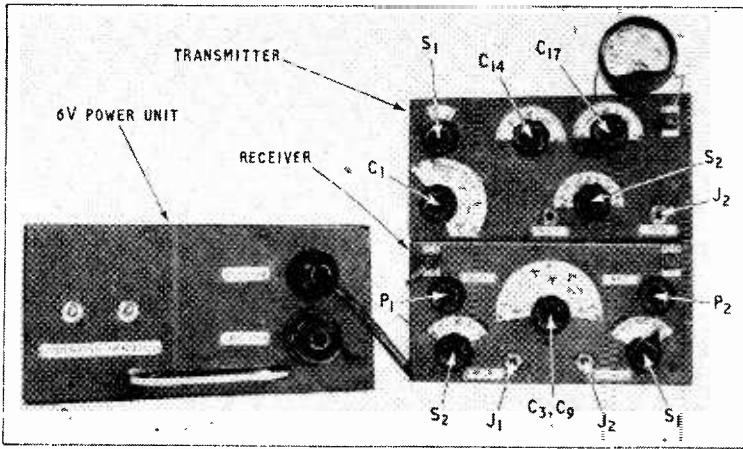
SOME idea of what television transmitters for Band 3 will look like, if we ever get them here, can be gained from the new Marconi 2½-kW medium-power equipments which have just gone into service at Rome and Pisa. Their design is particularly interesting in that coaxial-line techniques are used throughout the r.f. power stages of both the vision and sound transmitters.

The vision equipment has a crystal-controlled drive oscillator, two Class C r.f. amplifiers using earthed-grid triodes and a final modulated tetrode amplifier with broad-band output circuits. In the two Class C stages, coaxial lines form the anode and cathode circuits of the valves and are tuned by adjusting their lengths with shorting rings. A quarter-wave coaxial line provides the output circuit of the transmitter and this is coupled to the anode circuit of the final stage by capacitance and to the aerial feeder by a quarter-wave matching section. These two circuits, anode and output, together form a double-tuned circuit which is arranged to give a flat response. All three valve stages are neutralized.

The sound transmitters are very similar to the vision ones in the design of their r.f. amplifiers, but they have narrow-band output circuits and make use of the Marconi "FMQ" system in which frequency modulation is applied directly to the crystal-controlled driving oscillator.

One of the vision transmitters showing (from right to left) the first, second and final amplifiers. Sections of the coaxial lines have been removed to give access to the valves inside.





Two-Band Transmitter Receiver

Low Power Equipment for Portable and Fixed Stations

By G. P. ANDERSON*

THE apparatus to be described was built primarily for use as a portable station, but has been used also as the "home station" when the main transmitter was out of action. Physically it has been designed to fit comfortably into the glove compartment of a small family car, and is constructed in three units, including the power supply. It provides telephony and c.w. operation anywhere in the popular 160- and 80-metre bands, with switched band change, and an input of 5 to 7½ watts; at the lower input one type of valve is employed throughout thus simplifying the carriage of spares. But at the higher input a different valve is used in the final stage of the transmitter. Provision is made for operation with almost any length of wire as an aerial, and excellent results have been obtained with random wires of the order of 80 feet long simply thrown into a tree.

The units described can be placed in the car and be in operation within a few minutes; in view of recent natural disasters this feature is felt to be important.

Before proceeding to describe the circuits in detail, a general outline of the apparatus will be given. As mentioned above, the complete apparatus except for the power unit occupies two boxes. These are identical in size, and measure 8in x 4in x 5in deep. The transmitter is assembled in one box, and consists of a variable frequency oscillator, followed by a buffer amplifier and a power amplifier, switched for the 1.8- and 3.5-Mc/s amateur bands, with a "pi"-network tank circuit to facilitate connection to a wide range of aerials. The second box contains a t.r.f. receiver and the audio stages are used for modulating the transmitter when required. Provision

* Amateur radio station G2QY.

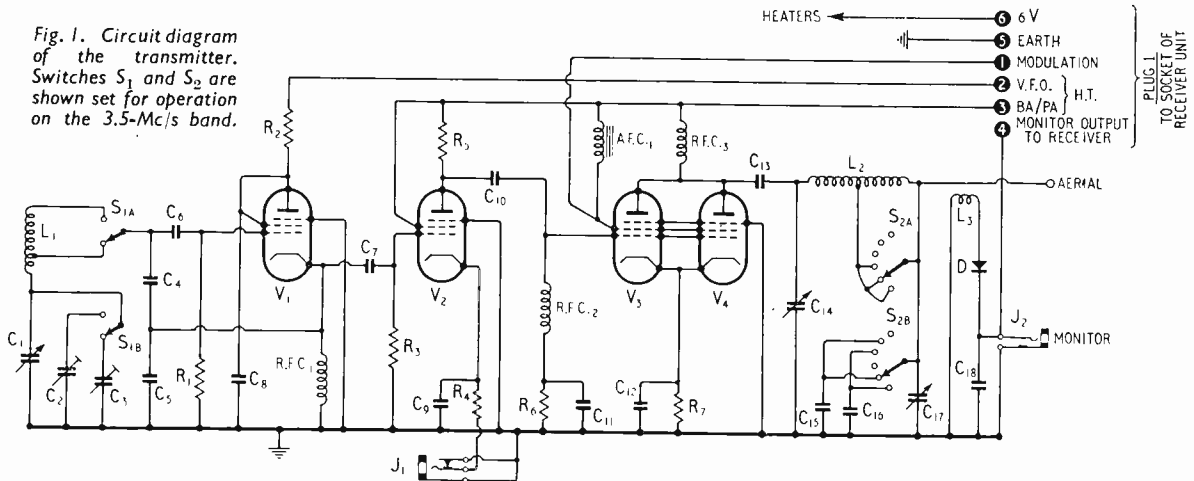
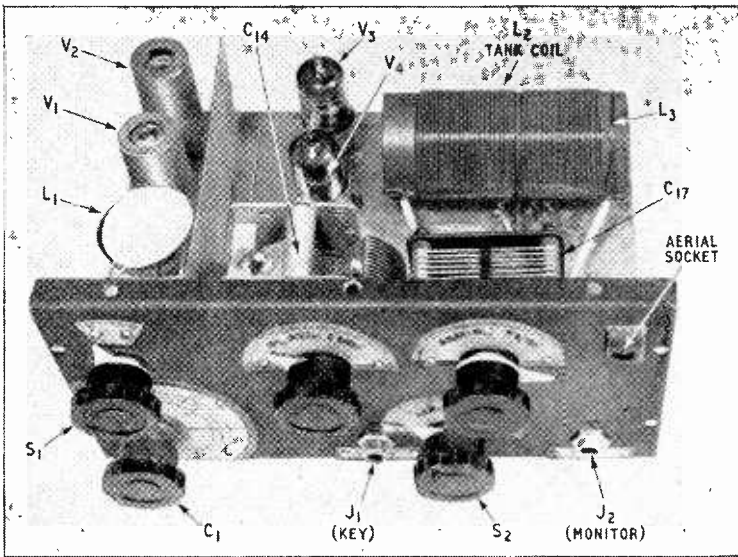


Fig. 1. Circuit diagram of the transmitter. Switches S₁ and S₂ are shown set for operation on the 3.5-Mc/s band.

Our title picture shows the complete station with the transmitter (upper right) receiver-modulator-control unit (lower right) and 6-V power supply unit on the left.



Looking down onto the transmitter unit. The buffer amplifier is on the left of the screen and the PA tank coil is in the right-hand corner at the back of the chassis.

is made also for monitoring the signal during transmission, and "netting"—that is, setting the transmitter accurately on a given frequency without radiating a signal, by means of the receiver. All control, except transmitter tuning, is performed from the receiver unit.

Power for the apparatus may be obtained from a vibrator or a rotary generator supply, from batteries or from a small mains unit.

Transmitter Unit:—The transmitter utilizes the popular "Clapp" VFO circuit, working always at half the transmitter output frequency; the circuit constants have been designed so that each band occupies the full 180° of dial spread. Originally the oscillator was designed to work on the fundamental output frequency, but when wires approaching a half wavelength long were used as aerials, pulling of the oscillator frequency occurred, presumably due to the transmitter chassis being at high r.f. potential, despite connection to earth. The oscillator is followed by an untuned buffer amplifier, to further reduce any likelihood of changes in the oscillator frequency when adjustments are made to the last stage; the BA is used also for keying, the key being inserted in the cathode circuit. The following stage is the power amplifier, and consists of two valves connected in parallel. At the frequencies covered by this transmitter the extra capacitance produced by paralleling the valves is not serious and the two valves enable the desired input of five watts to be easily achieved using the same type of valve as is used in the earlier stages, namely the 6AM6 or its equivalent. Alternatively, should a 50-% increase in power be desired, a pair of 6AM5 valves may be substituted in this stage.

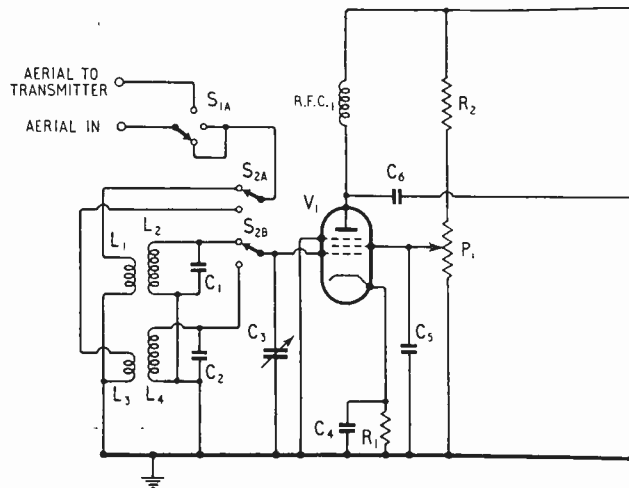
A further advantage of the parallel connection in preference to push-pull is that it allows a "pi" network to be used for the tank (or anode) circuit, and enables a wide range of aerial impedances to be catered for and thus simplifying the provision of aerials. For operation on the 3.5-Mc/s band approximately half the anode coil is short-circuited, but this does not

appear to seriously reduce the efficiency. As will be seen from the circuit diagram Fig. 1, a 300-pF variable capacitor is used to tune the valve side of the "pi" network and a 500-pF variable with switched additional fixed 500- and 1,000-pF capacitors on the load side. The crystal rectifier shown loosely coupled to the aerial circuit is used to monitor transmissions, either aurally or by means of a meter. The meter if preferred may be inserted in the jack on the front of the transmitter; alternatively, the output of the rectifier is connected to the receiver-control unit, and is automatically connected to the operator's headphones when transmitting.

The a.f. choke in the screen supply to the PA valves is used for modulation purposes. As will be seen later, when the apparatus is set in the "send" condition, audio output from the a.f. stages in the receiver-modulator unit is connected to the screen end of this choke, and modulation is applied to the screens. The choke is fitted in the transmitter unit so that the transmitter is complete in itself, and the required h.t. voltages are applied to all stages if the unit is used without the companion receiver-modulator.

The PA stage is provided with sufficient cathode bias to protect the valves during keying; the 100-Ω resistor, R₇, maintains a fairly constant load on the power supply with and without r.f. drive to the PA, thus further minimizing the possibility of frequency shift or "chirp." The resistor R₄ and capacitor C₉, in addition to providing bias for V₂, serve also as a filter for reducing key-clicks.

As will be described in more detail later, there are three positions of the main operating control—"Net," "Receive" and "Transmit." In the "Net" position power is applied only to the oscillator valve in the transmitter, while the receiver is also running, enabling the transmitter to be set to zero-beat or work alongside another signal. In the second ("Receive") position, no h.t. power is applied to any stage



of the transmitter, while in the "Send" position full power is applied to all transmitter stages, the r.f. section of the receiver is muted and the monitoring facilities are automatically brought into circuit. Modulation is applied also, but if telephony is not to be transmitted the removal of the microphone plug from its jack will ensure no modulation on the carrier.

The controls provided on the transmitter unit comprise: oscillator band selection and tuning, PA anode-circuit band selection, and tuning for the "pi" network. The two jacks visible on the front panel are for the key and either headphones for monitoring or connection of a d.c. milliammeter to assist in tuning the transmitter. In practice it has been found more convenient to use a 200-milliampere r.f. meter in the aerial lead for tuning purposes, the capacitors in the tank circuit being adjusted for maximum aerial current. Power and audio connections between the transmitter and the receiver-control units are made through multiway plugs and sockets fitted at the backs of the units, while the aerial is connected by a separate lead to the appropriate socket on the receiver. All connections from the transmitter (except the key) are made through the receiver to allow switching to be controlled from that unit.

The transmitter described is complete in itself for c.w. working, and may be so used in conjunction with any receiver covering the appropriate frequencies. The power consumption is of the order of 50 mA at 250 V h.t., while the heaters require 1.2 A at 6 V (1.0 A if 6AM5s are substituted in the last stage for greater power, when the h.t. consumption will be approximately 60 mA.).

A small moving-coil microphone is suitable for use with this apparatus, and an ex-government moving-coil headphone receiver serves the purpose admirably, being very sensitive as well as robust enough for use in the field. The one used by the writer was modified by cutting away the bakelite grill over the moving-coil unit diaphragm, but leaving the heavy rubber earpiece

flanges in place, as they protect the microphone if it is dropped.

The dial of the oscillator tuning control may be conveniently calibrated in kilocycles for each band, and a note on a suggested procedure is contained in a later paragraph. The calibration of the other controls may be made to suit the individual constructor.

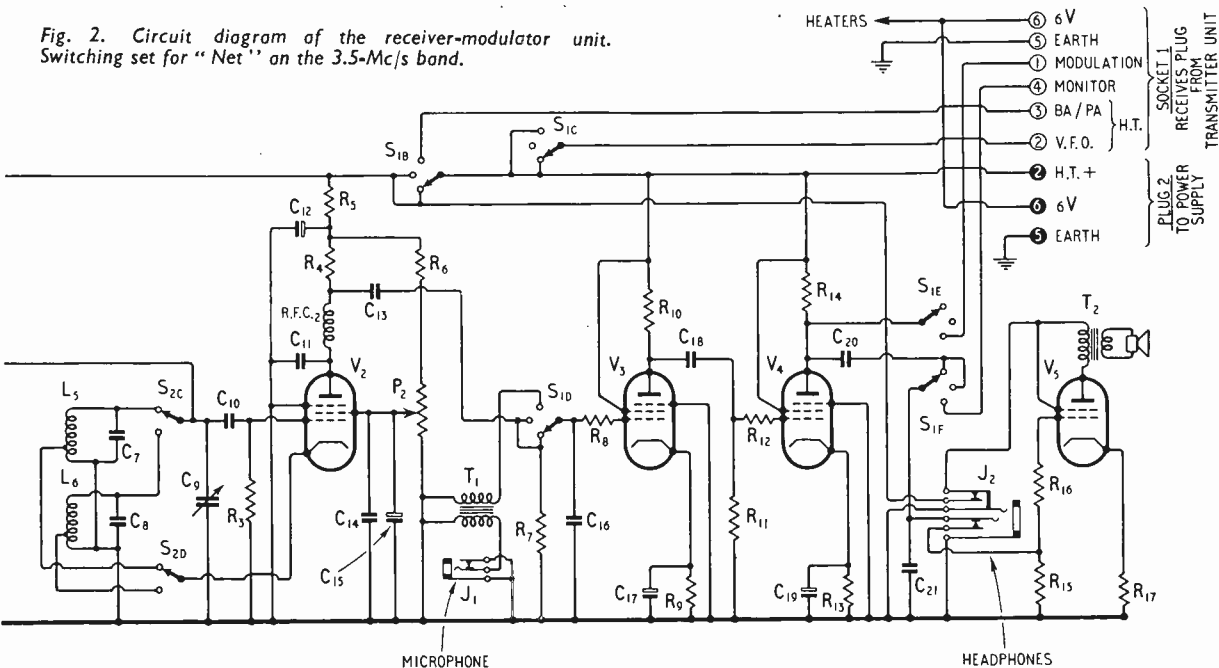
Receiver-modulator-control Unit :—In designing the receiver the question of superheterodyne or "straight" receiver was thoroughly examined, bearing in mind the need to receive c.w. and telephony signals, and the desire to restrict the design to the use of the 6AM6 type of valve in order to line up with the transmitter. Also in the interests of space it was desirable to limit the number of pre-a.f. stages, since two audio frequency stages were necessary to provide modulation for the transmitter. Unless sufficient signal frequency selectivity is provided the superheterodyne is prone to interference from second-channel signals, and provision has to be made for a beat frequency oscillator (or for the second detector to oscillate) to enable reception of c.w. to be carried out. It was decided therefore to build the receiver on the familiar t.r.f. circuit lines, with one stage of r.f. amplification ahead of the detector, and two stages of a.f. amplification following it. A further optional stage has been provided to operate a small loudspeaker.

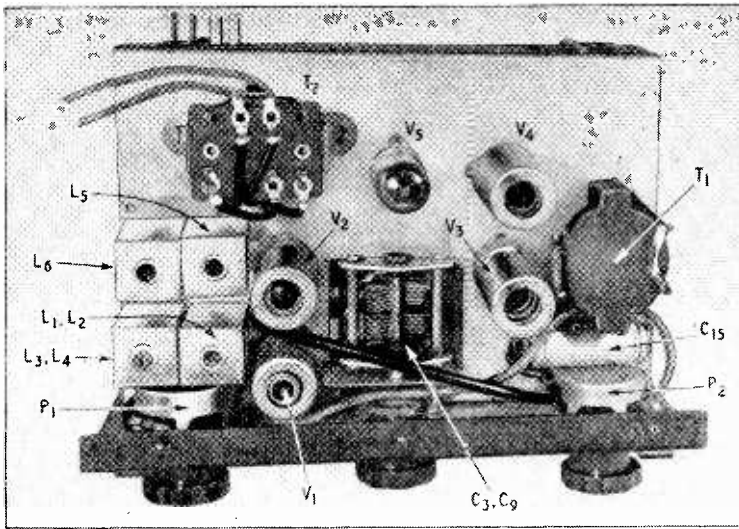
As in the transmitter the circuit constants have been selected to spread each band over the entire 180° of capacitor rotation. Detector oscillation is provided by a cathode tap on the grid coil, and is controlled by the screen potentiometer P₂ (see Fig. 2), while the r.f. gain is adjusted by means of P₁. Smooth regeneration control is assured by arranging for the detector to oscillate with a low screen voltage.

At first glance the functions of the several switches shown may not be apparent, so the service performed by each section will now be explained; the references are to Fig. 2.

S₁ is a six-pole three-way switch for net, receive

Fig. 2. Circuit diagram of the receiver-modulator unit. Switching set for "Net" on the 3.5-Mc/s band.





The receiver-modulator-control unit has the r.f. coils on the left and the a.f. and modulator components on the right. The tuning capacitor occupies the centre position.

L_1 should be adjusted—i.e. the part not included in the circuit when S_1 is set to 3.5 Mc/s—so that the calibration on that band is unaffected. Final trimming for this band (1.8 Mc/s) is of course made on C_2 . A check should finally be made of the calibration on the 3.5-Mc/s band in case it has been disturbed.

Having calibrated the oscillator the transmitter as a whole should be tested into a dummy load. A 100- Ω , 3-W resistor may be connected in series with a 200-mA r.f. meter between the aerial terminal and the chassis and h.t. applied to all stages. The loading controls C_{17} and S_2 should be set to approximately mid-value for the band under test, and the anode tuning capacitor C_{14} should be rotated until maximum current is indicated in the ammeter. Experimental changes in the loading capacitance followed by re-adjustment of the anode condenser may be made in order to obtain a higher value of current in the load.

The procedure described in this paragraph is to be followed in tuning the transmitter when it is connected to an aerial. Summarized it consists of:

Set VFO tuning to the desired frequency, with the control switch S_1 on the receiver unit at either "Net" or "Receive."

Set the coarse load switch S_2 on the transmitter to the mid-position for the appropriate band.

Apply h.t. to the transmitter (control switch to "Send") and rotate C_{14} to show maximum aerial current.

Vary the value of the loading capacitance (by C_{17} and S_2) and readjust C_{14} , until the absolute maximum aerial current is achieved.

Receiver Adjustment:—The method of setting the detector tuning to cover the range required is similar to that described for the transmitter, except it is suggested that the oscillator of the transmitter be used as the signal source, and the receiver adjusted to it. (Also, of course, check that the detector is oscillating on the fundamental frequency to be received.)

With the detector circuit tuning comfortably over the ranges 1,800 to 2,000 kc/s and 3,500 to 3,800 kc/s, an aerial should be connected and the r.f. gain control

advanced about half way, with the tuning set to a signal approximately in the middle of one of the ranges. Fixed capacitors of the same value as were determined for the detector stage should be connected across the r.f. grid coil, and the stage tuned by means of the dust core slug in the coil for maximum gain; an increase in the noise level will also be noticed when the stage is correctly tuned, and serves as an additional guide to the proper setting. This is then repeated on the other band.

Performance:—The units described have been used on several occasions when operating portable from sites near London. The transmitter and receiver fit neatly into the glove shelf of a small family car, and with a length of fine wire (of the order of No. 34 s.w.g.) simply thrown into a tree as the aerial, Telegraphy

contacts have been made with stations in all parts of the British Isles and adjacent European countries, on both the 1.8- and 3.5-Mc/s amateur bands. Telephony contacts at ranges up to 50 miles are easily attainable on 1.8 Mc/s, but the high power competition on 3.5 Mc/s renders telephony working on that band extremely difficult.

In order to comply with the conditions of the amateur licence, means of measuring the transmitted frequency must be available whenever a signal is radiated. During operation, however, a general check may be maintained by comparing the dial readings of the transmitter and the receiver; should any discrepancy appear, the transmitter should not be used until the cause of the disagreement has been located and cleared.

LIST OF COMPONENTS

Transmitter Unit (Fig. 1)

Capacitors

C_1	50 pF variable
C_2	140 pF approx. (fixed plus trimmer)
C_3	170 pF approx. (fixed plus trimmer)
$C_4, C_5, C_8,$ C_9, C_{11}, C_{12}	0.001 μ F
C_6, C_{18}	100 pF ceramic
C_7	220 pF Silvered mica
C_{10}, C_{13}	150 pF Silvered mica
C_{14}	500 pF variable
C_{15}	330 pF Silvered mica
C_{16}	680 pF Silvered mica
C_{17}	300 pF variable
(All)	capacitors 350 V working)

Resistors

R_1, R_3, R_6	22 k Ω , $\frac{1}{2}$ W
R_2	3.9 k Ω , 1 W
R_4	220 Ω , $\frac{1}{2}$ W
R_5	10 k Ω , 1 W
R_7	100 Ω , $\frac{1}{2}$ W

Miscellaneous

AFC ₁	50 H 15 mA A.F. Choke
RFC _{1, 2, 3}	1.25 mH R.F. Choke. (Eddystone 1010)
S_1	Two-pole two-way rotary switch (wafer)
S_2	Two-pole six-way rotary switch (wafer)
D	Germanium diode
J_1	Jack (closed circuit when plug removed; Bulgin type J12)
J_2	Jack (Bulgin Type J11)

List of Components—Continued.

Coil Details

- L₁ 1 in diameter, 140 turns tapped at 47 turns from earth, 32 s.w.g. enamel close wound. (222 μH, tap 53 μH)
 L₂ 1½ in diameter, 60 turns tapped at 20 turns from earth, 20 s.w.g. enamel close wound. (62 μH total)
 L₃ 2 turns on aerial end of same former as L₂

Valves

- V₁, V₂, V₃, V₄ 6AM6 (EF91, Z77 etc.)

Receiver-Modulator Unit (Fig. 2)

Capacitors

- C₁, C₇ 122 pF approx. (see text)
 C₂, C₈ 200 pF approx. (see text)
 C₃, C₉ 2 × 40 pF variable (see text)
 C₄ 220 pF Silvered mica
 C₅ 0.001 μF
 C₆, C₁₁ 47 pF Silvered mica
 C₁₀ 100 pF
 C₁₂ 8 μF Electrolytic
 C₁₃, C₁₄, C₁₈ 0.1 μF
 C₁₅ 2 μF Electrolytic
 C₁₆ 0.01 μF
 C₁₇, C₁₉ 50 μF 12 V working
 C₂₀ 0.5 μF
 C₂₁ 0.05 μF
 (All 350 V working, except where stated)

Resistors

- R₁ 150 Ω, ¼ Watt
 R₂ 47 kΩ, 1 W
 R₃ 1 MΩ, ¼ W
 R₄ 220 kΩ, 1 W
 R₅ 100 kΩ, 1 W
 R₆ 56 kΩ, 1 W
 R₇, R₁₁, R₁₅ 220 kΩ, ¼ W
 R₈, R₁₂, R₁₆ 4.6 kΩ, ¼ W
 R₉, R₁₃ 220 Ω, ¼ W

- R₁₀ 33 kΩ, 1 W
 R₁₇ 820 Ω, ¼ W
 P₁, P₂ 500 kΩ potentiometer 3 W

Miscellaneous

- RFC1, RFC2 1.25 mH R.F. choke (Eddystone 1010)
 S₁ Six-pole three-way rotary switch (wafer)
 S₂ Four-pole two-way rotary switch (wafer)
 J₁ Jack (closed circuit when plug removed; Bulgin Type J12)
 J₂ Jack (multi-circuit; Bulgin Type J20)
 T₁ Microphone transformer to suit microphone used
 T₂ Pentode output transformer

Coil Details

- L₁ 3 Turns } Wound on same
 L₂ 26 Turns (8.6 μH) } former (3.5 Mc/s)
 L₃ 6 Turns } Wound on same
 L₄ 70 Turns (37.6 μH) } former (1.8 Mc/s)
 (All close wound with 32 s.w.g. enamel wire on 0.3-in former. Neosid Coil Former Type 5,000/6E, with iron dust core Drg 500. Top Plate Drg 5001 and Screening Can DTV 2)

Valves

- V₁, V₂, V₃, V₄ 6AM6 (EF91, Z77 etc.)
 V₅ 6AM5 (EL91, etc.)

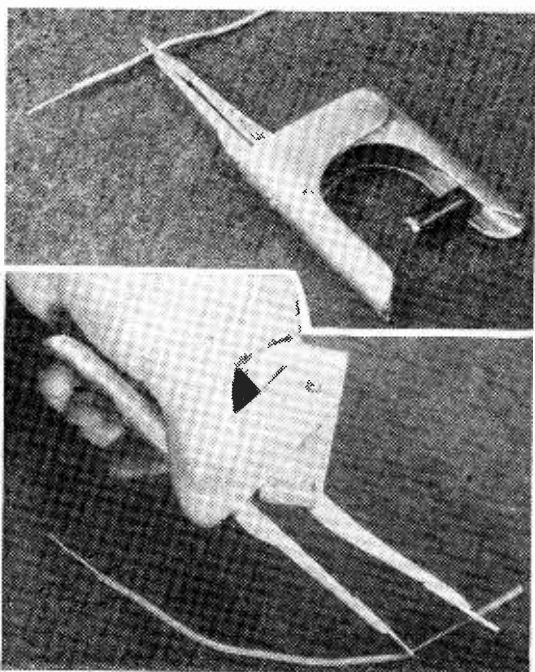
Six-Volt Power Unit (Fig.3)

Capacitors

- C₁, C₂ 0.5 μF 150 V Wkg.
 C₃, C₄ 0.1 μF 350 V Wkg.
 C₅ 4 μF 350 V Wkg.
 C₆ 16 μF 350 V Wkg.

Miscellaneous

- AFC 20 H. 70 mA A.F. choke
 RT Rotary transformer 6 V; 250 V 70 mA (ex A.M. Type 47)
 S₁, S₂ Single-pole on-off toggle switch



New Wire Stripper

CUTTING and removing up to one inch of the insulation from flex or single conductors is performed by this wire stripper, which is operated in one hand, without the necessity of gripping the wire in any way.

Each of the cutting faces has a keyhole-shaped aperture. When in the receiving position the two holes are aligned and the slots diametrically opposed. Pressure on the hand-grips makes the jaws slide apart, thus cutting the insulation and forcing the wire into the slots. Further pressure opens the jaws and forces the cut insulation from the end of the wire.

This wire stripper, which was designed by Norman E. Haley, of Cambridge, was recently shown to viewers in the B.B.C. television programme "Inventors' Club." It is understood that arrangements are being made for its manufacture.

"Modernizing the Wireless World Television Receiver": A Correction

An error in a valve type number occurred in the articles in the May, June and July issues dealing with the time-bases. The frame output valve V₄ was given as type EL42; it should be EL41.

Band 1 Colour Television

Vacant Space for an Independent Chrominance Signal?

ONE of the fundamental difficulties about the American N.T.S.C. colour television system which may go against its adoption in this country is that the colour signal is transmitted within the same band as the brightness signal (which provides the black-and-white picture for ordinary receivers). The system is designed to prevent this colour signal from getting through on to the monochrome picture, but nevertheless it seems there is still a possibility of a slight interference pattern being produced on the screens of existing sets.

A way of overcoming the trouble would be to transmit the colour signal separately in another channel where it could cause no interference—an expedient which the B.B.C. are already considering for this country. The problem of finding a suitable channel is another matter, but there is one possibility which arises in connection with the new London station to be built at Crystal Palace.

This station is being designed for double-sideband operation, like the present London transmitter, or for vestigial-sideband operation like the other British stations. When it goes on the air in about two years' time it will presumably radiate a double-sideband signal to cater for the double-sideband receivers still in use in the London area. Eventually, however, when these sets fall out of use, the transmitter can be put on to vestigial-sideband operation. This means that the upper sideband of the transmission will be partially suppressed and as a result there will be a gap left in the 41-68 Mc/s band approximately 2 Mc/s wide. It is this gap which could be used to accommodate the colour signal—which, in the N.T.S.C. system, only requires a bandwidth of just over 1 Mc/s.

Thus, with this colour signal and the existing monochrome signal a completely compatible colour trans-

mission could be made available in the London area within the 6-Mc/s channel at present occupied by Alexandra Palace. No interference patterns would be produced on existing black-and-white receivers, and it is probable that the arrangement would make for somewhat simpler and less critical transmitters and receivers than will be necessary on the proposed American system. If the colour signal were transmitted from Crystal Palace it would, of course, serve only the London area. There is, however, the possibility that it could be "piped" around the country and radiated on the same frequency from other stations in the television network. The only problem then would be to prevent beats between the colour signals of adjacent transmitters, but no doubt this could be overcome by synchronizing the carrier frequencies.

A somewhat similar suggestion has been made in America by P. Raibourn in a booklet issued by the Hollywood station KTLA (see *Tele-Tech*, January, 1953). It is described as "adjacent-channel colour television" and the main idea is to develop colour television without affecting the market for black-and-white receivers. By using the Lawrence colour c.r. tube in all receivers, says Mr. Raibourn, it should be possible to design a standardized chassis for both monochrome and colour sets. (The Lawrence tube being "a black-and-white picture tube with colour elements added.") Conversion of a monochrome set to colour would then be possible by inserting an extra chassis to receive the adjacent-channel colour signal—at an estimated cost of not more than 50 dollars.

On the question of interference from the colour signal, Mr. Raibourn suggests that this could be avoided by seeing that the carrier frequency of the colour signal is spaced from the monochrome carrier by an odd multiple of half the line scanning frequency.

CRYSTAL PALACE TRANSMITTER

AS already forecast in our September issue (page 411), the new London television transmitter at Crystal Palace will be very different in design from the last high-power station built at Wenvoe. It will, as suggested, have a self-supporting mast (actually 640ft high) and a dual arrangement of two vision transmitters and two sound transmitters. These will be operated together to give greater reliability in much the same way as the twin Third Programme transmitters at Daventry. The power, however, will be somewhat lower than was originally thought. Each of the vision transmitters will have an output of 15 kW, making a total of 30 kW, while the sound transmitters will have outputs of 4.5 kW each. However, the station will have a high-gain aerial system, as predicted, and this will give it an effective radiated power (on vision) of approximately 250 kW—considerably higher than the 34 kW e.r.p. of Alexandra Palace and the 100 kW e.r.p. of the regional high-power stations. Provision is being made for raising the power still further if needed later on.

According to the B.B.C., this higher e.r.p. will not greatly increase the area already served by Alexandra Palace, but it will give a much stronger and therefore more interference-free signal in those parts of London where the level of interference is high. They also say that it will greatly improve the service along the south coast.

The transmitters, which are being built by Marconi's, will operate on the same vision and sound frequencies as Alexandra Palace. The vision transmitters will be made to a standardized design based on a new type of tetrode valve, giving greater simplicity and smaller physical size. They will occupy only about a quarter of the floor space of those at Alexandra Palace and Holme Moss and about half the floor space of those at Kirk o'Shotts and Wenvoe. As mentioned above, they will be capable of radiating either a double-sideband signal or a vestigial-sideband signal, as may be required. The two sound transmitters will not be standardized types but designed specially to meet the B.B.C.'s requirements.

Point Contact Germanium Rectifiers

(Concluded from p. 514 of the previous issue)

Principles of Operation and Their Relation to Performance and Reliability

By R. T. LOVELOCK,* A.M.I.E.E.

THE impedance of a germanium rectifier varies rapidly when the frequency exceeds a certain critical region, and for a given construction and physical configuration, the greater the "turn-over" voltage the lower the critical frequency region above which this rapid variation occurs. As a crude picture, which will enable a qualitative picture of the phenomenon to be given, one may visualize the junction barrier to be a successive series of germanium layers, each containing a little less acceptor impurity as one progresses from p to n type material. When current is passed in the forward direction the conductivity of these layers is increased by the presence of positive holes originating in the p material, and it is the presence of these holes in the junction which decreases its resistance and allows such a large forward current to flow. The holes are not generated in the junction, but flow into it from the p material at a finite velocity, and in consequence there is a delay between the application of forward voltage and the fall of resistance to its final low value. The lower the breakdown voltage of the junction the greater the impurity concentration and the thinner the barrier. Hence in these thinner barriers the distance to be traversed by the holes is less, and the critical frequency at which periodic time becomes comparable with delay is higher. It is when the periodic time of an applied sinusoidal voltage has become comparable with the delay time that the barrier never has time to fall to its minimum value of impedance, with consequent rise in equivalent forward impedance and fall of rectification efficiency.

Once the barrier layer is permeated with holes, and its resistance has fallen, removal of the forward potential does not obliterate the holes, but only ceases to replenish them as they are neutralized by free electrons. The density of holes during maintenance of forward potential is an equilibrium between the rate of arrival from the p material, and the rate of decay in the barrier; upon removal of forward potential they cease to arrive, but only slowly decay in density. Hence, upon removal of forward voltage there is a delay before the resistance of the junction rises to normal value, and when this delay becomes an appreciable fraction of the periodic time of a sinusoidal input voltage, it will cause a fall of equivalent reverse impedance. In commercial rectifiers the rate of decay is slower than the rate of penetration, and in consequence the frequency at which reverse resistance commences to fall is lower than that at which forward resistance commences to rise. Fall of reverse resistance causes fall of equivalent damping resistance imposed across a resonant driving circuit. Variation of

rectification efficiency and damping resistance for a typical rectifier type is shown in Figs. 7 and 8.

In addition to the stray capacitance shunting the rectifier, due to leads, etc., there will be a quadrature component of current with leading power-factor, due to the mechanism of conduction within the junction. This component simulates a shunt capacitance, but the effective value of capacitance is frequency-dependent due to the delay in response just considered.

The theoretical variation may be calculated for a junction-type rectifier, and this variation is plotted in Fig. 9. The observed variation in point-contact rectifiers follows this theoretical law fairly closely, but it must be remembered that to obtain the total effective capacitance of the rectifier in its circuit the constant capacitance due to constructional strays must be added to this variable component. The capacitance plotted in the figure is that for zero applied potential: as increasing values of forward potential are applied to the junction, effective capacitance increases rapidly, but the increase on point-contact rectifiers is not so rapid as that for the junction, first because the full value of forward potential does not appear across the junction due to the presence of appreciable impedance in series with it, and secondly because as capacitance rises and impedance falls, the effect of the resistive component in series with it causes an increasing modification to the effective value. With increase of reverse voltage the effective capacitance falls, and observed variation is approximately equal to the theoretical value. When driven in a circuit by a sinusoidal voltage, it is evident that the effective capacitance is varying continuously throughout the cycle, and the effect is difficult to calculate; it is wise to measure the effective value of capacitance in the circuit to be used under various conditions of drive, and to use the observed values for calculation of performance.

Variations Between Samples.—If a batch of germanium rectifiers, all of the same nominal type be measured, it will be found that the impedance varies appreciably between the individual rectifiers. The problem in circuit design is to know the limits of this variation so that due allowance may be made for it. When calculating the spread of any parameter, it is always convenient to express it in terms of the "normal error distribution," a curve which is expressed in terms of two parameters and one variable. One parameter is the "mean value" and the other is the "standard deviation"; the variable is deviation from the mean value, and for the normal curve approximately two-thirds of the batch will lie symmetrically within one standard deviation of the mean, approxi-

mately 95 per cent will lie within two standard deviations of it, and an insignificant fraction will lie more than three standard deviations away. Even when the observed distribution does not conform to this law, it is often possible to "distort" the variable so that when plotted against the distorted scale it is "normal."

The reverse current at a particular voltage is not distributed according to this law, but if the logarithm of the current be taken it will be found to follow the normal form. In Fig. 10 the distribution of current at -50 volts is shown for a popular type of rectifier, and the current scale is logarithmic to normalize the distribution. This particular rectifier specification states a maximum value of 1 mA above which the current may not rise, and in production those few with larger currents are rejected. Another type of rectifier for use where the highest reverse impedance is important is supplied by selecting from the batch all rectifiers with currents less than 100 μ A, and in consequence, although the overall distribution is as shown by the whole curve including the dotted tails, only those shown within the shaded portion will be supplied against orders for the one type. Hence the distribution of this type becomes a "curtailed log-normal curve."

If a series of rectifiers be selected with identical current at -50 volts, the current at another voltage (say -10) will not be identical for all rectifiers, but will be distributed in a log-normal curve. In consequence, if the distribution of current at -10 be plotted for all rectifiers within the shaded area in the figure, the distribution will not be a sharply curtailed curve, but one with less sharply falling extremities, as shown by the second shaded curve in the figure. The distribution of forward current at low values less than 0.5 mA will also be found log-normal, while that at high values greater than 5 mA will be found normal when plotted directly against current. At intermediate values no simple distortion of scale can be found to ease calculation.

The "turn-over" voltage is also normally distributed when plotted directly against voltage, and for a given average value of mean, the smaller the standard deviation the more consistent the rectifier. In fact this statistic will be found a good measure of consistency in the product, and if the standard deviation is less than 10 per cent of the mean value, the product is very good.

The low-frequency capacitance has a distribution with a long tail extending into high values, and it is good practice to curtail this distribution by rejecting all rectifiers with a capacitance greater than twice the mean value: it is possible by careful control of manufacturing processes to ensure that the quantity so rejected is less than 10 per cent of the whole.

The distribution of rectified current is found to be approximately normal if measured under a selected circuit condition, and it is good practice to reject the very small quantity found to be more than 2db, down on the mean value.

Non-Cyclic Variation (Instability). As a quite separate issue to the cyclic variation of impedance, due to variation of temperature, some rectifiers exhibit a distressing arbitrary variation for no obvious reason, and the object of the manufacturer should be to reduce to a minimum all such effects. By far the commonest cause of such variation is the ingress of moisture to the rectification area, and the result of moisture within the rectifier is always to cause a large and semi-permanent deterioration. A good rectifier design seals the

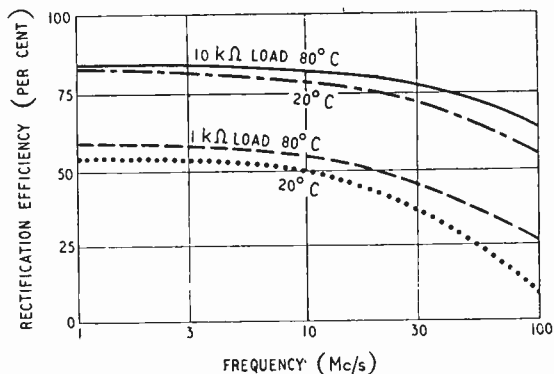


Fig. 7. Variation of rectification efficiency with frequency of typical high-reverse-voltage germanium rectifier.

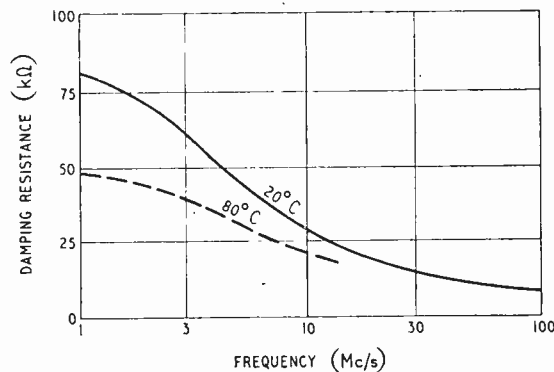


Fig. 8. Variation of damping resistance with frequency of typical germanium rectifier.

Fig. 9. Variation of capacitance due to "hole" current in n-type germanium, with variation of frequency. τ is a function of the "hole" and electron lifetime and the relative division of conductance between these carriers.

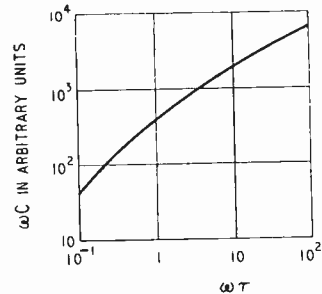
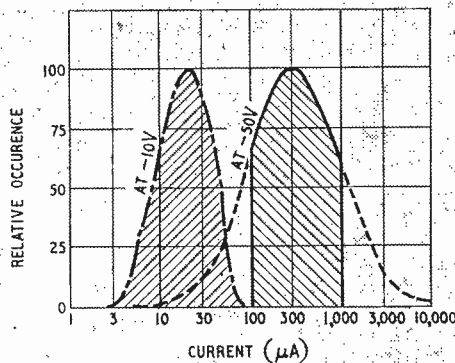


Fig. 10. Distribution of reverse current for a typical batch of germanium rectifiers.



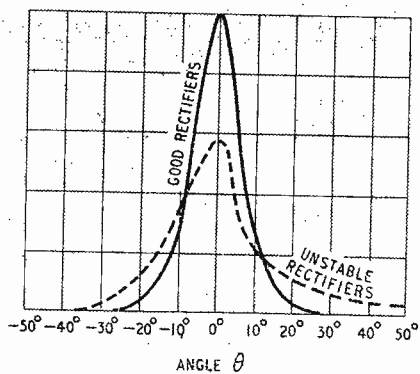


Fig. 11. Typical distribution curves for 5-60 seconds drift.

$$\text{Sin}^2 \theta = \frac{\text{Drift (per cent)}}{100}$$

rectification surface against ingress of moisture from the atmosphere and prevents the sealing of moisture into the unit during manufacture. If it is desired to test for this fault, it will be found that repeated temperature cycles will cause deterioration if moisture has been sealed into the unit, while repeated cycling in a humidity chamber will show a similar effect if the sealing against the atmospheric humidity is faulty. In a good design no appreciable trouble will be found due to this fault.

The major effect of a rectifier seal which is faulty is to cause a long-term increase of reverse current which may take several months to occur in the English atmosphere, but which will eventually increase the value to several times the original figure. In addition to this effect, some rectifiers show a short-term variation of reverse current which is not thoroughly understood at the moment. It is thought, however, that this short term variation may well be a secondary effect of moisture present within the rectifier casing, either through being sealed-in during manufacture, or through leaking-in through a faulty seal. This short-term variation may be detected by either of two simple tests. If a given value of reverse voltage within the rating of the rectifier be applied for a period and the reverse current plotted against time, a fault will be indicated by a continuous drift of current. A second method of test is to apply for some minutes a fixed value of reverse voltage, then apply for one second approximately five times this voltage (still within the rating) and then return to the original value of voltage, a faulty rectifier will show an excessive change of current at the low voltage as a result of applying the high voltage. Care must be taken when applying either of these tests not to be misled by the small change of current which normally occurs due to the heating of the rectifier.

Either of the above tests may be interpreted as a percentage variation of reverse current, the first as a percentage of the final value attained, the second as a percentage of the initial value before application of the higher voltage. If variation be examined over various periods of time with a fixed potential applied, it will be found that there is no correlation between variation over the first second of application and normal circuit performance; it will also be found that variation over a period of several days will be difficult to interpret. In practice a convenient period has proved to be one minute, and excellent correlation has been

found between the drift over the period five to sixty seconds and the variation resulting from applying the higher voltage pulse for one second. In attempting to interpret either of these tests, it will be found that a few rectifiers will always exhibit a small amount of drift, and the best method of evaluating the results is to examine the "distribution" of the percentage variation. The number of rectifiers exhibiting more than 50 per cent variation should be negligible, certainly less than 1 per cent of the total, and such should be neglected in plotting distribution, as rectifiers with a definite fault, and not members of a normal batch. The distribution plotted against the percentage variation is symmetrical about zero in the case of a good batch of rectifiers, but is much more sharply peaked than the "normal law." If, however, the distribution be plotted against an angle which has a sine equal in value to the square-root of the percentage divided by one hundred, positive variations being plotted as positive angles and negative variations as negative angles, a good batch of rectifiers will be found to follow the normal law with a standard deviation less than ten degrees of arc, but a faulty batch will be found to have a much wider curve than this, quite often having an unsymmetrical tail extending into the positive region. Typical curves are shown in Fig. 11.

Other faults besides humidity will give the type of instability described above, but these are mainly faults of manufacture which are not likely to be met to-day. Whatever the cause of faults, if a given type of rectifier will stand repeated cycling in an oven between 20° C and 85° C, repeated 24-hour cycles between 20° C and 55° C in an atmosphere with relative humidity always greater than 95 per cent, and will show a standard deviation less than ten degrees of arc when tested for sixty-seconds drift of reverse current, it may be used with confidence and will give reliable service. The only other cause of failure during life will be electrical overloading, and, providing it is operated within the rating shown to be safe by the manufacturer's quality control checks, this is not likely to occur.

The object of this article is to point out the variation with temperature and frequency natural to the germanium rectifier, and the nature of faults to which it may be heir; the concentration on the black side of the picture should not be taken as an indication that it is an undesirable component, but as a guide to choose the good examples of design which are available.

BOOKS RECEIVED

Dipole Moments, by R. J. W. Le Fevre. Monograph on the measurement of dipole moments in dielectrics and their application to the solution of problems of molecular structure. Pp. 140 + vii; Figs. 27. Price 8s 6d. Methuen and Company, 36, Essex Street, London, W.C.2

Copper in Instrumentation. Comprehensive survey of the use of copper and copper alloys in electromagnetic instruments and in the manufacture of pressure and strain-responsive elements such as diaphragms, Bourdon tubes and strain gauges. Pp. 152; Figs. 45. The Copper Development Association, Kendalls Hall, Radlett, Herts. (Free of charge.)

Carrier Current on Power Lines, by André Chevallier. Reprint of lectures on the propagation of r.f. waves along high-voltage power lines and their utilization for telephony, telemetering, control and fault location. Pp. 24; Figs. 43. Price 2s 6d. *The Beama Journal*, 36, Kingsway, London, W.C.2.

Ring-ing-Choke E.H.T. Unit

Inexpensive 2.5-kV Supply By D. M. MELLUISH

THE ringing-choke method of e.h.t. generation has been used fairly extensively for voltages in excess of 5 kV but, so far, little use has been made of the method in the range of 2-3 kV—the voltage required for operation of the 6-in surplus c.r. tubes at present used extensively for inexpensive television receivers. Since practically all these receivers utilise push-pull line deflection, this means that whatever saw-tooth generator is used, there is a positive-going saw-tooth voltage of 100-200 volts amplitude available for input to a ring-ing-choke system. The method also provides a use for the “high cycle” smoothing chokes or e.h.t. transformers to be found in many ex-Government units which form the basis of many such TV receivers.

The circuit described here has proved capable of providing 2.5 kV at 250 μ A from an h.t. supply of 350 volts at 10 mA. The regulation is good, the circuit is extremely reliable and offers the following advantages over other methods of e.h.t. generation of this voltage:—

- (i) the initial cost is small;
- (ii) no extensive screening is needed;
- (iii) the circuit is non-lethal.

The basic circuit is shown in Fig. 1. The saw-tooth voltage injected at A provides auto-bias for the SP61, which draws a steadily increasing anode current as the saw-tooth voltage approaches its maximum. The fly-back carries the grid to cut-off (and beyond) with the result that a high back e.m.f. is generated at the anode as the current in the choke decays. This voltage is rectified by the diode and the smoothed output appears at B. The diode rectifier may be either an EY51 with its heater supplied from an extra winding on the choke, or a surplus VU120 may be used with a separate mains winding to supply its heater (this winding must be insulated for 2.5 kV). There are only two critical points in the design—the choke and the initial adjustment procedure.

The Choke.—To avoid insulation-breakdown troubles the choke must be of multi-layer construc-

tion with paper insulation every few hundred turns. The inductance should lie between 0.1 H and 0.9 H—the optimum values being between 0.18 H and 0.24 H for maximum efficiency. Two methods of making this choke are available. First, the choke can be wound on a $\frac{3}{8}$ -in diameter wooden former having a winding length of 1 $\frac{1}{2}$ in (the wooden spool on which the necessary $\frac{1}{4}$ lb of 38 gauge enamelled wire is purchased makes an excellent former). 7,200 turns are required with paper insulation interleaved every 600 turns—no great care is needed in winding so long as the winding is kept reasonably even. For the EY51 an extra winding of 20 turns of 24 d.c.c. wire should be wound outside the primary—with a substantial waxed-paper insulation between the two separate windings.

An alternative method is to adapt the “high cycle” e.h.t. transformer or smoothing chokes from an ex-Government unit. In all cases, the modification is the same—simply *remove the iron core from the component*. If an EY51 is to be used an extra heater winding must then be added. Three typical modifications will serve as examples:—

(i) Indicator Unit Type 182A: smoothing choke, with core removed, inductance 0.19H; add 16-turn EY51 heater winding if required.

(ii) 1355 Receiver Unit: e.h.t. transformer with core removed and old heater winding removed and primary winding ignored; secondary inductance 0.81H; add 30-turn EY51 heater winding if required.

(iii) 1355 Receiver Unit: smoothing chokes, with cores removed, both chokes in series, inductance 0.15 H; not advised for EY51 operation owing to low value of inductance, which limits maximum e.h.t. voltage available to 2.3 kV.

Setting Up Procedure

Care is needed when making the initial circuit adjustments, otherwise, with auto-bias on the SP61 and a 350-volt anode supply, the valve may be severely over-run. Insert a milliammeter of range about 0-20 mA in the cathode lead of the SP61 and set the potentiometer to supply *maximum* available saw-tooth voltage to the valve. Upon switching on, the

Fig. 1. Circuit of e.h.t. supply unit

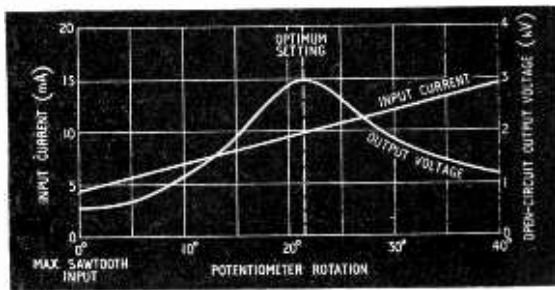
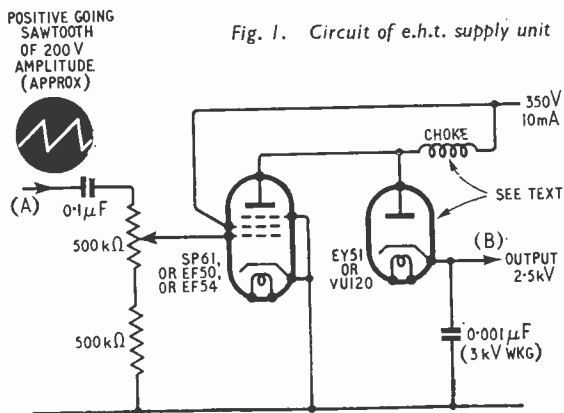


Fig. 2. Relation between saw-tooth drive and output

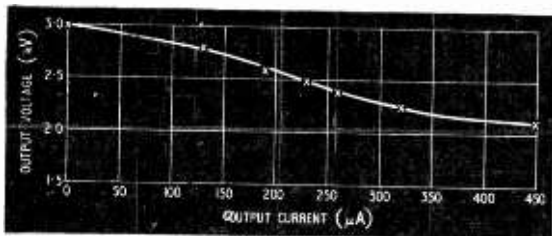


Fig. 3. Typical regulation curve.

working current should be 8 mA or less—little or no e.h.t. may be generated at this setting. Now rotate the potentiometer *slowly*, watching the cathode current reading while doing so—the current should not be allowed beyond 15 mA and before this figure is reached the maximum e.h.t. point should be attained (indicated by minimum size of raster, electrostatic voltmeter, or 0.1 mA milliammeter with 10-MΩ resistor in series across output terminals). Check anode current is between 5 mA and 15 mA at optimum e.h.t. setting, no further adjustment is required and the cathode-current meter may be removed. If an EY51

is used the heater colour should be observed during this setting-up operation and the heater winding on the choke adjusted to give correct colour.

Fig. 2 shows a typical graph relating input current, and output voltage to the potentiometer setting.

The component layout is in no way critical, though the choke should be situated on the opposite side of the chassis to the c.r. tube—but spaced about $\frac{1}{2}$ in from the chassis to avoid eddy-current losses. No other screening precautions are necessary and no interference with other TV or radio equipment operating in the same room has been experienced. The SP61 may be replaced by either an EF50 or EF54—they all give almost identical results. The circuit presents a negligible load on the saw-tooth generator—or its amplifier, the most suitable connection point being the “low” h.t. side of the line-deflector plate coupling capacitor which has correct phase (positive-going saw-tooth).

Most samples of the three suggested valve types will operate satisfactorily at the 2.5-kV level, but internal flash-over occurs beyond 3 kV and for this reason it is not advisable to attempt to get more than 2.5 kV with the suggested valves.

Fig. 3 shows typical output graph using an SP61.

SWEDISH RECORD CHANGER

A Novel Design with Automatic Stylus Selection

THE completely foolproof record changer has yet to be built, but a further step towards that ideal has been taken in the Luxor RT mechanism by coupling the speed-selecting control mechanically to the pickup head, so that the correct stylus is always automatically associated with any of the available turntable speeds of 33 $\frac{1}{3}$, 45 or 78 r.p.m. It is, of course, still possible to select the wrong speed (and stylus) for a given record, but the pitch will instantly proclaim the error, which can be quickly remedied. In a conventional record changer the use of the right speed but the wrong stylus may well escape detection by an uncritical listener until damage has been done either to the stylus or the groove wall.

Another interesting feature of this mechanism is that it will take *any* size of record below 30cm (“12 inch”) and is not tied to any series of conventional sizes. The method of finding the starting groove is the same in all

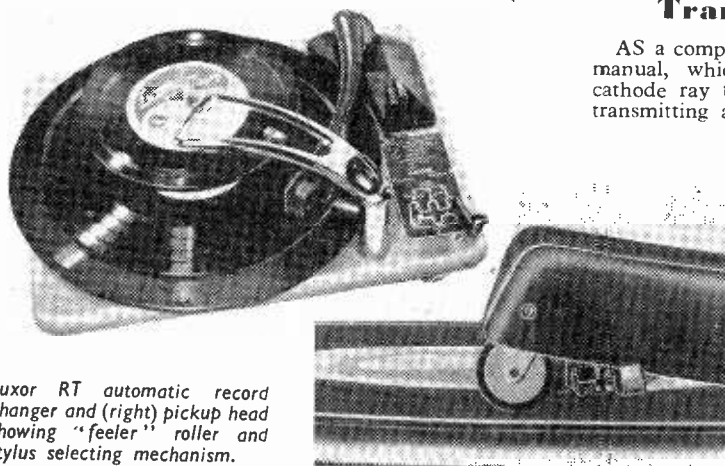
cases. First the tone arm moves to the *centre* of the record where it is lowered on to a tyred roller in the pickup head. The bearings of this roller are aligned so that there is a force tending to move the tone arm outwards. When the roller “feels” the edge of the record, it drops the arm a short distance on to the edge of the record, automatically retracts, and allows the stylus to find the lead-in groove by the normal inward resultant of the frictional drag.

The tone arm is frictionally coupled to the record-changing mechanism and no damage or maladjustment can result from mishandling during operation. Other safeguards include an interlock to prevent operation of the speed-change selector, except when the mechanism is stopped and the tone arm is locked in its starting position on its rest.

The makers are Luxor Radio A.B., Motala, Sweden.

Transmitting Valve Data

AS a companion volume to the first part of their valve manual, which covered Osram receiving valves and cathode ray tubes, G.E.C. have now issued Part 2 on transmitting and industrial valves. The types included are for operation at frequencies ranging from a.f. to 9,500 Mc/s and for power outputs up to 400kW. Among the smaller valves is the familiar KT66, which, as a transmitting type, has the extra distinction of being described as a “convection cooled” tetrode. Full technical data and characteristic curves are given on current types and tabulated information on maintenance types. In addition there are sections on the design of r.f. amplifiers and oscillators, on the interpretation of ratings and on operating precautions. The book can be obtained through radio dealers at 10s or from G.E.C., Magnet House, Kingsway, London, W.C.2, at 10s 9d by post.



Luxor RT automatic record changer and (right) pickup head showing “feeler” roller and stylus selecting mechanism.

C.R.T. Insurance

Television Maintenance Schemes

FORMED as an offshoot of the Radio and Television Retailers' Association in 1950, Telesurance, Ltd., was the first organization to provide an insurance and maintenance scheme covering the replacement of defective cathode-ray tubes in television receivers. Although the secretary of R.T.R.A. (H. A. Curtis) was the originator of the scheme and is in fact a director of Telesurance, Ltd. (37, Fitzroy Street, London, W.1), the two concerns are now operated independently.

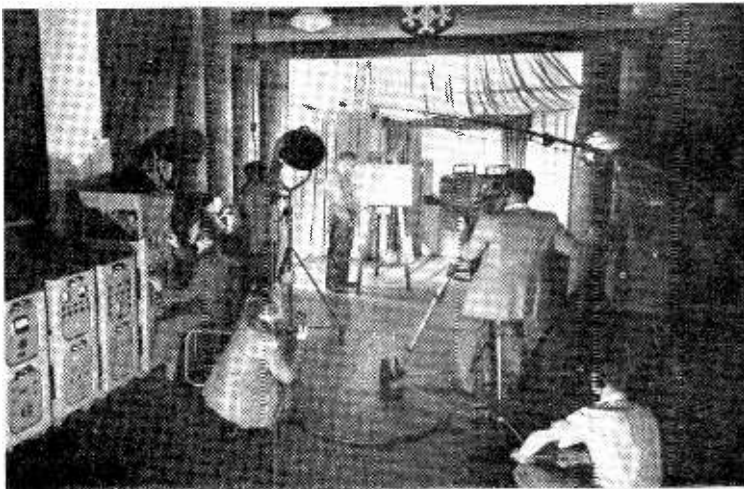
Two maintenance contracts and insurance schemes (operated through R.T.R.A. dealers) are provided by Telesurance; one for receivers up to two years old and the other for new sets. Both provide for the free replacement and fitting of all defective parts (including the c.r.t.) and insurance against fire, burglary or accidental damage, but the scheme for new sets also provides for the replacement of the c.r.t. after three years. The premiums vary, of course, according to the size of tube and the age of the set. Under the first-mentioned scheme the annual premium for the smallest tubes (9in and 10in) varies from £6 for new sets to £8 5s for receivers over one year and not more than two years old. For sets with 16in tubes or projection models it varies from £8 15s to £12 according to the age of the set. The annual premiums in the assurance plan providing for the replacement of the c.r.t. after three years, range from £9 10s for a 9in tube to £15 for 16in tubes. For projection models the premium is 10 guineas.

Since the introduction of the R.T.R.A. insurance scheme, a number of concerns have started operating maintenance schemes directly with the public. Various types of maintenance contract are provided, most of them for a duration of three years, which in some cases are renewable.

Some of the contracts cover only the replacement of the tube for as low a premium as £3 per annum, irrespective of the tube size. Others are fully comprehensive and provide for the complete maintenance of the receiver including the free replacement of all defective components, valves and the cathode-ray tube. These comprehensive schemes have a graduated scale of premiums according to the size of the c.r.t. In one instance, the annual premium varies from £6 15s for a 9in tube to £10 2s for 16in tubes. The premium for projection sets in this case is £10 10s.

The premiums quoted are irrespective of the age of the receiver, provided it is working to the satisfaction of the company's inspector. Most of the companies also provide a scheme for new receivers at a considerably reduced premium. Unlike the R.T.R.A. scheme these contracts do not cover loss or damage caused by fire or burglary, or damage by external means.

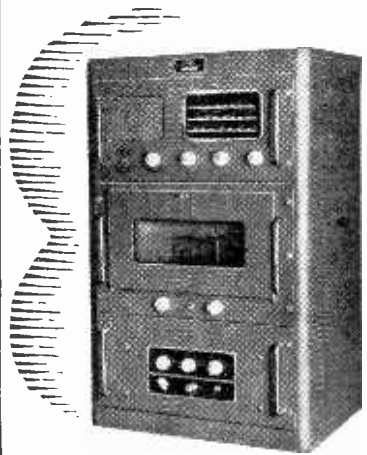
The details given in this note are based on information obtained from four companies operating in the London television service area: Television Mainstal (London), Ltd., Television Insurance and Maintenance Co., Ltd., K. L. Television services, Ltd., and King's (Fulham).



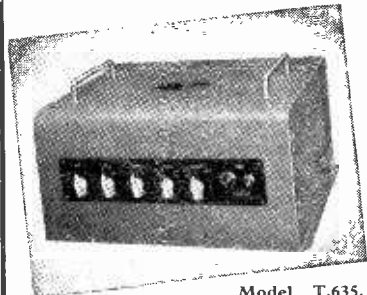
MELBOURNE TECHNICAL COLLEGE.—This photograph, one of a series sent by the principal, R. R. Mackay, gives some idea of the facilities provided for students at the M.T.C. in Victoria, Australia. Some of the students are here shown operating television studio equipment installed in the College. The camera, incidentally, was provided by Pye, of Cambridge.

SOUND'S GOOD!

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RANDOM RADIATIONS

By "DIALLIST"

Metre-Wave Oddities

WHAT UNPREDICTABLE THINGS the metre waves are! I've lately been collecting instances in my own locality of the queer behaviour of the television transmissions from the Alexandra Palace. Here's the first. Two pairs of semi-detached houses, close together, all 450 feet above sea level, surrounding ground open. The owners of Nos. 1, 2 and 4 all obtain good reception with indoor aerials. Hence, when the owner of No. 3 recently bought a television set he had no hesitation about having one too. But it just would not work, an excessive amount of "contrast" being needed to obtain even a poor, jittery picture. Was his set less sensitive than the others? That was soon tested by temporarily swopping over No. 4's set and his. His worked beautifully in No. 4's house; No. 4's set gave a poor performance on No. 3's indoor aerial, though it was of the same type and properly installed. No. 3, then, has had to put up an H-type aerial on a chimney stack to achieve results as good as those his neighbours get with quite simple indoor affairs. No one has discovered why.

Here, Yes ; There, No

Then, there is one small area in the little town in which I live (this is about 22 miles from Alexandra Palace, by the way) in which there is a much poorer signal than anywhere else. Nothing has so far been found to account for this state of affairs. The area is not in a hollow, nor is it surrounded by tall buildings. Actually, it is at the end of the town which lies nearest to the Alexandra Palace; yet it is quite a business to get a good picture there. Those two examples are concerned with houses or areas in which the signal is abnormally poor. My third is of precisely the opposite kind of conditions. I know one house standing in the lowest-lying part of the town in which the TV signals are better received than in any of the many neighbouring houses on the same level; better, in fact, than in the majority of those on sites from fifty to a hundred feet higher. It is actually the only house within a considerable radius in which an indoor aerial gives very satisfactory results. Such aerials have been tried in not a few

of the others and found to be inadequate.

Let Loose the Dogs of Law?

WRITING with reference to what I've had to say recently about motor-car interference with TV reception, a lawyer reader makes a rather horrifying suggestion. "Looking at the problem dispassionately and from the purely legal angle," he mused, "it can only be a matter of time before some sufficiently wrathful viewer gets a Legal Aid Certificate and sues his un-neighbourly neighbour for damages and injunction for his interference with television reception, basing his claim on 'Nuisance' or 'Trespass' or both." I have, as you know, little sympathy for the "unsuppressed" motorist, but I hope that this is a jest rather than a genuine view of the legal position. The possibilities are too awful to contemplate. One sees the Courts submerged by a mighty flood of suits, for there is no knowing where it would stop. Could Brown sue Robinson on the grounds of interference from his "fridge," Robinson counterclaiming that Brown's TV set caused interference with his radio reception? Smith has reason to believe that his "ghosts" have their origin in Jones's steel-framed home;

has he a case? Has Jones legal legs to stand on if he bases a counterclaim on the blue-chinned Smith's not infrequent use of a radiating electric razor before dining out of an evening? Is the pilot of the 'plane which causes flutter fair legal game? And what of the Central Electricity Board and its far-flung grid? I wait anxiously for enlightenment.

Stands, Catalogues and Things

IN THE OCTOBER issue of *Wireless World* a correspondent (S. Pearce) made some points which I hope will have the very particular attention of our manufacturers of radio, television and other electronic gear. Having been unlucky enough to injure a foot on my way home from the first day of this year's Earls Court show, I was able to make only one visit instead of my usual two or three. When I came to think over what I'd seen in seven hours spent in that vast hall I realized how much time I had wasted in digging out what was new from beneath the overburden of things already familiar. The official catalogue did little to fill in the gaps; in fact, if it hadn't been for *W.W.*'s excellent reports, I should have missed a good few notable new things. The manufacturers' position is, one realizes, by no means an easy one. The great majority of those who look at their stands will be ordinary non-technical folk, either "eye-shopping" or bent on selecting their new sound or television receivers



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and out to collect as much "literature" as possible. Those leaflets musn't be too technical and the people who answer their enquiries must be salesmen rather than boffins. But I do wish that those who want technical information could get it more easily, both verbally and in print. And the official catalogue and guide should certainly be more descriptive than it usually is. Would it be possible to have two? A small directory affair at, say, sixpence or a shilling; and a real catalogue selling at half-a-crown, or even a bit more?

A Shaping Tool

YOU MIGHT THINK that the saddler's or shoemaker's rasp was a queer sort of tool to find a place in the wireless workshop. But I can assure you, having had one in mine for a good few years, that it is a really useful thing. The rasp, D-shaped in section, is eight inches long by $\frac{3}{4}$ -in wide. One half of both the flat and the round faces is coarse-cut and the other half fine-cut. You can buy one of these rasps from most tool shops and many ironmongers. It is the quickest and handiest thing I know for shaping non-metallic materials such as wood, ebonite, bakelite and p.v.c. The coarse-cut faces have a grand bite for roughing out. Then you finish the job by using successively the fine-cut face, a file and emery cloth or glasspaper as required.

Big Tube or Projection?

THERE'S NO DOUBT that a well-designed and well-handled television receiver with a tube 14 inches or more in diameter can provide beautiful pictures. Somehow, though, I can't believe that the right way to give people the larger pictures for which they are always clamouring is to use bigger and yet bigger c.r. tubes. They certainly have their drawbacks. Unless, for instance, the cabinet has doors behind which the "alderman's waistcoat" end of a fat tube can be decently hidden when TV reception is not going on, the set is liable to be far from a thing of beauty. The worst snag of all, though, is the cost of replacement after the guarantee period has come to an end. For these and some other reasons I'd predict great success for small projection receivers, if they could be sold at moderate prices. I was surprised not to see more projection models at the Radio Show and I don't remember seeing any of the kind I have in mind.

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TVHF

I WAS exceptionally interested to hear the presidential address given to the I.E.E. by Mr. Bishop, the B.B.C.'s Director of Technical Services. When talking about the Corporation's plans for v.h.f. broadcasting and suchlike matters, he seemed to speak with personal enthusiasm. This is in such marked contrast to his "t'aint wanted" attitude to stereophonic broadcasting which he adopted in a letter to the Editor of *Wireless World* some time ago, that it sets me wondering what has caused this strange but welcome metamorphosis. Maybe he has a Jekyll and Hyde personality; if so, when the other side of it takes control of him once more he will probably liquidate himself for "dangerous thoughts."

However, it is not so much about Mr. Bishop that I wish to speak as about the B.B.C.'s plans he disclosed. I cannot help feeling that neither he nor anybody else, except myself, realize how unnecessarily wasteful they will be of money, labour, and, above all, of etheric elbow room. My own plan would obviate all this waste and is obviously so much better in every way than the B.B.C.'s proposals that I make no excuse for putting it forward.



"Better without a visual accompaniment."

The B.B.C. proposes to cover the country with a network of 51 v.h.f. stations which will exist side by side with the existing m.w. and l.w. transmitters. But it cannot be doubted, I think, that in the distant future m.w. and l.w. broadcasting will disappear altogether and v.h.f. will reign supreme. The B.B.C. also has its plans cut and dried for extending its TV coverage by means of a series of low-power stations. Eventually, as Mr. Bishop reminded us, it is the hope of the B.B.C. to provide an

alternative TV programme apart from any competitive service that may appear.

Now all this clutter of alternative TV stations means that a lot more etheric elbow room will be wanted and consequently TV will have to make use of higher frequencies. This won't be the only reason why higher frequencies are necessary because colour and 3-D, when they come—and come they most certainly will—will need a lot more elbow room.

It looks, therefore, as though we are eventually going to find the country covered by a network of v.h.f. "sound-only" stations and a network of television stations all working somewhere on microwaves. Why on earth not save money, labour and etheric elbow room by combining the two schemes? I will admit that many broadcasting programmes are better without a visual accompaniment; for these, only sound would be radiated. By this combined TVHF plan the B.B.C. would, in addition to lessening its capital outlay, save a lot of money in running costs as my scheme would halve the number of programme and engineering staff needed.

The B.B.C. probably won't listen to me, but after it has wasted a lot of public money on the two separate networks it will in the end be compelled to adopt my idea for nobody can doubt that "blind broadcasting" is on the way out. By the time we celebrate the Queen's Silver Jubilee it will be as extinct as silent films are to-day.

When Homer Nods

I DO NOT PROPOSE to stick my neck out by joining in the chemical warfare between two such well-known authorities as R. W. Hallows and R. W. Lewis, but I was a little surprised to find R. W. H. slavishly following popular convention by calling the carbon-manganese-dioxide electrode of a Leclanché cell the cathode (October correspondence columns). The O.E.D. tells me that the cathode is "the path by which an electric current leaves the electrolyte and passes into the negative pole . . ."; the anode is defined as "the path by which an electric current leaves the positive pole and enters the electrolyte on its way to the negative pole; *loosely*, the positive pole . . ."

Thus, according to the O.E.D. the positive pole is the anode and since we all know that it is the carbon-manganese-dioxide electrode (our old friend the porous pot in the case of

wet cells) which is marked with a + sign it would appear that R.W.H. and the O.E.D. are at variance. This is perhaps not so surprising as Major Hallows is very well known as a Cambridge man and he would naturally have no truck with the Oxford dictionary.

In my warped view it is impossible to apply the terms cathode and anode permanently to the electrodes of any sort of battery as they change places according to whether you are charging or discharging it. In these days of dry cell "reactivators," we battery set users do as much battery charging as car owners although the chemical process is not the same. In the case of a valve where we can only push current through one way



"Cambridge . . . no truck with the Oxford dictionary."

the heater end is *always* the cathode and the plate the anode.

The reason why the O.E.D. is so dogmatic in its statement "the anode . . . *loosely* the positive pole" is I believe because Faraday, whose words it quotes, was at the time talking about electrolysis and of nothing else. Of course, we all do a bit of electrolysis when we charge our batteries but, unlike Faraday, we do it not as an end in itself but for the purpose of subsequently getting our temporary electrolytic bath to supply us with current.

When Major Hallows tells the world so emphatically that one particular pole of the battery is the cathode he probably forgets that the cathode becomes the anode and *vice versa* when the battery is put on charge; this is rather surprising as he himself once wrote a very informative article in *W.W.* on re-activating dry cells. Maybe too he temporarily overlooked the literal meaning of the words cathode and anode.

Perhaps I'm quite wrong in my views but if so I'm sure the Editor's columns are open to my technical betterers and none will be more pleased than myself to have a universally accepted convention in this matter.

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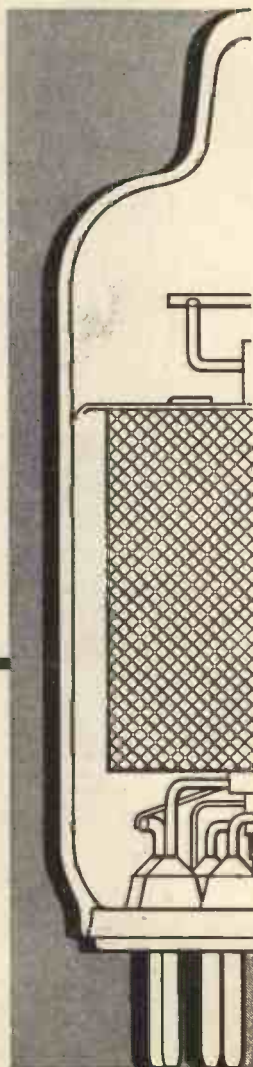
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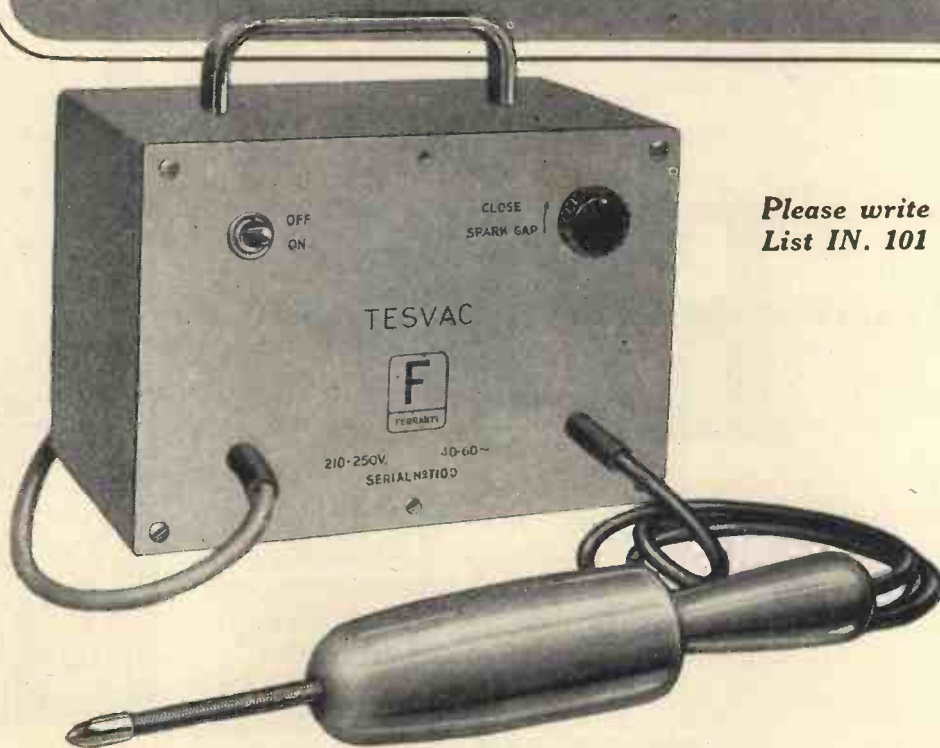
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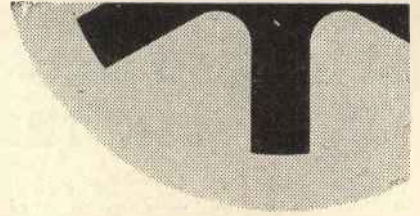
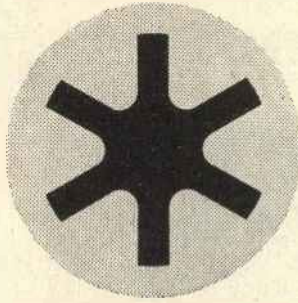
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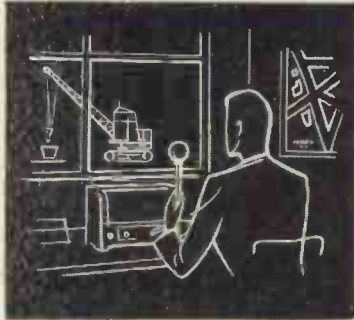
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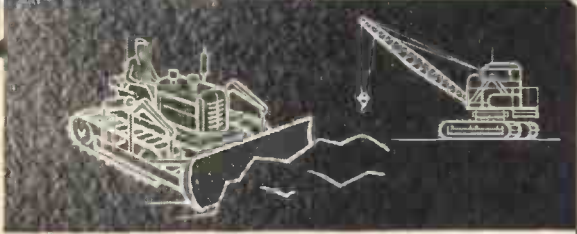
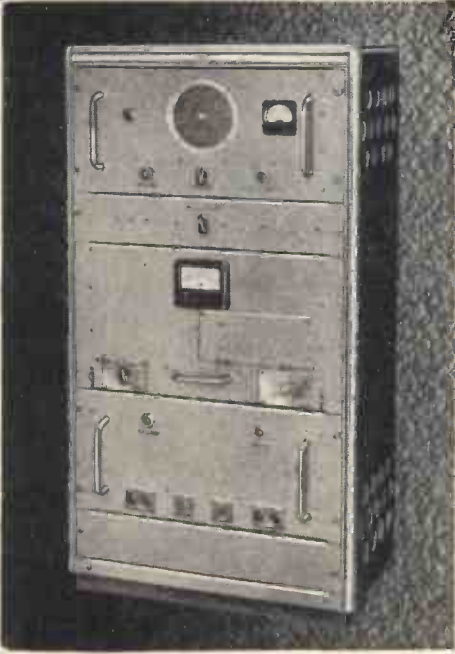
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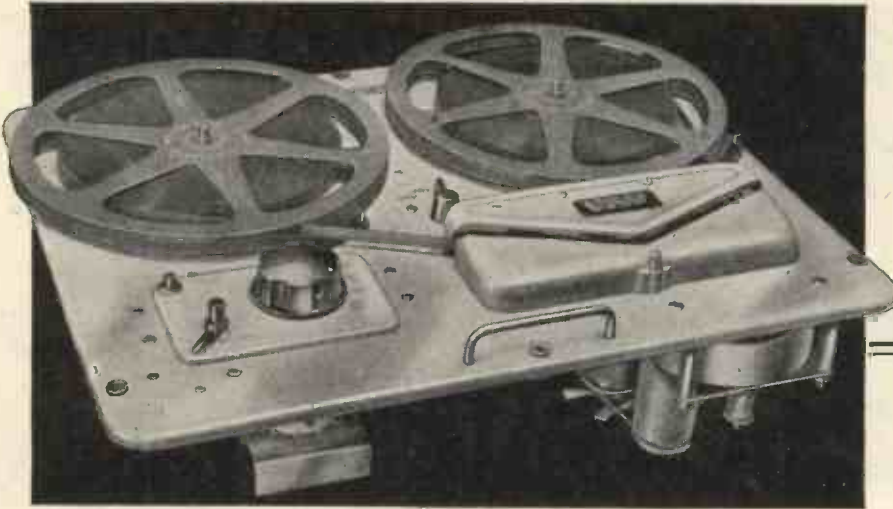
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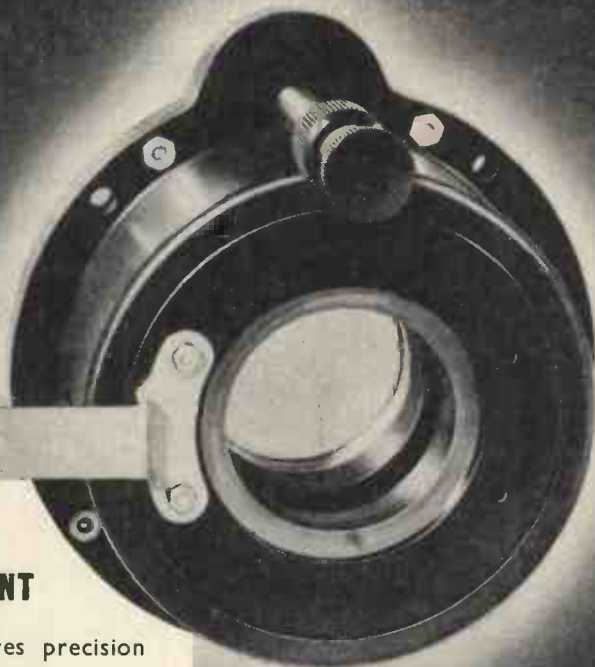
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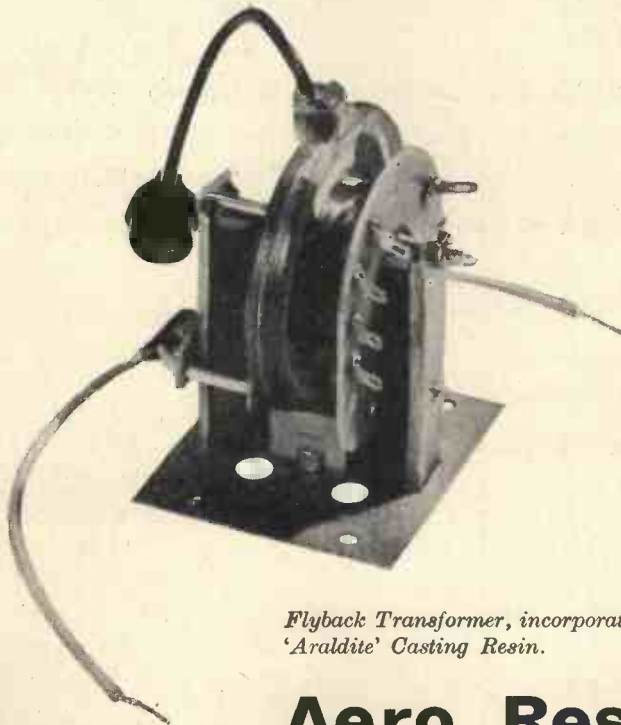
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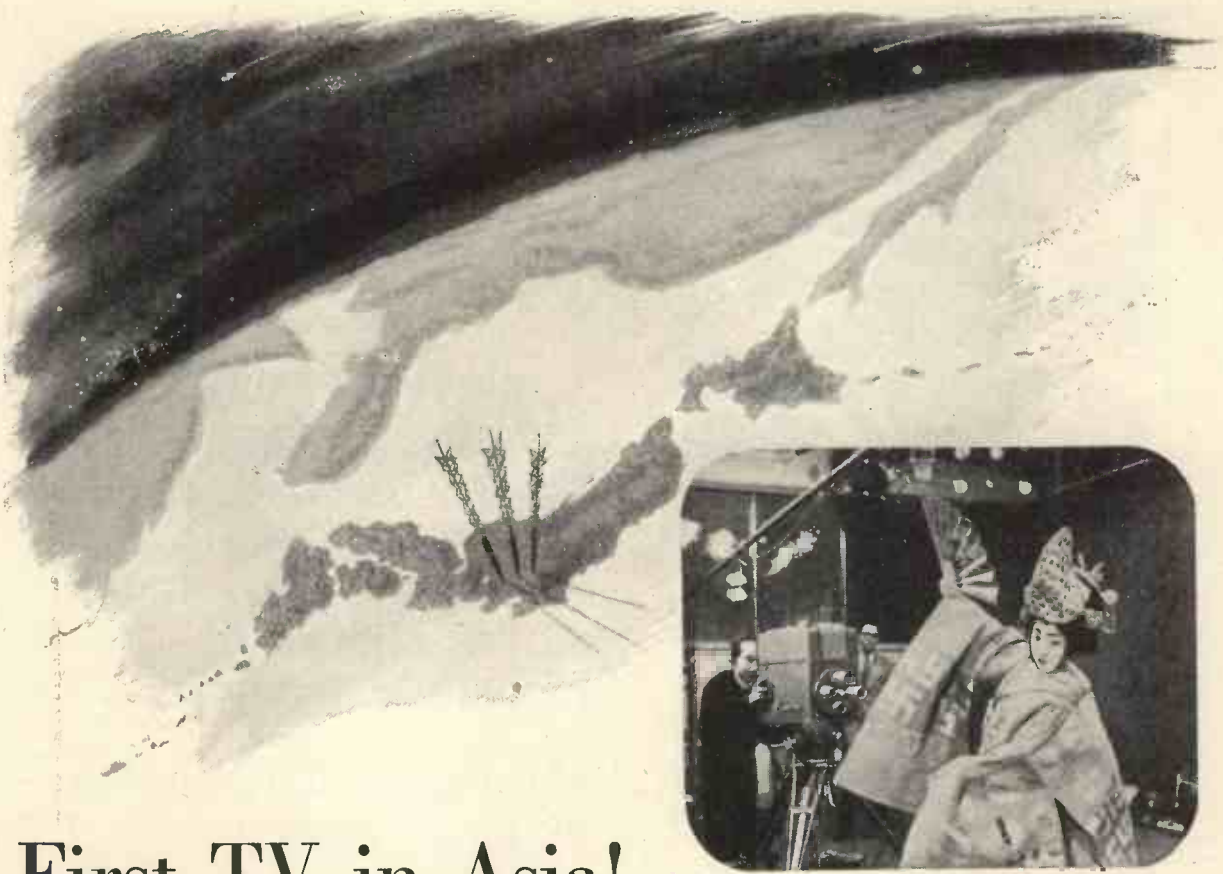
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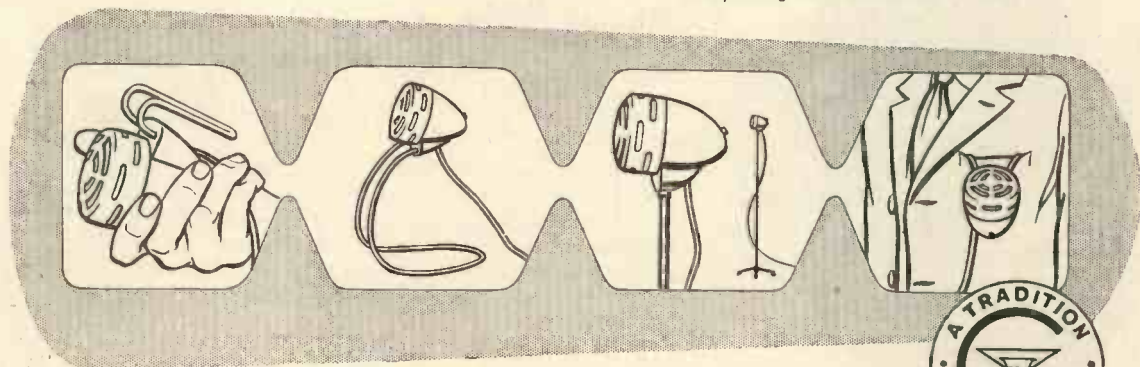
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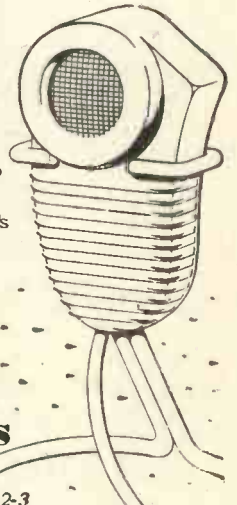
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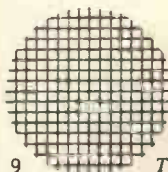


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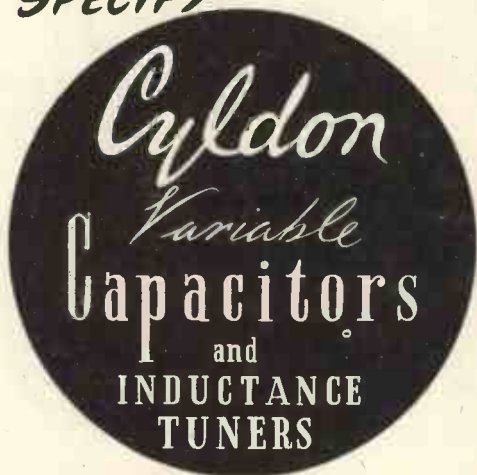
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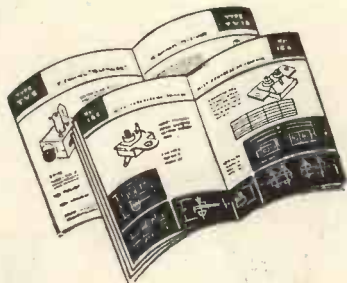
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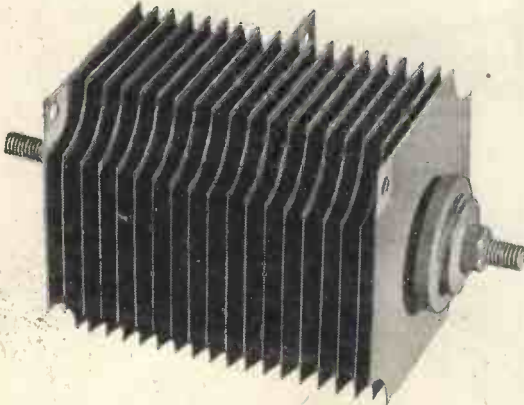
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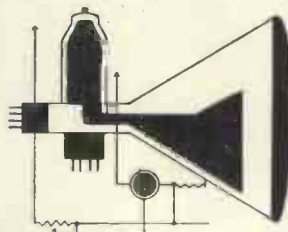
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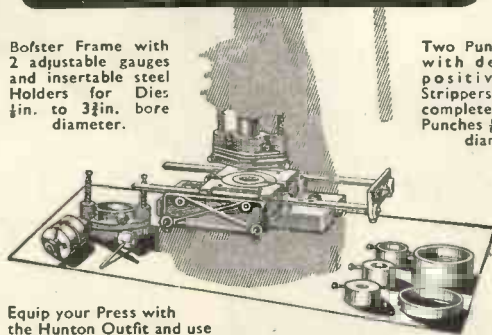
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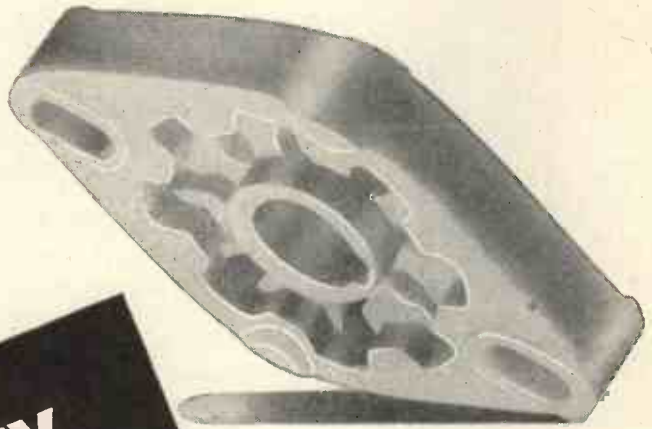
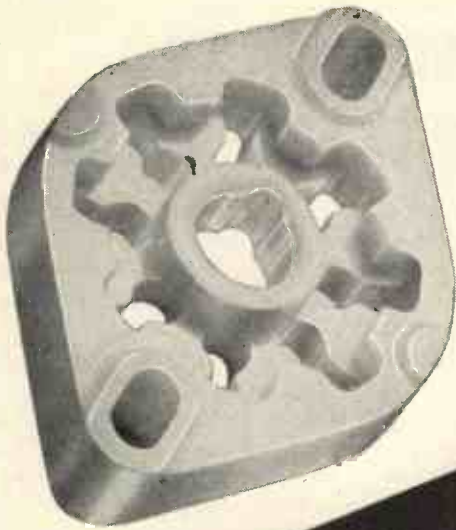
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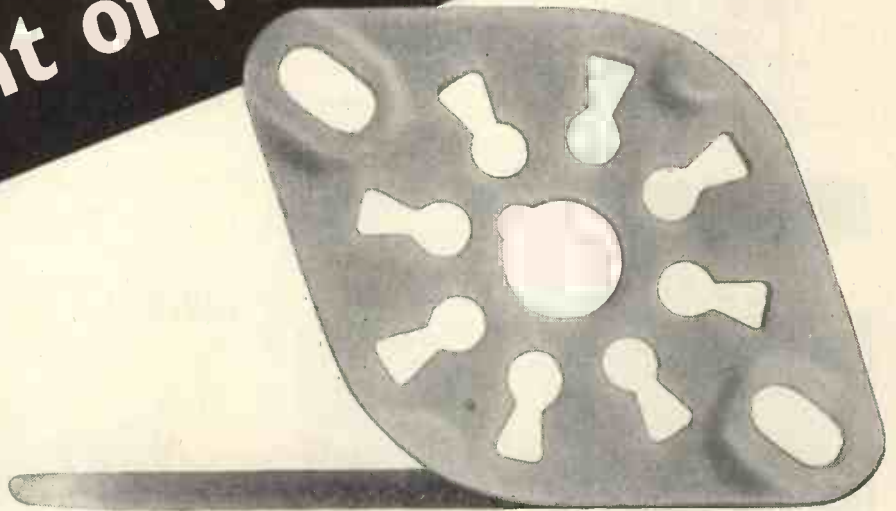
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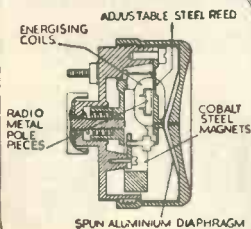
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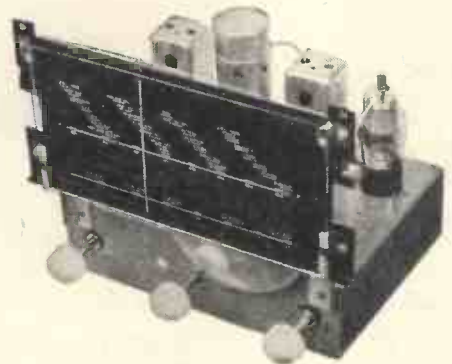
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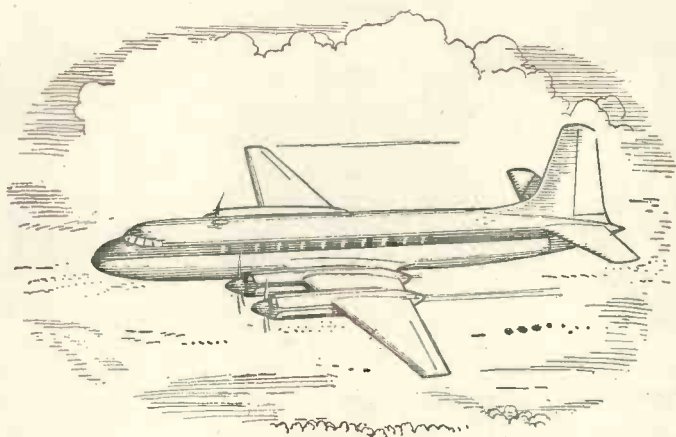
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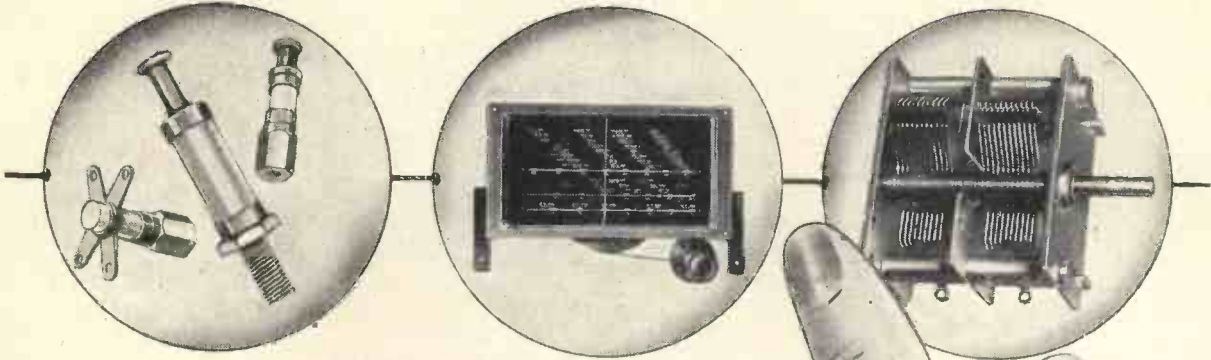
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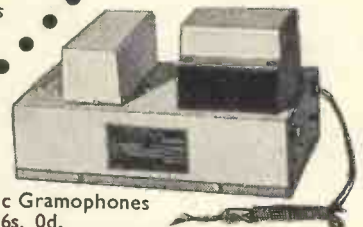


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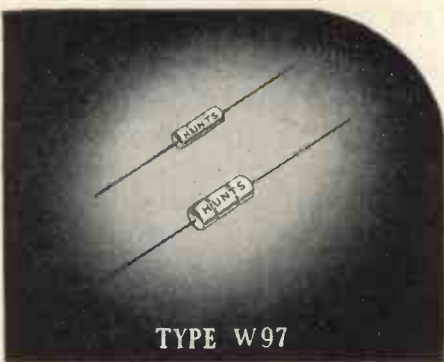


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With the hitherto unattainable temperature range of -100°C. to +120°C., Hunts W.97 "Thermetic" midget metallised Paper Capacitors are to Category A (100°C.) Class H1 (84 days tropical exposure) and are the smallest capacitors for their rating to this, the most stringent test condition of the R.C.S.C. Specifications.

Construction is the well known Hunts "castellated" metallised paper with rugged end connections ensuring freedom from intermittent open circuit and open circuits at low voltage. The capacitor unit is sealed in a metal tube with Hunts "Thermetic" compound, which also ensures mechanical rigidity of the end wires thus avoiding any reliance on foil and wire contacts for mechanical strength.

W97 Capacitors are non-inductive and suitable for operation at frequencies up to and in excess of 200 mc/s.

They are impregnated with a new material which is absolutely stable over the specified temperature range, and the temperature/capacitance co-efficient is infinitely superior to other types of capacitors in this class.

This unique capacitor is designed to withstand very high rates of "g". Its rugged construction enabling it to be used in equipment where such conditions are encountered.

W97 can be supplied with a transparent plastic sleeve where insulation of case is required.

TYPE W97 STANDARD RANGE

LIST NO.	CAP (µF.)	DIMENSIONS (inches)	
		L.	D.
		200 volts D.C.	Wkg. up to 100°C.
		150 volts D.C.	Wkg. up to 120°C.
BM7	0.002	0.610	0.135
BM8	0.004	0.610	0.135
BM11	0.004	0.500	0.180
BM9	0.005	0.610	0.135
BM12	0.005	0.500	0.180
BM10	0.01	0.610	0.135
BM13	0.01	0.500	0.180
BM14	0.02	0.610	0.180
BM15	0.03	0.610	0.260
BM16	0.04	0.610	0.260
		400 volts D.C.	Wkg. up to 100°C.
		300 volts D.C.	Wkg. up to 120°C.
BM4	0.0004	0.610	0.135
BM5	0.0005	0.610	0.135
BM6	0.001	0.610	0.135
BM17	0.001	0.500	0.180
BM18	0.002	0.500	0.180
BM19	0.003	0.500	0.180
BM20	0.005	0.610	0.180
BM21	0.01	0.610	0.260
		600 volts D.C.	Wkg. up to 100°C.
		450 volts D.C.	Wkg. up to 120°C.
BM22	2.5 pF.	0.500	0.180
BM23	4 pF.	0.500	0.180
BM24	10 pF.	0.500	0.180
BM25	50 pF.	0.500	0.180
BM1	0.0001	0.610	0.135
BM26	0.0001	0.500	0.180
BM2	0.0002	0.610	0.135
BM27	0.0002	0.500	0.180
BM28	0.00022	0.500	0.180
BM29	0.00025	0.500	0.180
BM3	0.0003	0.610	0.135
BM30	0.0003	0.500	0.180
BM36	0.0004	0.500	0.180
BM31	0.0005	0.500	0.180
BM32	0.001	0.500	0.180
BM33	0.002	0.610	0.260
BM34	0.003	0.610	0.260
BM35	0.004	0.610	0.260

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Treble Units Facing Upwards Crossover Frequencies 800 and 5,000 c/s

The bass speaker is the W.15/CS with a fundamental resonance below 30 C/S; the middle speaker is the Super 8/CS; and the third speaker is the Super 5 with response well maintained to 16,000 C/S. The crossover unit is a $\frac{1}{2}$ section type, with crossover frequencies of 800 and 5,000 C/S. A Volume Control is now fitted to the middle and top speakers which also face upwards to avoid undue directional effects.

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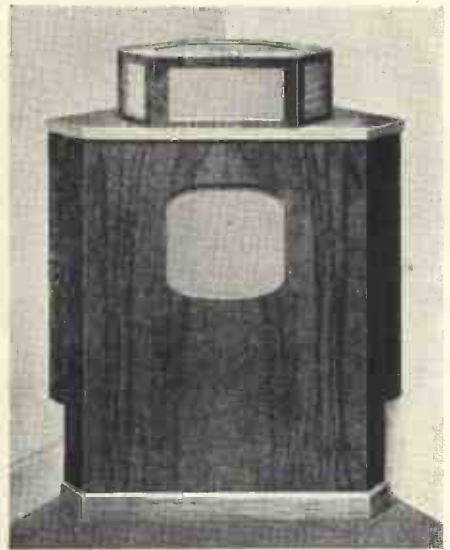
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| City Sale & Exchange Ltd., 93/4, Fleet Street, London, E.C.4. | Tel: Central 9391 |
| Classic Electrical Co. Ltd., 364, Lower Addiscombe Road, Croydon, Surrey. | Tel: Addiscombe 6061 |
| Holley's Radio Stores, 285, Camberwell Road, London, S.E.5. | Tel: Rodney 4988 |
| Jewkes & Co., 28/31, Broad Street, Birmingham, I. | Tel: Midland 4829 |
| C. Milsom & Son, North Gate, Bath. | Tel: Bath 5675 |
| Webb's Radio, 14, Soho Street, Oxford Street, London, W.1. | Tel: Gerrard 2089 |
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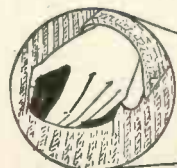


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W.15/CS sand-filled Enclosure	£47 0 0
Treble Assembly	£16 10 0
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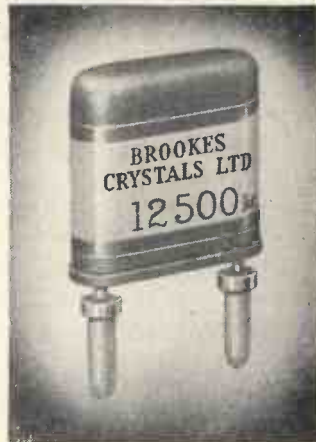
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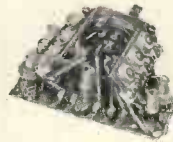
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Type	Hole Sizes	Price
1	1in. x 1½in.	19/6
2	¾in. x 1½in.	18/9
3	¾in. x 1½in.	22/6
4	1½in. x 2in.	27/3

Post and Packing 1/- (any type). Tommy Bars 1/3 each

The **OSMOR** "JIFFY PUNCH"

For cutting smaller holes neatly and quickly with one blow of a light hammer.



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3	1in.	8/9

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Overall size 5½in. sq. as illustrated. Cream background, 3-colour. Type M1, L.M.S. waves. M2, L. & M. waves. M3, M. & 2½ waves. Price 3/6 each. Pointer, 1/6. Drum, Drive, Spring and Cord for use with both types of dials, 3/2.



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Stabilisation Ratio	100 : 1	66 : 1	66:1+ve 300:1-ve
Impedance	2 ohms	2 ohms	3 ohms+ve 1 ohm-ve
Ripple	< 5mV	< 2mV	< 5mV+ve < 2mV-ve
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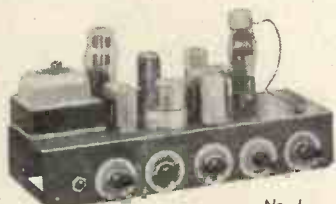
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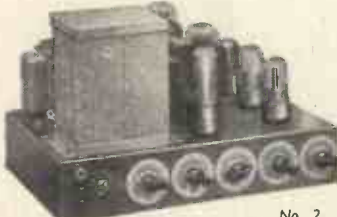
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MODEL "TA," as above, but fitted with the latest Radio Show High-Fidelity Acos HGP35 Pick-up Heads (one for Std. and one for L.P.). Price £12/3/9, post and pack, 2/6.

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GARRARD 3-SPEED AUTO-CHANGERS, MODEL RC90 in de luxe rexine-covered Portable Case, £23/1/-. Or fitted with Garrard Magnetic Turnover Head, £25/3/5. Or fitted with two separate Acos high-fidelity HGP35 Heads, £27/7/-. Carriage in all cases 7/6.

GARRARD 3-SPEED AUTO-CHANGERS, Model RC80. Plays up to ten records 7in., 10in. or 12in. at 78, 45 and 33½ r.p.m. Stylus pressure on L.P. 10 grammes (adjustable). New ultra-sensitive auto-trip mechanism and heavy loaded turntable to eliminate "wow." Price £14/2/6 or with Garrard Magnetic or Astatic crystal Turnover Pickup Head £16/2/6. With two separate Acos Hi-fi Heads, £18/2/6. With two separate Decca XMS Heads, £19/7/6. Carriage 5/-. Optional Extras: 45 r.p.m. Auto Centre Spindle, 20/9; A.C./D.C. Operation, £7/14/-. Fitting in de luxe rexine-covered Portable Cabinet, £5. Pick-up Head to take Fibre Needles, 25/- to 35/-.

"SYMPHONY" BASS REFLEX CABINET KITS (left). 30in. high, consist of fully-cut ½in. thick, heavy, inert, non-resonant patent acoustic board, deflector plate, felt, all screws, etc., and full instructions. 8in. speaker model, 85/-; 10in. speaker model, 97/6; 12in. speaker model, £5/7/6. The design is the final result of extensive research in our own laboratory and is your safeguard of optimum acoustic results. Carriage 7/6. Ready built, 10/6 extra, also available fully finished in figured walnut veneer as illustrated, 8in., £10/10/-; 10in., £11; 12in., £11/10/-. Treble baffle to match, 45/-.

CONSOLE AMPLIFIER CABINETS (right), 33in. high, lift-up lid, take Gram Unit or Auto-changer, Amplifier, Pre-amplifier, and Radio Feeder Unit, finished medium walnut veneer. De luxe version, 10 gns., carriage according to area. Bass Reflex Cabinets to match available. Details 2½d.



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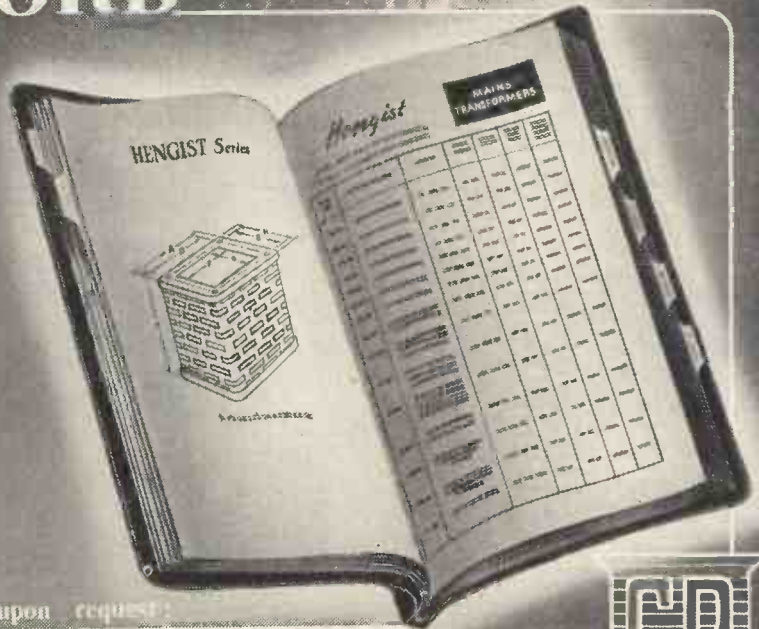
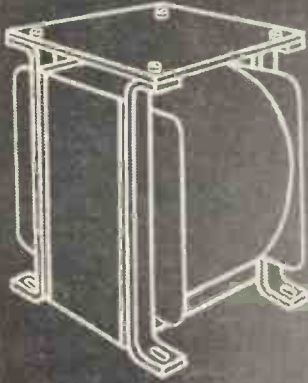
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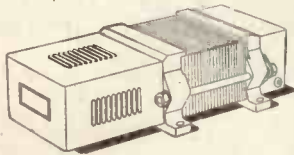
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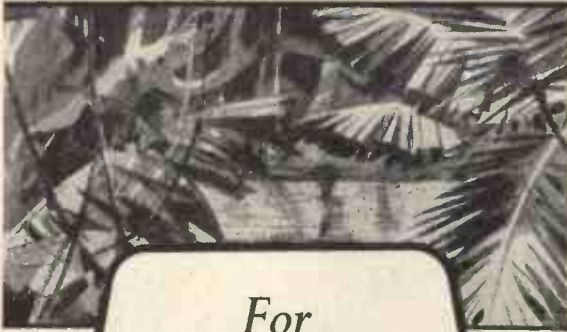
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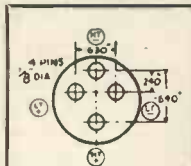
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to -55 db $\pm 5\%$
to -75 db $\pm 10\%$
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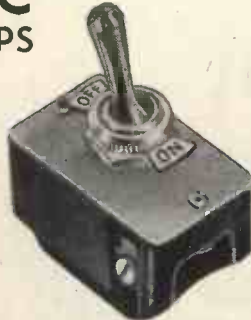
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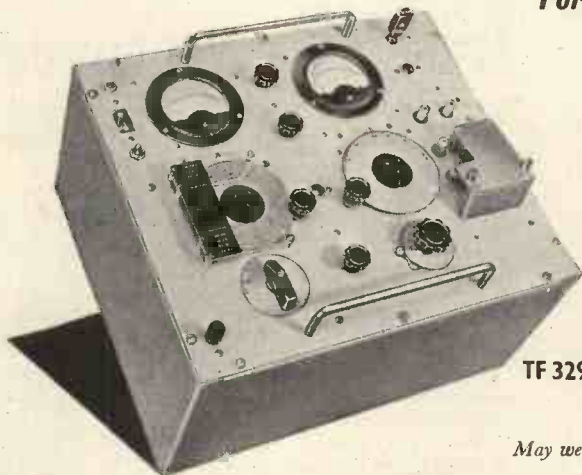


TF 868

OPERATING FREQUENCY : 1 kc/s
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For measurements up to 50 megacycles
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TF 329G

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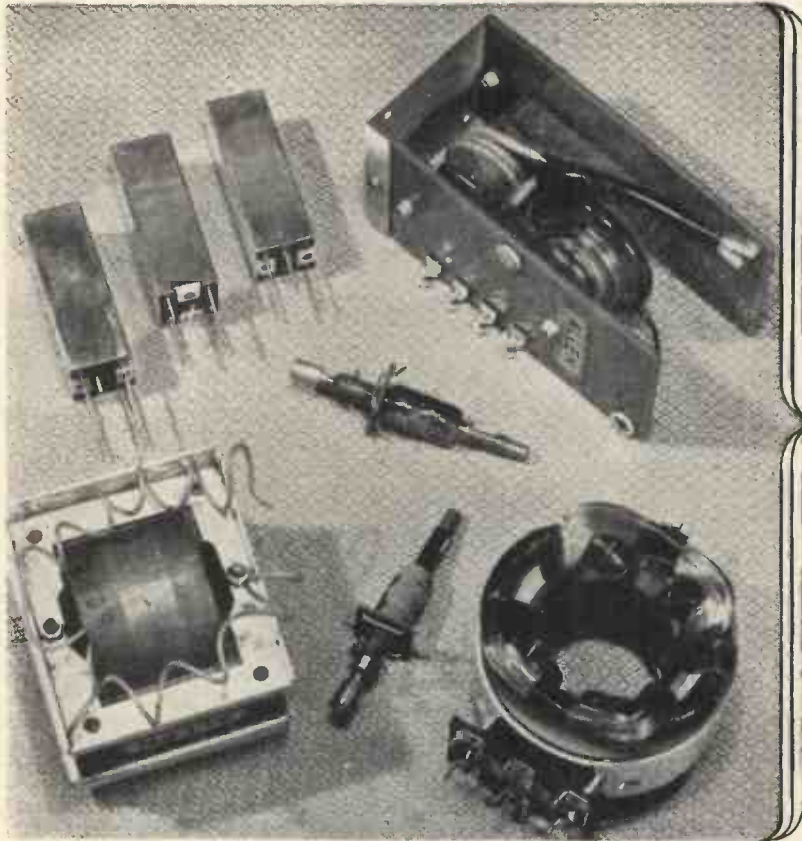
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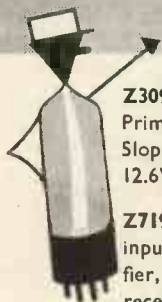
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N329 Output pentode for use in sound and frame time base output stages in transformerless television receivers. Audio output 4 watts with 170V H.T. Heater 16.5V 0.3A. Base: B9A.

U43 Miniature wire-in television EHT rectifier. Indirectly heated. P.I.V. 17kV. Heater 6.3V 90mA.

305 Barretter 0.3A. Voltage range 40-90V. For the regulation of heater current in transformerless television receivers. Base: E.S.

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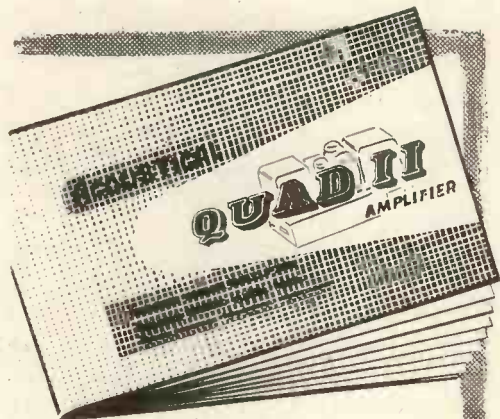
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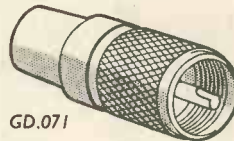
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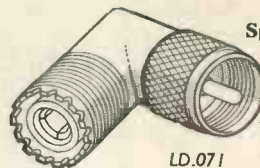
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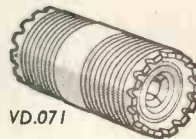
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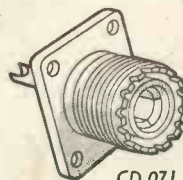
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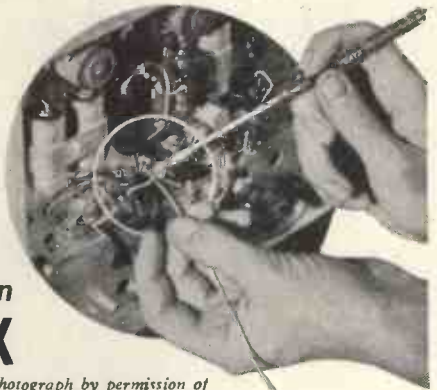
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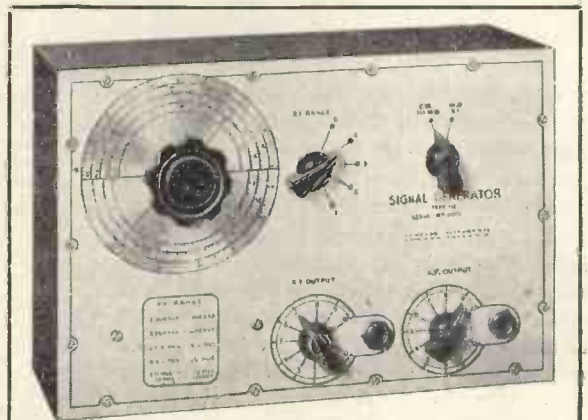
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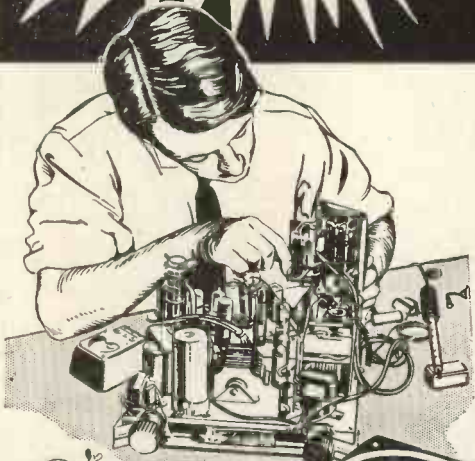
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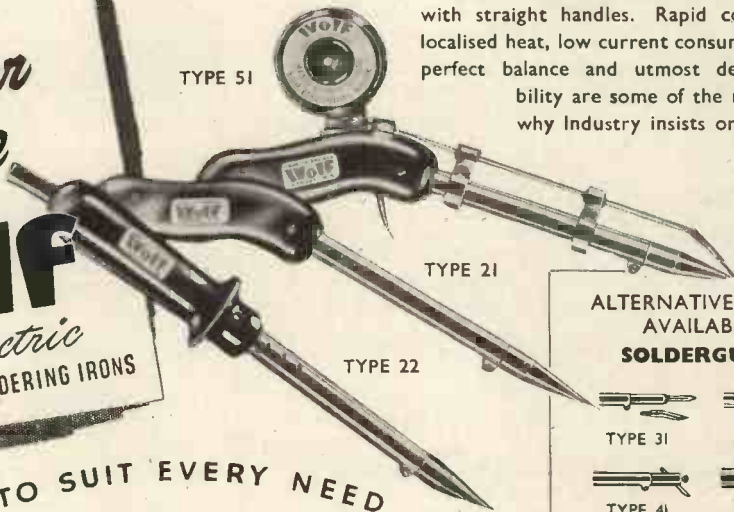
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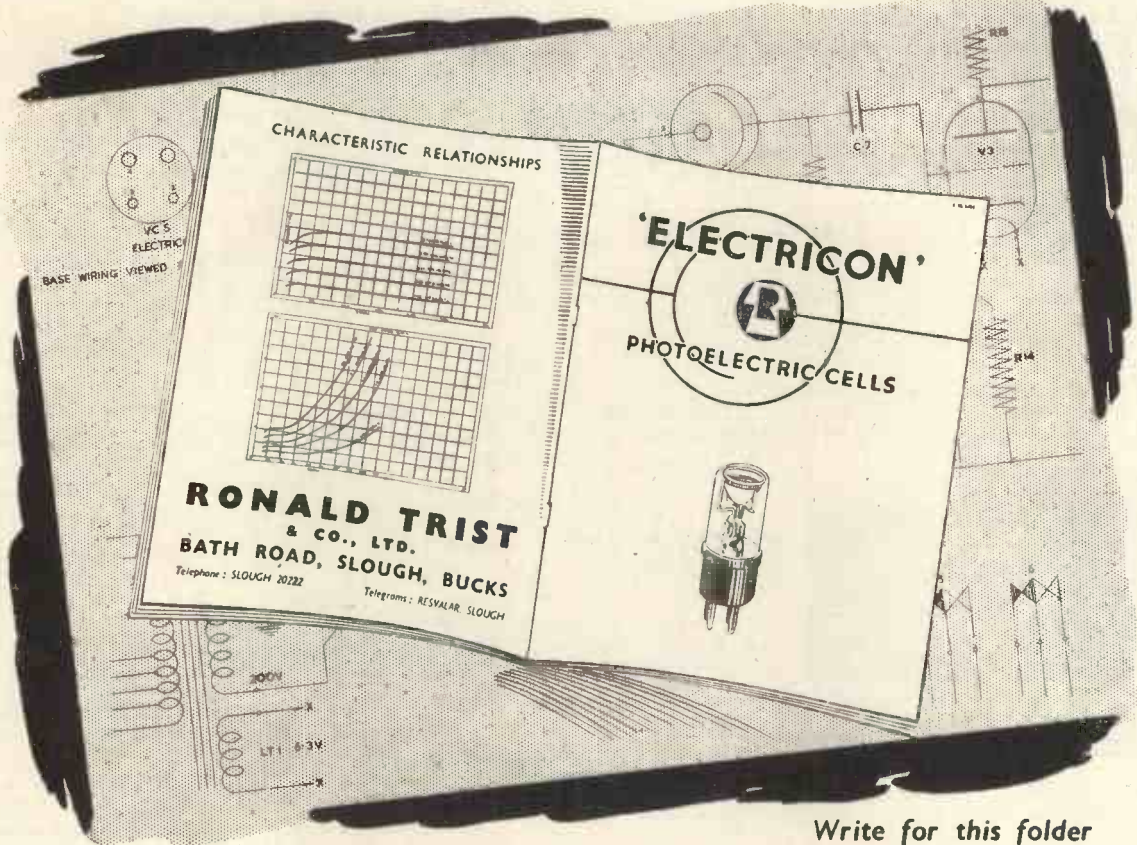
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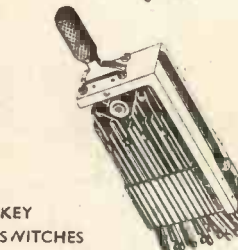
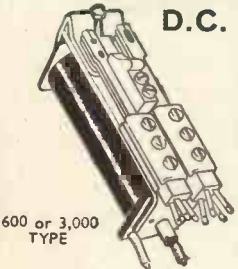
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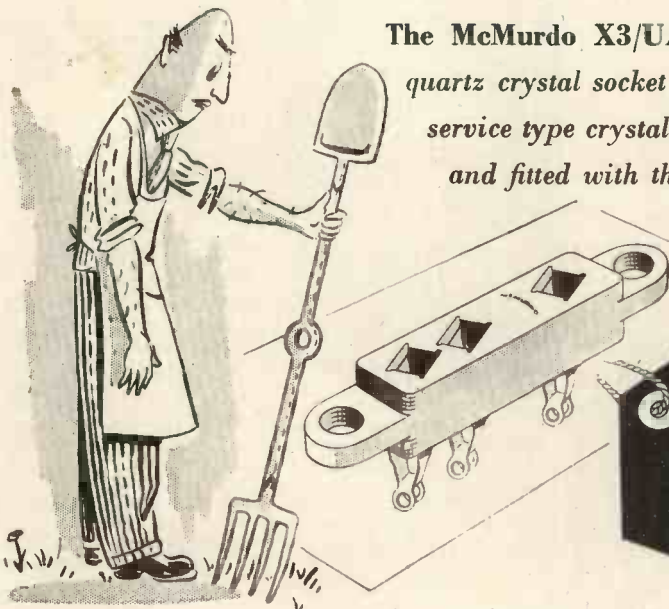
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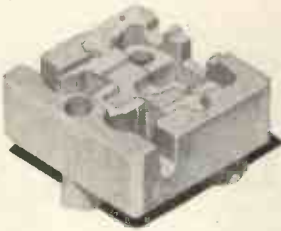
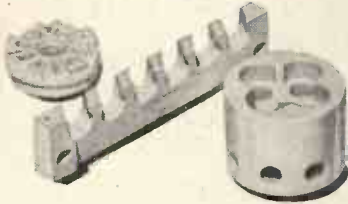
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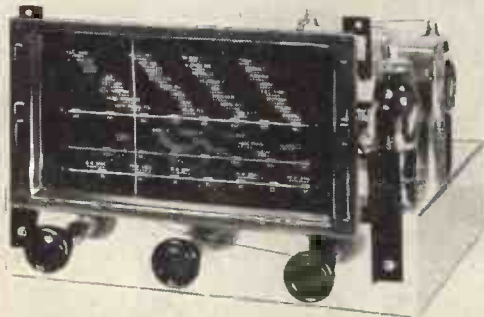
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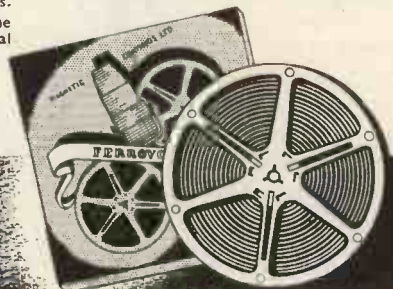
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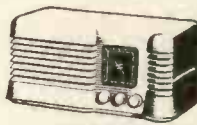
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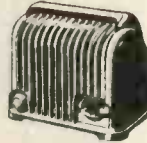


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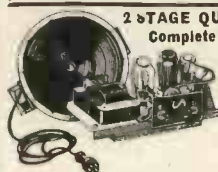
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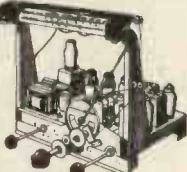
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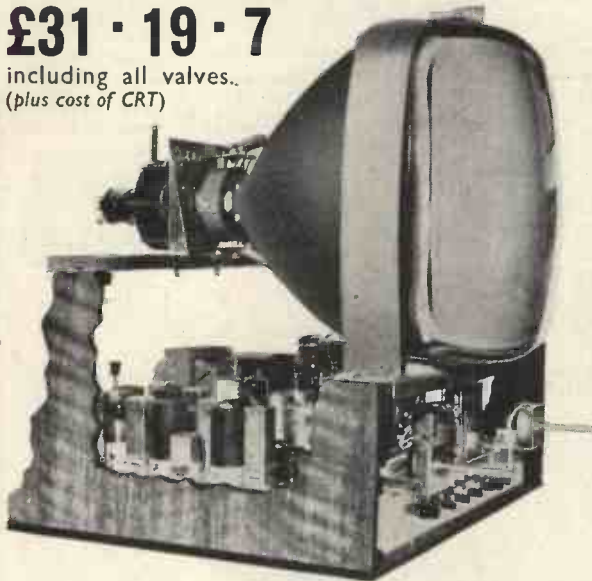
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The Televisor may be constructed in 5 easy stages: (1) Vision, (2) Time Base, (3) Sound, (4) Power Pack, (5) Final Assembly. Each stage is fully covered in the Instruction Book, which includes layout, circuit diagrams and point-to-point wiring instructions. The Instruction Book also includes full details for converting existing Premier Magnetic Televisors for use with modern wide angle tubes. All components are individually priced. Instruction book 3/6 post free.

The NEW PREMIER TELEVISOR

Three years ago we gave you the 6in., 9in. and 12in. Televisors which achieved tremendous popularity. Now after a considerable period of research our Technical Staff have designed a very worthy successor to these original Models.

Brief Technical Details are as follows:

19 valves (plus tube) Superhet Receiver, tunable from 40-68 Mc/s without coil or core changing. Wide Angle scanning Flyback EHT giving 14 kV, Duomag Focalsiser permanent magnet focussing with simple picture centering adjustments, suitable for any 17in. or 14in. wide angle Tube, may also be used with a 12in. Tube with very minor modifications.

VISION CIRCUIT. Common RF Amplifier, single valve frequency changer, two IF stages, Video Detector and Noise Limiter followed by special type of Video Output Valve. ALL COILS PRE-TUNED ASSURING ACCURATE ALIGNMENT AND EXCELLENT BANDWIDTH.

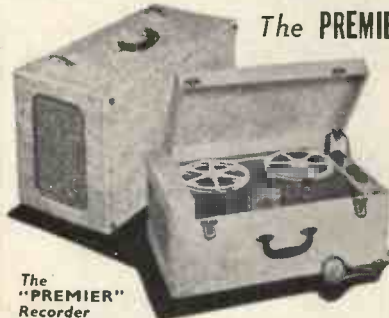
SOUND CIRCUIT. Coupling from anode of frequency changer, two IF stages, Double Diode Triode detector and first LF Amplifier, Diode Noise Limiter and Beam type Output Valve, feeding a 10in. Speaker. ALL COILS PRE-TUNED.

TIME BASES. 2 valve sync. Separator, giving very firm lock and excellent interlace.

LINE TIME BASE. Blocking Oscillator using a pentode driving a high efficiency output stage comprising Ferroxcube Cored Output Transformer with Booster Diode.

FRAME TIME BASE. Blocking Oscillator driving a Beam Output Valve coupled through a Transformer to the high efficiency FERROXCUBE Cored Scanning Coils.

POWER PACK. Double wound Mains Transformer supplying all L.T. and H.T. using two full-wave Rectifiers.



The PREMIER De Luxe PORTABLE MAGNETIC TAPE RECORDING KIT

PRICE
£37 · 4 · 0
 (Plus 15/- Pkg., Carr. & Ins.)

★ Including ALL parts, Valves, Portable, Cabinet, 8 in. Loudspeaker, Tape-Table, Reel of 'Scotch Boy' Tape and Rewind Spool, and Microphone. THE 7-VALVE AMPLIFIER IS SPECIALLY DESIGNED FOR HIGH QUALITY REPRODUCTION

Brief Specification: VALVE LINE-UP: 6F37A First Stage, 6SL7 Second Stage and Tone Control; 6V6 Output 6X5 Rectifier; VT501 Bias and Erase Oscillator; 7193 Record Level Amplifier; 6U5 Magic Eye Record Level Indicator. OUTPUT: 4 Watts. FREQUENCY RANGE: 50 c.p.s. to 9,000 c.p.s. CONTROLS: Volume; Record/Playback Switch; Treble Boost; Base Boost—on/off. A VISUAL MAGIC EYE Record Level Indicator is incorporated. The unit is housed in a superbly finished rexine covered portable cabinet which incorporates a compartment for the Microphone when not in use. Weight complete 35lb. Dimensions: 2in. long, 13 1/2in. deep, 9 1/2in. high.

The RECORDER incorporates an entirely NEW VERSION of the famous LANE TAPE TABLE. Brief Specification: Made to high standards and incorporating features ensuring low level of "Wow" and "Flutter" throughout the full length of tape.

FAST REWIND. Provision for fast rewind and forward run in less than 1 min. in either direction. WIND AND REWIND WITHOUT UNLACING OF TAPE. INSTANTANEOUS BRAKING. THREE MOTORS obviating friction drive.

HIGH FIDELITY RECORD PLAYBACK (1 HOUR APPROX. PLAYING). The Table is fitted with high fidelity record playback head of new design wound to high impedance and a separate A.C. Erase Head. The Heads are half-track size allowing approx. 1 hr. playing from standard 1,200ft. Reel of Tape.

TAPE SPEED: 7 1/2 in. sec. For use on A.C. 200/250, 50 cycles mains only.

MICROPHONE: Crystal—specially designed for Premier by famous manufacturer.

INSTRUCTIONAL BOOKLET . . . 2/6
 This is credited if a complete kit of the Tape Recorder is ordered.

As is usual in all PREMIER KITS, every single item down to the last nut and bolt is supplied. The Chassis is punched and layout diagrams and theoretical circuits are included. When completed the PREMIER PORTABLE TAPE RECORDER compares MORE than favourably with any other make at double the price.

SEPARATE UNITS CAN BE SUPPLIED AS LISTED BELOW
 AMPLIFIER KIT (including Bin. Speaker) . . . £11 0 0 plus 5/- pkg./carr.
 AMPLIFIER (already built, wired and tested) £14 15 0 plus 7/6 pkg./carr.
 LANE TAPE TABLE & REWIND SPOOL £16 10 0 plus 7/6 pkg./carr.
 PORTABLE CABINET (rexine covered) . . . £4 19 6 plus 5/- pkg./carr.
 MICROPHONE £2 19 6 plus 1/- pkg./carr.
 REEL OF NEW M.C.-2-III "SCOTCH BOY" TAPE (1,200ft.) £1 15 0 plus 1/- pkg./carr.

To those unable to build this PORTABLE TAPE RECORDER we can supply it completely wired, tested and ready to plug in at 39 GNS Plus 1 gn. pkg./carr.

CRYSTAL MICROPHONE
 An entirely insulated crystal microphone which can be safely used on A.C./D.C. amplifiers. High impedance. No background noise, really natural tone. The ideal Mike for tape, wire and sound projectors. Price 22/6.
MICROPHONE STAND BASE
 Heavy Moulded Black Base fitted with Standard thread adaptor. Dimensions: 7 1/2 in. across, 2 in. deep. Weight: 1 1/2 lb. Post paid 3/11.



SPECIAL OFFER
CRYSTAL HAND MICROPHONE
 High impedance. Excellent frequency response, light weight. Gives very high quality results when used with tape recorder, amplifies for any type of P.A. equipment. Complete with screen lead and plug. Plus 2/6 Pkg & Carr. PRICE 37/6



MICROPHONES
LUSTRAPHONE: Moving Coil; High Impedance. Stand Type: £5 15/6—Hand Mike £6/6/0.
RONETTE—Crystal Mike; Incorp. the Filter Cell Insert; High Imped. Ball Type: £3/19/6.
CRYSTAL MICROPHONE—Rothermel 2AD56. Especially recommended. £2/19/6. Table stands for all the above 10/6 and 17/6.

PREMIER RADIO COMPANY

WHY PAY MORE?

WILLIAMSON AMPLIFIER KIT 15gns.
plus 7/6 post, pkg. & ins.
This kit is absolutely complete and all components are guaranteed exactly to author's specification.

WILLIAMSON OUTPUT TRANSFORMER
(author's spec.), 3.6 ohms. sec. **£4.40**

MAINS TRANSFORMER SP425A (with additional 6.3 v. 3.a. and capable of supplying an extra 50 mA. for Pre-amp. or Feeder Unit) **£3.7.6**

PREMIER MAINS TRANSFORMERS
All primaries are tapped for 200-230-250 v. mains 40-100 cycles. All primaries are screened. All 17's are centre tapped.

SP175B, 175-0-175, 50 mA., 4 v. @ 1 a., 4 v. @ 2-3 a.	25/-
SP301B, 300-0-300, 120 mA., 4 v. @ 2-3 a. 4 v. @ 2-3 a. 4 v. @ 3-5 a.	28/-
SP350A, 250-0-250, 100 mA., 5 v. @ 2-3 a. 6.3 v. @ 2-3 a.	29/-
SP351, 350-0-350, 150 mA., 4 v. @ 1-2 a. 4 v. @ 2-3 a. 4 v. @ 3-5 a.	36/-
SP352, 350-0-350, 150 mA., 5 v. 2-3 a. 6.3 v. 2-3 a. 6.3 v. 2-3 a.	36/-
SP375A, 375-0-375, 250 mA., 6.3 v. @ 2-3 a. 6.3 v. @ 3-5 a. 5 v. @ 2-3 a.	55/-
SP501, 500-0-500, 150 mA., 4 v. @ 2-3 a. 4 v. @ 2-3 a. 4 v. @ 2-2 a. 4 v. @ 3-5 a.	47/-
SP601A, 500-0-500, 150 mA., 5 v. @ 2-3 a. 6.3 v. @ 2-3 a. 6.3 v. @ 2-3 a.	50/-
SP425A, 425-0-425, 200 mA., 6.3 v. @ 2-3 a. 6.3 v. @ 3-5 a. 5 v. @ 2-3 a.	67/6
250-0-250, 80 mA., 6.3 v. @ 4 a. 5 v. @ 2 a.	19/6
350-0-350, 80 mA., 6.3 v. @ 4 a. 5 v. @ 2 a.	19/6
200-230-250, output 3 v.-30 v. @ 2 a.	17/6
Charger, 2-6-12 v. @ 1.5 a.	12/6

SPECIAL OFFER

DOUBLE WOUND AUTO-TRANSFORMER 250 watts.

Input/Output 100, 110, 200, 210, 220, 230, 240, 250 Volts. Output/Input 110, 111, 112, 119, 122, 134, 146 Volts.

With the two windings connected in series a vast number of voltage tapplings are available.

Plus 2/6 Pkg. and Carr. Price **35/-**

PREMIER VARIABLE IMPEDANCE "MATCHMAKER" M.O.15 OUTPUT TRANSFORMER

Designed to meet the demand for an efficient variable ratio Output Transformer. 11 ratios from 13:1 to 80:1 all centre tapped and can be used to match any output valves either single or push-pull. Class "A" "AB1" "AB2" or "B" to any low impedance speech coil or combination thereof. Primary Inductance 60 henries 16 watts audio 100 mA. Price 45/-.

WEYMOUTH MINIATURE I.F. TRANSFORMERS

465 Kcs./s., iron cored, permeability tuned, 10/6 pair.

WEYMOUTH MINIATURE COIL PACK
Covering Med./Long/Short wave bands. Iron cored coils, gram position on switch. Dimens: Height, 1 1/2 in. Length, 3 1/2 in. Width 2 1/2 in. Spindle length 2 in. Price 19/6.

MINIATURE TUNING CONDENSERS
2 gaug. .0048 mfd. with trimmers **6/9**

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Input 230 v. A.C. Output 12 v. at 1 amp. Completely shrouded. Price 9/11

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200-250 v. A.C. Will charge 2 v., 6 v. and 12 v. Car Battery at 1 amp. Housed in strong metal casing. Finished in Green hammered enamel. Size: 6 1/2 in. long, 3 1/2 in. wide, 3 1/2 in. high. Guaranteed 12 mths. The above unit is manufactured by PREMIER and does not contain ex-Govt. components. Plus 2/6 post and pkg. **39/6**

BATTERY CHARGER KITS

All incorporate metal rectifiers. Transformers are suitable for 200/250 v. A.C. cycle mains.

2002 Charges 6 volt accumulator at 1 amp. Resistance, supplied to charge 2 v. accumulator **21/-**

2003 Charges 12 volt accumulator at 1 amp. **22/-**

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H. T. Eliminator Ex. Govt.
By famous manufacturer

NEW & UNUSED. Input 200/250 v. A.C., Output 120- at 30 mA., housed in strong metal box size 10in, long, 7in. wide, 6 1/2 in. deep. **37/6**

Plus 2/- pkg. and carr.

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. 37/6.

C.R. TUBES

VCR516

9in. Blue picture, Heater volts 4 Anode 4 Kv. In manufacturer's original carton. **£3/19/6.** Plus 5/- pkg., carr., ins.

VCR517C

9 1/2 in. picture. This tube is a replacement for the VCR97 and VCB317. Guaranteed full size picture. **Price 35/-** Plus 2/6 pkg., carr., ins.



ALL BRAND NEW

AUTO TRANSFORMER, 50 watts

Input/Output 0-110-210-220-230-240-250 volts. Plus 1/- P. & P. **7/6**

Famous Set Manufacturer's surplus of

ELECTRIC 'GRAM UNITS

Two-speed, 33 1/3 and 78 r.p.m. For playing Standard and L.P. recordings. Complete with Turntable. For use on 200-250 v. A.C. mains. Each unit is in its original manufacturer's carton and is fully guaranteed. Limited quantity only available at approx. half list price.



£4.2.6

Plus 2/6 pkg., carr., ins.

SPECIAL OFFER

THE FAMOUS "CHANCERY" HIGH FIDELITY MICROCELL PICK-UP TYPE GPX for Standard and Long Playing



The Chancery Light Weight GPX Pick-up which has a sapphire stylus which is precision ground and semi-permanent. With two cartridges 1 L.P. and 1 Standard. Price 52/6. Additional L.P. or Standard Cartridges can be supplied from stock at 19/6 each.



QUALITY CRYSTAL PICK-UP ROTHERMELL TYPE U48 26/-
plus 1/6 Pkg. and Carr.

PORTABLE GRAMOPHONE UNIT

Ready to plug into Radio or Amplifier. Fitted with B.S.P. 2-speed motor 33 1/3 and 78 r.p.m. and Chancery high fidelity microcell pick-up type G.P.X. with L.P. and Standard Cartridges. Assembled in rexine covered cabinet. Height 5 1/2"; Length 16 1/2"; Depth 13 1/2". Price **£7.7.0**



plus 5/- Pkg. & Carr.

Cabinets can be obtained separately at 29/6 plus 2/6 Pkg. & Carr. Carrying handle and clips are supplied free.

THE COLLARO RC3.521 3-SPEED AUTOMATIC RECORD CHANGER



Magnetic Studio head transformer included. Motor suitable for 100/125v. or 200/250v. Play either 7" or 10" or 7" and 12" not mixed.

Price **£9.19.6**

Plus 5/- Pkg. and Carr.

GARRARD Type 75A. Latest 3-speed Autochange Unit complete with 2 Acos High Fidelity G.P.19 Pick-up Heads. 1 L.P. and 1 Standard. **£14.19.6**

Plus 5/- Pkg. and Carr.

GARRARD Rim Drive 78 r.p.m., complete with magnetic pick-up and turntable **£5.19.6**

COLLARO 3-speed single-gram. unit, complete with head for L.P. and Standard recordings **£6.19.6**

Price 10 Gns.

Packing and carriage on each of the above units 2/6.

PLESLEY 3-SPEED AUTO CHANGER UNITS

Brand new in maker's cartons, complete with mounting instructions.

This unit will auto change on all 3 speeds, 7in., 10in. and 12in. Fitted with separate sapphires for L.P. and STD., which are moved into position by a simple switch.

Price 10 Gns.

Plus 5/- Pkg. and Carr.

"MASTERADIO" VIBRATOR PACK

6 v. input; 160 v. 60 mA. output; complete with valve rectifier and leads. 49/6. Plus 5/- pkg., carr.

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Lead Acid Celluloid Non-Spill, 2v., 7 amps **8/6**

2 volt 10 amp (by ambus maker) **4/11**

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E.H.T. Pencil Type S.T.C.

Type K3/25	650 v.	1 mA.	4/7
.. K3/40	3.2 kV.	1 mA.	6/-
.. K3/45	3.6 kV.	1 mA.	8/2
.. K3/60	4 kV.	1 mA.	8/8
.. K3/160	12 kV.	1 mA.	21/6

H.T. Type S.T.C.

Type RM1	125 v.	60 mA.	4/-
.. RM2	125 v.	100 mA.	4/6
.. RM3	125 v.	125 mA.	6/6
.. RM4	250 v.	250 mA.	18/-

L.T. Type Full Wave

6 v. 1 amp.	4/-
12 v. 1 amp.	8/-
12 v. 2 amp.	10/9
12 v. 4 amp.	12/6

A.C.R.I. C.R. TUBES

5 1/2 in. screen. 4 volt Heater. This Electrostatic Tube is recommended as eminently suitable for Television, 15/- plus 2/6 Pkg., carr. and ins. Data sheets supplied.

SUPER QUALITY TELEVISION MAGNIFYING LENS

5in. lens suitable for 6in.	18/6
6in. lens	25/-
10in. lens	£2/10
12in. lens	£3/10-

ALUMINIUM CHASSIS 18 s.w.g.

Substantially made from Bright Aluminium, with four sides

7 x 5 1/2 x 2 1/2 in.	4/-
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9 1/4 x 4 1/2 x 2 1/2 in.	4/3
10 x 8 x 2 1/2 in.	5/6
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10 x 9 x 3 in.	7/-
12 x 10 x 3 in.	7/9
14 x 10 x 3 in.	7/11
16 x 10 x 3 in.	8/3
16 x 8 x 2 1/2 in.	8/-



ALUMINIUM PANELS 18 s.w.g.

7 x 6 in.	1/3	7 x 4 in.	1/-
9 1/4 x 6 in.	1/8	9 1/4 x 4 in.	1/5
10 x 9 in.	2/2	10 x 7 in.	1/11
12 x 9 in.	2/8	12 x 7 in.	2/5
14 x 9 in.	3/2	14 x 7 in.	2/11
16 x 9 in.	3/8	16 x 7 in.	3/5
20 x 9 in.	4/8	20 x 7 in.	4/5
22 x 9 in.	5/2	22 x 7 in.	4/11

LOUDSPEAKERS

ELAC—2 1/2 in. dia., Moving Coil, 15 ohms imp.	15/-
PLESLEY—3 in. dia., Moving Coil, 3 ohms imp.	15/-
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SPECIAL OFFER

A 12in. TRUVOX P.M. SPEAKER
(2-3 ohm Voice Coil) For only **49/6**
These are brand new in Maker's Cartons
Plus 2/- Pkg. and Carr.

METERS

Large stocks available, a few of which are enumerated below:

Full Scale Deflection	Scale Length	External Dimensions in.	Movement	
25 A	1 1/2"	2 1/2" round	R.F. Thermo	7/6
3.5 A	1 1/2"	2 1/2 x 2 1/2"	R.F. Thermo	7/6
4 A	1 1/2"	2 1/2 x 2 1/2"	R.F. Thermo	7/6
20 A	1 1/2"	2 1/2" round	M/C	8/6
40 A	1 1/2"	2 1/2" round	M/C	8/6
1.5 mA.	1 1/2"	2 1/2" round	M/C	12/6
5 mA.	2"	3 1/2" round	M/C	7/6
6 mA.	2"	3 1/2" round	M/C	16/9
50 mA.	1 1/2"	2 1/2 x 2 1/2"	M/C	7/6
20 V	2"	2 1/2 x 2 1/2"	M/C	8/6
40 A	1 1/2"	2 1/2 x 2 1/2"	M/C	8/6
1 mA.	2"	3 1/2" round	M/C	25/-

MOVING COIL METER

A super quality Moving Coil Meter basic construction 2 in. dia. scale dimensions 2 1/2 in. Overall dimensions 2 1/2 in. dia. 1 1/2 in. deep. Bakelite Case projecting type. At present scaled 1 amp. R.F. By removing thermo couple, reversing scale and recalibrating the meter, a high grade test instrument with any range above the basic F.S.D. may be built up. Price 4/9

1 mA METER IN PLASTIC CASE

The movement is 1 mA. mounted in a case 3 1/2 in. square and 3 1/2 in. high. The scale is 2 1/2 in. long and the dial is 2 1/2 in. diameter. There is ample room in the case for a switch and multipliers. Internal Resistance 100 ohms. Price 27/6



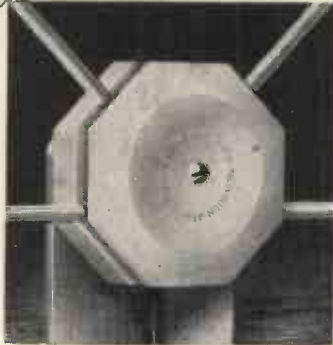
Germanium Crystal Diodes. G.E.C. wire ended. 2/6-24/- doz.



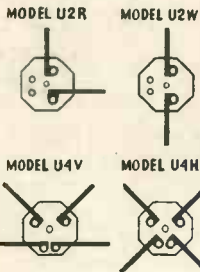
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-the ALL CHANNEL T.V. Aerial
with TELESCOPIC SWIVELLING RODS

These models mark an entirely new departure in the design and construction of room, loft and wall mounting aerials. Their important and novel feature is the use of telescopic rods which, by simple adjustment, virtually "tune" the aerial to any of the present transmissions. The basic design allows the rods to be locked in any position, and the user can select a "Univex" model that is ideally suited to his own particular need.



SHOWING FITTING POSITIONS OF RODS FOR



FULL DETAILS ARE GIVEN ON LEAFLET U₁/3/W

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MODEL U2RC. As above but complete with 15ft. co-axial cable. LIST PRICE 21/-
MODEL U2W. For Window Frame fitting. Complete with "Univex" insulator, two telescopic rods fitted with insulating sleeves, weatherproof gasket, mounting bracket and fixing screws. Suitable for all channels. LIST PRICE 16/6
MODEL U4V. For Loft Mounting. Complete with "Univex" insulator, four telescopic rods, mounting bracket and fixing screws. A directional aerial with a greater signal pick-up than any other indoor or loft aerial. Suitable for channels 1 to 5. LIST PRICE 22/6
MODEL U4H. For Loft Mounting. Complete with "Univex" insulator, four telescopic rods, support tube mounting assembly and fixing screws. Suitable for Channels 1/HOR and 5/HOR. LIST PRICE 25/-



BICESTER ROAD : AYLESBURY BUCKS.
Telephone : Aylesbury 1467/8

**SCALAMP
ELECTROSTATIC
VOLTMETER**



Cat. No. W.W. 11310

- DIRECT READING.**
- ZERO CURRENT DRAIN.**
- THREE SECONDS PERIOD.**
- LAMP OPERATES FROM MAINS OR 4 VOLT BATTERY.**
- BRIGHT SPOT-AND-HAIRLINE INDICATOR.**

This instrument introduces a completely new conception of electrostatic voltmeter. It is compact, portable and robust, and does not require critical levelling or special mounting. The movement has a taut suspension, is critically damped, and readings can be taken with rapidity and ease. Three models are available:

- Cat. No. W.W. 11308
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- Cat. No. W.W. 11309
3 - 10 kV A.C. D.C.
- Cat. No. W.W. 11310
5 - 18 kV D.C. and
5 - 12 kV A.C. R.M.S.

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Gerrard 3660 (16 lines) ★ Open 9-6 (Thurs. 9-7)

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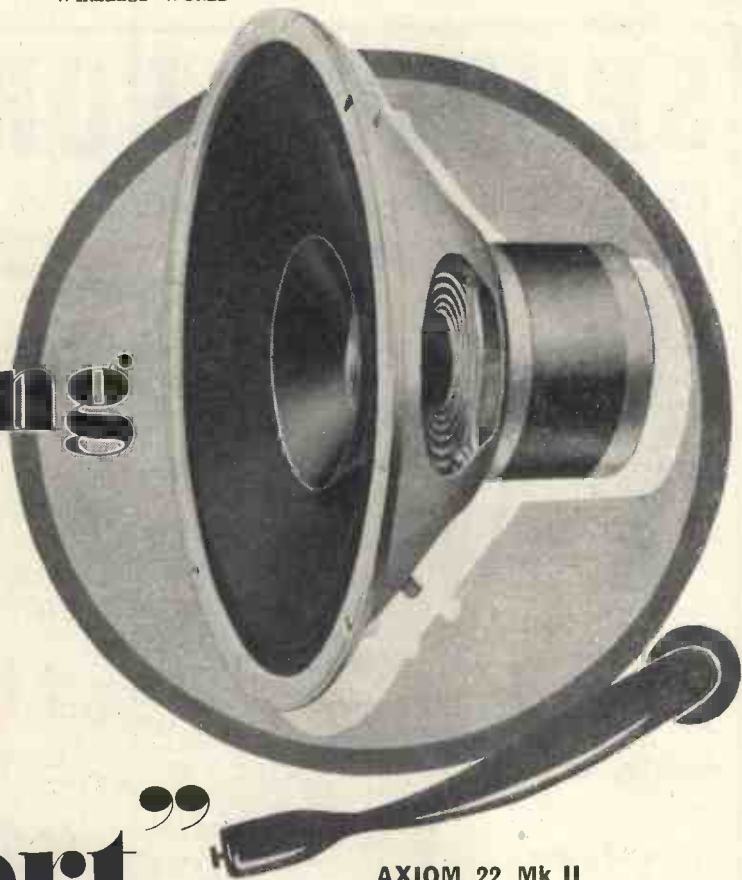
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“The Making of the Concert”

Comments on a concert held by the Portsmouth Long Playing Record Club, at the Oddfellows Hall, Portsmouth.

10 Queens Road, Portsmouth.

12th October, 1953.

Dear Sirs,

I would like to thank you for your effort in making our Long Playing Concert a success, by supplying us with your Axiom 22, Mk II loudspeaker, in sufficient time.

It was undoubtedly, as far as the music was concerned, the making of the Concert. The Hall sat 460 people, and at an output of about 15 watts the speaker was quite sufficient for the Hall.

Thank you once again,

Yours sincerely,

ERNEST WYATT.

AXIOM 22 Mk II

BRIEF SPECIFICATION

Frequency Coverage 30/15,000 c/s
 Fundamental Resonance 35 c/s
 Voice Coil Impedance .. 15 ohms at 400 c/s
 Max. Power Capacity .. 20 watts peak A.C.
 Flux Density 17,500 gauss
 Price £14 : 14 : 0 (Tax Free)

The Axiom 22 Mk II, 12in. loudspeaker is a high flux version of the Axiom 150 Mk II, providing increased power handling capacity, greater sensitivity, and due to the higher magnetic damping factor, even cleaner separation.

This is but one of the numerous unsolicited testimonials which are continually reaching us, the originals of which are available for inspection.

Dimensional drawings of specially designed corner and standard Reflex cabinets, equally suitable for the Axiom 150 Mk II and the Axiom 22 Mk II, will be sent free on request.

There is a loudspeaker in the Goodmans' range for every application and you are invited to write for full details and advice.



GOODMANS

GOODMANS INDUSTRIES LIMITED AXIOM WORKS, WEMBLEY, MIDDLESEX

Telephone : WEMbley 1200 Cables: Goodaxiom, Wembley, England

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Order your **SOUND-MASTER** from this list of parts as specified by the designer

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Amplifier Chassis . . .	WB201	1 15 0
Power Unit Chassis . . .	WB202	1 11 6
Brackets, Pillars and Screens	WB203	11 2
Mains Transformer 1	WB204	3 7 6
Smoothing Choke . . .	WB205	19 6
Output Transformer	WB206	12 0
Bias Rejector Coll. . .	WB207	6 0
Loudspeaker, New Type 610 with Cambrie Cone	WB208	2 10 0
Sound-master Cabinet	WB209	6 0 0
		17 12 8
MULLARD VALVES		
2—EF40's at 22½		2 5 6
1—E141		17 3
1—EM34		17 3
1—ECC40		1 2 9
1—E240		13 11
		5 16 8
BULGIN PACK		
All 25 components in carton		3 10 0
		3 10 0
N.S.F. PACKS		
Switch SM20		1 1 0
Switches SM.21 and SM.22 (2)		14 6
		1 15 6
LAB PACK SM.10		
Resistors and Potentiometers		2 8 6
		2 8 6
COLLARO PACK		
3 motors		5 15 0
		5 15 0
WRIGHT & WEAIRE		
Record/Replay and Erase Heads		4 4 0
Head Lift Transformer		1 10 0
Treble Boost Inductor		1 5 0
Oscillator Coil		7 6
		7 6 6
T-C-O. PACK		
Complete sets of all necessary condensers		4 3 0
		4 3 0
BRENNELL PACK		
Complete set of parts for building the Sound-master tape desk		13 13 0
		13 13 0

CLASSIC TEN-POINT POLICY

GUARANTEES CUSTOMER SATISFACTION

- 1 EXCEPTIONALLY LARGE STOCKS TO CHOOSE FROM.
- 2 SEPARATE DEPARTMENTS FOR HIGH-FIDELITY, TAPE-RECORDING AND TELEVISION EQUIPMENT.
- 3 SPECIAL SHOWROOMS TO ENABLE SIDE-BY-SIDE COMPARISON TO BE MADE OF LATEST PRODUCTS.
- 4 MAIL ORDER SERVICE TO ALL PARTS OF THE WORLD.
- 5 H.P. FACILITIES ON ORDERS OVER £10. IN GREAT BRITAIN ONLY.
- 6 PERSONAL ATTENTION TO ALL ORDERS.
- 7 PROMPTEST POSSIBLE DELIVERY AT ALL TIMES.
- 8 SERVICE AND ADVICE.
- 9 OUR OWN SPECIAL CATALOGUES AND LISTS.
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IMPORTANT

In the event of there being any difference between prices quoted here and those quoted by the manufacturers, the latter shall be deemed operative at time of ordering.

PURCHASE TAX

Where P/Tax is charged on goods, it is deducted for customers overseas. Application for our special EXPORT LIST invited (not available to customers in Gt. Britain).

From Stock

SOUND-MASTER TAPE RECORDER

ALL SPECIFIED PARTS AS ADVERTISED ANY PARTS CAN BE SUPPLIED SEPARATELY

INSTRUCTION ENVELOPE as published—
Post free 6/6
(Cost refunded on receipt of order for kit or parts over £20 in value.)
Complete kit of parts as specified by the designer /including FREE Instructions, Envelope and FREE carriage £60.0.0 in Gt. Britain).
or £20/0/0 deposit and balance by 12 monthly payments 78/- of
LUSTRAPHONE C.51 MICROPHONE as specified £5/5/0. All leading Magnetic Tapes stocked. Send for Classic T/R List.



FOR QUALITY FIRST



THE CLASSIC ELECTRICAL CO., LTD.

352/364, LOWER ADDISCOMBE ROAD, CROYDON, SURREY. Telephone: ADDiscombe 6061-6062.

QUALITY ENTHUSIAST

FROM "CLASSIC" THE MODERN QUALITY SPECIALISTS IN HI-FI, T.R. AND T.V.

FOR TAPE-RECORDING ENTHUSIASTS

TAPE DECKS	£	s	d
583 Qualtape	16	16	0
584 Motek	16	10	0
585 Lane, Mark IV	17	10	0
586 Truvox, Mark III*	23	2	0
587/1 Wearite, Type 2A*	35	0	0
587/2 Wearite, Type 2B*	40	0	0
588/1 Bradmatic, Type 5/6RP*	41	0	0
588/2 Bradmatic, Type 5c*	45	10	0
588/3 Bradmatic, Type 5/6RP*	42	0	0
588/4 Bradmatic, Type 5CL*	47	10	0
588/5 Bradmatic, Type 5D*	50	0	0
589 Soundmirror	33	0	0
591 Reflectograph	39	10	0

*Equipped for half-tape recording.

COMPLETE INSTRUMENTS	£	s	d
580/1 Ferrograph Model 2a (as available)	79	10	0
580/2 G.B. Standard	99	10	0
580/3 Vortexion with Wearite Deck	84	0	0
581/2 Grundig, 2-speed	84	0	0
581/8 R.M.C. with new Lane Tape Desk	47	10	0

HEADS AND COILS	£	s	d
All Bradmatic items including			
500 Bradmatic Plate Coil	9	0	0
501 Bradmatic Oscillator Coil	12	6	0
502 Bradmatic Bias Reflector Unit	12	6	0
506 Bradmatic 5 B.P. Heads	3	5	0
508 Bradmatic 6 B.P. Head	3	15	0
510 Tapemaster Oscillator Unit wired 6V6 valve	2	5	0
511 Tapemaster Recording Head	1	19	6
511/A Tapemaster Junior Erase Head	1	19	6
512 Tapemaster Senior Play/Record Head	2	5	0
All Weartite items including			
513 Weartite Head List Transformer Type 977	1	10	0

MICROPHONES	£	s	d
553 Reolo VMC (Moving-coil)	6	0	0
554 Reolo R.V. Ribbon	9	0	0
557 Gramplan Moving-coil	5	17	6
560 Cosmocond Mic/30 Desk Model, Crystal	2	10	0
561 Cosmocond Mic/22-1 Acos Crystal	4	4	0
563 Cosmocond Mic/16-2 Acos Crystal	12	12	0
565 Lustraphone C.H.51 Hand Model, Moving-coil	5	15	6
566 Lustraphone L.X.55 Crystal Model	2	10	0

Stands of all types available.

T.R. AMPLIFIERS	£	s	d
592/1 Lane Amplifier Kit, K.A.-1/RP	13	10	0
592/2 Lane Amplifier, assembled	15	10	0
593/1 Elipico Junior Amplifier	18	16	0
593/2 Elipico Senior Amplifier	24	0	0
584 Bradmatic C.I. with Push/Pull O/P	62	0	0
593 C.J.R. C.P./1 with P/O/P	24	12	6
595/1 C.J.R. Professional Type P.A.L.	94	0	0

MOTORS	£	s	d
520 Collaro Clock and Anti-clockwise	1	18	6
521 B.S.R. Model S.R.2	1	5	0
522 B.S.R. Model S.R.1	1	12	0
523 B.S.R. Model F.F.10	1	18	0

T.R. TAPES	£	s	d
569 Emiltape H69/6—600ft.	1	1	0
570 Emiltape H69/12—1200ft.	1	15	0
570 Emiltape H65/12—1200ft.	1	15	0
572 G.E.C. Plastic—1200ft.	1	10	0
573 Gevaert—1200ft.	2	0	0
574 Agfa—1200ft.	1	17	6
575 Magnetophon—1200ft.	2	0	0
576 Ferrotape (Wearite)—1200ft.	2	5	0
577 Ferrotape (Wearite)—1750ft.—8jin.	3	3	0

CLASSIC "HI-FI" SELECTION FOR XMAS

MOTORS, PICK-UPS, ETC.

CONNOISSEUR	£	s	d
400 3-speed Motor	21	17	3
400/1 3-speed Motor with pick-up and one head	27	18	6
400/4 2-speed Motor—small number of demonstration and used models at...	16	0	0

GARRARD	£	s	d
401 Autochanger RC.80. Less pick-up head	15	1	6
401/H Ditto with 2 Decca XMS Heads	20	11	6
401/1 Autochanger RC.75A. Less pick-up head	13	8	4
401/1/H Ditto with 2 Decca XMS Heads	18	17	8
401/6 Model T, 3-speed, with crystal T/O head	9	14	6
401/6M Ditto with magnetic T/O head	9	17	6
401/7 Model TA, 3-speed single player with P.U. arm, but less heads	7	17	9
401/8 Autochanger RC.110. (as available)			

COLLARO	£	s	d
402 Autochanger Model 3RC.531, 3-speed, less pick-up head	12	3	1
402/H Ditto with crystal head T/O	15	3	10
402/1/H Ditto with crystal head T/O	17	10	0
402/6 A.C. Motor 3/534, 3-speed	6	5	4

DECCA	£	s	d
403 GU.4C, 3-speed motor with crystal turnover pick-up	9	10	0
403/1 GU.4A, with 2 Acos head, 3-speed	10	18	8
403/2 GU.4M, 3-speed unit with pick-up and two Decca XMS magnetic heads	12	18	5
403/3 Decca transcription motor, 3-speed, with Decca XMS pick-up and 2 heads	23	18	2

PLESSEY	£	s	d
406 Plessey 3-speed Autochanger Unit, with pick-up. Special price, limited number	10	10	0

E.M.I.	£	s	d
407 E.M.I., 3-speed, type 2125	17	2	6

AMPLIFIERS	£	s	d
100 Leak T.12 Standard	28	7	0
101 Quad, with control unit	35	0	0
103 Goodsell MA.15	19	10	0
103/2 Goodsell MA.5	13	10	0
103/3 Goodsell Williamson	33	0	0
104 Rogers Baby de-luxe	14	0	0
105 Lowther B.5F	21	0	0
105/1 Lowther A.10F 7.5 watts	35	0	0

CLASSIC ASSEMBLIES

Enable you to have the Instrument of your choice by offering balanced amplifier, motor, pick-up and speaker assemblies to suit your taste and pocket. LEAFLET AVAILABLE.

PRE-AMPLIFIERS	£	s	d
150 Leak "Vari-Slope"	12	12	0
151 Goodsell Type U/TC	8	15	0
151/1 Goodsell Type F/U/TC	12	12	0
151/2 Goodsell Type P/FA	22	10	0
152 Rogers Junior de luxe Mk. II.	9	0	0
153 Lowther Pre-Amp. and Tone Control Unit	20	0	0

TONE-CONTROLS, FILTERS, ETC.	£	s	d
200 E.M.G. Infinitely Variable Steep-cut Filter	4	10	0
201 Leak Steep-cutting Filter	5	10	0
203 Wharfedale Microgroove Equaliser MG.1	2	17	6
203/1 Wharfedale Cross-over Unit, 1000 c.p.s., 7-16 ohms	3	12	6
203/2 Wharfedale Cross-over Unit, 3000 c.p.s., 7-16 ohms	2	18	6
204 Lowther Independent Bass and Treble Corrector B.T.3	9	9	0
204/1 Lowther 9 Kc Whistle Filter	3	3	0

RADIO UNITS COMPLETE	£	s	d
(Supplied in chassis form for building into cabinets.) Broadcast and Shortwave			
250 Leak	34	19	0
251 Quad, for use with Quad amp.	24	10	0
252 Rogers	24	16	0
255 Lowther Straight Tuner LEI.2	22	7	8
256 Grundig (for use with T/R)	21	0	0
257 Chapman S.4	16	0	0
259 Armstrong BXP.73 Superhet	23	10	0
259/1 Armstrong RF.41	31	19	8
259/2 Armstrong BX P.119	55	19	4
259/3 Armstrong BS.125	70	12	6
VHF, AM, FM Units			
280 Lowther VHF "Wrotham" AM Unit	6	10	0
280/1 Lowther AM/FM	22	0	0

LOUDSPEAKERS	£	s	d
WHARFEDALE			
600/9 Golden 10in.	7	13	3
601/1 W.10/CSB	12	6	0
601/2 W.12	9	5	0
601/3 W.12/CS	9	15	0
601/4 Super 12in./CS/AL	16	0	0
601/5 W.15	15	10	0

GOODMANS	£	s	d
603/1 Audiom 70 12in.	13	15	0
603/2 Audiom 80 15in.	22	10	0
603/5 Axiom 22 12in.	14	14	0
603/7 Axiom 102 8in.	9	18	2

TANNOY	£	s	d
606 Tannoy 12in. Dual Concentric, with built-in crossover network	27	10	0
606/1 Tannoy 16in. Dual Concentric, with built-in crossover network	33	0	0

LOWTHER VOIGT	£	s	d
607 LOWTHER VOIGT PM/2 Drive Unit	35	0	0
607/1 LOWTHER VOIGT PM/4 Drive Unit	48	0	0

VOIGT	£	s	d
608 Voigt P.M. Pressure Unit	42	0	0

CABINET AND BAFFLE-MOUNTED SPEAKERS	£	s	d
700 VITAVOX Klipschcrn	145	0	0
701/1 LOWTHER VOIGT Corner Horn, less unit, white wood, type PW.1	25	0	0
701/2 LOWTHER VOIGT Domestic Corner Horn, white wood	47	10	0
703 ACOUTICAL Corner Ribbon	85	0	0
704 WHARFEDALE Sand-filled Corner Assembly, with 15in. and 10in. speakers and crossover	71	8	11
704/1 WHARFEDALE Sand-filled baffle/panel (less speaker)	31	0	0

TO MAKE CHOOSING AND BUYING EASIER

We publish at regular intervals our own special comprehensive lists of today's most popular and efficient equipment. Separate lists are already available for Hi-Fi, T.R. and T.V. enthusiasts, will be gladly sent free on request. We will also send manufacturers' lists when requested. Stamps to cover postage should be included when the latter are required.

PLEASE MENTION "WIRELESS WORLD" WHEN REPLYING TO THIS ADVERTISEMENT

THE **CLASSIC ELECTRICAL CO., LTD.** 352/364, LOWER ADDISCORNE ROAD, CROYDON, SURREY. Telephone: ADDISCORNE 6051-6062.



FOR QUALITY FIRST

THE SEAL OF PERFECTION

that identifies the finest auto-changer in the world

CONSIDER THESE STAR POINTS —

The 'Magidisk,' a unique and exclusive feature of the Monarch, is something different in radiogram engineering. By its ability to select any record of any size inter-mixed in any order, the 'Magidisk' gives a long continuous record programme at 33 $\frac{1}{3}$, 45 or 75 r.p.m.

Quick Change. No other changer can match the Monarch's speedy record change. So swiftly and so effortlessly is this accomplished, that there is no distracting interruption to mar enjoyment. *Tonal Purity* is emphasized by the dual stylus cartridge which attains a new high fidelity performance.

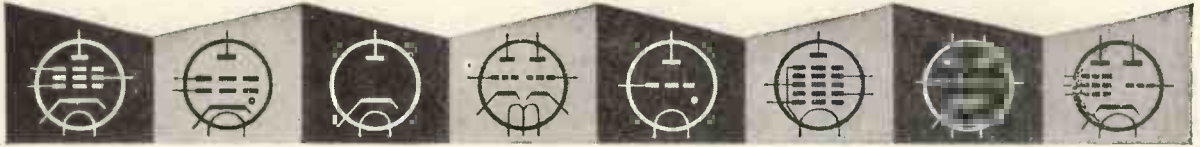
Control is as central and simple as the reliability is permanent.

Census of Opinion shows that leading radiogram manufacturers automatically insist on the Monarch because it is the finest auto-changer manufactured.



WORLD'S MOST WANTED AUTOCHANGER

BIRMINGHAM SOUNDREPRODUCERS LTD., OLD HILL, STAFFS, ENGLAND



VALVES, TUBES & CIRCUITS

12. APPLICATIONS OF DOUBLE TRIODES IN AUDIO AMPLIFIERS.

There are three double triodes, types ECC81, ECC82 and ECC83 in the Mullard range of noval-based valves which can be used in audio amplifiers. These three types provide designers with a range of characteristics which enables the most suitable valve to be chosen for any particular application.

Each valve type is single-ended and of all-glass construction, being in the miniature bulb with a B9A (noval) base. The pin connections and dimensions of the three types are identical. The two independent triode sections and the high heater-cathode voltage rating considerably widen the field of application. Either triode section can be used to drive the other when used in a cascade circuit, the choice depending on the most convenient wiring arrangement.

One end of each of the two heaters is joined to a common pin so that the heaters may be operated in series at 12.6V, 0.15A or in parallel at 6.3V, 0.3A. With this type of heater, operation in series chains of 0.3A or 0.15A, or in mobile equipment is possible. With 6.3-volt A.C. operation the heater supply should be centre-tapped to earth, in order to reduce hum. Under these conditions the equivalent hum level on the grid of each section when used in a typical amplifier circuit is less than 25µV with a grid circuit resistance of 500kΩ.

CHOICE OF VALVE

For general purpose amplifier use, the high-µ type ECC83 is the most suitable, a stage gain of 50 to 60 times being obtained under the recommended operating conditions. This, together with its low microphony ensures satisfactory performance at the low signal levels which occur, for example, in pre-amplifier circuits. For such applications the ECC81 is less favourable due to its greater microphony. Although in later stages the ECC81 can be an alternative to the ECC83, the latter is generally to be preferred because of its better linearity.

The audio applications of the low-µ ECC82 are more limited because of its low voltage gain, but it may be found useful in penultimate stages where a low impedance is desirable.

VALVE DATA

HEATER Suitable for series or parallel operation, a.c. or d.c. The heater is centre-tapped and the two sections may be operated in series or in parallel with one another.

Series	V_h applied between pins 4 and 5
Parallel	V_h applied between pin 9 and pins 4 and 5 connected together
	Series Parallel
V_h	12.6 6.3 V
I_h	0.15 0.3 A

CHARACTERISTICS (Each Section)

	ECC81	ECC82	ECC83	
V_a	250	250	250	V
I_a	10	10.5	1.2	mA
V_g	-2.0	-8.5	-2.0	V
g_m	5.0	2.2	1.6	mA/V
μ	60	17	100	
r_a	12	7.7	62.5	kΩ

LIMITING VALUES (Each Section)

	ECC81	ECC82	ECC83	
V_a max.	300	300	300	V
P_a max.	2.5	2.75	1.0	W
I_k max.	15	20	8.0	mA
V_{h-k} max.	150	180	180	V

BASE B9A

DIMENSIONS Max. overall length 56 mm. Max. seated height 49 mm. Max. bulb diameter 22.2 mm.

TYPICAL PERFORMANCE AS R.C. COUPLED AUDIO AMPLIFIER.

(Each Section). At $V_b = 300V$.

	R_a (kΩ)	R_k (kΩ)	R_{g1}^* (kΩ)	I_a (mA)	$\frac{V_{out}}{V_{in}}$	V_{out}^{**} (V)
ECC81	100	1.0	330	1.7	42.5	30
	220	2.2	680	0.9	42	34
ECC82	100	4.7	330	1.5	12.3	43
	220	6.8	680	0.9	13	48
ECC83	100	1.5	330	1.0	53	40
	220	2.2	680	0.6	66	45

Grid resistor of following valve.

** $D_{tot} = 5\%$

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



MULLARD LTD., TECHNICAL PUBLICATIONS DEPARTMENT, CENTURY HOUSE, SHAFESBURY AVENUE, W.C.2

BRITISH MADE
BRIMAR

V ALVES

More reliable



than EVER!

Brimar's long experience in the manufacture of special quality TRUSTWORTHY valves is now being reflected throughout the entire Brimar range.

Improved production methods, new and better assembly jigs, tighter control on the composition of materials, and the closer supervision of vital processes have resulted in valves with more uniform characteristics, greater mechanical strength and a higher standard of reliability as shown in the 6AL5.

This valve and its direct equivalents have been used for sound and vision detection and noise limiting in the majority of T.V. Receivers manufactured since the war and is extensively employed in this season's models.

Because of its improved performance the Brimar 6AL5 is also used widely in Industrial Electronic Equipment, Computers, Navigational Aids, Test Equipment, etc.

Use the **BRIMAR 6AL5**
the improved replacement
—at **NO EXTRA COST**

BRIMAR	FERRANTI	MAZDA	MARCONI OSRAM	MULLARD
6AL5	DD6	6D2	D77 D152	EB91



*now is the time to **BRIMARIZE!***

Standard Telephones and Cables Limited

FOOTSCRAY · SIDCUP · KENT

FOOTSCRAY 3333

2 New MODELS

~~acos~~ quality crystal
microphones at a
reasonable price

MIC 33-1: A crystal hand or desk omni-directional microphone for the high quality public address and tape recording field, incorporating a specially designed acoustic filter giving a response flat from 30 to 7,000 c.p.s.

RETAIL PRICE £2-10-0d.



**Ideal for tape and disc recording,
P.A. and amateur radio.**

MIC 35-1: A general purpose hand microphone of robust construction with substantially flat response from 50 to 5,000 c.p.s. Suitable for recording apparatus, Public Address equipment etc.

RETAIL PRICE £1-5-0d.



always well ahead

*ACOS devices are protected by patents,
patent applications and registered designs
in Great Britain and abroad.*

THE "BELLING-LEE" PAGE

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

PERTURBATIONS



Our English-French dictionary gives the meaning of this French word as "disturbance." It appears as part of the title C.I.S.P.R. In full, Comité International Special des Perturbations Radioélectriques. This committee has been a guest in this country and has attended sessions of the Institution of Electrical Engineers at Savoy Place.

It is refreshing to be reminded that in working towards the abatement of radio interference, we are in no sense alone, but are a small part of a very large international organisation affecting many industries. We are probably justified in saying that without the efforts of C.I.S.P.R. broadcast, television and navigation communications, etc., could never have reached present standards, nor could any of the airports handle anything like the number of aircraft, in a given time, that they do now.

On the last day at Savoy Place, we were privileged to be one of several bodies who staged an exhibition to show delegates what contribution we make towards the art of suppression. The exhibition was to let delegates see what was being done by countries other than their own. The countries supporting this feature with exhibits were Britain, America, Germany and Switzerland.

The most recent addition to our range of suppressors is a very small flex lead suppressor type L1314, illustrated above. This is intended where T.V. suppression only is required, and to be used in a flex lead close-up to the offending component of an appliance. As mentioned in the last edition of WIRELESS WORLD if used in conjunction with a suppressor at the supply point, say type L1308, all wave suppression can be achieved. You will note we have emphasised the "very small" feature. It is necessary to keep these flex lead

suppressors small—they will not be used if large. What is more annoying than a large protuberance dangling from a hairdryer, electrical drill or perhaps worse still, a razor?

Needless to say, the ideal place for a suppressor is within the casing of the offending piece of apparatus. The suppressor itself is generally a tiny inductor and perhaps a very small capacitor, but it is quite a job to dismantle an appliance and "house" these suppression components. Therefore, they have to be in a bakelite case in the lead, and must have terminals and cord grips, etc., if they are to be serviceable at all and all this adds to the size and price.

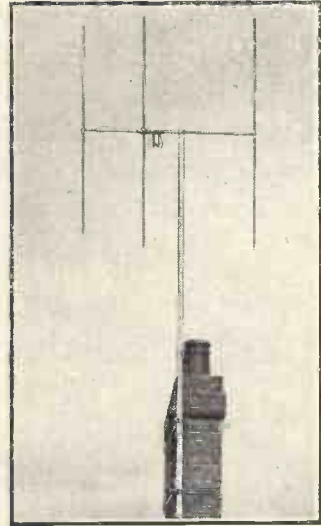
When an appliance is being serviced the necessary little inductor and capacitor units should be fitted inside its housing. In that form they are very small and inexpensive.

Concerning the Mast Head Amplifier



We have evidence that some users expect the T.V. Masthead Amplifier to reduce interference. One dealer even underlined the fact that it was known that there was some interference being picked up on the aerial itself and who considered the amplifier unsatisfactory because the interference persisted.

We cannot emphasise too strongly that the amplifier cannot alter the signal-to-noise ratio at the aerial. In cases where there is a long cable run from the aerial and where interference is being picked up on the feeder, there



The "Belling-Lee" mast head pre-amplifier fitted to a "Junior Multivrod."

may be some improvement in signal-to-noise ratio, but not otherwise.

We have investigated a number of cases where indifferent results have been reported. Invariably, the trouble has either been faulty installation, e.g., failure to remove the matching stub in the aerial. The matching stub, illustrated below, is the short $\frac{1}{4}\lambda$ length 50Ω feeder (about $\frac{1}{8}$ dia.) with a plug on one end. The amplifier should be connected directly to the dipole. The other trouble is lack of appreciation of what can be expected of the system. We would like to emphasise that we have made no extravagant claims regarding performance.



Written 27th October 1953

BELLING & LEE LTD
GREAT CAMBRIDGE ROAD, ENFIELD, MIDD., ENGLAND

POLYTAGS...lead-through and stand-off insulators

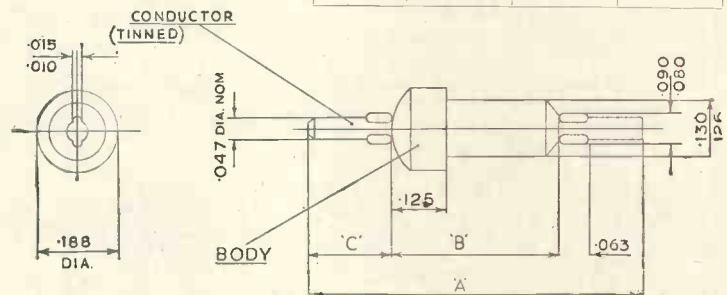
Polytetrafluoroethylene (P.T.F.E.) is an outstanding insulator. It is tough, durable and will not crack or arc. Its dielectric properties are substantially constant over a frequency range of 60 c.p.s. to at least 300 Mc.p.s. and are unaffected by temperature changes between minus 100°C. and plus 288°C. It has zero moisture absorption and is water repellent. It is, therefore, a most suitable material for stand-off and feed-through insulator terminals and has been chosen by Ediswan for this purpose. Ediswan Polytags are available in five types as illustrated below.

PT 1 & 2. Lead-through

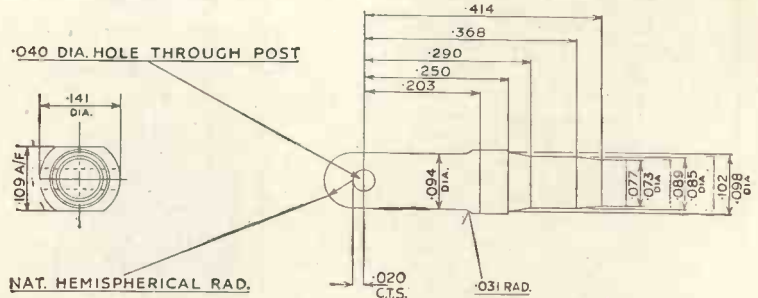


	A	B	C
PT 1	.750	.375	.188
PT 2	.875	.500	.188
PT 3	.563	.375	—
PT 4	.688	.500	—

PT 3 & 4. Stand-off



PT 5. Component mounting



Fixing: Polytags are primarily designed for fixing with a 5 B.A. nut—PT 1—4 or an 8 B.A. nut PT 5. They are self-tapping.

We are equipped to produce components fabricated or moulded in P.T.F.E. to individual specifications and enquiries will be welcomed.

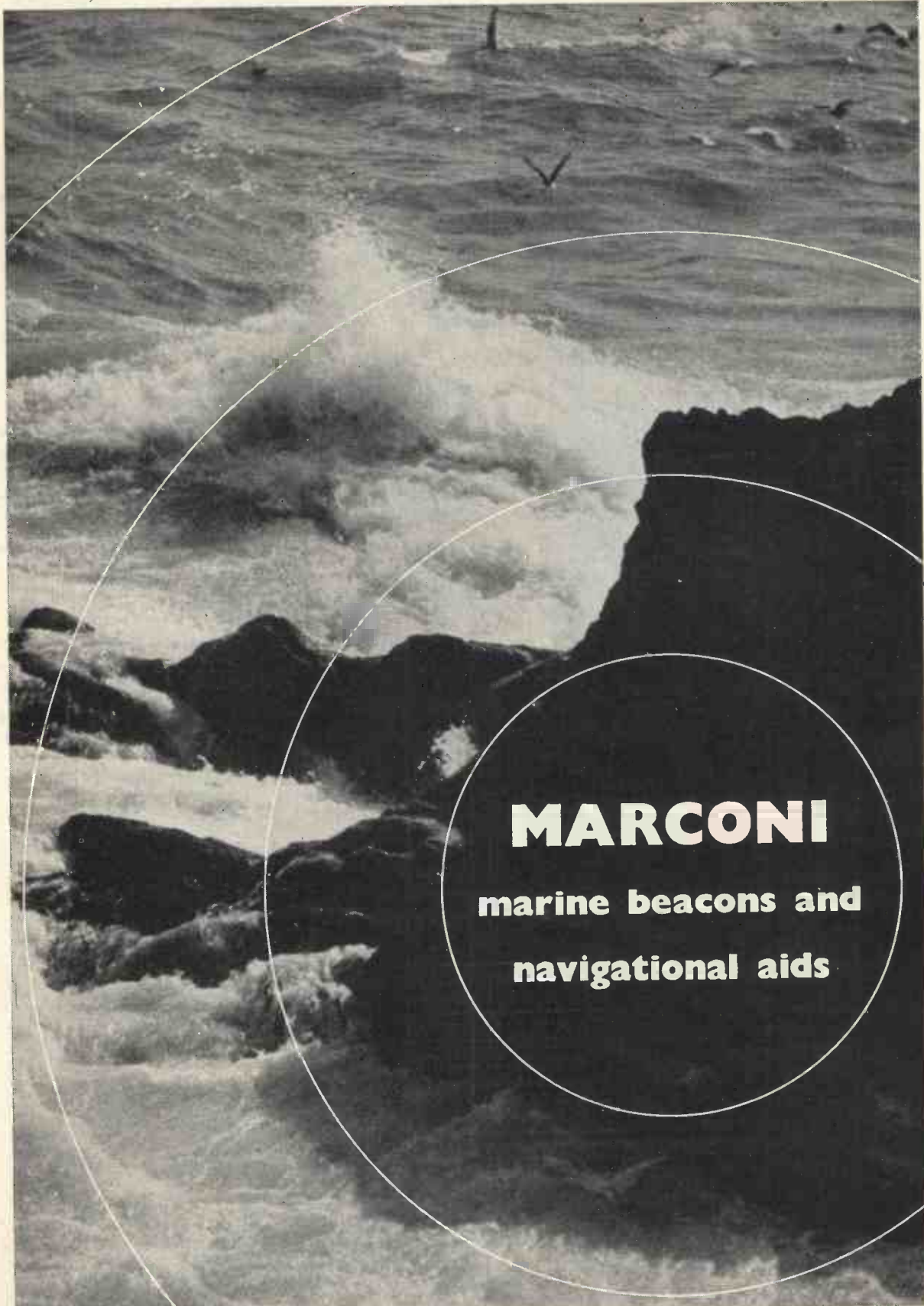
EDISWAN



THE EDISON SWAN ELECTRIC CO., LTD.,

Sales Department P.T.F.E.6, 21 Bruton Street, London, W.1. Telephone: Mayfair 5543

Head Office: 155 Charing Cross Road, London, W.C.2. Member of the A.E.I. Group of Companies



MARCONI
marine beacons and
navigational aids

COSSOR *presents...*



The new Cossor Double Beam Oscilloscope

MODEL 1052

Two identical amplifier channels with a maximum gain of 2000 and an upper frequency response of 3 megacycles are features of this new Cossor Double Beam general purpose oscilloscope. The repetitive or triggered time base has a sweep duration from 200 milliseconds to 5 microseconds.

The instrument will operate from power supplies of any of the various frequencies and voltages encountered in the Armed Services or from standard civil supply mains. The top and side panels are quickly detachable to allow inspection and a removable plate at the rear of the instrument allows access to tube plates, anode and modulator.



and Voltage Calibrator

MODEL 1433

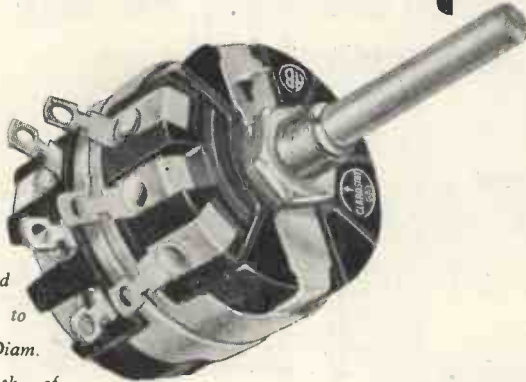
Primarily designed to be used with the new Cossor oscilloscope the Cossor Voltage Calibrator model 1433 provides an accurate means of calibration of input voltages to the plates or amplifiers of any oscilloscope. Calibrating voltages are read directly from a wide scale meter without any computation being necessary. Measurements can be made to an accuracy of $\pm 3\%$ and the instrument can be used in any application where a source of accurately-known voltage is required.

COSSOR ELECTRONIC INSTRUMENTS

Write for illustrated leaflets about both of these instruments
A. C. COSSOR LTD., INSTRUMENT DIVISION, DEPT. 1,
HIGHBURY GROVE, LONDON, N.5
Telephone: CANonbury 1234 (33 lines)

ALWAYS USE
COSSOR
TUBES &
VALVES

Introducing

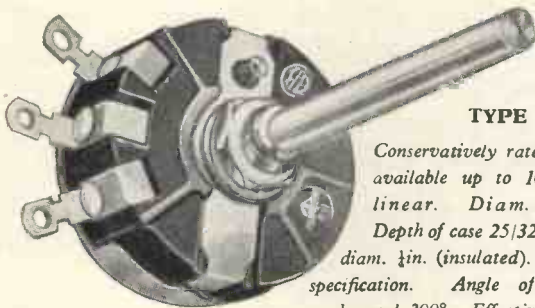


TYPE 58 (Dual)

Two controls in tandem operated by a common spindle. Each control wound to any resistance up to 100,000 ohms linear. Diam. 1.21/32in. Total depth of case 1.9/16in.

Further additions to the range of
Clarostat†
WIRE-WOUND
Controls

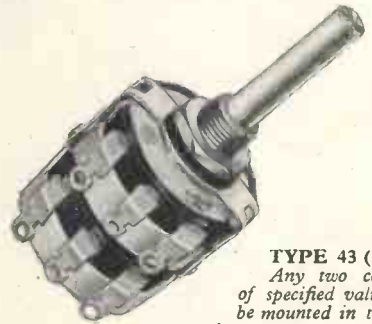
All Clarostat controls are manufactured with high grade Bakelite cases of rugged construction. Solder tags are heavily silver-plated and of special design, removing all danger of turning or loosening under operating conditions. The controls are fitted with metal dust covers which are firmly keyed into the Bakelite casing and connected to the fixing bush, thus providing automatic earthing of cover. Samples available on application.



TYPE 58

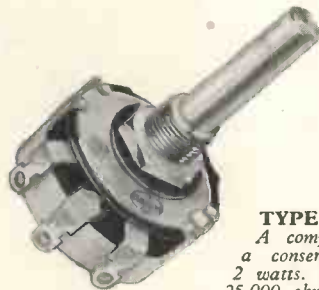
Conservatively rated at 3 watts; available up to 100,000 ohms linear. Diam. 1.21/32in. Depth of case 25/32in. Spindle diam. 1/4in. (insulated). Length to specification. Angle of rotation, mechanical 300°. Effective 280°.

All controls can be supplied with special windings and closer tolerances to specification. Can also be supplied fitted with single or double pole mains switch if required.



TYPE 43 (Dual)

Any two controls of specified value can be mounted in tandem operated by a common spindle. Diam. 1 1/4in. Total depth of case 1.3/16in.



TYPE 43

A compact control with a conservative rating of 2 watts. Available up to 25,000 ohms linear. Diam. 1 1/4in. Depth of case 19/32in. Spindle diam. 1/4in. (insulated). Length to specification. Angle of rotation, mechanical 300°. Effective 280°.

WHOLESALEERS

Clarostat wire-wound Potentiometers are supplied with a spindle 2 1/4in. long with full length flat, individually packed in sturdy two-colour cartons. Delivery is prompt. Write for details of very attractive trade terms.

† Regd. Trade Mark



Controls and Resistors



METAL PRODUCTS LIMITED.

16, Berkeley Street, London, W.1.

Phone: GROsvenor 5206/7

When is this *NOT* a rectifier?



The answer, of course, is when it's a UNISTOR . . . from that useful range of asymmetric resistors made by *Standard*. SenTerCel Unistors have a wide field of application in electronic circuits, particularly those associated with digital computers and other equipments of a similar nature.

Four current ratings are at present available . . . 0.25 mA, 1.5 mA, 7 mA and 10 mA at various D.C. voltages between 20 and 100V.

Here are some specimen data.

Unistor Code	D.C. Current Rating in Max. Ambient Temp.		Maximum Continuous Inverse D.C. Voltage Volts	Maximum Instantaneous Inverse D.C. Voltage Volts	Capacitance at Approx. Zero Volts pF
	55°C.	71°C.			
Q1/1	0.25	0.25	20	56	20
Q3/1	1.5	1.5	20	56	65
Q6/1	7	3	20	56	500
Q8/1	10	4	20	56	1,000

SenTerCel UNISTORS

(asymmetric resistors)

Standard Telephones and Cables Limited

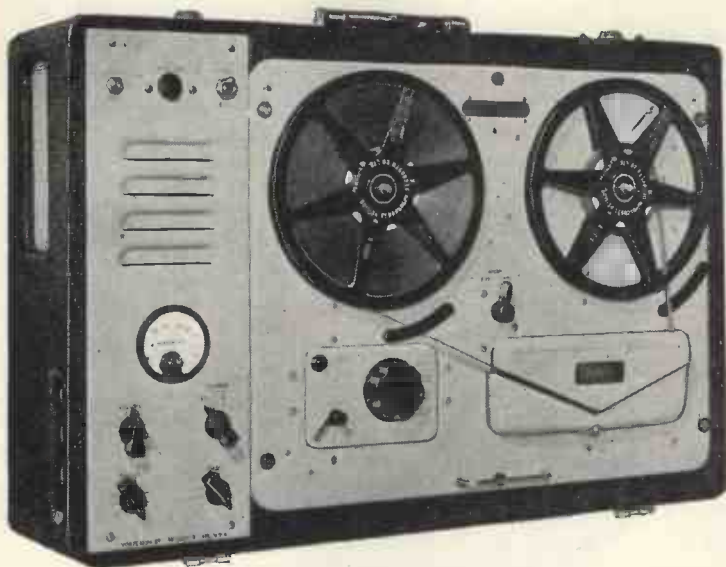
Registered Office: Connaught House, Aldwych, W.C.2

RECTIFIER DIVISION: Warwick Road, Boreham Wood, Hertfordshire

Telephone: Elstree 2401

Telegrams: Sentercel, Borehamwood

VORTEXION TAPE RECORDER



The amplifier, speaker and case, with detachable lid, measures 8½ in. x 22½ in. x 15½ in. and weighs 30 lb.

PRICE, complete with WEARITE TAPE DECK £84 0 0

★ The noise level is extremely low and audibly the hum level and Johnson noise of the amplifier and deck are approximately equal. Only 25% of this small amount of hum is given by the amplifier alone.

★ Extremely low distortion and background noise, with a frequency response of 50 c/s.—10 Kc/s., plus or minus 1.5 db. A meter is fitted for the measurement of signal level and bias level.

★ Sufficient power is available for recording on disc, either direct or from the tape, without additional amplifiers.

★ A heavy mu-metal shielded microphone transformer is built in for 15-30 ohms balanced and screened line, and requires only 7 micro-volts approximately to fully load.

★ The .5 megohm input is fully loaded by 18 millivolts and is suitable for crystal P.U.s, microphone or radio inputs.

★ A power plug is provided for a radio feeder unit, etc. Variable bass and treble controls are fitted for control of the play back signal.

★ The power output is 3.5 watts heavily damped by negative feedback and an oval internal speaker is built in for monitoring purposes.

★ Facilities are provided for using the amplifier alone and using power output or headphones while recording or to drive additional amplifiers.

★ The unit may be left running on record or play back even with 1,750 ft. reels with the lid closed.

POWER SUPPLY UNIT to work from 12 volt Battery with an output of 230 v., 120 watts, 50 cycles within 1%. Suppressed for use with Tape Recorder. **PRICE** £18 0 0.

3-WAY MIXER AND PEAK PROGRAMME METER

FOR RECORDING AND LARGE SOUND INSTALLATIONS, ETC.

One milliwatt output on 600 ohm line (.775V) for an input of 30 micro-volts on 7.5-30 ohm balanced input.

Output balanced or unbalanced by internal switch. The meter reading is obtained by a valve voltmeter with 1 second time constant, which reads programme level, and responds to transient peaks.

Calibration in 2 db steps, to plus 12 db and minus 20 db referred to zero level. Special low field internal power pack supplies 8 valves including stabilising and selenium rectifier, consumption 23 watts.



Manufactured by

VORTEXION LIMITED, 257-263, The Broadway, Wimbledon, London, S.W.19

Telephones: LIBerty 2814 and 6242-3

Telegrams: "Vortexion, Wimble, London."

E·M·I

RECORDING

EQUIPMENT

Made by E.M.I. — with their unrivalled knowledge and experience of sound recording — the Emicorda combines quality of recording and reproduction with simplicity of operation (which is so important to the non-professional user).

The Emicorda is the home version of the E.M.I. Tape Recorders used by the leading broadcasting and recording organizations.

The

EMICORDA

PRICE 90 GNS.

Model 2301 (right)



FOR BETTER



RECORDINGS

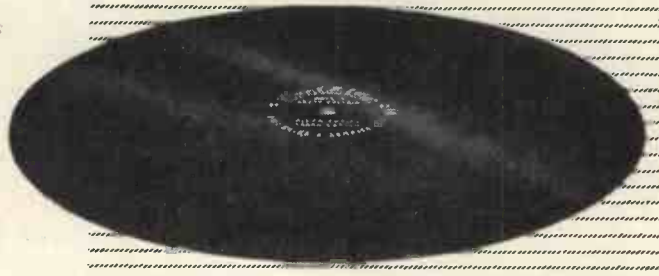
Emitape is the outcome of 50 years of research in the science of sound recording by the E.M.I. Group (H.M.V., Columbia and Parlophone). Available for all types of tape recorders, the Standard High Coercivity tape is made in two lengths — 600ft. (Type H60/6), 21/-, and 1,200 ft. (Type H60/12) 35/-.

EMITAPE

Emidiscs are the supreme lacquer recording blanks noted for free cutting and low background noise, allied with excellent frequency response and anti-static properties. Available in four grades, and wide range of sizes.

EMIDISCS

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E.M.I. SALES & SERVICE, RECORDING EQUIPMENT DIVISION, HAYES, MIDDLESEX

SOUTHALL 2468

ES26L

Crystal Palace Transmitters

**Britain to have most powerful transmissions with
Marconi-equipped station**

By 1956 BBC television transmissions will be the most powerful in the world.

For the new Crystal Palace station which will replace Alexandra Palace, the Corporation has ordered Marconi sound and vision transmitters. They will be used with a high gain aerial system which will radiate 200/250kW—twice the power of existing Regional transmitters.

Two 15kW vision transmitters, the first two in the world to work in parallel, will ensure the highest reliability of service. They will use a new type of tetrode valve of small size, a Marconi development permitting valuable space savings in transmitter design. Two 4½kW sound transmitters will also operate in parallel.

Marconi high or medium power transmitters and high power aerials are installed in every one of the BBC's television transmitter stations, while Marconi television equipment has been ordered by countries in North and South America, Europe and Asia.

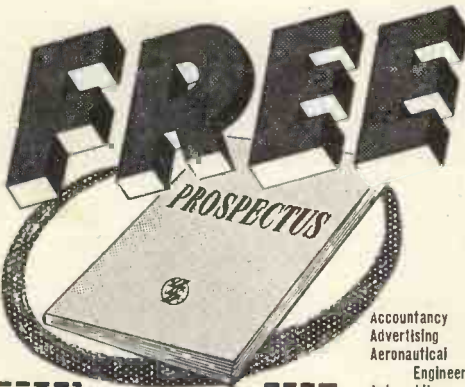
MARCONI

complete television transmitting equipment

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Z RADIO LUXURY BY SOUND SALES
 -THE ULTIMATE CHOICE



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 LONDON AGENTS: WEBB'S RADIO - HOLLEY'S RADIO



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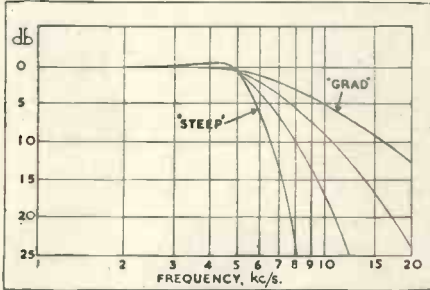
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 43 Grove Park Road, London, W.4 Phone: Chiswick 4417/8
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LEAK equipment is unique—

It is acceptable to professional communications engineers for recording and broadcasting. The B.B.C. use several hundreds of the TL/12 Amplifier, and 1,000 are used by other Broadcasting Corporations.



The Vari-Slope



Frequency amplitude curves for the "TREBLE-3" position (5kc/s turn-over). Curves of the same slopes are obtained on the other two positions turning over at 7kc/s and 9kc/s ("—2" and "—1" positions).

Representing a unique feedback circuit development, the "Vari-Slope" pre-amplifier gives audibly better reproduction. This advance consists of variable-slope "electronic" low-pass filters operating on negative voltage feedback principles. No Inductors ("Chokes") are used, and their disadvantages are completely eliminated. The turnover frequencies are 5kc/s, 7kc/s, and 9kc/s, and the slopes of attenuation are continuously variable over the range 5db per octave.

The filters consist essentially of Twin-T resistor-capacity networks inserted in the return circuit of a single-loop feedback amplifier. The more obvious advantages of this electronic feedback method over conventional choke filters include:—

(a) Improved transient response characteristics (due to absence of chokes having self-capacitance) and the consequent reduction of "ringing."

- (b) Extremely low harmonic and inter-modulation distortion due to negative voltage feedback action.
- (c) No discontinuities in the rates of slope when the slope control is operated, and no change in signal level at frequencies below turnover. (Both these faults occur in variable-slope choke filters due to the slope control altering the terminating impedance and the insertion loss.)
- (d) No chokes to cause magnetic hum pickup.
- (e) Smaller size, lighter weight, greater uniformity in production.

Point-One TL/12 Triple Loop Feedback Amplifier

Used with the "Vari-Slope" pre-amplifier and the best available complementary equipment, the TL/12 power amplifier gives to the music-lover a quality of reproduction unsurpassed by any equipment at any price.

For laboratory use as a stabilised-gain audio frequency power amplifier. For the highest possible standard of disc recording. For the highest possible quality of reproduction from Pickup, Radio, Microphone, Film and Magnetic Tape. For use as a driver amplifier in the speech modulator chain of broadcast transmitters.

27 Gns.

The "Point-One" TL/12 Amplifier is built to a tropical specification and used throughout the world, including:

- The British Broadcasting Corporation.
- The South African Broadcasting Corporation.
- The Swedish Broadcasting Corporation.
- The Swiss Broadcasting Corporation.
- The Italian Broadcasting Corporation.

LIST PRICE IN BRITAIN **12 Gns.**



£5. 10s.

Steep-Cutting Filter

For use with the TL/12 power amplifier and pre-amplifiers preceding the Vari-Slope. This filter unit is of particular interest to the record enthusiast.

Write for fully descriptive literature.

H. J. LEAK & CO., LTD., BRUNEL ROAD, WESTWAY FACTORY ESTATE, ACTON, W.3

Phone : SHEpherds Bush 1173/4.

Telegrams : Sinusoidal, Ealux, London.

Cables : Sinusoidal, Lonaon.

ELECTRONIC PRECISION EQUIPMENT LTD.



BE PREPARED

For a cold winter by making our low cost Electric Blanket. 27 yards of special heater wire and blueprint 20/- . Blueprint only 1/6. Alternatively make a Bed Warmer. Constructional data 1/6.



CONNECTING WIRE SNIP

P.V.C. insulated 23 s.w.g. copper wire in 100ft. coils, 2/9 each. Colours available: Black, Brown, Red, Orange, Pink, Yellow, White, Transparent. 4 coils for 10/-.

SOMWEAVE



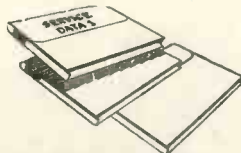
This really lovely loud-speaker fabric we offer at approximately a third of today's cost. It is 42in. wide and our price is 12/- per yard or panels 12in.

× 12in., 1/0 each. This is also very suitable for covering plain wooden cases, for portable radio amplifiers, etc.



PLUGS FOR MODERN VALVE HOLDERS

Each is fitted with a rubber shroud. For B7G button base and type 2 for B8A. Price 1/4 each, discounts for quantities.

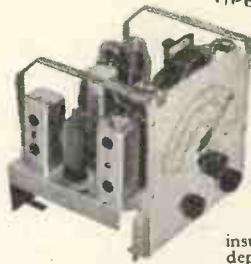


SERVICE DATA

100 service sheets, covering British receivers which have been sold in big quantities, and which every service engineer is ultimately bound to meet. The following makes are included: Aerodyne, Alba, Bush, Cossor, Ekco, Ever-Ready, Ferguson, Ferranti, G.E.C., H.M.V., Kolster-Brandes, Lissen, McMichael, Marconi, Mullard, Murphy, Philco, Philips, Pye, Ultra. Undoubtedly a mine of information invaluable to all who earn their living from radio servicing. Price £1 for the complete folder. Our folder No. 2 consists of 100 data sheets covering most of the popular American T.R.F. and superhet receivers "all dry" etc., which have been imported into this country. Names include Sparton, Emmerson Admiral, Crossley, R.C.A., Victor, etc. Each sheet gives circuit diagrams and component values, alignment procedure, etc., etc. Price for the folder of 100 sheets is £1. Post free.

REAL BARGAINS STILL AVAILABLE

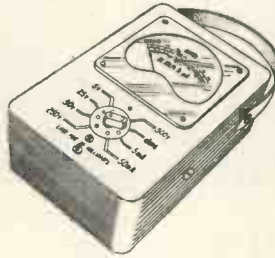
SUPERHET RADIO BY BEETHOVEN



Extremely well built on chassis size approx. 9½ x 7 x 8½ using only first class components, fully aligned and tested, 110-240 volt A.C. mains operation. Large clear edge-lit dial. Three wave bands covering 200-550, 35-120, 13-42 metres. Complete with five Mullard valves, frequency changer, double diode triode, pentode output and full wave rectifier. Complete with Rola loudspeaker ready to operate. Special cash with order price this month, £7/17/6, carriage and insurance 7/6. Hire purchase terms £3 deposit, balance over 12 months.

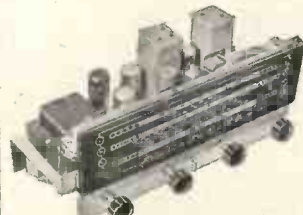
MULTI-METER KIT

The Multi-meter illustrated measures D.C. volts, D.C. m/amps and ohms. It has a sensitivity of 200 ohms per volt and is equally suitable for the keen experimenter, service engineer or student. All the essential parts including 2in. moving coil meter, selected resistors, wire for shunts, 8-point range selector, calibrated scale, stick on range indicator and full instructions for making are available as a kit price 15/- plus 9d. post and packing.



HUGE NEW PURCHASE

We have purchased another large quantity of the Collaro Auto Record Changer, type R.C. 3/521, three speed suitable for all types of records and with the latest type crystal pick ups. Buy one this month as you will not be able to again at this special price of £10 plus 7/6 carriage and insurance.



THE "WINDSOR" 5

This is a 5 valve A.C. superhet covering the usual long, medium and short wavebands. It has a particularly fine clear dial with an extra long pointer travel. The latest type local valves are used and the chassis is complete and ready to operate. Chassis size 15in. x 6in. x 6in. Price £9/19/6 complete with 8in. speaker. Carriage and insurance 10/- . H.P. terms £3/7/- deposit.

TABLE RADIO CABINET

Due to a special purchase, we are able to offer this very fine cabinet, size approx. 16 x 16 x 7—walnut veneered and satin finished. 37/6, carriage and packing 3/6. Note. This cabinet is the correct one for the chassis above.



RADIOGRAM CABINET

Console Type Cabinet. With full grained walnut finish, will take standard type auto change gram unit. Price £11/10/- . H.P. terms, £3/17/- deposit, and 12 monthly payments of 16/9, plus 15/- carriage.

Radio Chassis to suit. £8/19/6. H.P. terms. £3 deposit and 10 monthly payments of 13/-, plus 7/6 carr.

Auto Change Units. For long-playing and standard records with suitable pick-up head, £11/11/-.

SPECIAL OFFER. Cabinet Radio Chassis and Auto Changer, 29 gns. H.P. terms, £10/14/- deposit and 12 monthly payments of £2/3/-.



ELECTRICAL BARGAINS

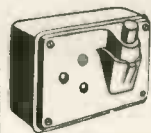
In addition to our large range of radio accessories we also carry a good stock of electrical wiring accessories; details of a few of these can be found below—

T.R.S. CABLES. 250 v. CLASS

1/044 Twin flat	9d.
3/029 Twin flat	1/-
3/029 Twin with earth	1/3
3/020 3 Core flat	1/6
3/036 Twin flat	1/4
3/036 Twin with earth	1/7
3/036 3 Core flat	2/-
7/029 Twin flat	1/6
7/029 Twin with earth	1/11
7/036 Twin flat	2/9
7/036 Twin with earth	3/3
7/064 Twin flat	4/9

LEAD COVERED CABLES 250 v. CLASS

3/029 3 core	2/3
3/036 3 core	2/8
7/044 twin	3/3
3/036 twin	2/-
7/029 twin	2/9
7/064 twin	5/-



CLIX 15 AMP. FOOT PLUG
Madedo B.S.S. specification, shuttered in moulded bakelite, case 8/6 each.

IRON CLAD SWITCH FUSES

Best makers, M.E.M., etc., 15 amp., 10/6, plus 1/6 post. 30 amp., 16/6, plus 2/6 post. 15 amp., used but in good condition, 8/6. 10 amp. porcelain (Memdix), 6/-.



5 AMP SURFACE SWITCHES—HICRAFT

Oblong Brown Plastic 1-way 1/3 each.
Oblong White Plastic 1-way, 1/3 each.
Oblong Brown 2-way .. 1/6 each
Oblong White 2-way .. 1/6 ..
Round Brown 1-way .. 1/3 ..
Round White 1-way .. 1/3 ..
Round Brown 2-way .. 1/6 ..
Round White 2-way .. 1/6 ..

15 per cent. discount if bought in dozens.

10 AMP. SWITCH
Rotary pattern with chrome cover and on/off indicator. 2/3.



SOCKETS HICRAFT

Flush type for skirtings, 5 amp. 3-pin shuttered, 1/3 each; ditto with switch, 2/3 each.



CEILING SWITCHES—HICRAFT

With cord and acorn. Brown or White, 1-way, 3/9 each; 2-way, 4/3 each.

LAMP HOLDERS

Bakelite, 1/- each or 10/6 doz. Bakelite skirted Batten holder, 1/6 or 15/- doz. Bakelite type threaded for lin. with HO skirt, 1/6.

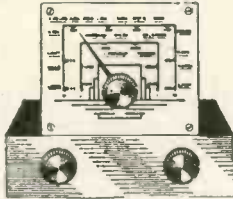


ELECTRONIC PRECISION EQUIPMENT LTD.

THIS MONTH'S SNIP



Complete kit comprises Hi-craft 40 watt control unit, starter lamp, lamp holders, clips and wiring diagram. Price, less tube, 22/6, plus 1/6 post. With tube, 30/6, plus 3/6 P.P. Tubes 7/6 each, carr. free, minimum quantity 6.



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 valves, ganged tuning, dust coated coils, on metal chassis. Tunes long and medium wavebands. Large clear dial. Receives Home Services, Light Programme, Luxembourg, etc. Chassis size approximately 9in. x 4in. x 5in. Complete with valves, but less speaker. Obviously not the last word in receivers, but useful standby or for workshop, bedroom or even the greenhouse where a radio helps to make the job more pleasant. Few only left to clear at 49/6 plus 3/6 packing and insurance. Suitable speaker with matching transformer, 16/6. Nothing else needed.

GRAMOPHONE UNIT

BSR 3-speed motor Type MU14 with Chancery pick-up and two crystal heads, one for long playing and one for normal records. £7/7/- plus 3/6 carriage and insurance.

AMERICAN POWER PACK
Built to operate H.R.O. receiver from British mains. Gives 80-100 m/a. smoothed D.C. at 200 volts, also 5 volts and 6.3 volts. Totally enclosed in metal case. An extremely nice unit. Price £2/17/6, plus 5/- postage and insurance.

SLIDER RESISTORS

Heavy Duty Type.
Size 7in. x 1 1/2in. 11 ohms 4.5 amp., 22/-; Size 9in. x 1 1/2in. 1.2 ohms. 15 amp. 15/-; size 13 1/2in. x 1 1/2in. 3 ohms 10 amp., 15/-.



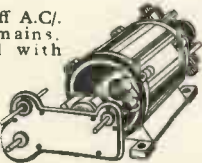
LAST FEW

£3/19/6
The Lectross warms room as it dries clothes, bathing costumes, towels, etc. Size 3ft. wide, 3ft. high and 5in. deep. It has four stove enamelled

rails and works off A.C. or D.C. mains, consuming 650 watts. Fully guaranteed. Price £3/19/6 plus 7/6 carriage.

MULTI-SPEED MOTOR

Works off A.C./D.C. mains. Fitted with gearbox a ny speed from 1 r.p.m. 12/6, and post p k g., 1/6.



One of this country's largest Manufacturers changed the design of their Televisor recently; consequently we are able to offer you a very fine cabinet at well below cost. The cabinet is suitable for Televisors using tubes from 12in. to 17in., its overall dimensions being 3ft. 5in. high, 1ft. 4in. deep, 1ft. 10in. wide. It is complete with back fitted with "bowler hat" nicely polished walnut veneer. Price £6/19/6, carriage, packing, etc. 12/6.



THE REGINA

T.V. Console Cabinet, undrilled but cut for 12in. tube, with adjustable, platform. This cabinet looks really superior and is ideal for all popular sets—Viewmaster, Tele-King, etc. Price £7/17/6. Carriage 10/- extra.



The table model illustrated is available in fair quantity at £3/17/6, plus 7/6 carriage and insurance, which price includes the armour plate glass and surround. Mechanical details for this Table Model are available as a parcel: Punched and prepared metal chassis, punched outrigger valve plate with spacers, 12in. Tube Clamping ring, tube rear support brackets, etc. Price 25/-, plus 2/6 post.

SPECIAL RADIOGRAM OFFER

To those who want an auto radiogram at a low price, we offer the Cabinet illustrated alongside complete with Collaro three-speed record changer with dual purpose crystal pick-up, at a special bargain price of £17/16/8, plus 12/6 carriage and insurance or H.P. terms £6/7/- deposit.



A Superhet Chassis to fit is now available. L.M. and S. waves, 3 colour scale, A.V.C. Tone control, etc., complete with 8in. P.M. Speaker. Price £9/19/6, or H.P. £3/7/- deposit. Carriage 7/6 extra.

SURPLUS BARGAIN CABINETS FOR: RADIOS, TELEVISORS — TAPE RECORDERS — CLOCKS — RADIOGRAMS, ETC., are always on show at our branches—E.C.4. FINSBURY PARK or RUISLIP.

IDEAL GENERAL PURPOSE RECEIVER

The Elpreq "Wolsey" 5 valve A.C./D.C. superhet has a built-in aerial and is of convenient size and weight to carry from room to room. Powerful reception on long, medium and short waves — handsome wooden cabinet — illuminated glass dial with station names, A.V.C. and usual refinements. Size 11in. x 5 1/2in. x 7in. with B.V.A. valves 12 months' guarantee. Limited quantity only, £9/5/- or £3/2/- deposit and balance over 12 months, carriage and insurance 5/-.



RADIO STETHOSCOPE

A novel device aptly called a Radio Stethoscope. With it in most districts a receiver can be checked from the grid of the first valve right through to the output. The only parts needed to make the simple circuit tracer are a pair of crocodile clips, a germanium crystal, and a paper tubular condenser, and we will supply whole outfit for 6/6, post free,



CHASSIS ASSEMBLY

3 colour, 3 waveband scale covering standard Long, Medium, and short wavebands, scale pan, chassis punched for standard 5 valve superhet, pulley driving head, springs, etc., to suit Scale size 14 1/2in. x 3 1/2in. Chassis size, 15in. x 5in. x 2in. deep. Price 15/-, plus 1/6 post. Note: This is the one that fits our £7/10/- Radiogram cabinet and our 37/6 table cabinet.



DEMORBED VALVES

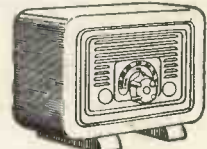
Gives the commercial equivalents of many thousands of Service Valves, an invaluable publication recently revised. Price 2/3.



TOGGLE SWITCHES

Metal body standard size made by a leading maker. Available with round dolly or with special V cut dolly. State which type when ordering. Price while stocks last only 2/3.

CRYSTAL SET



Two waves. uses latest crystal valve—good results without batteries or mains 18/-.



NEW 12in. T.V. TUBES

A special purchase enables us to offer some brand new, latest type 12in. T.V. tubes at the special price of £11/10/- each. Each tube is in original carton and complete with maker's guarantee. Carriage 10/- extra.

ELECTRONIC PRECISION EQUIPMENT LTD.

MORE NEW BARGAINS

NUTS, BOLTS AND WASHERS	
6 B.A. BRASS FULL NUTS 2/- per gross	
4 B.A. " " " " " "	3/-
6 B.A. 1/2in. Brass Bolts " " " "	2/9
6 B.A. 1/4in. " " " " " "	3/3
4 B.A. 1/2in. " " " " " "	3/6
4 B.A. 1/4in. " " " " " "	4/3
6 B.A. 1/2in. Steel " " " " " "	1/6
6 B.A. 1/4in. " " " " " "	1/9
4 B.A. 1/2in. " " " " " "	2/-
4 B.A. 1/4in. " " " " " "	2/9
6 B.A. Brass Washers " " " " " "	2/6
4 B.A. " " " " " "	2/6
6 B.A. Steel " " " " " "	1/3
4 B.A. " " " " " "	1/6

SPECIAL OFFER—SERVICE-MAN'S ASSORTMENT, containing 3 gross of mixed popular sizes as above, 4/6.

SILVER MICA CONDENSERS, all sizes from 5 pf. upwards, 6d. each or 100 assorted, 30/-.

60-WATT VARIABLE RESISTORS, blank formers—wind on your own resistance wire—screw adjustment so Vernier control possible, 9/6 each, £5 doz.

18-WAY TELEPHONE SWITCHBOARDS. These are ex-M.O.'s stock, but are brand new and unused. Price £20 each.

4-WAY TELEPHONE SWITCHBOARDS. These are for use with the Royal Navy SOUND POWERED TELEPHONES which we sell. Only a small quantity are available. The price is £12/10/- each.

2-CIRCUIT TELEPHONE AMPLIFIERS. These are for amplifying the signal in both directions of traffic and for reducing distortion over long distance—Service No. YB/YA 3757. These are unused but may require attention, due to long storage. Circuit diagrams and details available. Price £12/10/- each.



VIBRATOR UNIT

This unit gives 150 v. at 50 mA. from 4 or 6 v. car battery, also gives L.T. supply, suitable for all dry valves. IT4, IR5, etc. Ex-W.D. Price 15/-, plus 2/6 post.

HEADPHONES, lightweight American make, type HS30, 27/6 pair. British made types: high resistance, 14/6, low resistance, 6/6.

40 VOLT 2 1/2 AMP STEP DOWN TRANSFORMER Totally enclosed in metal box—primary 200-240 50 c.p.s.; secondary easily rewindable to other voltages—ideal safety unit for operating children's toys or domestic gadgets, 17/6 each.

2-VOLT WET CELLS, lead acid type, in small glass jars. Make up your own wet L.T. 2/6 per cell, post 6d. per cell.

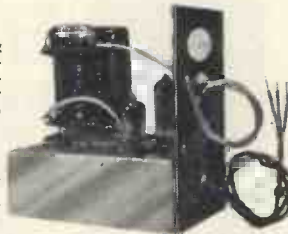
CRYSTAL OVENS. Mains operated, thermostatically controlled, new and unused, £2/10/- each. Few only.

MAINS OPERATED BELLS. Use these in connection with our low-priced thermostat and you can make a frost- or fire-alarm for less than 10/-. Plenty of other uses. Price only 5/6 each.

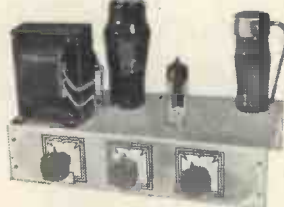
NEW ITEMS THIS MONTH

THE ELPREQ E.H.T. GENERATOR

This is a made up unit working on the blocking oscillator/overwound amplifying stage principle. It is of moderate power consumption (6.3 volt .8 amp filament and approx. 59 mA. H.T.) and contains three of the latest BVA all glass valves. Output obtainable ranges from 6 kv. to 9 kv. with normal H.T. rail input but somewhat higher outputs can be obtained with higher H.T. supply. Valve rectification is employed in the output stage. The core of the overwound transformer is kept insulated from chassis in order to give additional protection against possible flashovers. This unit is particularly suitable for those who during the course of their T.V. construction have come to appreciate the advantages of separate E.H.T. supply, but should also prove invaluable as experimental or stand-by high voltage source. Effective screening (not shown in the illustration) is provided, and the dimensions are 6 1/2 x 4 1/2 x 7 in. Price 69/6, post, packing, etc., 5/-.



THE ELPREQ "SELECTIVE FEED-BACK" SMALL RECORD REPRODUCER



To accommodate the wishes of many of our old customers we are releasing this month a record reproducer. For a very small outlay this instrument is capable of a performance usually only associated with a number of famous reproducers of the high fidelity class.

The amplifier is fitted with independent bass and treble control, both connected through different feed-back loops so that no "cut" at all in the ordinary sense is applied. The variation which can be achieved by applying various degrees of negative feed-back in the higher and lower ranges of the sound strata will accommodate all individual tastes.

We strongly recommend a 12in. speaker in order to make the fullest use of the instrument's potentialities. Booklet and set of components available at once at £2/19/6, post, etc., 2/6. Booklet separate 1/6. 12in. speaker to suit, £3, post free if bought with amplifier.

BEDROOM-NURSERY MAINS MIDGET RADIO

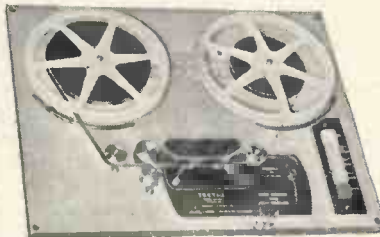
Xmas is not far off—but if you act promptly you will have enough time to make several of these little A.C. Mains radios. All the parts, bakelite cabinet valves, knobs, back—in fact everything will cost you only £3/15/- (plus 2/6 postage) which, we think you will agree, is not too much to spend on your dear ones. The set is economical to run, too, for it uses only three valves in a special reflex T.R.F. circuit which gives ample power combined with good tone. Incidentally if you wish to give the sets to young children why not decorate the cabinet with a few suitable transfers? These can usually be obtained from local handicraft shops. Circuiting and construction data free with the parts or available separately at 1/6.



TRUVOX TAPE DECK

Yours for £7/14/- Now available ex-stock, this fine tape deck has many superior features some of which are as follows:

1. Powered by 3 shaded-pole A.C. motors.
 2. "Drop-in" Tape loading.
 3. Push-button control, electrically and mechanically interlocked.
 4. Separate push-button brake. Patented electric type.
 5. "Fast-forward" and "fast-rewind" without tape wear, one minute for a full reel.
 6. Silent drive eliminating "wow" and flutter.
 7. Half-track working, and two Tape speeds giving 60 minutes each track at 3 1/2 in. per second or 30 minutes each track at 7 1/2 in. per second.
 8. Visual playing-time indicator
 9. With a suitable amplifier, the equipment covers a frequency range from 50-10,000 c.p.s. at 7 1/2 in. per second.
 10. The deck will take all standard reels, plastic or paper-based tapes, up to 1,200ft. capacity.
- We have a good stock and will be pleased to supply. Price is 22 gns., or if you wish send only £7 14s. deposit, the balance can be spread over 12 months. Non callers please add 7/6 carriage and insurance.



MORE NEW BARGAINS

CO-AXIAL CABLE 70 to 80 ohms for T.V. by one of our leading manufacturers, medium thickness, Price 8d. yd. cut to your length.

L.F. CHOKES

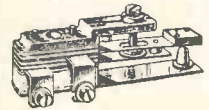
50 H	30 mA.	6/6
50 H	20 mA.	6/6
30 H	20 mA.	6/6
20 H	10 mA.	5/6
15 H	80 mA., fully shroud	15/-
10 H	150 mA.	18/-
10 H	100 mA.	15/-
10 H	75 mA.	4/9
10 H	60 mA.	4/9
5 H	250 mA., fully shroud	20/6

Please add 1/- post. & pkg.

COILS

T.R.F. Long and medium wave, complete with circuit diagram, 5/6 pr. Superhet, long wave 900-2,000 metres, medium wave 185-550 metres, short wave 16-50 metres with aerial and oscillator coils that is set of six. Coils with circuit diagram price 10/6.

NEW 5 AMP THERMOSTAT (MINIATURE)



2 1/2" x 1" x 1 1/2" high

Useful for the control of appliances such as convectors, gluepots, vulcanisers, hot plates, etc. This thermostat is adjustable to operate over the temperature range 50-550 deg. F., fitted with heavy (5 amp A.C.) silver contacts size 1 1/2 in. long x 1/2 in. wide, price 8/6, post 6d.; 1 amp type, 3/6, 2 amp type, 5/6.

MINIATURE 7-PIN PLUG AND SOCKET



With non-breakable plastic rubber shroud. Overall size 1 1/2 in. long, diameter approximately 1/2 in. Price 2/- pair.

VACUUM THERMOCOUPLE Of interest especially to scholastic establishments and available at a very low price is the vacuum thermocouple made originally for the Government. Unused, fitted with standard Octal base. Type No. WY2232; regret no other details available. Price 5/-, 54/- doz.

ENERGISED TYPE L.S. 6 1/2 in. Rola, field resistance 700 ohms, 12/6. Add 1/- per speaker for packing and insurance.



3 TORCHES 3/9

1. Hand lamp—takes twin cycle battery with switch and removable coloured discs for signalling.
2. For forehead fixing, miner's lamp type with adjustable head-strap.
3. Round pocket torch with magnifying lens. 3/9 the 3, post 6d.

1 H.P. MOTORS by very famous makers, standard, 50 c.p.s. 200-230 v., mains operated. Delivery expected before Xmas. Price around £3/10/-. Write or call for more details.

"Superior 15"

SOME QUESTIONS ANSWERED



QUESTION

Can I expect sound and pictures equal to factory made sets?
Is it robust and likely to go for long periods without trouble?
Why is it so much cheaper than any other big picture televisor?
Does it look like a home-made set?

How about soldering? Is it difficult like repairing a kettle or saucepan?
Is aligning the set difficult?

Will the Elpreq "Superior 15" receive all B.B.C. stations?

What happens if I cannot get my televisor to work once I have it finished?

ANSWER

The picture compared favourably with any set at the Radio Show.

Yes, because all parts are standard size and proved types.

The reason is because you assemble it yourself and thus save labour and other costs.

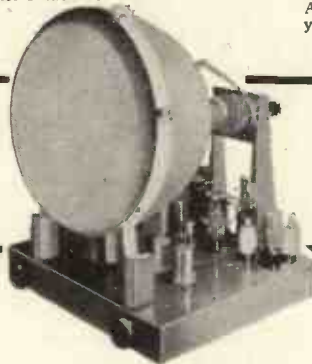
No, because it isn't really home made, it is simply assembled from factory made parts, just as are all so-called "factory made" T.V. models.

Soldering radio parts is simplicity itself.

No, the coils are all specially designed which "pre-aligns" them and you have only to follow the simple directions to ensure receiving the perfect picture. No instruments are necessary.

Yes, and all constructors will be notified of the modifications that will be necessary when Commercial T.V. starts.

You send for a service form which you complete and then our engineer will indicate your trouble. Alternatively, for a nominal charge, we will take your chassis and make it perfect.



UP TO THE MINUTE
BIG PICTURE T.V.

ONLY £37.10
OR £12.10 deposit

— MORE QUESTIONS ANSWERED

QUESTION

What is the cost?
Are Hire Purchase terms available?
Are there any guarantees?
Are cabinets available?

How much is the data and can I have it on approval?

How can I order?

ANSWER

All components, valves and Cossor 15in. cathode ray tube cost £37-10-0.

Yes, the deposit is £12-10-0, the balance is spread over 12 months.

You are covered by two guarantees, one covers the components and the other ensures that you will get perfect results.

The illustrations show the cabinets which are available. The Console costs £11-10-0 and the Super corner model £18-0-0. H.P. terms again are available.

The data costs 7/6, but providing you keep it clean and in good condition you can return it within 7 days if you think you cannot make the televisor (7/- will be refunded to you).

An order form is enclosed with the 7/6 data, which you can complete and post to us.



— AS DEMONSTRATED AT THE NATIONAL RADIO SHOW

ELECTRONIC PRECISION EQUIPMENT LTD.

Post orders should be addressed to:—

ELPREQ HOUSE (Ref 2.), HIGH STREET,
WEALDSTONE, MIDDX.

Personal shoppers however must continue to call at:—

42-46, WINDMILL HILL, RUISLIP, MIDDX.
Phone: RUISLIP 5780 Half-day, Wednesday.

152-153, FLEET STREET, E.C.4.

Phone: CENTRAL 2833. Half-day, Saturday.

29, STROUD GREEN RD., FINSBURY PARK.
Half-day, Thursday.



MODERN ELECTRICS LTD.,

164, Charing Cross Road, London, W.C.2.

Phone: TEMple Bar 7587.

Export enquiries welcomed.

Immediate delivery from stock.

Prompt attention to post orders.

TAPE RECORDERS

GRUNDIG 700L	£84	0	0
SIMPHONIC 8 watts	£83	0	0
BAIRD Soundmaster	£68	5	0
Baird Mk. II	£61	19	0
Soundmirror Twin Track			
Table	£69	10	0
Portable	£74	10	0
WEARITE TAPE DECK			
£35	0	0	
TRUVOX TAPE DECK			
£23	2	0	

RECORDING TAPES

GRUNDIG			
L.G.S. 1,200ft.	£2	0	0
SOUNDMIRROR			
Paper Tape 1,200ft.	£1	5	0
FERROVOICE			
Spare Spools	4	6	
E.M.I. H60, 1,200ft.	£1	15	0
E.M.I. H60, 600ft.	£1	1	0
E.M.I. H65, 1,200ft.	£1	15	0
E.M.I. H50, 1,200ft.	£2	8	0
SCOTCH BOY			
1,200ft.	£1	15	0
600ft.	£1	1	0
Spare Spools 1,200ft.	4	3	
Spare Spools 600ft.	3	3	
FERROGRAPH			
1,200ft.	£2	5	0
1,750ft.	£3	3	0
8in. Spools	9	6	
AGFA			
1,200ft.	£1	17	6
600ft.	£1	2	6

RECORD REPRODUCING EQUIPMENT

B.S.R.			
3-sp. Motor and Plate	£5	18	11
COLLARO			
3-sp. Unit complete with Studio P/U	£10	6	1
GARRARD			
R.C.80	£17	1	3
R.C.90	£17	16	6
R.C.80 A.C./D.C.	£24	14	4
3-sp. TA Unit	£9	17	6

SPEAKERS

TRUVOX			
12-in. 3Ω	£2	5	0
GOODMANS			
Axiom 150 Mk. 2 ...	£10	5	6
Axiom 102	£9	18	2
Axiom 101	£6	12	1
Audion 60	£8	12	6

WHARFEDALE

W15 CS	£16	0	0
Super 12 CS/AL	£16	0	0
W12 CS	£9	15	0
Golden 10 CSB	£8	6	7
Super 5 and 8 CS/AL	£6	13	3
Bronze 10in.	£4	12	9
Bronze 8in.	£3	4	0
W.B. Crossover Unit	£1	6	6
W.B. Tweeter Unit	£3	15	0
Stentorian HF912 ...	£3	7	6

TEST GEAR

AVO			
Model 8	£23	10	0
Model 7 (latest)	£19	10	0
Uniminor Mk. II	£10	10	0
Electronic Meter	£40	0	0
Wide Band Sig./Gen.	£30	0	0
Valve Characteristic Meter	£60	0	0
D.C. Minor	£5	5	0
10kV Multiplier for Model 8	£3	5	0
Carrying Cases for Models 7, 8 and 40 ...	£3	0	0
ADVANCE			
H.1 (Sig./Gen)	£25	0	0
E.2 (Sig./Gen)	£28	0	0
J.1 New Model	£35	12	0
COSSOR			
Oscilloscope 1049 ...	£150	0	0
Oscilloscope 1035 ...	£110	0	0
TAYLOR			
All new Taylor Test Gear in stock.			

PICK-UPS

ACOS			
GP.20 (Std. or L.P.) ...	£3	6	1
Spare heads for above	£2	0	0
DECCA			
X.M.S. Magnetic	£6	9	5
CONNOISSEUR			
Super 2 Hds.	£9	5	6
Spare Heads	£3	6	3
COLLARO STUDIO			
Type O or P	£3	14	4

VALVES

We are one of London's largest stockists—Please write for requirements.

MICROPHONES

Mic 22 (Crystal)	£4	4	0
Mic inserts for above	£1	0	0
Mic 16 (Crystal)	£12	12	0

LUSTRAPHONE

M/C with T/F.C 51 ...	£5	15	6
Heavy Table Base for above	£1	1	0

RESLO M/C (Low Imp.)

Ribbon High Fidelity	£7	5	0
Mumetal Transformer	£1	15	0

MICROPHONE STANDS

Floor, 3 extensions ...	£3	12	6
Table Stand	£1	1	0

LEAK AMPLIFIERS

Point 1, TL.12	£28	7	0
Point 2, TL.25	£34	7	0
Vari-slope pre-amp ...	£12	12	0
Type VS R.F. Tuner Unit	£34	19	0

SOLON. New Instrument

Iron 200-250 v. 25 w.	19	8	
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ALL GARRARD, CONNOISSEUR, DECCA and COLLARO

HEADS AND STYLI IN STOCK.

H.P. Terms available on all items over £10.0.0.

SLOW MOTION DRIVE FOR SELF-CALIBRATION



50-1 reduction and direct, single hole fixing. Black Crackle Escutcheon 10in. x 6 1/2in., 66/- . As above but with 6-1 reduction and fluted knob, 32/6.

STRONGLY BUILT METAL CABINET



Finished black crackle and complete with sliding chassis. Size 19in. x 10 1/2in. x 10in. (as illustrated). £5/13/6.

HIRE PURCHASE AVAILABLE ON PURCHASES OVER £10.

"Q. MAX" B4/40 TRANSMITTER COMPLETE 40 WATT—FOUR BAND FOR PHONE OR C.W.

Built in Modulator and Power Pack. Nothing external except microphone and key housed in attractive black crackle finished steel cabinet 19in. x 10in. x 9 1/2in. £75.

GIVE YOURSELF A USEFUL CHRISTMAS PRESENT SPECIAL OFFER OF COMPLETE SET OF "Q-MAX" CHASSIS CUTTERS & KEYS FOR £10

each	
1" or 1 1/2"	11/6
1 1/2" or 2"	12/6
2" or 2 1/2"	14/9
2 1/2" or 3"	16/6
3"	18/6
3 1/2"	30/-
4"	35/-
1" square	23/-
Keys, small 10d., medium 1/3, large 1/9.	



Patent No. 619178

TAPE RECORDING

DETAILS OF ALL TAPE EQUIPMENT ADVERTISED IN LAST MONTH'S ISSUE

(Send S.A.E. for Special List)

Full range of quality Speakers, Gramophone Motors and Amplifying equipment in stock.



"Q-MAX" MODEL G.D.O.I.A. GRID DIP OSCILLATOR

Is an ideal instrument for the determination of tuned circuit resonant frequency, tuning transmitters without application of power, for the determination of coil, mutual and stray inductances and both fixed and stray capacitances. Covers 1.5 to 300 Mc/s in eight ranges. PRICE: 12 Gns. Complete.

eight ranges. PRICE: 12 Gns. Complete.

BERRY'S (SHORT WAVE) LTD.

25 HIGH HOLBORN, LONDON, W.C.1

TEL: HOLBORN 6231

Illustrated Catalogue 6d. post free.

N.B. If you already have catalogue, send S.A.E. for latest additions and amendments.

MERRY XMAS

and

Best Wishes to all our customers

Set of 12 brightly coloured FAIRY LIGHTS, 220/240 volts A.C./D.C. A real bargain at 17/6 per set. Spares 1/- each.

COLLARO AUTO CHANGER

WORLD'S BEST "COLLARO" Record Changer in time for the Christmas buy. Model 3RC521. A 3-speed version of Model RC521, for operation at 33 $\frac{1}{3}$, 45 or 78 R.P.M. with 7in., 10in. or 12in. records. Fitted with pick-up arms designed to take COLLARO plug-in pick-up heads.

A.C. only, 100/125 volts or 200/250 volts.
Brand new in cartons. Ideal as a Gift.
Carriage paid. £9/19/6 complete.



ROTARY TRANSFORMERS. Midget type. 11.5 volt Input, 365/310 volt, 30 m/a. output. Brand new, 15/- each, post 1/-.

SOLDER. Still a few 1lb. reels left Fry's 40/60, 5/- reel, post 1/-.

SPEAKERS. Permanent Magnet. All brand new and boxed. No trans. 4in., 13/6; 8in. 16/-; 10in. 22/6; post 1/3.
2-GANG VARIABLE CONDENSERS. .0005 with trimmers, 6/6, post 9d.

JONES PLUGS. 8-way Chassis Mounting, 7/6 doz. 8-way with covers, 9/- doz.; 4-way Chassis Mounting, 6/- doz., post 9d. doz.

JONES SOCKETS. 8-way Chassis Mounting, 7/6 doz.; 8-way, with covers, 9/- doz.; 2-way with covers, 4/6 doz.

JONES PLUGS AND SOCKET MIDGET. 12-way. Plug covered. Socket chassis mounting, 2/6 pair, post 3d.

SIGNALLING TORCHES. Red, White and Green. A further supply of these has just arrived and we offer them at 3/9 each, complete with bulb. Take standard flat battery, 11d. extra, post 9d.

TOGGLE SWITCHES. D.P.D.T. 3 amp., 250 volt, 3/- each; S.P.S.T. Momentary on, 3 amp., 250 volt, 2/6 each; S.P.S.T. Momentary off, 3 amp., 250 volt, 2/6 each, post 3d. each.

JACK SOCKETS. Large 2-way, 1/9 each, post 3d. Bakelite single, 9d. each; Bakelite twin, 1/6 each, post 3d.

PANEL MOUNTING FUSE HOLDERS. With 3 amp., fuse, 2/9 each, post 6d.

INDICATOR LAMPS. Bakelite panel mounting, Red or White, 1/6 each, post 3d.



ACCUMULATOR CUT OUTS. 12 volt and 24 volt, 60 amp. Type "D" suitable for using on battery chargers, etc., 10/- each. Post 9d. 0/50 A.C.M.I. AMMETERS. 4in. scale, Panel Mounting, 25/- each, post 1/6. 0/15 A.C.M.I. AMMETERS. 3in. scale, panel mounting, 15/- each, post 1/6. 0/120 D.C.M.C. VOLTMETERS. 5in. flush mounting, 22/6 each, post 1/6.

EARPHONES. 60 ohm C.L.R., 5/- pair, post 1/-; 4,000 ohm brand new, 17/6 pair, post 1/-.

D.C. AMMETERS. 30 amp., centre zero. Left and right deflection. Made by Triplett. Brand new. 10/6 each, post 9d.

LONDON'S LOWEST-PRICED RELAYS

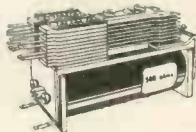
Ex-Government stocks of 3,000 and 600 types.

Specimen Quotations for 3,000 Types. Coils, including frame and armature, 5/- each.

Contacts, make and break twinsilver, 1/- each.

C/O or K set; twinsilver 1/6 each.

Other prices on application. Quotations apply only if stocks available. New relays on application.



SEND YOUR ORDERS TO:—

UNIVERSAL ENGINEERING CO.

Havelock Works, Havelock Place, Harrow, Middx.
Har. 1432.



LEAK QUALITY EQUIPMENT for the Connoisseur

POINT-ONE TL/12 12-WATT Triple Loop Feedback Amplifier



For the highest possible quality of reproduction from Pick-up, Radio, Microphone, Film and Magnetic Tape this amplifier has won world-wide recognition. As used by the B.B.C. and many overseas Broadcasting Corporations.

Cash Price £28/7/0.

THE NEW VARI-SLOPE PRE-AMPLIFIER

Gives audibly better reproduction. No chokes to cause magnetic hum pick-up. Extremely low harmonic and intermodulation distortion. Cash Price £12/12/0.



For fuller details see maker's advertisement on p. 83

TERMS for these TWO UNITS

£9 deposit with order and 18 monthly instalments of 40/-. Passenger carriage 10/- extra, payable with deposit.

LEAK V.S. TUNER AND DYNAMIC P.U. also supplied on similar terms. All the above available separately

Armstrong Chassis

Two new models incorporating many new features including Bass and Treble lift controls and improved tuning scales with flywheel action. **MODEL FC38.** 3-wavebands 16-50m., 190-500m., 1,000-2,000 m. 8-watt P.P. Output. Cash Price £23/13/0 (incl. P.T.). **MODEL RF41.** 10 valves, 4-wavebands, 12-35, 35-90, 190-550, 800-2,000m. 10-watt P.P. output. Cash Price £31/19/8 (incl. P.T.). See maker's advertisement on p. 173.

Connoisseur 3-speed **GRAM UNITS** and **LIGHTWEIGHT PICK-UPS** to match, can be supplied from stock.

Wharfedale & Goodmans LOUDSPEAKERS. Complete range available.

Illustrated lists of any item and details of our **EASY TERMS** will be sent upon request by return.

HAVE YOU TRIED?

the amazing ALL-NEW

REMINGTON '60'

ELECTRIC DRY SHAVER

OUR 14 DAYS FREE TRIAL OFFER

WILL CONVINCE YOU

that it really does shave every type of beard quicker and closer than any other method.

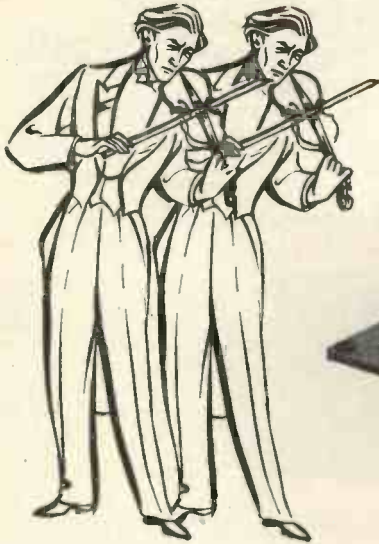
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3-SPEED MOTOR

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Identify each instrument in the orchestra with "Connoisseur" High Fidelity Equipment. Records seem to live when played.

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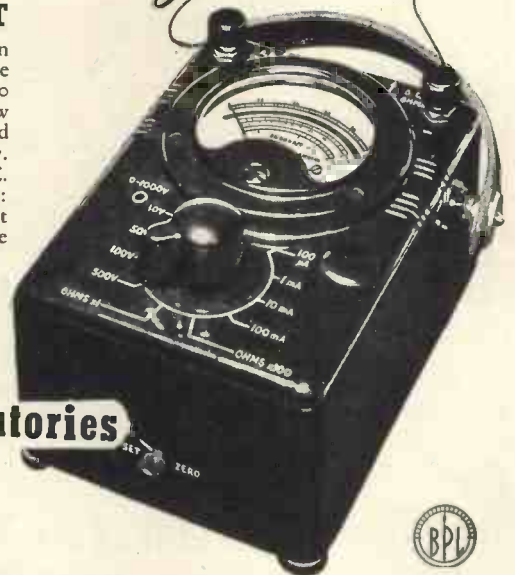
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A NEW HIGH POWER PULSE MODULATOR

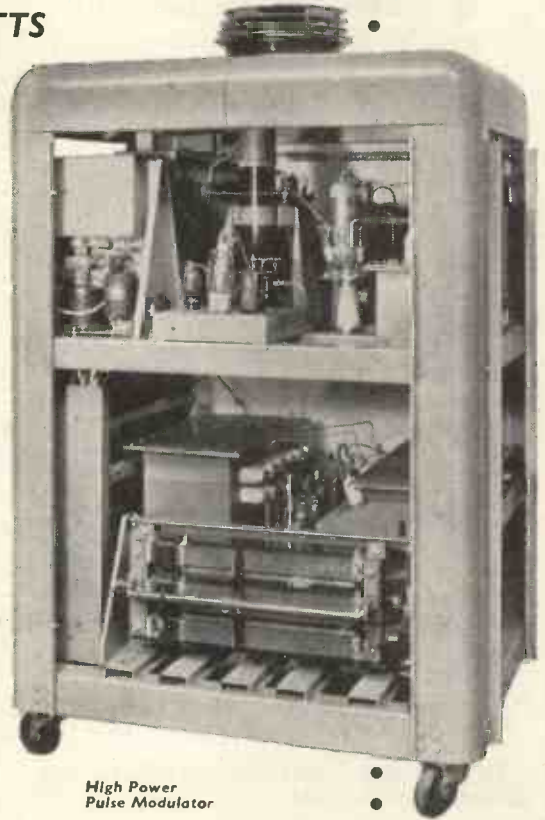
PEAK OUTPUT POWER 5 MEGAWATTS

THIS new high power modulator provides pulses of 2 microseconds duration at powers up to 5 megawatts. It is housed in two space-saving cabinets and incorporates extensive protection and metering systems. These features combine to make it an ideal equipment for testing magnetrons, operating very high power radar ground stations, and many nuclear research applications.

The normal pulse duration of 2 microseconds can be altered to meet particular requirements by simple adjustment of the delay line. Triggering is effected by a built-in generator, which gives pulse repetition frequencies of 100, 200, 350 and 500 pulses per second. The equipment may be triggered externally at any p.r.f. between 10 and 500 p/s.

The protection system of the equipment includes inter-locking devices for personnel safety, as well as devices that protect against possible damage through failure of the magnetron field, the magnetron filament, or the water cooling system. In addition, an extensive metering system makes the equipment virtually self-checking should a fault occur.

Abridged technical details of the Mullard high power pulse modulator are given below; more comprehensive information will be gladly supplied on request.



High Power
Pulse Modulator

ABRIDGED DETAILS

Output: 30-50 kV into 500 ohm load.

Pulse duration: 2 microseconds.

Pulse recurrence frequency: 10 to 500 p/s.

Water Cooling requirements: one litre per min.

Input: 400V, 50 cycles, 3 phase, 20kVA.

240V, 50 cycles, single phase, 5kVA.

Cabinet dimensions:

Modulator — 4' 6" x 3' 6" x 6' 6" high.

Control desk — 2' 7" x 3' 3" x 4' 6" high.



Control desk of Modulator

Mullard



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ALL-ROUND SUPERIORITY

Editor

SUITCASE
TAPE RECORDER



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- ★ LOW PRICE
- ★ MAINS OPERATED
- ★ FULLY AUTOMATIC
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- ★ FAST REWIND
- ★ HIGH FIDELITY PLAYBACK

Headlining the news about modern tape recording is the EDITOR SUITCASE TAPE RECORDER, made by TAPE RECORDER (ELECTRONICS) LTD. This exceptionally high quality low priced unit, embodying remarkable developments in chassis construction, is the smallest all-mains fully automatic tape recorder made. The operating height of only just over 5 inches is made possible by the ingeniously planned, compact circuitry, which is easily and quickly removed in a matter of seconds for inspection on an all steel frame.

★ Tape speed 7 1/2 in. per second. ★ Miniature valves. ★ Twin track heads. ★ Three high grade specially designed recording motors provide fast forward run and 50 sec. rewind without unloading tape. ★ Independent Bass and Treble Controls for recording and playback. ★ Negligible wow and flutter. ★ Overall negative feedback. ★ 1,200ft. reel of tape will provide ONE hour playing time. ★ Amplifier may be used independently for high quality record reproduction and public address. ★ High fidelity Record head. ★ Special high grade speaker. ★ Provision for external speaker. ★ Speaker muting switch. ★ Extremely high output and brilliant reproduction. ★ Positive servo braking on all functions. ★ Compact size for ease of handling, only 16 1/2 in. x 12 in. x 7 in. (with lid). ★ Magic eye recording indicator. ★ Weight only approx. 40 lbs. ★ 200-250 v. A.C. Mains.

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Goodsell PA2	£7	10	0	21/4	£2	10	0	11/8	W10CS (B)	£12	6	6	31/10	£4	2	6	16/11
Rogers Baby de Luxe	£14	0	0	35/6	£4	13	4	19/-	Golden 10	£7	13	3	21/8	£2	11	0	11/10
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Lowther A15F	£45	0	0	115/-	£15	0	0	58/4	Super 8CSAL	£6	13	3	19/5	£2	4	5	10/9
M.O.S. A8	£5	12	6	14/-	£1	17	6	8/3	Super 8CS.	£6	6	7	18/9	£2	2	2	10/1
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12in. Table	£7	14	0	21/-	£2	14	0	11/8	Ditto (with transformer)	£23	16	0	60/-	£7	19	0	30/9
12in. Console	£13	15	0	35/-	£3	15	0	20/-	10in. Concentric Duplex (less transformer)								
9in. Table	£6	3	9	17/8	£2	3	9	10/-	Ditto (with transformer)	£9	7	6	24/11	£3	2	6	13/9
9in. Console	£13	15	0	35/-	£3	15	0	20/-	Tweeter Unit	£10	15	6	28/-	£3	12	0	15/4
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GATHODE RAY TUBES, ETC.					GOODMANS												
MULLARD					Axiom 22					£14	14	0	37/6	£5	4	0	19/2
9in. (or Mazda)	£12	10	3	32/2	£4	3	6	17/2	Axiom 101	£6	12	1	19/2	£2	4	0	10/7
12in. (or Mazda)	£16	13	8	42/2	£5	11	3	22/-	Axiom 102	£9	18	0	26/5	£3	6	0	14/4
14in.	£19	9	3	49/2	£6	9	9	25/-	Axiom 150	£10	5	6	27/-	£3	8	6	14/9
17in.	£23	12	8	53/10	£7	17	6	30/3	Audiom 60	£8	12	6	23/6	£2	17	6	12/11
MW6-2 Projection	£8	6	10	29/0	£2	15	7	7/6	MICROPHONES								
BRIMAR					RONETTE												
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17in.	£24	13	6	62/-	£8	4	6	31/6	HM Hand with Filtercel Insert	£4	7	6	14/3	£1	7	6	8/-
English Electric 16in.	£22	4	10	57/-	£7	8	3	28/6	044 Burgoyne Desk	£2	15	0	9/4	—	—	—	—
E.M.I. 10in.	£14	18	11	38/-	£4	19	8	20/-	088 Ball with Filtercel Insert	£4	10	0	14/6	£1	7	6	8/3
GRAMOPHONE UNITS					G210 Streamlined Tilting Head with Filtercel Insert					£2	15	0	9/4	£1	7	6	8/3
B.S.R.					G210/L Streamlined Tilting Head with low impedance built-in Transformer					£5	2	6	15/6	£1	12	6	9/-
Monarch	£16	10	0	42/-	£5	10	0	21/8	088/F Ball mounted on Flexible Chrome Tube with Universal Joint	£6	19	6	19/3	£1	19	6	11/6
Regent (GU4/TOH)	£9	4	11	24/9	£3	1	4	13/3	GS210 Built-in on/off switches for G210 models 20/- extra on each type.	£6	19	6	19/3	£1	19	6	11/6
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MU15 78 r.p.m.	£3	0	0	10/-	£1	0	0	6/6	S742 Twin Microcell	£9	5	0	24/3	£2	7	6	14/6
GU4/DEH with 2 Decca XMS Heads	£12	18	0	33/-	£4	6	0	17/8	S752 Twin Microcell Studio	£9	19	6	26/6	£2	9	6	15/6
Connoisseur 3-speed	£21	7	3	54/2	£7	2	6	27/6	R572/L Twin Microcell Studio with low impedance built-in Transformer	£11	19	6	31/3	£2	19	6	18/4
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As above with Studio Pick-up	£18	4	9	45/3	£6	1	9	23/6	RESLO								
Conrad 334 r.p.m.	£2	5	0	7/9	15	0	0	4/6	R type Ribbon	£9	0	0	24/6	£3	0	0	13/4
GARRARD					ROTHERMEL												
RC75A (less head)	£13	8	4	34/8	£4	9	6	18/4	2AD56 Crystal	£2	9	6	9/-	—	—	—	—
RC80 (less head)	£15	11	0	39/6	£5	3	8	20/7	CARRIAGE & PACKING EXTRA. ALL ABOVE PRICES ARE EX WAREHOUSE.								
RC90 (less head)	£17	16	6	44/6	£5	18	10	23/6	MAIL ORDER								
201B5 Transcription	£22	11	8	57/3	£7	10	6	28/9	Telephone: MUSeum 6667. THE RADIO CENTRE.								
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RC75A AC/DC (less head)	£21	1	10	53/9	£7	0	8	27/9									
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S.G. BROWN																	
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Connoisseur Super Lightweight (2 heads)	£9	5	6	25/-	£3	1	10	13/6	No. 44 Sander	£12	10	0	32/5	£4	3	4	17/2				
Decca XMS (2 heads)	£6	9	3	19/-	£2	3	1	10/-	1in. Drill	£12	7	6	32/-	£4	2	6	17/-				
Leak Ruby 78 or L.P.	£11	11	0	30/-	£3	17	0	15/10	1in. Bench Stand	£5	10	0	16/8	£1	16	8	9/4				
Marconi T14 (with trans.)	£2	9	0	9/-	16	4	5/4	6in Electric Saw	£17	5	0	43/4	£5	15	0	22/6					
RONETTE					DEPTH AND BEVEL ATTACHMENT																
Miniweight (2 heads)	£3	9	6	11/11	£1	3	2	7/-	(Saw)	£1	18	0	—	—	—	—	—				
Miniweight (14,000 c/s.) (2 heads)	£3	16	3	12/10	£1	5	5	7/4	Rip Fence (Saw)	9	6	—	—	—	—	—	—				
RECORD PLAYERS					WOLF																
(less Amplifiers)					Flex. Shaft Grinder					£32	15	0	82/-	£11	15	0	40/3				
BURGOYNE					TEST EQUIPMENT																
Auto 3-speed					£16	10	0	42/-	£5	10	0	38/-	£5	0	0	20/-					
Non-Auto 3-speed					£9	5	0	25/-	£3	1	8	13/3	£19	10	0	49/-	£6	10	0	26/-	
DECCA					AVO																
37A					£12	1	6	31/3	£4	0	6	16/6	£10	10	0	27/6	£3	10	0	15/-	
33B					£8	19	6	24/-	£3	0	0	13/-	Signal Generator, Mains or Battery	£30	0	0	74/6	£10	0	0	79/-
Regentone Disc Player					£9	9	0	26/-	£3	3	0	14/-	Universal Bridge	£34	0	0	86/-	£12	0	0	42/-
RECORD PLAYERS					ADVANCE																
(with Amplifiers)					Audio Generator H.I.					£25	0	0	63/-	£8	6	8	33/-				
Decalcan					£34	18	10	88/-	£11	13	0	45/-	Signal Generator E.2	£28	0	0	70/-	£9	6	8	36/6
E.A.R.					Leather cases for 7, 8, 40 and heavy duty meters					£23	0	0	9/6	£1	0	0	5/-	£11	17	4	45/6
Music Maker Non-Auto					£19	15	0	49/3	£6	11	8	25/4									
Music Maker Auto					£24	17	6	62/-	£8	5	10	31/6									
Plus a Gram Danette					£32	1	1	80/3	£10	13	8	41/8									
Trixette A375					£37	16	0	95/2	£12	12	0	48/4									
Trixette A375 Universal					£47	5	0	120/-	£15	15	0	60/-									
Regentone P33					£30	9	0	76/9	£10	3	0	40/4									
RADIO RECEIVERS AND CHASSIS					TAYLOR																
BURGOYNE					20B Circuit Analyser					£15	15	0	40/-	£5	5	0	21/6				
RG1 Superhet 8 valve					£23	2	0	59/-	£7	14	0	29/-	44A Montrose Meter	£2	10	0	8/9	16	8	5/-	
RF1 Feeder Unit					£3	12	6	11/4	£1	4	2	6/4	45B Valve Tester	£25	10	0	64/-	£8	10	0	32/6
Chapman S5 Tuner					£21	6	8	54/2	£7	2	2	27/-	66A Signal Generator	£22	10	0	58/-	£7	10	0	30/-
Ekco Portable MBP149					£21	10	0	53/4	£7	3	4	27/6	70A Universal Meter, 1,000 o.p.v.	£12	10	0	32/2	£4	3	4	17/3
Goodsell SP Tuner					£19	5	0	49/2	£6	8	4	25/-	71A Universal Meter, 1,000 o.p.v.	£12	10	0	32/2	£4	3	4	17/3
Leak Tuner					£35	0	0	89/-	£11	13	4	46/6	72A Universal Meter, 1,000 o.p.v.	£16	0	0	40/6	£5	6	8	21/2
TRUCHORD					75A Universal Meter, 20,000 o.p.v.					£15	0	0	38/-	£5	0	0	20/6				
Model 101A					£19	8	5	49/2	£6	9	8	25/-	77A Universal Meter, 20,000 o.p.v.	£15	0	0	38/-	£5	0	0	20/6
Radio Unit for Grundig					£20	16	1	53/2	£6	18	8	27/-	85A/P Universal Meter, 20,000 o.p.v.	£19	10	0	49/-	£6	10	0	26/-
TAPE RECORDERS					88A Universal Meter					£21	10	0	54/6	£7	3	4	27/9				
and Accessories					90A Universal Meter					£15	15	0	40/-	£5	5	0	21/6				
Baird "Sound Master" Recorder					£68	5	0	171/-	£22	15	0	86/6	£14	10	0	37/-	£4	10	0	20/-	
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Sound Master KIT					£60	0	0	152/-	£20	0	0	79/-	COSSOR Tele-Check	£27	0	0	68/-	£9	0	0	35/-
Vortexion Recorder (Wearite Deck)					£84	0	0	213/-	£28	0	0	106/9	Portable Oscillograph 1039	£28	0	0	70/-	£9	6	8	36/2
Lane Tape Table					£17	10	0	42/10	£5	16	8	22/9	EVERSHED Wee-Megger	£20	14	0	52/-	£6	18	0	26/8
Truxox Tape Table					£23	2	0	59/-	£7	14	0	29/-	HUNTS Bridge	£14	14	0	37/6	£4	14	0	20/-
Wearite Tape Deck					£35	0	0	89/-	£11	13	4	46/6									
Burgoyne Oscillator Unit					£1	17	6	7/-	12	6	4/-										
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1in. Drill Kit					£12	3	0	31/5	£4	1	0	16/8									
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6AQ5	16/5	6X6G	13/3	EM1	16/5
6AT8	15/1	150Q(W4)	13/3	EM4	16/5
6AU6	22/1	AZ1	18/3	EM34	16/5
6BA6	16/5	AZ31	13/3	GZ34(GZ33)	18/6
6X4	13/3	AZ60(DW4)	13/3	EY31	25/2
6J6	31/6	OBL1	22/1	EZ40	13/3
68A7GT	20/2	CL4	20/2	EZ41	13/3
68K7GT	16/5	EY1	13/3	FX90	18/9
69Q7GT	16/5	EB41	11/4	FY82	13/3
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7E7	14/6	EB33	15/1	PL82	16/5
12A7T	22/1	EBL1	22/1	UBC41	15/1
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20B	15	10	0	2	7	3	1	10	2	17 8 11
45B	25	10	0	3	16	6	2	8	9	28 4 0
66A	22	10	0	3	7	6	2	3	0	24 17 6
71A	12	10	0	1	17	6	1	4	0	13 17 6
72A	12	10	0	1	8	0	1	8	0	11 14 8
77A	15	0	0	2	5	0	1	8	6	16 11 8
88A	21	10	0	3	4	6	2	1	2	23 16 2
110C	14	10	0	2	3	6	1	7	9	16 1 0
130A	9	0	0	1	7	0	1	17	3	9 19 8
130A	15	0	0	1	5	0	1	2	8	16 1 8
170A	24	0	0	3	12	0	2	9	11	26 11 2
190A	22	10	0	3	7	6	2	3	0	24 17 6
240A	14	0	0	2	2	0	1	6	9	15 9 6
260A	36	15	0	5	10	3	3	10	4	40 13 7
520A	10	0	0	1	10	0	1	19	2	11 1 8
290A	29	10	0	4	8	6	2	16	5	32 12 8

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C14BM 14"	20	10	0	T9/5 9"	12	10	3	TA15/15	15
C17BM 17"	24	13	6	T12/14 12"	16	13	8	TA15/15	17
COSSOR and EMITRON				T12/91 12"	16	13	8	MULLARD MWP/32 9"	
*ICPI Industrial	1	17	6	T14/2 14"	20	10	1	projection	8 6 10
12XP4 12"	16	13	0	G.E.C.				MW22/16	
12XP4 12"	16	13	0	6504A	9	13	11	1	19 10 3
14KP4 14"	19	9	3	6505A	9	13	11	1	12 10 3
15EP4 15"	20	17	0	6703A 12"	17	14	6	MW31/74	
17ASP417"	23	12	8	6901A 16"	23	5	8	12"	16 13 8
65K 15"	20	17	0	7101A 12"	17	14	6	MW36/22	
171K 17"	23	12	8	7102A 12"	17	14	6	14"	19 9 3
ENGLISH ELECTRIC MARCONI								MW36/24	
T900 18"	22	4	10	3/16 18"	14	18	11	14"	19 9 3
T901 18"	22	4	10	3/18 12"	17	14	6	MW41/1	
ELAC ION TRAPS	3/31	12"	17	14	6	16"	22	4	10 8
*Type 1T/6	5	0	0	3/32 13"	21	17	11	*Modelled B 1 2 A	
*Type 1T/9	5	0	0	TA10 10"	14	18	11	bases ca.	2 6

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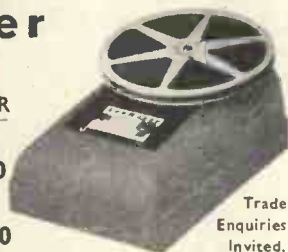
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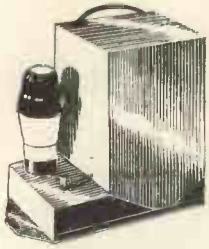
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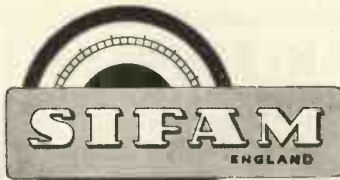
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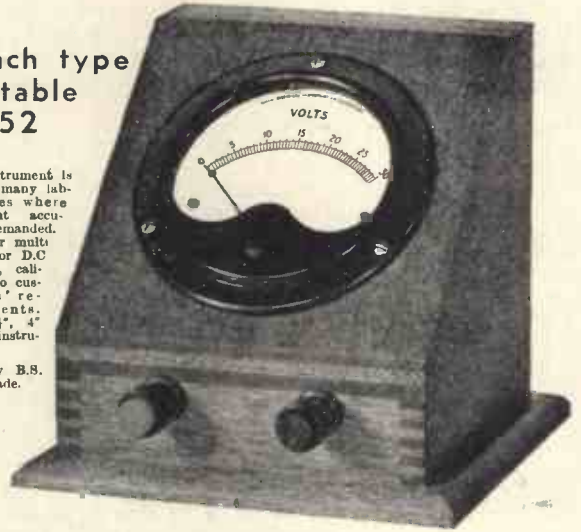
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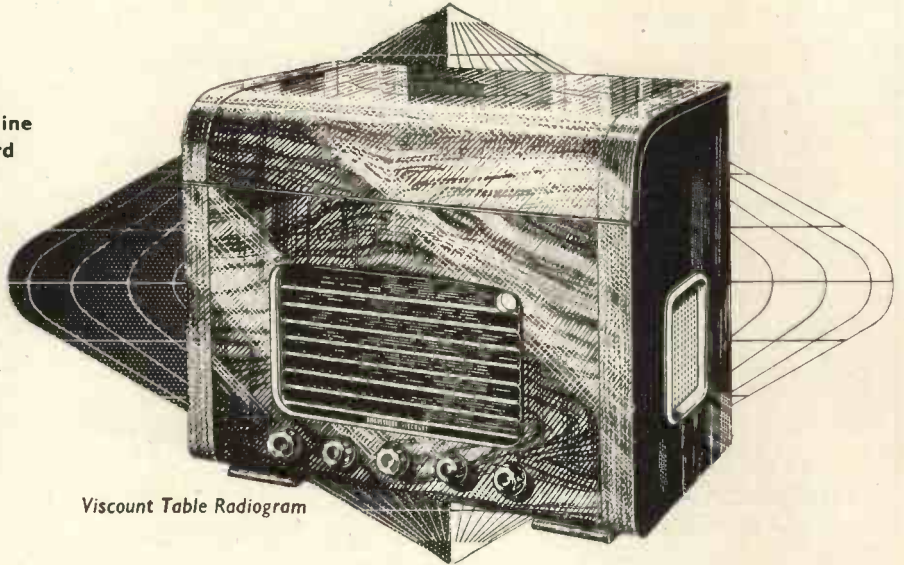
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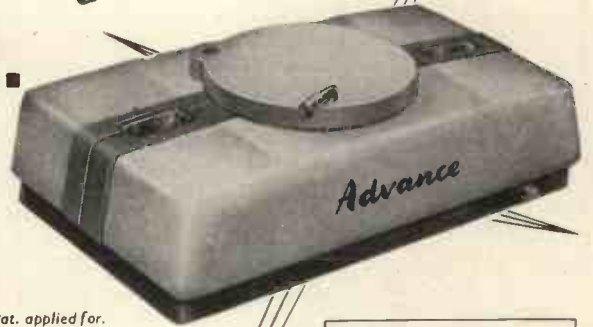
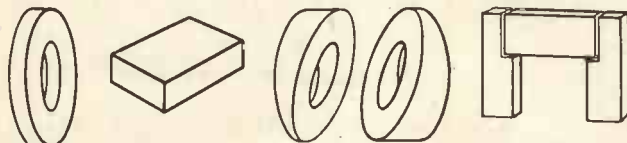
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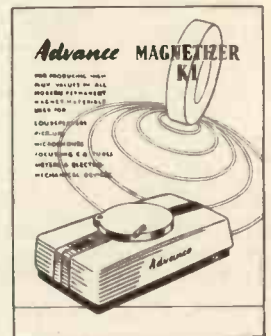
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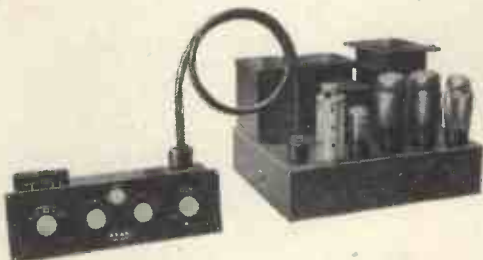
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Output ★ V.A.	Secondary Voltage V	Secondary Current A	No- Load Losses W	DESIGN						
				Panel Mounting			Bench Mounting			
				Type No.	Dimensions mm.			Type No.	Dimensions mm.	
				a	b	c	d	e		
260	0-260	1	6.8	84514	137	130	30	84515	137	165
520	0-260	2	9	84516	137	150	30	84517	137	185
1040	0-260	4	17	84518	187	190	30	84519	190	260
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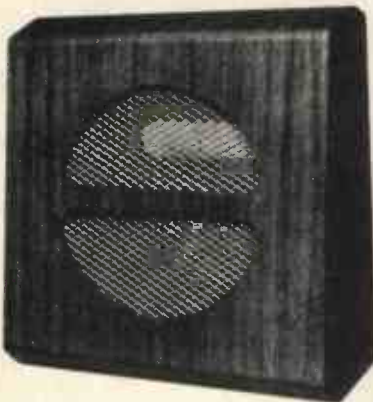
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BY THE CREATORS OF THE VIEWMASTER
 All components in stock. Write for list. Wearite, Bulgin, T.C.C., Collaro, etc.

GARRARD RECORD PLAYERS

For 6 and 12 v. operation, complete with magnetic pick-up and volume control. In metal cabinet size: 17in. x 14in. x 11in. Very limited quantity.
LASKY'S PRICE £5.19.6
 Carriage 10/- extra.



SENTERCEL RECTIFIERS

RM1 3/10
 RM2 4/3
 RM3 5/-
 RM4 18/-

WESTINGHOUSE RECTIFIERS

250 v. R.M.S.
 14A976. 80 m/a 8/6.
 14A86. 200 m/a 20/4.
 14A100. 270 v.R.M.S. 200 m/a. 21/6.

CONDENSERS. Elect. rolytics.

Can	Elect. rolytics	Tubular
16 mfd. 500 v.w. 3/6	1 mfd. 200 v.w. 1/-	1 mfd. 250 v.w. 9d.
24 mfd. 450 v.w. 3/11	2 mfd. 150 v.w. 1/-	2 mfd. 150 v.w. 1/-
32 mfd. 500 v.w. 5/11	2 mfd. 350 v.w. 1/6	4 mfd. 350 v.w. 1/3
60 mfd. 350 v.w. 3/6	4 mfd. 450 v.w. 1/8	8 mfd. 150 v.w. 1/8
64 mfd. 450 v.w. 4/11	8 mfd. 350 v.w. 2/-	8 mfd. 450 v.w. 1/9
8 + 8 mfd. 450 v.w. 3/11	8 mfd. 500 v.w. 2/3	15 mfd. 200 v.w. 2/-
8 + 16 mfd. 450 v.w. 3/11	15 mfd. 350 v.w. 2/3	16 mfd. 450 v.w. 2/9
8 + 32 mfd. 475 v.w. 3/11	16 mfd. 500 v.w. 3/3	16 mfd. 500 v.w. 3/6
16 + 8 mfd. 500 v.w. 4/6	32 mfd. 350 v.w. 4/9	32 mfd. 450 v.w. 4/6
16 + 16 mfd. 500 v.w. 4/6	32 mfd. 350 v.w. 4/6	250 mfd. 12 v.w. 2/-
16 + 24 mfd. 450 v.w. 4/11	32 mfd. 450 v.w. 4/9	250 mfd. 25 v.w. 2/11
16 + 32 mfd. 450 v.w. 4/9	50 mfd. 350 v.w. 4/6	8 + 8 mfd. 350 v.w. 3/-
20 + 20 mfd. 275 v.w. 2/-	250 mfd. 12 v.w. 2/-	8 + 8 mfd. 450 v.w. 3/11
32 + 32 mfd. 500 v.w. 4/11	250 mfd. 25 v.w. 2/11	12 + 12 mfd. 350 v.w. 2/6
32 + 32 mfd. 350 v.w. 3/11	8000 mfd. 3 v.w. 8/11	
60 + 100 mfd. 350 v.w. 7/6		
250 mfd. 350 v.w. 4/11		
8000 mfd. 3 v.w. 8/11		

MANY OTHER TYPES IN STOCK

SPECIAL T.V. CONDENSERS

32 + 100 mfd. 450 v.w. 7/6 .04 mfd. 12.5 Kv. 7/6

Bias	High Voltage
10 mfd. 25 v.w. 1/3	.1 mfd. 2.5 Kv. 2/6
12 mfd. 50 v.w. 1/3	1 mfd. 3 Kv. 3/6
25 mfd. 25 v.w. 1/6	1 mfd. 3.5 Kv. 4/6
25 mfd. 50 v.w. 1/6	1 mfd. 10 Kv. 12/6
50 mfd. 12 v.w. 1/3	.25 mfd. 2.5 Kv. 5/6
50 mfd. 25 v.w. 1/6	1 + .1 mfd. 3.5 Kv. 5/11
50 mfd. 50 v.w. 1/9	
75 mfd. 12 v.w. 1/-	
100 mfd. 25 v.w. 2/-	
100 mfd. 50 v.w. 2/6	

T.C.C. VISONCOL HIGH VOLTAGE CONDENSERS (Cathodray)

.001 mfd. 12.5 kv. 7/6
.001 mfd. 15 kv. 10/-
.001 mfd. 25 kv. 18/-
.0005 mfd. 25 kv. 18/-
.0005 mfd. 12.5 kv. 10/-
Plastic case, single bolt fixing. Other h.v. types.
1 mfd. 7 kv. 15/-
.04 mfd. 12.5 kv. 7/6

R.1155 RECEIVERS

BRAND NEW AERIAL TESTED BEFORE DESPATCH

These well-known ex-Air Ministry Receivers need no further introduction.
 Supplied complete with 10 valves.

LASKY'S PRICE £11.19.6
USED MODELS £7.19.6

A Few Only. Model R1155.N. Covering the shipping band of 1.5-3.0 Mc/s. Price £17.

Carriage 12/6 per unit extra, including 10/- returnable on packing case.

TOGGLE SWITCHES. BULGIN

S.P.S.T. 1/6
 D.P.S.T. 2/6
 D.P.D.T. 2/11
 Double pole change over 3/6

12 VOLT VIBRATOR UNITS

Output 230 volts 80 mA. BRAND NEW AND UNUSED. Size: 9 x 5 x 5 1/2in. Supplied less vibrator. Vibrator required is 6-pin synchronous.
LASKY'S PRICE 19/6
 Carr. 3/6 extra.
 Other types in stock from 15/-.

BRANDENBERG R.F. E.H.T. UNITS

Complete with valves.
 6-9 Kv. £6 6 0
 13-16 Kv. £9 9 0



Fully Assembled Power Pack and Output Stage, for R1155 Receiver. For use on 200-250 volts A.C. mains.
LASKY'S PRICE 79/6
 Carriage 5/- extra.

MUIRHEAD SLOW MOTION DRIVES 8/6

CRYSTAL DIODES
 Germanium 1/6 each, post free.

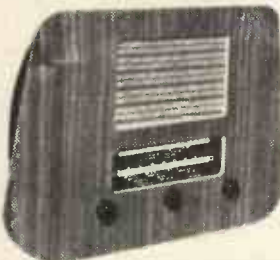
12 VOLT D.C. MOTOR GENERATORS

Output 300 volts at 150 mA. D.C. 7,500 r.p.m. Size: 2 1/2in. diam. 6in. long.
LASKY'S PRICE 17/6

I.F. TRANSFORMERS

465 Kc/s Iron dust cores in cans, midget type. Size 1 1/2in. x 1in. x 2 1/2in. By Plessey. Price 9/6 per pair.
WEARITE TYPE 550. 445-520 Kc/s. 10/- per pair.
WEARITE TYPE 500. 450-470 Kc/s. 10/- per pair.

BAFFLE RADIO CABINETS



Pleasing design, complete with knobs, drilled chassis, dial, drum drive and back. Finish in satin mahogany veneer, natural colour polish. Outside dimensions: 17 1/2in. wide, 11 1/2in. high, 5in. deep.

LASKY'S PRICE 36/6
 Carriage 2/- extra

A LASKY'S RADIO ADVERTISEMENT. SEE OVER.



R.1132.A RECEIVERS

Supplied in maker's original wood transit case. Frequency coverage 100-124 Mc/s. 11 valves: 1 VR65, 1 VR66, 4 VR53, 2 VR54, 1 6J5, 1 VS70, 1 VR57. Large tuning scale with slow motion drive. 0.5 mA. tuning meter. R.F. and L.F. gain controls, jacksockets for line and 'phone. Totally enclosed in metal case, grey enamelled with plated handles. Size: 18 x 10 x 11in. Supplied with all valves, also circuit and calibration chart.
GRADE 1. Brand New 79/6. GRADE 2. Soiled 49/6. GRADE 3. Secondhand 39/6. Carriage 10/- per unit extra.

TWO-GANG TUNING CONDENSERS .0005MFD.

No. 1. Miniature. With Perspex dust cover and trimmers. Size: 1 1/2in. x 2in. x 1 1/2in., 1/4in. spindle.
LASKY'S PRICE 8/6.
 No. 2. Midget. With trimmers. Size: 2 1/2in. x 1 1/2in. x 1 1/2in., 1/4in. spindle.
LASKY'S PRICE 8/6.
 No. 3. Midget. Less trimmers. Size: 2in. x 1 1/2in. x 1 1/2in., 1/4in. spindle.
LASKY'S PRICE 6/6.
 No. 4. Standard type. Size: 2 1/2in. x 2 1/2in. x 1 1/2in., 1/4in. spindle.
LASKY'S PRICE 6/6.



LINE TRANSFORMERS FOR "ETRONIC" T.V. RECEIVERS

No. 1. For models 1536 and 1637. Complete with EY51 rectifier, 39/6.
No. 2. 7Kv. type, 35/-.

POT/METERS. All values. Wire Wound from 3/6. Depending on wattage and length of spindle. Carbon. Less switch 3/3 each With s.p. switch 4/3 each With d.p. switch 5/6 each

VCR97 C.R. TUBES, new unused. 35/- Carriage 5/-.

EHT. Trans. For VCR97. 2.5 Kv, and 4v 1.1a and 4v 1.5a (CT). 45/-.

Screen enlarger for VCR97. Filter type, 17/6. Postage 2/6.

BASES for VCR97. 2/6.

C.R.T. Neck Protectors. 2/6.

10 K.V. METROSIL E.H.T. REGULATORS. By Metrovick. Pencil type, 5/- each.

TELEVISION SELENIUM RECTIFIERS

The very latest "Sentercell" S.T.C. range.
K3/40, 3.2 kv. 7/6
K3/45, 3.6 kv. 8/2
K3/50, 4.0 kv. 8/8
K3/100, 8.0 kv. 14/8
K3/160, 12.8 kv. 21/6

DARK SCREEN FILTERS
18in. x 14 1/2in. 25/-
14 1/2in. x 12in. 19/6
13 1/2in. x 11in. 14/11

PERSPEX. 13 1/2in. x 10 1/2in. x 1/2in. Neutral shade, slightly marked, 4/11 per piece.

TEST PRODS

Fully fused, with retractable points, 4/11 per pair (1 red, 1 black).

9in. TABLE T.V. CABINETS



Medium shade mahogany finish. Complete with back, safety glass, speaker-fret. Internal dimensions: 19 1/2in. high, 16in. wide, 14in. deep.
LASKY'S PRICE 39/6 Carriage 7/6 extra.
Adaptor frame available for 6in. C.R. tubes. The aperture can easily be enlarged to take 12in. or 14in. tubes.

SPECIAL C.R.T. OFFER

Brand new and unused 12in. ion trap cathode ray tubes. 6.3 volt heater, 7-9 Kv. E.H.T. 35 mm. neck. Black and white picture. By famous manufacturer.

PERFECT £12/19/6
Carriage and insurance 15/- per tube extra.

SECOND HAND C.R. TUBES. A few only, with either ion burns and/or heater cathode shorts.
PERSONAL CALLERS ONLY. 9in. 35/-; 10in. 45/-; 12in. 55/-.

MANUFACTURERS' SURPLUS T.V. COMPONENTS

Wide Angle Scanning Coils. Low imp. line and frame ... pair 19/6
Scanning Coils. 35 mm. Low imp. line and frame 12/6
Frame multi ratio output trans. 10/6
Focus Coil. 35 mm. electro magnetic ... 12/6
P.M. Focus magnets. With Vernier adjuster. For all 35 mm. tubes 19/6

PLESSEY
Scan coils per pair 25/-
Width Control 6/6

NOW AVAILABLE LARGE SCREEN WIDE ANGLE CONVERSION DETAILS FOR THE VIEWMASTER

Send 3d. stamp for full data. Fully itemised price list of all Viewmaster components now available.

Co-Axial Cable. 70-80 ohms impedance.
Single core, 9/- doz. yards.
Twin core, 12/- doz. yards.
Twin feeder, 6/- doz. yards.
Co-Axial Connectors.
For standard 1/4in. cable, 1/11.

WIREWOUND POT/METERS.

Type 901. Most values. 2/6 each.

C.R.T. MASKS Brand New LATEST ASPECT RATIO

9in. 7/-
10in. 7/6
12in. 15/-
12in. Flat Face ... 15/-
12in. Old ratio ... 9/6
12in. Plastic, with dk. sc. filter and gold finish escutcheon ... 17/6
14in. Rectangular ... 21/-
16in. Eng. Elect. 42/-
16in. Double D ... 31/6
16in. With dark screen filter and gold finish escutcheon 32/6
17in. With dark screen filter and gold finish escutcheon 37/6
17in. Rectangular ... 21/-

SOILED. NEW ASPECT RATIO

9in. 5/-
12in. 7/6
12in. with fitted armour plate glass, cream 11/6
12in. do. Black 8/6

ARMOUR PLATE GLASS

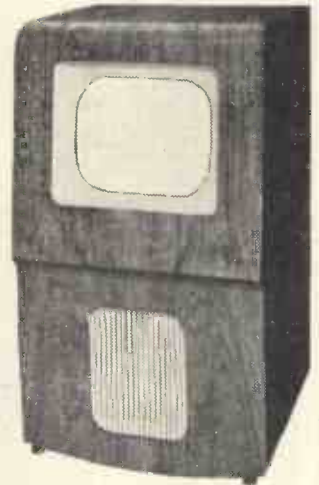
16in. Actual size 17 1/2 x 15 1/2 x 1/2 inch 7/11
15in. Actual size 16 1/2in. x 13in. x 1/2in. 6/11
12in. Actual size 13in. x 10 1/2in. x 1/2in. 4/-
9in. Actual size 9in. x 8in. x 1/2in. 3/-

DE LUXE T.V. CABINETS

NEW 1954

12 INCH MODEL

(Mark II)



This cabinet is now supplied complete with mask, glass, castors, shelf, bearers, c.r.t. neck end protector, back, speaker fret and baffle board. Finished in beautiful figured medium, light or dark walnut veneer, with high polish. Suitable for most home constructor T.V. receivers, including the "Viewmaster," "Practical Television," "Tele King," "Magniview," "Wireless World," etc. Can be supplied with cut-out for 16in. c.r. tube at no extra cost.

WHY NOT CONVERT YOUR TABLE RECEIVER TO A CONSOLE MODEL

Adaptor frames for fitting 9in. or 10in. c.r. tubes can be supplied if required.

LASKY'S PRICE £8.10.0
Carriage 12/6 extra.

An allowance of 4s. 6d. will be made if the mask is not required.

Mask and glass extra when cabinet is ordered with cut out for 14, 16 or 17 in. C.R.T.'s.

Inside Dimensions: Depth 16 1/2in.; width 17 1/2in.; height 28in. Overall height 32in. and width 18 1/2in.

THE VIEWMASTER

Construction envelope 7/6 **POST FREE.**
All components in stock. Write for price list.

COLLARO 3-SPEED AUTOMATIC RECORD CHANGERS

MODEL 3RC/321.

Brand new and unused in maker's original carton. Pleasing cream finish. Complete with hi-fidelity studio crystal turnover head. Type GP. 29.

LASKY'S PRICE £9.19.6
Carriage Free.



NOW IN STOCK. 3-Speed Mixer Changer model 3RC/522. Price on request.

TYPE AT/9 T.V. MAINS AUTO TRANSFORMER

200, 220, 250 and 375 volt tappings, 250 mA. Also 5 v. 1 a.; 6.3 v. 7a., and 6.3 v. 3 a. secondaries. Price 25/-.

LASKY'S

Lasky's (Harr

370 HARROW ROAD, PA

(Opposite Paddington

MAIL ORDER & DESPATCH DEPARTMENTS

Telephones: CUNningham

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THE TELE-KING

A practical 5-channel SUPERHET TELEVISION RECEIVER

Using the new 16 and 17 inch cathode ray tubes and wide angle components for the home constructor. Complete instructions, wiring diagrams and 32-page descriptive booklet.

6/- POST FREE

ALL COMPONENTS IN STOCK
WRITE FOR LIST

ALLEN WIDE ANGLE COMPONENTS

D.C. 300 latest type Ferroxcube Coils ... 39/6
GL. 16 Coil 7/6
GL. 18 Coil 7/6
Focus Coil 31/-
FO.305 trans. ... 21/-
Frame B.O. transformer 15/-
Line EHT. transformer, 40/-

CHASSIS

Power pack Sound-vision and Scan chassis. PRICE 11/- each. All other metal work available from stock.
CONDENSERS
All condensers as specified. Manufacturers' surplus £3/16/-
COILS 13 all exactly as specified. Price 44/6.

RESISTANCES. 72 Resistances, all exactly as specified, 18/-.

CABINET
Walnut veneer, £8/10/-, plus carriage 12/6 extra. As illustrated here.

WIDE ANGLE CATHODE RAY TUBES

14in. MW36-22 ... £19 9 3
14in. C14B ... £20 10 1
16in. MW41-1 ... £22 4 10
16in. T901 ... £22 4 10
17in. MW43-64 ... £23 12 8
17in. C17BM ... £24 13 0
Carriage and insurance extra.

OUTPUT TRANSFORMERS

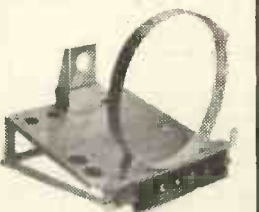
40 mA Multi ratio ... 4/11
80 mA Multi ratio ... 14/11
80 mA Pentode ... 12/6
60 mA Plessey, 6,000 ohms 5/11
Standard pentode ... 4/11
Pentode ... 3/6
Midget Pentode ... 3/6
Miniature Pentode, 354, 1S4 4/6
PX4 Intervalve ... 8/6
5:1 Intervalve ... 5/11

P.M. LOUDSPEAKERS

All with 3 ohm speech coil.
2 3/4in. 15/- 6jin. 13/6
3in. 12/6 8in. 15/-
4in. 9/6 10in. 17/6
5in. 14/6
NEW AVAILABLE 12 inch Goodmans heavy duty speaker. Capacity 15 watts, 15 ohms speech coil impedance.
LASKY'S PRICE £5/19/6. Car. 3/6 ex. All loudspeakers offered are first grade and of highest quality construction. Many other types in stock. Send us your reqts.

LASKY'S T.V. CONSTRUCTORS' PARCELS

No. 1. All brand new components by Igranic. Comprises E.H.T. flyback line transformer, 7-10Kv. with ferroxcube core and rectifier heater winding; scanning coils; frame output transformer; Elac focus unit with vernier adjuster, U37 E.H.T. rectifier and brand new 12 inch cathode ray tube with ion trap, mask and glass. **LASKY'S PRICE FOR THE COMPLETE PARCEL** £15/19/6. Carriage and insurance 15/- extra.



No. 2. The Constructors' Parcel as above, but less the cathode ray tube and ion trap. **LASKY'S PRICE** 79/6. Carr. 3/6 extra.

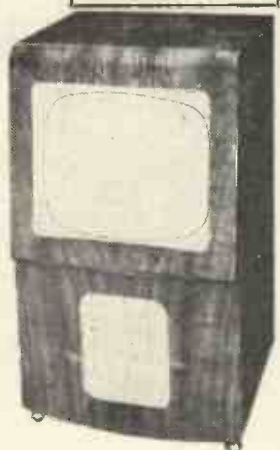
No. 4. Complete set of metal-work, as illustrated here. Un-assembled. Comprising main chassis, tube supports and valveholders. (Less sound-vision chassis). **PRICE** 25/- . Carriage 3/6 extra.

No. 3. Condenser Parcel. 1 of each:—.04mfd. 12.5kv; 32 +32mfd. 350 v.w.; 32+100mfd. 450 v.w. AND 24 1,000pf. ceramic tubes; 6. 1mfd. 500 v.w.; .01mfd. 500 v.w. ALSO 12 assorted "pf" condensers of your own choice. **PRICE** 45/- . POST FREE.

No. 5. **RESISTANCES.** 1 Watt. 85 resistances your choice. **PRICE** 18/- POST FREE.

No. 6. One of each of the following:—Ion trap IT6; Duodecal tube holder; low impedance line and frame scanning coils. **PRICE** 15/- . Postage 1/6 extra.

Alexandra Palace, Sutton Coldfield, Holme Moss, Wenvoe, Pontop Pike, Belfast, Kirk o'Shotts.



NOTICE TO ALL PURCHASERS OF THE ENGLISH ELECTRIC 16 inch C.R.T. TYPE T.901
The first and only reconditioning service. By English Electric. A reconditioned 16in. metal tube costs £12 and carries maker's full guarantee. Write for further details.

MAINS TRANSFORMERS

All 200-250 v. 50 c.p.s. primary. Finest quality, fully guaranteed. M.B.A./3. 350-0-350 v. 80 mA., 6.3 v. 4 a., 5 v. 2 a. Both filaments tapped at 4 volts. An ideal replacement trans. Price 18/-
MBA/6. 325-0-325 v. 100 mA. 6.3 v. 3 a., 5 v. 2 a. With mains tapping board. Price 22/6.
MBA/7. 250-0-250 v. 80 mA., 6.3 v. 3 a., 5 v. 2 a. Both filaments tapped at 4 volts. Price 18/-
AT/3. Auto transformer. 0-10-120, 200-230-240 volts 100 watt. Price 17/6.

FILAMENT TRANSFORMERS

6.3 v. 1.5 a., 5/9.
6.3 v. 3 a., 9/6.
6.3 v. tapped at 4 v. 2 amps., 7/9.
Special Transformer. 2 amps., with the following tappings; 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24 and 30 volts. Price 17/6.

SMOOTHING CHOKES

20 mA 40 H ... 3/6
40 mA 8 H ... 3/6
40 mA 10 H ... 4/3
100 mA 10-20 H ... 7/3
250 mA 10 H ... 18/6

THE "UNIVERSAL" LARGE SCREEN AC/DC TELEVISOR

By A. S. Torrance, A.M.I.P.R.E., A.M.T.S.

A 28 page booklet giving full instructions for building a large 17 inch screen televisior.

- * A.C. and D.C. mains.
- * P.M. Yocussing.
- * Mullard valves and c.r. tube.
- * 5-channel superhet.
- * Table model.
- * Convertible into radiogram console.
- * Incorporates all latest developments.

3d. POST FREE.

No. 7. One of each T.V. Mains auto-transformers (type AT/9), 60+100mfd. 350 v.w. condenser; 5H 250 m/a choke; 14A100 rectifier. **PRICE** 60/-, Carriage 2/6 extra.

SPECIAL THIS MONTH. BLACK & DEKKER "HANDY UTILITY"

Drill ... £5 19 6
Bench stand ... £2 10 0
Drill stand ... 15 0

DUOMAG FOCALISER

Low Flux ... 37/6
Med. Flux ... 39/6
High Flux ... 42/-

POSTAGE STAMP TRIMMERS

Paxolin. Up to 100pf. 6d. each. 5/- per doz.
Ceramic. Up to 100pf. 9d. each. 7/6 per doz.
350 and 550pf. Ceramic 1/- each. 10/6 per doz.

Duodecal (B12A) bases. VCR139 c.r.t. bases. 1/- each. 10/6 dozen.

RF25 UNITS. New, with valves, 19/11. Carriage 2/6.

COIL PACKS
Medium and 2 short wave bands. Price 16/-.

COIL PACKS
Long, medium and short wave bands. 29/6.

LASKY'S LINE TRANSFORMER

RF.EHT for line fly-back. 6-8Kv, with EY51 heater winding. Suitable for home construction T/V 25/-.

INTERCOM UNITS

4-station operation. For use on A.C./D.C. mains 200-250 volts. Supplied complete, with 3 new valves, ready for immediate installation. Fitted in attractive plastic cabinet.

Suitable for use as baby alarm. **MASTER UNIT £5.19.6**

Carr. 5/- extra. Extension Units. Price 21/- each complete. Carriage 2/- each extra.

RADIO

Low Road) Ltd., PADDINGTON, LONDON, W.9

(Hospital) 85/487 Harrow Road, Paddington, London, W.10 979 and 7214. All Departments.

TERMS: Pro Forma, Cash with order, or C.O.D. on post items only. Postage and package on orders value £1-1/- extra, £5-2/- extra. £10-3/6 extra. Over £10 carriage free. All goods fully insured in transit.

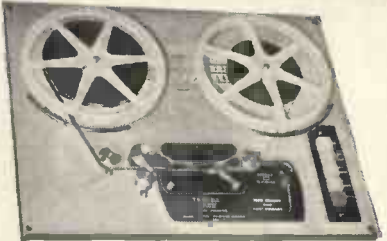


5 Harrow Road, Paddington, W.2

Paddington 1008/9 and 0401
OPEN MONDAY to SAT. 9-6. THURS. 1 o'clock.

TRUVOX TAPE DECK MARK III

Incorporating high impedance mu-metal twin-track heads. Two-speed capstan, for tape speeds of 7½ and 3½ inches per second. Three heavy-duty motors allowing for fast forward and rewind facilities without tape handling. All controls operated by electrically and mechanically interlocked push buttons.



Price £23/2/-, carriage free. (Available from stock).

RADIO-GRAM CHASSIS
3 Wave-band Superhet. Med., long and short.
5 Latest Type MULLARD Valves.
4 Position Switching. Gram., med., long and short.
Provision for A.C. Mains
Extension Speaker 110/250 volts.
Chassis 11in. x 7in. x 2½in. Scale 8in. Square.
Or Chassis 13½in. x 6½in. x 2½in. Dial 10in. x 5½in.
PRICE £10/5/-
BRAND NEW AND GUARANTEED CARR. PACKING AND INS. 10/-.

SEND STAMPS FOR NEW 1953 28-PAGE CATALOGUE

★ TAPE-DECK AMPLIFIER AND POWER UNIT ★
This unit is specially designed for the "Truvox" unit and we believe this quality amplifier lifts tape recording from the novelty, into the quality class.

AMPLIFIER SPECIFICATION :
★ 2-6BR7, 2-6V6GT, 1-6J5, 1-6U5G ★ Variable selective negative feed back circuits ★ Variable tone control ★ Magic eye level indicator ★ Four watts undistorted output ★ Amplifier complete with valves, £13/5/-.
Chassis size 10in. x 6in. x 2½in.

POWER UNIT (AC200/250 volts)
Chassis size 9in. x 5in. x 2½in., complete with 5Z4 £4 15 0
Amplifier and Power Unit complete £16 16 0
COMPLETE KIT OF PARTS for Amplifier, Power Unit..... £13 10 0

CALL FOR DEMONSTRATION OR SEND FOR FULL DETAILS

PYE 45 M/CS. STRIP, TYPE 3583 UNITS
Size 16in. x 8in. x 2in. Complete with 45 Mc/s. Pye Strip, 12 valves, 10 EF50, EB34 and RA50, volume controls and hosts of Resistors and Condensers. Sound and vision can be incorporated on this chassis with minimum space. New condition. Modification data supplied. Price £5. Carriage paid.

6 WATT AMPLIFIER (UNDISTORTED)
Manufactured by Parmeko and Sound Sales for Admiralty. 4 valves, PX25, 2-AC/HL, MUI4. Output Matching and 3Ω and 15Ω, 100/250 v. A.C.
COMPLETE IN STEEL GREY AMPLIFIER CASE.
£12/10/0
CALL FOR DEMONSTRATION

COLLARO AUTO-CHANGER
Type RC3/521. 3-speed, complete with 2 crystal heads, £9/19/6, carr. free.

AMERICAN 12 v. DYNAMOTOR
Output 250 volts. 60 mA. Weight 5 lb. Suitable for Car Radio or Electric Razors. 22/6.

VCR139A. 2½in. C/R Tube Brand new in original cartons 35/-, carr. free.

PHOTO CELLS CMG25. Brand new, 25/-.

T.V. PRE-AMPLIFIER FOR LONDON AND BIRMINGHAM. Complete with 6AM6. Ready to plug in to your set, 27/6. P.P. 2/6.

INDICATOR UNIT TYPE SLC5
This Unit is ideal for conversion for a "Scope Unit" or basis for Midget Television. It contains C/R Tube type ACR10 (VCR193A) complete with holder and cradle, also earthing clip. 1-VR66, 2-VR65, 24 mfd. 550 v. wkg. condenser, potentiometers and a varied assortment of resistors and condensers. These Units are in new condition and packed in wooden transit cases. The C/R Tube will be tested before despatch. Dimensions: 8½in. x 6½in. x 11½in., 45/-.

STROBE UNITS. Brand New, in sealed cartons, these contain 6 EF50s, 5 EA50s, 1 8P61, a host of condensers, resistors, transformers, chokes, relays, switches, 7 pots, and 5 smoothing condensers. Size 18in. x 8½in. x 7½in. Only 59/6.

BOWTHORPE CONTINUITY METER
Dual scale 0-500 ohms and 100-200,000 ohms moving coil operated from 4½-volt internal battery. Size 6in. x 3in. x 4in. Original price £8/19/-. Our price, brand new, £3/5/-.

INDICATOR UNIT TYPE 182A
Unit contains VCR517 Cathode Ray 6in. tube, complete with Mu-metal screen, 3 EF50, 4 8P61 and 1 5U4G valves, 9 wire-wound volume controls and quantity of resistors and condensers. Suitable either for basis of television (full picture guaranteed) or Oscilloscope. Offered BRAND NEW (less relay) in original packing case at 67/6. Plus 7/6 carr.

VOLTMETERS

15 v. (50 c.) A.C. M.I. 2½in. flush panel mounting	10/-
20 v. M.C. 2in. square panel mounting	7/6
150 v. M.C. 2½in. flush panel mounting	10/-
3,000 v. M.C. 2½in. flush panel mounting	21/-
4,000 v. M.C. 2½in. flush panel mounting	21/-
3,500 v. M.C. 3½in. Projection	21/-

RECEIVER R1355. As specified for "Inexpensive Television." Complete with 8 valves VR65 and 1 ca. 5U4G, VU120, VR92. Only 29/6, carriage 5/-. Or brand new in original packing cases 55/- carriage 5/-. RF, 25/-; RF25, 25/-; RF26, 59/6; RF27, 59/6.

VIBRATOR PACKS

Input 6 v., Output 150 v., 40 mA.	25/-
Input 6 v., Output 180 v., 40 mA. (ex 21 set)	17/6
Input 200 v., Output 200 v., 80 mA. (Masteradio)	50/-
Input 12 v., Output 300 v., 100 mA.	30/-
6 v. Vlb. Trans. 250 v., 80 mA.	7/6

MILLIAMMETERS

500 Microamp M.C. 2in. round panel mounting	15/-
1 mA. M.C. 2in. square panel mounting	12/6
1 mA. M.C. 2½in. flush panel mounting	22/6
5 mA. M.C. 2in. square panel mounting	7/6
10 mA. M.C. 2½in. flush panel mounting	10/-
30 mA. M.C. 2in. round panel mounting	7/6
30 mA. M.C. 2½in. flush panel mounting	10/-
50 mA. M.C. 2in. square panel mounting	7/6
200 mA. M.C. 2½in. flush panel mounting	10/-
300 mA. M.C. 2½in. flush panel mounting	10/-
500 mA. M.C. 2½in. flush panel mounting	12/6

RECEIVER UNIT TYPE 159. Size 8in. x 6½in. x 4½in., containing VR91, VR92, CV66, VR65 and 24 v. selector switch. New condition, 15/-.

THE COLLARO Model A.C. 514 Record Player £3/19/6 (Plus 5/- carr. and ins.)
RIM DRIVE 78 r.m.p. complete with the COLLARO Plug-in type MAGNETIC HEAD and 10 inch TURNTABLE. These are COMPLETE BRAND NEW UNITS for A.C. Mains 200-250 Volts.

AMP-METERS

1 amp T.C. 2½ Projection	7/6
3 amp. T.C. 2in. square panel mounting	7/6
6 amp. T.C. 2½in. flush mounting	7/6
20 amp. M.I. 2½in. round	10/-
15 amp. M.I. (50 c.) Projection	35/-
300 volts 50 cy. A.C. 5in. dial projection type	50/-

M.C. = Moving Coil. M.I. = Moving Iron.
T.C. = Thermo-Coupled.
All Meters are Brand New and in original cartons.

WALKIE-TALKIE TYPE "48," complete with 6 valves, 2VP23, HL23 DD, QP25, TP25 and ATP4, aerial rods, I.F. trans., 1.6 Mc/s. mike trans. in new condition, but less transmitting components and coils removed by M.O.S., 30/-, carr. paid. (Less valves, 10/-)

VCR517C BLUE & WHITE 6½in. TUBE
This tube replaces the VCR97 and VCR517 without alteration and gives a full blue and white picture. Brand new in original cartons 35/-, carr. free. Three Months' Guarantee.

CATHODE RAY TUBES

VCR97. Guaranteed full TV picture (carr. 2/-)	£2 0 0
VCR157. Guaranteed full TV picture (with mu-metal screen)	£2 0 0
3BP1, with shield suitable for TV or scope (carr. 1/6)	£1 5 0
MU-METAL SCREENS for VCR97 or 517. P.P. 1/6	10 0
6in. ENLARGER for VCR97 or 517. P.P. 1/6	17 6

SHADED POLE MOTORS
A.C. 200/250 v. 50 cycles, 2,000 r.p.m. Ideal for Tape Recorders, Gram. Motors, Timing Mechanisms, or Switch Movements, etc. Size 2½" x 3½" x 2½". Brand new, 10/6 each.

VR91 (EF50). Brand new Red Sylvanian, original boxes 10/-
British types, brand new and boxed 8/6
VR91 (EF50). Ex-brand new units, 5/-, or ten for 45/-
FX25, 12/6. Matched FX25's at 25/- per pair.
Raytheon CK510AX Sub-Miniature Valves, brand new, 5/- GU60, 12/6.

WANTED
723 A/β and CV129 Klystron Valves, 9002, RL18, NR88. Any quantity.

No. 38 "WALKIE TALKIE" TRANS-RECEIVER, complete with Throat Mike, phones, Junction Box and Aerial Rods in canvas bag. Freq. range 7.4 to 9 Mc/s. Range approx. 5 miles. All units are as new and tested before despatch, £4/10/-.

You're **SURE** to get it at
STERN'S
ESTABLISHED 25 YEARS

SELENIUM RECTIFIERS

6 or 12 Volt 1 amp. rating	7/6
6 or 12 Volt 2 1/2 "	12/6
6 or 12 Volt 4 "	17/6
6 or 12 Volt 6 "	£17/9

THE WILLIAMSON AMPLIFIER

We have the complete range of specified Components in stock for this famous quality Amplifier. Enquiries are welcomed and immediately dealt with. The complete assembly instructions and diagrams are available for 3/6.

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 "Aldry" 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 "Aldry" Battery Superhet Personal Set which can then be accommodated in the attache case as illustrated (size 9 1/2 in. x 4 1/2 in. x 7 1/2 in.), this is attractively finished in lizard, maroon, dark green or blue resin, or (b) as a combined Mains/Battery Superhet Portable Receiver, for which a polished 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. transf. and drilled chassis, etc. Overall size of assembled chassis 8 1/2 in. x 4 in. x 2 1/2 in. This receiver, as illustrated, can be completely built for approx. £10 (plus Mains Unit if required). Send 1/9 for the fully descriptive Assembly Book which includes Practical Layouts and complete price list of Components. Attache case available separately. 37/6.

"PERSONAL SET" BATTERY ELIMINATOR

A complete Kit of parts to build Midget "Aldry" Battery Eliminator, giving approx. 69 volts and 1.4 volts. This eliminator is for use on A.C. mains and is suitable for any 4-valve Superhet Receiver requiring H.T. and L.T. voltage as above, or approx. to 69 volts.



The Kit is quite easily and quickly assembled and is housed in a light aluminum case, size 4 1/2 in. x 1 1/2 in. x 3 1/2 in. Price of complete Kit with easy-to-follow assembly instructions, 42/6. In addition we can offer a similar COMPLETE KIT to provide approx. 90 volts and 1.4 volts. Size of assembled unit 7 in. x 2 1/2 in. x 1 1/2 in. Price 47/6.

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, 25/5-/. Ditto including dial and drive assembly, 28/-. To construct the complete set, including dial and drive assembly and cabinet, 27/5/6. Overall size of cabinet is 7 1/2 in. x 3 1/2 in. x 1 1/2 in. 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.



"MINI-TWIN"

1-VALVE BATTERY SET



A design of a simple 1-valve 2-stage Battery Receiver, giving excellent results on medium and long wavebands and having exceptionally low battery consumption. Drilled chassis and practical diagrams make it the ideal set for the beginner to build. The complete chassis, including valve, can be built for 37/6 Plus 5/11 P.Tax. the attractive plastic case is 9/6, and suitable headphones 14/9. The complete assembly instructions, layouts and a component price list, are available for 1/6. This Receiver also performs excellently, without modification, as a tuning unit, and, in addition, with simple modification for which a complete diagram is provided, makes a first-class pre-amplifier for pick-up or microphone.

A DUAL CHANNEL PRE-AMPLIFIER and TONE CONTROL UNIT

This comprehensive PRE-AMPLIFIER and TONE CONTROL UNIT provides full control of bass and treble in conjunction with a main Volume/Mixer Control.



It can be used with any amplifier and with any pick-up, the range of frequency control provided by the unit affording ample compensation for all types of pick-up and all natures of recordings, i.e., English, American and long-playing, without recourse to pick-up correction. The extreme flexibility of the bass and treble controls is such that the level of bass and treble can be set to suit any conditions irrespective of the volume output of the amplifier. Response characteristics are given in 12-watt amplifier advt. The unit measures only 7 in. x 4 in. x 2 in., including self-contained power supply, and can be accommodated either on or away from the main amplifier, i.e., on the front panel of a cabinet or any other position. Price, including drilled chassis, valves (6B7 and 6X5), £3/16/6. Complete assembly data is available separately for 1/-. Completely assembled and ready for use. 25/5/-.

A Famous Manufacturer's SHADED POLE GRAM MOTORS 10/6

(Plus 1/- carr. and ins.) Clockwise rotations and incorporates a Mains Adjustment Panel. Could also be used as Recording Take Up or Rewind Motor.

A COMPLETE

"CAR RADIO" FOR THE HOME CONSTRUCTOR



11" x 4 1/2" x 3 1/2"

A design of a complete 5-VALVE SUPERHET RECEIVER employing an R.F. Stage and incorporating a separate VIBRATOR PACK size 4 1/2 x 2 1/2 x 6 1/2 in. for use on 6 or 12 volt D.C. supplies. We can supply all components to build this complete Receiver and Vibrator Pack including a Metal Case. Valves, Drilled Chassis and 5in. P.M. Speaker for £12/19/6. (Carr. and Ins. 5/6 extra). Or the receiver Components for 29/19/6, and the Vibrator Components for 23/-. This is NOT an EX-90V.T. Receiver, it is a new design employing new Components.

Send 2/8 for the complete set of ASSEMBLY INSTRUCTIONS, CIRCUITS and PRACTICAL LAYOUTS, including a complete individual Component Price List.

THE DENCO ULTRA MIDGET SUPERHET COIL TURRETS WITH A ROTARY TURRET ACTION

Type CT9 consists of a four-station "pre-set" unit from which any three stations on medium waveband and one on long wave can be received by a turn of the turret switch. Price 39/6. Type CT10, is a 3 waveband coil pack incorporating a fourth switch position for Gram. Complete coverage is, long waveband 700-2,000 metres, medium waveband 190-570 and shortwave 15-50 metres. Price 22/8/-. A complete receiver circuit and all necessary data are included with each turret. These can be supplied separately for 6d.

SPECIAL OFFER

A 12in. P.M. SPEAKER (2-3 ohm Voice Coil) by a very famous manufacturer for only **49/6** (plus 2/- carriage and insurance).

THESE ARE BRAND NEW IN MAKER'S CARTONS

"HOME CONSTRUCTORS" THE NEW "SOUNDMASTER"

TAPE RECORDER IS NOW AVAILABLE

Send 6/6 for the complete set of building and operating instructions. These provide for an easily assembled complete PORTABLE TAPE RECORDER including a component price list enabling all components to be bought separately.

When submitting, please include post and packing charge.

STERN RADIO LTD.

109 & 115, FLEET STREET, E.C.4
Tel: CENTRAL 5812-3-4

TWO BATTERY PORTABLES

(a) THE "MINI TWO-THREE"

An "Aldry" Battery Portable of midget size, 6 1/2 in. x 4 1/2 in. x 3 1/2 in., designed to cover medium waveband 190-559 metres, with use of short trailer aerial. The simple design of this Receiver is so arranged that either a 3-valve set or a 2-valve (afterwards easily converted to the 3-valve) can be made. Consists of a T.R.F. circuit using a regenerative detector with H.F. stage and a high gain output pentode. Valve line up IT4—IT4—D134. The 2-valve set can be completely built for 24/3/6 (less case), and the 3-valve for 25/3/- (less case). Each price includes valves, speaker and drilled chassis. Send 2/- for the assembly instructions; they include simple and complete practical component layouts and diagrams, which enable the most inexperienced constructor to successfully build either set. All components are available for separate sale, a price list being supplied with assembly instructions.



(b) THE "MINI-FOUR"

A 4-valve Battery Superhet Receiver designed to receive 4 pre-set stations, three on medium waveband and one on long wave to suit local conditions. Each station is obtained on the set by the turn of a rotary switch. No tuning is necessary. It is of midget size, being only 4 1/2 in. x 6 1/2 in. x 4 1/2 in. when completely built and is very easily assembled from diagrams supplied. Cost of all components to build this set, in accordance with the design, including a drilled and cut chassis and panel and new valves, is 29/10/- (or less valves for 26/7/6). Attractive carrying case finished in blue leatherette, 16/9. Complete constructional data with a blue print, which shows the practical component layout and wiring diagram, together with an individual component price list, are available separately, 1/6. Our battery eliminators (illustrated above) available in kit form are suitable for use with this set.

WE HAVE THE NEW W. B. "STENTORIAN" HIGH FIDELITY SPEAKERS IN STOCK

Model H.F., 6-inch	£2 10 6
Model H.F., 9-inch	£3 7 0
Model H.F., 8-inch	£3 0 6
Model H.F., 10-inch	£3 13 6

These speakers are of the very latest design and provide quality reproduction for the lower-price range. 3 or 15 ohm models are available.

THE VIEWMASTER TELEVISOR

We have had very considerable experience in assisting customers to build this TV and can supply SPECIFIED COMPONENTS EX-STOCK. The assembly instructions showing practical layouts and price list are available for 7/6 for London, Sutton Oldfield, Holme Moss, Kirk-o'-Shotts and Wenvoe.

The "TELE-VIEWER"

5 CHANNEL TELEVISOR

A Design of a Complete 12 in. or 9 in.

SUPERHET T/V RECEIVER FOR THE HOME CONSTRUCTOR

This receiver has been developed after most careful research and affords a high standard of Television entertainment by producing a picture of really outstanding quality.

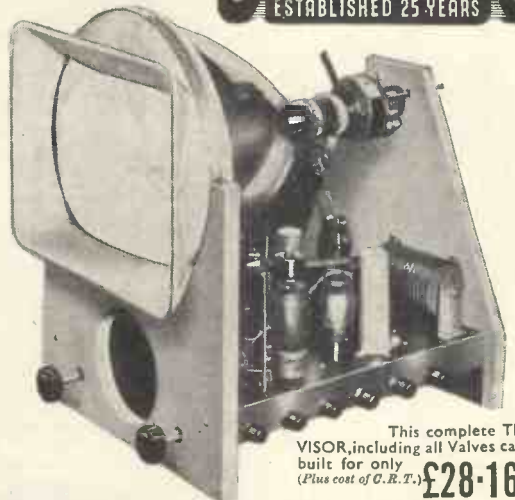
We confidently believe that not only have we achieved a T.V. Receiver that surpasses in efficiency any other designed for the home constructor, but that successful construction, even by the most inexperienced, is assured by the step by step wiring detail and diagrams provided, and at about half the cost of the nearest comparable commercial receiver.

Here are some of the features which combine to make this such a fine receiver.

- The Superhet circuit easily tuned to any of the five channels, i.e. LONDON, SUTTON COLDFIELD, HOLME MOSS, WENVOE and KIRK-O-SHOTT'S. (The extreme ease of tuning is accomplished by the provision of pre-aligned I.F.T's.).
- A lifelike, almost stereoscopic, picture quality made possible by the following factors:
 - a. Excellent band width of I.F. circuits.
 - b. A really efficient video amplifier.
 - c. C.R.T. Grid modulated from low impedance source.
 - d. High E.H.T. voltage (approx. 10 kV.).
 The picture brilliance is also much above the average and enables comfortable viewing with normal room lighting or daylight.
- FIRM picture "HOLD" circuits (Frame-Line) ensure a steady picture free from bounce or flicker even under the most adverse conditions met with in "fringe" areas and excellent "interlace" ensures the absence of "liney effect."
- Negative feedback is used in the audio frequency circuits which provide 2/3 watts of High Quality Sound.
- Entire receiver built on two chassis units each measuring 14 1/2 in. x 6 1/2 in. x 3 1/2 in.
- Rigid C.R.T. mounting enables entire receiver to be safely handled with tube in position.
- All pre-set controls are mounted on side of chassis enabling all adjustments to be carried out whilst facing the C.R. Tube.

We can supply a New 12 in. C.R.T. at specially reduced price of **£12/19/6** These, when available are for purchasers of the Televiewer only.

You're SURE to get it at **STERN'S** ESTABLISHED 25 YEARS



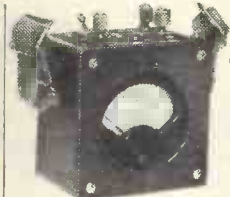
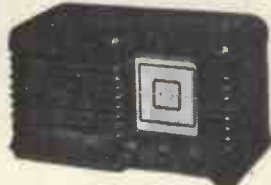
This complete TELEVISOR, including all Valves can be built for only **£28-16-4** (Plus cost of C.R.T.)

As no hire purchase terms are available the receiver can be bought in five separate stages (practical diagrams and circuits are provided for each stage) thus enabling hire purchase interest rates to be avoided. The complete set of ASSEMBLY INSTRUCTIONS is now available, price 5/-. The instructions include really detailed PRACTICAL LAYOUTS, WIRING DATA AND COMPONENT PRICE LIST. ALL COMPONENTS ARE AVAILABLE FOR INDIVIDUAL PURCHASE. A CABINET WILL ALSO BE AVAILABLE.

SURPLUS TO AN EXPORT ORDER A 5 VALVE SUPERHET RECEIVER

covering the COMPLETE MEDIUM WAVEBAND and TWO SHORT WAVEBANDS. ENTIRELY COMPLETE and CONTAINED IN ATTRACTIVE BAKELITE CABINET. (Plus 10/- Carr. and Ins.) **£6/19/6**

- INCORPORATING THE LATEST RANGE OF B.V.A. MINIATURE VALVES. UY.41, UL.41, UBC.41, UP.41 and UCH.42 AND A 5 INCH P.M. SPEAKER.
- Complete Waveband Coverage 13-35, 35-100 and 195 to 550 Metres.
- We have a limited number only, some being for A.C. Mains and some AC/DC Mains operation. They are genuinely BRAND NEW, being surplus to an export order recently completed.



Ex W.D. TESTMETER
Complete with case and carrying strap. **23/6** Post and Ins. 1/3
Provides direct readings of
(a) 1.5 volts and 3 volts D.C.
(b) 6 mA. and 60 mA. D.C. current.
(c) 500 ohm and 5,000 ohm resistance ranges. Voltages can be increased to 150, 300 and 600 volts D.C. at 6 mA. F.S.D by an external series resistor arrangement for 6/-.

!! The TRUVOX TAPE UNIT !!

We can now offer this very successful Unit ex stock. Price **£23/2/0** (Plus 5/- carr. and ins.)
A really good class TAPE AMPLIFIER is also available. Price **£16/16/0** (Plus 5/- carr. and ins.)
The combination of these two Units provides a really first-class complete TAPE RECORDER. Send S.A.E. for complete details.

One of the best known makes !!

A 3 SPEED AUTOCHANGE UNIT COMPLETE WITH THE TWIN STYLUS CRYSTAL PICK-UP **£13/15/0** (Plus 7/6 carr. and ins.)

- These Units will autochange on all three speeds, an adaptor, price £1/0/7, being required for the 48 r.p.m. Records.
- They have separate sapphires for L.P. and 78 r.p.m. which are moved into position by a switch on the pick-up head.

These Units are one of the best made today, they are brand new, complete with mounting instructions, etc.

!! STOP PRESS !!

A COMPLETELY ASSEMBLED CHASSIS OF A 3 WATT A.F. AMPLIFIER WITH SELECTIVE FEEDBACK

For A.C. Mains **£4/9/6** (Plus 5/- carr. and Operation.)

- Designed for good quality Gram. reproduction up to a maximum output of 3 Watts.
- The selective feedback circuit incorporates separate Bass and Treble Controls.
- New Valves are used, the line up comprising the new Mullard types EF.40, EL.41, EZ.40. Suitable P.M. Speakers are available at 16/-, 18/9, 25/- and 34/4.

HIGH FIDELITY PICK UP

Incorporating the famous CONNOISSEUR Light Weight Moving Iron Head and including the Connoisseur matching Transformer **39/6** (Plus 1/- carr. and ins.)

THE FAMOUS "SHAFTESBURY" RIBBON MIKE

Incorporating internal line transformer having transformation ratio from ribbon impedance up to 500-600 ohms . . . reduced from 10 gms. to £6. A special line to rigid, 500-600 ohms transformer also available for 25/-.

COMPLETE BATTERY CHARGER KIT

For charging either 2, 4, 6 or 12 volts at 1 amp. Complete in metal case, and incorporating a limiter resistor. Size 5 1/2 in. x 4 1/2 in. Complete and ready for use, 39/6.

SMITHS "PRESET" SELF-STARTING SYNCHRONOUS CLOCK

incorporating automatic "on-off" switching. **SPECIAL OFFER 57/6** (Normal Price £47-6.) (Postage and Packing 1/3)

- NEW!! and carries maker's guarantee.
- WILL SWITCH ON (AND OFF) YOUR RECEIVER AT ANY PRESELECTED TIME.
- WILL ALSO OPERATE ANY APPARATUS (i.e. LIGHTING, etc.) UP TO 300 WATTS.
- EASILY INSTALLED—SIMPLY CONNECTED IN THE MAINS LEAD.
- THE IDEAL "ALARM CLOCK."
- FOR USE ON A.C. MAINS 200-250 VOLTS.

GOODMANS' SPEAKERS

5in. 3 ohm. with trans.	21/-
5in. 3 ohm. less trans.	16/-
8in. 3 ohm. with trans.	19/6
8in. 3 ohm. less trans.	25/-
10in. 3 ohm. less trans.	25/-

AN AMAZING OFFER! A COMPLETELY ASSEMBLED 4 VALVE T.R.F. CHASSIS

Including a 5in. P.M. SPEAKER and VALVES. **FOR ONLY £6.9.6** (Plus 7/6 Carr. and Insurance.)



This receiver is of the very latest design covering both Long and Medium Wavebands, and includes the modern BVA miniature valves. The line up being 12 BA6-12AT6-12AG-35W4. It incorporates Permeability Tuned Coils thus ensuring excellent selectivity and sensitivity. The overall size of the complete chassis including speaker is 10 1/2 in. x 4 1/2 in. x 6 1/2 in. An attractive Bakelite Ivory finished Cabinet size 11 1/2 in. x 5 1/2 in. x 6 1/2 in. is available for 16/6 (plus 2/6 carriage and insurance).

BATTERY CHARGER TRANSFORMER
for 2, 6 or 12 Volt Charging. Input 200 to 240 volts. Output 17 volts tapped 11 and 17 Volts at 1 1/2 amps., 11/6.

BROS, Ltd.

MAGNETIC TAPE. Now available, the new Scotch Boy High Coercivity Tape MC2-III, with higher output and signal-to-noise ratio. Price 35/- per 1,200ft. reel. Still available: Scotch Boy MCI-III: 1,200ft., 35/-; 600ft., 21/-; 300ft., 12/3. Spare 7in. spools, 4/3. Ferrovoice, the new kraft-based medium coercivity tape: 1,200ft., 22/6. Spare 7in. spools, 4/6. Magnetophon Tape: £2 per 1,200ft. reel.

GOODMANS H6 OUTPUT TRANSFORMERS. Rated up to 30 watts push-pull; ten-section wound on silicon steel laminations with primary inductance of 100 H and negligible leakage inductance and capacitance. Primary 10,000 ohms C.T. Secondary 3.75 plus 3.75 ohms. Price £3/3/-, plus 2/6 p. and p.

TAMSA TYPE 100 TAPE RECORDING HEADS. As used by the leading commercial tape recorder manufacturers. Housed in chromium plated brass case on adjustable mounting. Record/playback heads have 1-thou. gaps and erase heads have 2.5 thou. gaps. These heads are of high impedance. Price 45/- each.

VARLEY MAINS TRANSFORMERS. Primary 10-0-200-220-240 volts. Secondary 300-0-300 volts at 150 mA., 5 volt at 3 amps., 6.3 volts at 4 amps., 6.3 volts at 1 amp. Open type construction. Price 45/-, post 2/6.

BRENETTE MICROPHONES. Large sales of these popular microphones have enabled us to make substantial reductions in the prices. The following range is available: **Type 9ND:** Multi-directional ball-type, in black and chrome, £2/2/-, post 2/6. **Type IIA:** A wide-frequency response microphone in brown cast case with chrome grille, £5/5/-, post 2/6. **Type I3U:** A highly sensitive studio microphone with outstanding frequency characteristics. Flexible mounting enables it to be used directionally or not as required. Black and chrome finish, £6/6/-, post 3/6.

CERAMIC SWITCHES. Single pole, eight-way, 3/6 each.

T.R.F. COILS. Medium and long wave, aerial and H.F., 6/- per pair; with reaction winding, 6/9 per pair.

BRIMISTORS. Non-linear resistors to protect valves from current surges: CZ1, 0.3A, 3/6; CZ2, 0.3A, 2/6; CZ3, 0.2A, 1/6; CZ4, -1.25A, 5/-; CZ6, 0.45A, 3/6.

MOULDED BROWN BAKELITE CABINETS. Suitable for fitting Decca 3-speed gram. motor, amplifier or loudspeaker. Outside dimensions (closed) 15 1/2 in. x 10 in. x 5 1/2 in.; thickness of wall, 1/6th in. Price 22/6, to callers only.

TELEVISION MAGNIFYING LENSES. 6in. clear, 19/6; 9in. clear or filter, 50/-; 12in., clear or filter, 70/-. Please state which and add 5/- for carriage and packing.

WHANDA WIRE AND CABLE STRIPPERS to take all size flexes and cables up to 3/8 in. diam. with 3 alternative heads and triple screw adjustment. These are brand new and boxed, and the original price was 15/- each. Our price 5/- each, post paid.

ALL GOODS NEW AND UNUSED (except where otherwise stated).

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.

SHOP HOURS: Mon: Tues: Wed: and Sat: 9a.m.—6p.m. Thurs: 9a.m.—1 p.m. Fri: 9a.m.—7p.m.

GARLAND BROS. LTD

CHESHAM HOUSE, DEPTFORD BROADWAY, S.E.8.
5 OBELISK PARADE, LEWISHAM, S.E.13.

TEL: TIDEWAY 4412/3
TEL: LEE GREEN 4038

TYANA SOLDER GUNS. Weight 30 oz., for 220-250 v. A.C. mains only; consumption 100 watts. The low voltage bit can be easily bent to reach into corners and is insulated from the earthed case. Price 3 guineas.

WINDSOR SAPPHIRE NEEDLES. Available in the following three patterns: trailer type for magnetic or heavyweight pick-up; straight type for crystal pick-up; midget type for lightweight or high fidelity pick-up. Price 2/6 each.

GARLAND TAPE RECORDER OSCILLATOR UNITS. With valve, for use with high impedance heads only. Price 35/-.

DECALS. 500 1/2 in. high black or white transfer letters and words for marking electronic equipment. Price 4/9 per book. The new Decals book for the amateur now available. 29 words per page, 4 pages radio and audio, 4 pages T/V and Scope, 2 pages misc. incl. Tx. and Tape Recording, 3/6 per book, post 3d. When ordering please state colour required.

GOODMANS OUTPUT TRANSFORMERS. 10 watts push-pull to match into 10,000 ohm., with two 3.75 ohm. secondaries for 3 or 15 ohm. speaker. Price 14/9.

MAINS TRANSFORMERS. All at 19/6 each. MT1. 250-0-250 v., 80 mA, 0-4-5 v., 2 A., 0-4-6.3 v. 3 A.

MT2. 350-0-350 v., 80 mA, 0-4-5 v., 2 A., 0-4-6.3 v. 3 A.

MT3. 0-30 v., tapped to give 3 v., 4 v., 5 v., 6 v., 8 v., 9 v., 10 v., 12 v., 15 v., 18 v., 20 v., 24 v., 30 v., all at 2 amp.

MT4. 4 v. 4 amp.; 10 v. 4 amp.; 20 v. 3 amp., for battery chargers.

MT5. Auto: 0-10-120-200-230-250 v., at 100 watt.

JACKSON BROS. SPIN WHEEL DIAL ASSEMBLIES. 3 wave band, 27/6, plus 1/6 post and packing. **SQUARE PLANE**—2 wave band, 12/9, plus 1/6 post and packing.

OSMOR GLASS DIAL ASSEMBLIES. Long, Medium and Short, or Medium Short, Short, 24/6, plus 1/6 post and packing.

JUNEIRO ENGRAVING TOOL. Engraves on Metals, Plastics, Woods, etc. For 200-240 v. A.C. mains, 10/- each.

ELAC Sin. LOUDSPEAKER, 17/6, plus 1/- post and packing.

TRIMMERS. 50 pF 50 + 50 pF, 100 + 100 pF, 100 + 500 pF, ceramic mica, 9d. each; 250 pF, 1,000 pF, 9d. each; 50 pF, 75 pF, airspaced preset, 1/3 each; 75 pF, air-spaced, 2in. spindle, 2/- each. 33 1/2 per cent. discount in dozen lots.

RECTANGULAR KNOBS. Size 1 1/2 in. x 3/4 in., with gold indicating spot; to fit standard 1/2 in. spindles. Price 5/- per doz., 37/6 per 100.

UNITELEX RECORD/PLAYBACK AMPLIFIER PR3A. Using latest type miniature valves (EF40, 12AX7, EL41, EL41, EM34; full wave metal rectifier system) 10 Kc/s response; separate bass control (boost) operative on both record and playback; treble control (cut and boost) operative on playback; magic eye monitoring. Inputs for Radio, Gramophone or Microphone. Provision for use as straight playback amplifier from Record Players or Changer. 4 watts output and provision for feeding two external speakers or amplifiers. Price £20 or on H.P.

SELECTION OF BOOKS

Practical Radio for Beginners	3/3
Wireless World Guide to Broadcasting Stations	2/3
Television Servicing Manual	4/10
High Fidelity Radio	3/9
The Midget Radio Instructors Manual.....	3/9
Radio and T.V. Pocket Book	2/9
Tape and Wire Recording	2/9
Mullard Valve and Service Reference Manual	5/6
Mullard Amateurs Guide to Valve Selection	1/9
Osram Valve Manual, Part I.....	5/6
Brimar Radio Valve and Teletube Manual...	5/6
Wireless World Radio Valve Data, 3rd edition	3/9
Radio Valve Guide. By W. J. May	5/6
The Williamson Amplifier Manual, latest edition	3/9
Wireless World High Quality Amplifier Manual	2/9
T.V. Fault Finding	5/4
Television Faults	5/4
Television Explained (Miller).....	5/4
Viewmaster Envelope (state transmitter for which required)	7/10
Tele-King Envelope	6/4
The Oscilloscope Book	5/4
Magnetic Recording (Quartermaine).....	4/10
(Add 3d. to price in all cases for postage.)	



WE WISH OUR MANY FRIENDS AT HOME AND OVERSEAS A HAPPY XMAS AND A PROSPEROUS NEW YEAR.

GARLAND AMPLIFIER ACII. Self-contained general-purpose amplifier, providing 3.5-watts output. All power supplies derived from mains transformer, ensuring isolated chassis. Standard valves throughout. Volume and Tone Controls incorporated. Negative feedback loop. Price £6/12/6 plus 5/- carriage, etc. Weight 10lb.

TAPE RECORDER OSCILLATOR COILS. 6.3 mH, 45 kc/s, for high impedance heads only. Price 6/9 each.

"UNITELEX PRIMA" PORTABLE TAPE RECORDER: We are appointed stockists for this recorder, features include ultra-modern cabinet design, giving exceptional lightness and portability without sacrifice of quality. Push-button control on mechanical side, twin-track heads, dual-speed (7 1/2 in. and 3 1/2 in. per sec.), giving up to two hours playing on one reel of tape; latest type miniature valves used (EF40, 12AX7, EL41, EL41, EM34; full-wave metal rectifier system). Genuine 10 Kc/s. response; separate bass control (boost) operative on both record and playback; treble control (cut and boost) operative on playback. magic eye recording level indicator; provision for use as straight playback amplifier from record players or changers; 4-watts output to internal 10in. elliptical high-flux speaker, with provision for feeding two external speakers or amplifiers. Price, complete with filter cell microphone housed in recorder, and with 1,200ft. reel of high coercivity tape, 57 guineas. Send 2 1/2d. stamp for illustrated brochure.



Prices slashed at Clydesdale

EX.-R.N. GAUSS INDICATION AND RANGE METER AP58150

Made by E.T.E.I Ltd., for use with a Fluxmeter. Measuring head for 0.625in. gap. Dim.: overall 3½ x 2 x 1½in. with leads in wood box 6½ x 3½ x 2in. ASK FOR X/E345 **4/6** each POST PAID

AUDIO FREQUENCY OSCILLATOR

A.C. mains operation 230 v. 50 c/s. input with 6 valves 3/6J5G, 2/EL32, 5Z4G, 2 mains transformers, etc., 3 audio ranges 100-1,500 cps., calibrated dial, motor tuning, 20 v. A.C. motor fitted. The whole built in an enclosed metal cabinet with shock mounts. Dim.: 21 x 15 x 10in. Finish grey. Used, good condition. ASK FOR X/H793 **£7.19.6** each CARRIAGE 7/6 Extra

POWER MODULATION UNIT

for the WS.36 Transmitter

An A.C. mainspower unit with built-in modulator. Input 110-250 v. A.C. 50 c/s. Mains providing H.T. and L.T. Output, 3 transformers, L.T. 4 v. 4 a., 3.25-0-3.25 v. 8 a. HT (1) 200-0-200 v. 50 m/a. H.T. (2) 500-0-500 v. 200m/a and 500-0-500 v. 200 m/a., fully rectified and smoothed, valves 3/6C5, 2/807, 2/AV1 (FW4/800) built in a varnished wood case with carrying handles. Dim.: 22½ x 16½ x 14½in. ASK FOR X/H43 **£6.17.6** each CARRIAGE PAID

WAVE FORM GENERATOR TYPE 26

With valves VR55, 2/VR54, VR116, 3/VR56, 6/VR65, 2 relays, plus conds., etc. Input 80 v. 2,000 c/s. A.C. In metal case 12 x 7½ x 11½in. ASK FOR X/H884 **21/-** each CARRIAGE 2/6 EXTRA

DRIVER TRANSFORMER

for ET-4436 Transmitter

Ref. No. 110K/117 part XT-3202. Centre tapped primary, inductance 3.4 henries. Two secondaries inductance 14 henries each. Ratio whole pri. to one sec. 1-2 approx. Dimensions 4½ x 3½ x 3½in. Wgt. 6 lb. 4 hole fixing. ASK FOR E562 **18/6** each POST PAID

FOR EXPORT ONLY WIRELESS SET NO. 38 Mk. II

Range 7.7-9 mc/s. 5 valves and all accessories. Complete (less batteries) and unused in original wood case. 4 complete units per case. ASK FOR X/H519/4 **£20** per case of 4 sets F.O.B. GLASGOW

RECEIVER UNIT TYPE 25

REF. 10P/11

part of TR1196, range 4.3-6.7 mc/s., with valves 2/VR53 (EF39), 2/VR56 (EF36), VR55 (EBC33), VR57 (EK32), 2/L.F.T. 460 k/c/s., etc., in metal case 8½ x 6½ x 6½in. ASK FOR X/H299 **35/-** each POST PAID

ELECTROSTATIC KILOVOLT METER

Range 0/2 kv. 2½in. round mid. Case, drilled flange. ASK FOR X/E333 **27/6** each POST PAID

500 MICROAMP METER ref.: ZN2106

For WS-18 Transmitter 2in. round, clip mounting case. Res. 500 ohms. ASK FOR X/E303 **15/-** each POST PAID

WALNUT-FINISH WOOD RADIO CABINET

Dim.: Internal 8½ x 15½ x 7½in. approx. External 9½ x 17 x 8in. approx. ASK FOR X/H394 **12/6** each POST PAID Or Cabinet as above with 3 waveband glass dials, expanded metal L.S. Grill 3 knobs 1½in. dia. fluted type. ASK FOR X/H945 **17/6** each POST PAID

PLASTIC RADIO CABINET

Dim.: Internal 11 x 6½ x 4½in. approx. External 12 x 7½ x 6½in. approx. ASK FOR X/H720 **12/6** each POST PAID

MORSE PRACTICE BOARD ONLY

Comprises Key, buzzer, and phone terminals on board 6½ x 6½ x ½in., with battery clamps. ASK FOR X/E1X **5/6** each EXTRA

EGG INSULATOR TYPE H6, 108/153

Standard, medium, large, insulator finished in brown. 3in. long, 2in. max. dia. ASK FOR X/E192 **1/9** each POST PAID

Box of 4 for 5/6. Gross lots for £7/4/-.

AERIAL SYSTEM TYPE 62

U.H.F. Antenna on streamlined moulding with VR92 (EA50) untuned detector stage. Overall dim.: 13½ x 4½ x 2½in. Antenna 22.5 cm. ASK FOR X/H496 **3/6** each 9d. POST EXTRA

AERIAL ROD

15in. lengths, copper plated steel tube, ferruled to interlock and an Aerial of desired length. 3/16th in. dia.: Ask for X/H709. ¼in. dia: Ask for X/H710. EITHER **4/6** Doz. Lengths 6d. POST EXTRA

RADAR REFLECTOR AERIAL MX/137/A

Spider Web mesh Aerial in original moisture proof carton, with assembly instructions. ASK FOR X/E175 **4/11** each 9d. POST EXTRA

STAINLESS STEEL AERIAL WIRE

7/015in. reels of approx. 1,600ft. made by Temco. ASK FOR X/E143 **25/-** per reel CARRIAGE PAID

DINGHY TELESCOPIC MAST

Aluminium Telescopes from 14½in. to 7½ft. Seven sections, base dia. ½in. Wgt. 4 oz. ASK FOR X/H489 **4/6** each 6d. POST EXTRA

COOLANT PUMP by Packard, U.S.A.

A turbine type pump, directly driven from semi-ball joint splined socket (by motor NOT SUPPLIED), clockwise rotation. Dim.: overall 11½ x 7½ x 13in. ASK FOR X/H407 **39/6** each CARRIAGE PAID

ELECTRIC MOTOR TYPE 153 ref. 10 kv./1703

Input voltage 19 volts D.C. or 20 volts A.C. Speed approx 1,000 r.p.m. Overall size 6½ x 4in. Spindle dia. 7/16in. Projects lin. In original carton. ASK FOR H879 **32/6** each POST PAID

SMALL D.C. MOTOR by A. G. Redmond of U.S.A.

Input 24 volts D.C. 0.96 amps. 1,500 r.p.m. 2 hole fixing spindle, dia. ½in., length 3in. Dim.: 3½in. long by 2½in. dia. ASK FOR H816 **15/6** each POST PAID

DIRECT CURRENT GENERATOR TYPE 3DG3

ref. 42U/506 Output 14/32 v. 9 amps. 2,500 r.p.m. ½in. diam. splined lin. projection. Size 1lin. x 7in. x 6in. Wgt. 31 lb. Can be used as a battery charger or low voltage lighting generator, when driven by a motor or petrol engine. ASK FOR H937 **£2.19.6** each CARRIAGE PAID

CANADIAN R.E.L. BINOCULARS

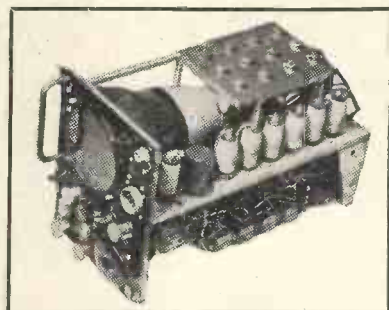
Brand New and Guaranteed optically perfect. Individual eye-piece focussing (diopter setting) and variable inter-ocular setting, leather neck-strap. In original cartons Magnification 6 x 30 ASK FOR X/H920 **£8.19.6** each POST PAID In fitted Leather Case Magnification 7 x 50 ASK FOR X/H921 **£21.10.0** each POST PAID

PLOTTER FIELD Mk. IV, Ref. OS.739A

A precision made Protractor Unit, first-class condition. With 2 scales 0-180 deg., moving crossarms, scaled 21-65 each 12½in. long. Straight edge base scaled 0-3,500 length 25in. fully extended. In soiled leather case 16 x 5½ x 2in. ASK FOR X/H864 **9/11** each POST PAID

INEXPENSIVE T.V.

INDICATOR UNIT TYPE, 62A with EF50¹⁵ containing VCR-97 tube and valves. 12-VR91 (EF50), 4-VR65-CV118 (SP61), 3-VR92 (EA50), 2-VR54 (EB34), etc., etc., in metal case 18 x 18½ x 11½in. Used, good condition. ASK FOR X/H868 **79/6** each CARRIAGE PAID



INDICATOR UNIT TYPE 62

In original wood case.

ASK FOR X/H526 **£5.19.6** each CARRIAGE PAID

INDICATOR UNIT TYPE 62

Used, good condition.

ASK FOR X/E774 **49/6** each CARRIAGE PAID

INDICATOR UNIT TYPE 6

In original wood case.

ASK FOR X/H524 **89/6** each CARRIAGE PAID

INDICATOR UNIT TYPE 6H

In original wood case.

ASK FOR X/E777 **£89/6** each CARRIAGE PAID

INDICATOR UNIT TYPE 305

BRAND NEW Ref. 10QB/6504 Contains VCR524A-VCR525, 7 EF50, 2 VR54 6 EA50, 2.0I high voltage condensers, 3 relays, 4 make, 4 break, 500 ohm coil. Numerous condensers, pots, and resistors. Dim.: 12 x 7 x 18in. Wgt. 30 lb. ASK FOR X/H943 **£3.19.6** each CARRIAGE PAID

5CPI CATHODE RAY TUBE

In original carton.

6in. electrostatic type, heaters 6.3 v., 0.6 A. ASK FOR X/H529 **19/6** each POST PAID

ION TRAP MAGNET ASSEMBLY

Mfg. surplus.

Type 17/6 by Elac for 35 mm. tube neck. ASK FOR X/H919 **2/6** each POST 3d. EXTRA

POWER UNIT TYPE 285

Ready made for T.V.

A.C. mains. Input 230 v., 50 c.p.s. Outputs E.H.T. 2K.V., 5 m/a., H.T. 350 v. 150 m/a. L.T. 6.3 v. 10 a. and 6.3 v. 5 a. Fully smoothed and rectified with valves VU120, 5U4G, VR91 (EF50) plus cond., resistors, etc. ASK FOR X/H947 **£4.19.6** each CARRIAGE PAID

I/F/A F AMPLIFIER UNIT R1355

In transit case.

With valves, I.F. frequency 7.5 mc/s. Dim.: 18 x 8½ x 7½in. Used, good condition. ASK FOR X/E770B **37/6** each CARRIAGE PAID

ALSO STILL AVAILABLE

R1355 as above, but loose stored. ASK FOR... **22/6** each CARRIAGE PAID

R.F. UNIT TYPE 24

In original carton.

Switched tuning 20-30 mc/s. with valves, etc. ASK FOR X/H850 **22/6** each POST PAID

R.F. UNIT TYPE 25

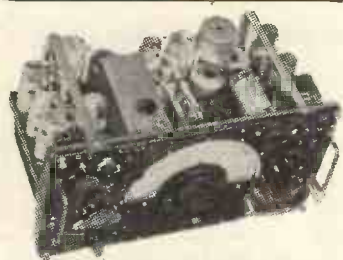
In original carton.

Switched tuning 40-50 mc/s. with valves, etc. ASK FOR X/H847 **22/6** each POST PAID

R.F. UNIT TYPE 27

With broken dial.

Variable tuning 65-85 mc/s. with valves, etc. Used, good condition. ASK FOR X/E771 **39/6** each POST PAID



R1155 RECEIVER UNIT
 Communications, D.F. and "Ham" 20, 40, 80, 5 ranges 18-7.5 Mc/s., 7.5-3 Mc/s., 1,500-600 kc/s 500-200 kc/s. and 200-75 kc/s. Complete with 10 valves. S.M. drive M.E. tuning, B.F.O., etc., in metal case 16½ x 9 x 9in. External power supply required. **APPEARANCE AS NEW.**
 ASK FOR X/H938 **£8.19.6** CARRIAGE PAID

APPEARANCE ROUGH
 ASK FOR X/H898 **£5.19.6** CARRIAGE 7/6 EXTRA
 Circuit 1/3.

LOOP AERIAL TYPE 17, 10D/16950
 NOT designed for R1155, but could be used. NO housing, scaled 0-350 degrees. Wgt. 2½ lb.
 ASK FOR X/H938 **21/-** each POST PAID



F.24 AIRCRAFT CAMERA
 in Transit Case

Lens 5in., f/4 with internal iris diaphragm stops to f/11, fixed focus set at infinity, screw-in housing project 5½in. Focal plane shutter speeds 1/60th to 1/1,000th of a second and time, fitted in film magazine designed for 5½in. wide film, picture size 5½ x 5½in. Shutter release and rewind spindle fits standard spanner. Hand operated as it stands. Net. wgt. 17 lb. Packed in fitted transit case 42 lb. Dim.: body 6½ x 9 x 9½in., overall incl. lens housing 11½ x 9 x 9½in. Provision for external motor drive (not supplied). Lens housing grooved for fitting to aircraft camera port. A precision Air Survey Camera could be adapted for Laboratory, Industrial or Portraiture uses.

ASK FOR X/H302 **£4.19.6** CARRIAGE PAID

14 INCH F/5.6 LENS for F/24 CAMERA
 Complete with Iris, Filter, Mount and Extension in Transit Case.

ASK FOR X/H563 **£6.19.6** each CARRIAGE PAID

VISUAL INDICATOR TYPE 1, REF. LOQ/2

Dual reading Left/right D.F. meter for R1155, 2½in. Scale, overall dim. 3½ x 2½in. In used condition.

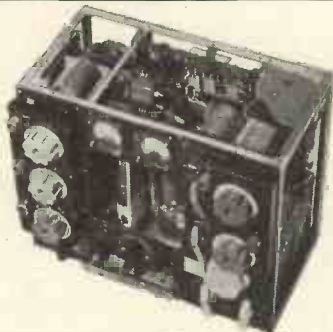


ASK FOR X/H862A **12/6** each POST PAID

POWER UNITS FOR T1154/R1155 UNITS
 Types 33 or 33B. Input 24 v. D.C. 16 a. Output 1,200 v. D.C. 200 m/a.
 ASK FOR X/E7A.
 Types 35 or 35A. Input 18 v. D.C. 12 a. Outputs 7.2 v. D.C. 13 a. and 225 v. D.C. 110 m/a.
 ASK FOR X/38A.

Each a motor generator unit, smoothed, etc., in metal case 16 x 7½ x 6in.

ANY UNIT **42/6** each CARRIAGE PAID
 LOOSE STORED



Still Available as detailed in Previous Issues

RECEIVER CHASSIS, RANGE 150-200 m/c/s.
 ASK FOR X/H940 **21/-** each POST PAID

SUPPLY UNIT RECTIFIER
 for No. 43 Transmitter.
 Ex-Cdn. Army in original wood case.
 A.C. 50/60 c/s. 1.7 k.v.a.
 ASK FOR H26 **£25** each CARRIAGE PAID

SELSYN MOTOR TYPE 5J/2512
 Ref. No. W.325A
 230 volts A.C., input single phase.
 ASK FOR X/H83 **39/6** each CARRIAGE PAID

POWER UNIT TYPE 266
 in transit case.
 Input 80 v. 1.5 k. c.p.s. A.C.
 ASK FOR X/E870 **22/6** each CARRIAGE PAID

TEST SET SE2 PATTERN No. W5799
 Brand new.
 ASK FOR X/H937 **£3.19.6** each CARRIAGE PAID

CALIBRATOR UNIT R.D.F. No. 1 ZA-14401
 In original wood case.
 ASK FOR X/H829 **21/-** each CARRIAGE PAID

TEST OSCILLATOR TS-24/ARR-2
 (U.S.A. made).
 ASK FOR X/H364 **21/-** each CARRIAGE PAID

TEST OSCILLATOR TS-24A/ARR-2
 (U.S.A. made.)
 ASK FOR X/H364A **27/6** each CARRIAGE PAID

TEST SET TYPE L02
 ASK FOR X/H561 **21/-** each CARRIAGE PAID

AMPLIFIER A1271, Ref. 10U/549
 ASK FOR X/H532 **4/11** each POST PAID
 Circuit 1/3

JEFFERSON TRAVIS UF 2
 Transceiver Chassis (U.S.A. made)
 Less valves, partly stripped by the M.O.S.
 ASK FOR X/H518 **17/6** each CARRIAGE PAID
 Circuit 2/6.

BC-456 SPEECH MODULATOR UNITS
 ASK FOR X/E42 **27/6** each CARRIAGE PAID
 Circuit 1/3.

MODULATOR 169
 BRAND NEW. In original wood case.
 ASK FOR X/H713 **21/-** each CARRIAGE PAID

WS-18 RECEIVER CHASSIS
 Partly stripped by M.O.S.
 ASK FOR X/H22 **25/-** each POST PAID

WS-18 TRANSMITTER-RECEIVER CHASSIS
 Partly stripped by the M.O.S.
 ASK FOR X/H349 **33/6** each POST PAID

GYRO ANGLING POWER UNIT 9/2201
 ASK FOR X/E874 **12/6** each POST PAID

MONITOR CRYSTAL TYPE 2 IOT/11390
 Less valves and crystals.
 ASK FOR X/H872 **5/-** each 1/- EXTRA

FLUXMETER TYPE I, WY.0023
 ASK FOR X/H361 **55/-** each CARRIAGE PAID

RECORDER MK. II, 24 VOLTS
 ASK FOR X/H883 **27/-** each POST PAID

MAGNETIC MARCHING COMPASS MK. I
 ASK FOR X/H406 **12/6** each POST PAID

PUMP, DESSICATOR, Adm. Patt. No. 12128
 for Telescopes and Binoculars
 ASK FOR S/H358 **£3.10.0** each CARRIAGE PAID

ROTARY CONVERTER TYPE 195
 ASK FOR X/H914 **£5.19.6** each CARRIAGE PAID

AMPLIFIER A1368
 for Battery Operation
 ASK FOR X/E898 **8/6** each POST PAID

GUN SIGHT PROJECTOR UNIT TYPE 30
 ASK FOR X/H882 **19/11** each POST PAID

THROAT MICROPHONE ref. ZA.13935
 ASK FOR X/E14 **3/11** each 6d. EXTRA

THROAT MICROPHONE, ref. ZA.19374
 ASK FOR X/H955 **4/11** each 6d. EXTRA

THROAT MICROPHONE (U.S.A. made)
 ASK FOR X/E16 **3/11** each 6d. EXTRA

MICROPHONE, ref. 10A/14381
 (Flying Helmet type)
 ASK FOR X/E16 **3/11** each 6d. EXTRA

CARBON HANDSET MICROPHONES
 No. 8. Ask for X/H480.
 No. 4A. Ask for X/E13.
 EITHER UNIT **7/6** each POST PAID

HEADPHONES CHR-2
 High impedance. 4,000 ohms.
 ASK FOR X/H786 **10/9** each POST PAID

HEADPHONES D.L.R.-1
 Low impedance 50 ohms.
 ASK FOR X/H1390 **7/8** each POST PAID

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R.S.C. MAINS AND OUTPUT TRANSFORMERS

Fully Guaranteed, Interleaved and Impregnated

FILAMENT TRANSFORMERS

Primaries 200-250 v. 50 c./cs.

6.3 v. 1.5 a.	5/9
6.3 v. 2 a.	7/6
6.3 v. 3 a.	9/6
0-4-6.3 v. 2 a.	7/9
12 v. 1 a.	7/11
6.3 v. 6 a.	17/6
0-2-4-5-6.3 v. 4 a.	16/9
12 v. 3 a. or 24 v. 1.5 a.	17/6

CHARGER TRANSFORMERS

All with 200-230-250 v. 50 c/s. Primaries: 0-0-15 v. 250-0-250 v. 70 mA., 6.3 v. 2.5 a., 16/9; 0-0-15 v. 6 a., 22/9; 0-4-9-15-24 v. 3 a., 22/9 0-9-15-30 v. 3 a., 23/9. 0-22-23-24 v. 5 a., 19/6.

TOP SHROUDED DROP THROUGH TYPE

Primaries 200-230-250 v. 50 c/s.

250-0-250 v. 70 mA., 6.3 v. 2.5 a.	12/11
280-0-280 v. 70 mA., 6.3 v. 3 a., 5 v. 2 a.	14/11
350-0-350 v. 80 mA., 6.3 v. 2 a., 5 v. 2 a.	16/9
350-0-350 v. 80 mA., 6.3 v. 3 a., 4 v. 2.5 a.	14/11
250-0-250 v. 100 mA., 6.3 v. 4 a., 5 v. 3 a.	23/9
300-0-300 v. 100 mA., 6.3 v. 4 v. 4 a., c.t., 0-4-5 v. 3 a.	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. 150 mA., 6.3 v. 4 a., 5 v. 3 a.	29/11
350-0-350 v. 150 mA., 6.3 v. 2 a., 6.3 v. 2 a., 5 v. 3 a.	29/11

E.H.T. TRANSFORMERS. 2,500 v. 5 mA., 2-0-2 v., 1.1 a., 2-0-2 v. 1.1 a., for VCR97, VCR517 or ACR2X

5,000 v. 5 mA. 2 v. 2 a.	35/-
	36/6

SILVER MICA CONDENSERS. 5, 10, 15, 20, 25, 30, 35, 50, 100, 120, 150, 180, 200, 230, 300, 330, 400, 470, 500, 1,000 pfd. (.001u.F), .002 mfd. (2,000 pfd.). All at 5d. each; 3/9 dozen one type.

DIAL BULBS, M.E.S., 8 v. 0.15 a., 6/9 doz.

VOLUME CONTROLS with long spindles, all values less switch, 2/9; with S.P. switch, 3/9.

WIRE WOUND POTS: 20 ohms, 30 ohms, 1,000 ohms, 5K, 50K (medium length spindles), 2/9. 220 ohms, 2K, 10K, 20K, 50K Preset type, 1/9 ea.

AMMETERS. Moving coil. G.E.C. 0-5 amps, 2in. scale, 12/6.

ELECTROLYTICS (Current production. NOT ex-Govt.)

Tubular Types	Can Types
8uF 450 v.	1/11
8uF 500 v.	2/9
16uF 350 v.	2/3
16uF 450 v.	2/9
16uF 500 v.	3/9
24uF 350 v.	3/3
32uF 350 v.	3/9
32 mfd. 500 v.	5/9
8-16uF 500 v.	4/11
25uF 25 v.	1/3
50uF 12 v.	1/2
50uF 50 v.	2/3
Can Types	
8 mfd. 450 v.	2/3
8 mfd. 500 v.	2/11
16 mfd. 350 v.	1/11
16uF 450 v.	2/9
24uF 350 v.	2/11
32 mfd. 450 v.	4/9
40uF 450 v.	4/9
64 mfd. 450 v.	4/9
8-8uF 350 v.	3/9
8-8uF 450 v.	3/11
8-16uF 450 v.	4/6
16-16uF 450 v.	4/11
16-16 mfd. 500 v.	5/9
16-32uF 350 v.	4/9
32-32uF 350 v.	4/9
32-32uF 450 v.	5/11
64-120 mfd. 350 v.	7/6
3,000 mfd. 6 v.	5/9

MISCELLANEOUS EX-GOVT. ITEMS

Slydelock Fuses, 15 amp., 1/9. Bulgin panel mounting Fuseholders (ex-equip.), 11d. Bulgin octal type moulded Bakelite, 5-pin or 7-pin Plugs and Sockets, 1/11 pr. Earphones (Single), low resistance, 1/3.

EX-GOVT. ACCUMULATORS with non-spill vents. Unused and guaranteed. 2 v. 16 A.H. Size 7 1/4 x 2 1/4 in. 4/9 ea. Or set of 3 wired for 6 volts in wood carrying case 0-7-5in., 13/9, plus 2/6 Carr.

P.M. SPEAKERS. All 2-3 ohms. 5in., Goodmans, 14/9, 6in. Elac, 14/11, 6in. Plesey with Pentode Trans., 14/11, 8in. Plesey, 15/9, 8in. R.A. Heavy duty, 18/9, 10in. Goodmans, 31/-, 10in. Plesey, 18/6, 10in. Rola with Trans., 29/6, 12in. Truvox, 49/0.

M.E. SPEAKERS. All 2-3 ohms, 6 1/2 in. Rola field 700 ohms, 11/9, 10in. R.A. field 600 ohms, 23/9. 10in. R.A. field 1,500 ohms, 23/9. 10in. R.A. Field 1,000 ohms, 23/9.



Primaries 200-230-250 v. 50 c/s. FULLY SHROUDED UPRIGHT MOUNTING

250-0-250 v. 60 mA., 6.3 v. 2 a., 5 v. 2 a., Midget type 2 1/2-3-3in.	16/9
350-0-350 v. 70 mA., 6.3 v. 2 a., 5 v. 2 a.	18/9
300-0-300 v. 60 mA., 12 v. 1.5 a., c.t.	18/11
250-0-250 v. 100 mA., 6.3 v. 4 v. 4 a. c.t., 0-4-5 v. 3 a.	25/9
250-0-250 v. 100 mA., 6.3 v. 6 a., 5 v. 3 a., for R1355 conversion	29/9
300-0-300 v. 100 mA., 6.3 v. 4 v. 4 a. c.t., 0-4-5 v. 3 a.	25/9
350-0-350 v. 100 mA., 6.3 v. 4 v. 4 a. c.t., 0-4-5 v. 3 a.	25/9
350-0-350 v. 150 mA., 6.3 v. 4 a., 5 v. 3 a.	33/9
350-0-350 v. 150 mA., 6.3 v. 2 a., 6.3 v. 2 a., 5 v. 3 a.	33/9
350-0-350 v. 160 mA., 6.3 v. 6 a., 6.3 v. 3 a., 5 v. 3 a.	45/9
350-0-350 v. 250mA., 6.3 v. 6a., 4 v. 8a., 0-2-6 v. 2 a., 4 v. 3 a., for Electronic Eng. Televisor	67/6
425-0-425 v. 200 mA., 6.3 v. 4 v. 4 a. c.t., 6.3-4 v. 4 a., c.t., 0-4-5 v. 3 a., suitable Williamson Amplifier, etc.	49/9
425-0-425 v. 250 mA., 6.3 v. 6 a., 6.3 v. 6 a., 5 v. 3 a.	65/6

BAKELITE AND WALNUT VENEERED CABINETS



Size approximately 12in. x 6 1/2 in. x 5in. Bakelite type available in Brown or Cream. Price of Cabinets, 17/6 ea., carr. 2/6. Suitable fully punched T.R.F. 3-valve and rectifier chassis 3/9. Suitable fully punched superhet chassis (4 valves and rect.) 4/0. Dial Scales, 2 colour, 2 waveband, station named, glass 1/6. Dial Scales, 3 colour, 3 waveband, station named, glass 1/9. Suitable coloured Metal Backplates 1/3. Pointers, Double ended. 4d. T.R.F. Coils, 2 waveband with circuit. 6/9. Drum Drives, complete 2/6. Constructional Envelope of an All Mains 2 wave T.R.F. Receiver (3 valves and rectifier) which can be built in any of above cabinets for approximately £4/15/- 2/6

SELENIUM RECTIFIERS

L.T. Types	H.T. Types H.W.		
2/6 v. 1/2 a. h.w.	1/11		
70 v. 20 mA.	2/11		
F.W. Bridge Types	90 v. 20 mA.	3/6	
6/12 v. 1 a.	5/9	120 v. 40 mA.	3/11
6/12 v. 2 a.	9/9	250 v. 50 mA.	5/9
6/12 v. 4 a.	17/9	350 v. 50 mA.	7/9
6/12 v. 6 a.	22/9	250/350v. 80 mA.	8/9

EX-GOVT. E.H.T. SMOOTHING CONDENSERS

.02 mfd. 5,000 v. Bakelite Tubulars	1/6
.02 mfd. 8,000 v. Cans	1/11
1 mfd. 2,500 v. Cans	3/6
1 mfd. plus .1 mfd. 8,000 v., large blocks (common negative isolated)	9/6

SPECIAL PURPOSE EX-GOVT. VALVES (GUARANTEED)

VR91, 5/9, SP61 (VR65) 2/9, VR50 3/11, AC6Pen 5/3, 807 6/11, 7193 1/3, 6J610/8, 954 1/11, 955 3/9, 6SH7Met 6/11, 12SC7GT 6/11, RK34 2/6, VU120A 2/9, SP41 (VR65A) 1/11.

EX-GOVT. WIRE WOUND POTS.

(Ex-equip., insulated spindles). Bakelite type, spindles approx. 1in. 2K, 2.5K, 15K, 50K, 100K, 2/3 ea.

SMOOTHING CHOKES

250 mA. 7-10 H. 200 ohms Shrouded	16/9
250 mA., 3 H. 50 ohms	11/9
100 mA., 15 H. 350 ohms	7/6
80 mA., 10 H. 350 ohms	5/6
60 mA., 10 H. 400 ohms	4/11
50 mA., 40 H. 1,000 ohms Potted	10/9

ELIMINATOR TRANSFORMERS

Primaries 200-250 v. 50 c/s.

120 v. 40 mA.	7/11
90 v. 10 mA., 8-0-8 v. 250 mA.	9/11

OUTPUT TRANSFORMERS

Midget Battery Pentode 66: 1 for 3S4, etc.	3/6
Small Pentode, 5,000Ω to 3Ω	3/9
Small Pentode, 8,000Ω to 3Ω	3/9
Standard Pentode, 5,000Ω to 3Ω	4/9
Standard Pentode, 8,000Ω to 3Ω	4/9
Standard Pentode, 10,000 ohms to 3 ohms	4/9
Multi-ratio 40 mA. 30:1, 45:1, 60:1, 90:1, Class B Push-Pull	5/6
Push-Pull 10-12 Watts 6V6 to 3Ω or 15Ω	15/9
Push-Pull 10-12 Watts to match 6V6 to 3-5-8 or 15Ω	16/9
Push-Pull 15-18 Watts to match 6L6, etc., to 3Ω or 15Ω Speaker	22/0
Push-Pull 20 Watts high-quality sectionally wound, 6L6, KT66, etc., to 3 or 15Ω	47/0
Williamson type, exact to author's specification	85/-

MICROPHONE TRANSFORMERS

100:1	5/9
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EX-GOVT. AUTO TRANSFORMERS 50 c/s

15-10-5-0-215-235 v. 200 watts... 25/9
Double wound 10-0-200-220-240 v. input, 10-0-270-290-310 v. output 200 watts 27/9

EX-GOVT. MAINS TRANSFORMERS.

All 230 v. 50 c/s input. 48 v. 1 a. output	9/6
Outputs 250-0-250 v. 40 mA., 6.3 v. 2 a., 5 v. 2 a.	10/9
350-0-350 v. 150 mA. 5 v. 3 a.	17/6

VALVE SCREENING CANS. International Octal 3 piece, 10/8 doz., 1/3 each.

EX-GOVT. SMOOTHING CHOKES

250 mA., 10 H. 50 ohms. Potted type	14/9
250 mA., 40 H. 200 ohms. Trop. type	17/6
250 mA. 20 H. 250 ohms. Tropicalised	13/9
250 mA. 10 H. 100 ohms	12/9
250 mA. 5 H. 100 ohms. Potted type	9/6
250 mA. 3 H. 50 ohms Potted	7/6
150 mA. 10 H. 50 ohms	10/11
100 mA. 10 H. 100 ohms	6/11
100 mA. 15 H. 450 ohms. Tropicalised	5/9
100 mA. 5 H. 100 ohms. Tropicalised	4/6
50 mA. 50 H. 1,250 ohms. Potted type	8/11

EX-GOVT. T.V. TYPE TRANSFORMERS. All 230 v. 50 c/s input.

610-0-610 v. 150 mA., 300-0-300 v. 150 mA., 1,250 v. 250 mA.	19/9
2 v. 3 a., 2 v. 3 a., 2 v. 3 a., 2 v. 3 a., 6.3 v. 6 a., 6.3 v. 6 a., 5 v. 3 a., 5 v. 3 a., 4 v. 3 a.	8/9
278-0-278 v. 80 mA.	7/9
350-0-350 v. 160 mA., 6.3 v. 6 a., 5 v. 3 a.	27/6
400 v. C.T. 150 mA.	5/9
4 v. 6 a., 6.3 v. 6 a., 6.3 v. 0-6 a., 4 v. 6 a., 4 v. 3 a., 4 v. 3 a., 4 v. 3 a., 5 v. 2 a.	22/9

EX-GOVT. BLOCK PAPER CONDENSERS

4 mfd. 500 v., 2/9	4 mfd. 1,000 v. 3/11
4 mfd. 750 v., 3/3	4 mfd. 2,000 v., 5/9
10 mfd. 500 v., 6/9	8 mfd. 500 v. 4/9

EX-GOVT. CATHODE RAY TUBES

VCR517 (guaranteed full picture) (carr. 5/-) 29/6ea. ACR2X (guaranteed full picture) (carr. 5/-) 12/8ea.

SPECIAL OFFERS. Germanium Crystal Diodes 1/11. Midget Mains Transformers (size approx. 2 1/2 x 2 1/2 in.). Screened Primary 220/240 v. 50 c/s. Output, 250-0-250 v. 60 mA, 6.3 v. 2.5 a. Only 11/9.

CO-AXIAL CABLE. 75 ohms 1/2 in., 9d. yard. Twin screened feeder, 8d. yard.

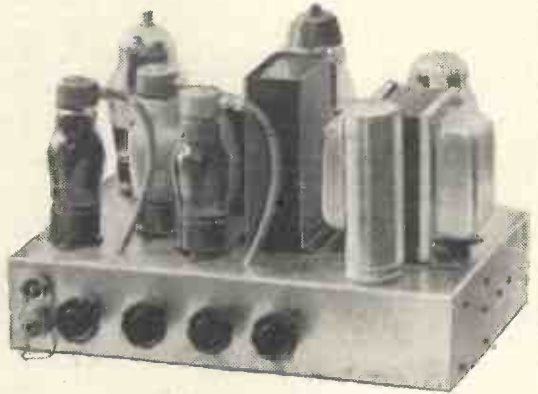
EX-GOVT. CATHODE ISOLATING FILAMENT TRANSFORMERS. 6.3 v. to 6.3 v. c.t., 3/9 ea.

R.S.C. 25 WATT "PUSH PULL" AMPLIFIER

Now firmly established and proving extremely popular, our AII Quality Amplifier we consider to be the best value in amplifiers offered to-day. The volume of its high fidelity reproduction is completely controllable, from the sound of a quiet intimate conversation to the full glorious volume of a great orchestra. Its sensitivity is so high that in areas of fair signal strength it can be operated straight from a crystal receiver. Entirely suitable for standard or long playing records in small homes or in large auditoriums. For electronic organ or guitar or for garden parties or dance bands.

The kit is complete to the last detail, and includes easy to follow point-to-point wiring diagrams.

Twin volume controls with twin input sockets allow SIMULTANEOUS INPUTS for BOTH MICROPHONE and GRAM, or TAPE and RADIO. SEPARATE BASS and TREBLE CONTROLS giving both LIFT and CUT. FOUR NEGATIVE FEEDBACK LOOPS with 15 db in the main loop from output transformer to voltage amplifier. Frequency response ± 3 db. 50-20,000 c.p.s. Hum and distortion LESS THAN 0.5 per cent. measured at 10 watts. This is comparable with some of the highest priced amplifiers. Six B.V.A. valves, Marconi/Osram KT series output valves. A.C. only, 200-230-250 v. 50 c/cs. input. 420 v. H.T. LINE. Paper reservoir condenser. Compact chassis. Matched components. OVERALL SIZE 4-10-9in. approx. Output impedances for 3 and 15 ohms speakers.



Available in kit form at the amazingly low price of **9 gns.** Plus carriage 5/- Or ready for use 50/- extra.



R.S.C. MASTER INTERCOMM. UNIT, with provision for up to 4 "Listen-Talk Back Units" individually switched. A high gain amplifier enables speech and other sounds emanating from the rooms containing remote control units to be heard at the master control. The unit is in kit form and point-to-point wiring diagrams are supplied. A walnut veneered wood or Brown Bakelite cabinet is included. Mains input is 200-250 v. 50 c/s. H.T. line 300 v. CHASSIS IS NOT "ALIVE." Ideal also for use as "Baby Alarm." Sound amplification 4 watts. Price only **£5/19/6**. "Listen-Talk Back Unit" as illustration can be supplied at 27/6 each. Full descriptive leaflet 1/- The Master Unit can be supplied assembled and tested for 27/6 extra.

R.S.C. BATTERY CHARGER KITS. For mains input 200-250 v. 50 c/s. To charge 6 v. accumulator at 2 amps., 25/9.

To charge 6 v. or 12 v. accumulator at 2 amps., 31/6.

To charge 6 v. or 12 v. accumulator at 4 amps. 49/9.

ABOVE KITS CONSIST OF BLACK CRACKLE STEEL CASE, MAINS TRANSFORMER, FULL WAVE METAL RECTIFIER, FUSES, FUSE-HOLDERS AND CIRCUIT. Due to careful design the use of resistors for regulation of charge has been obviated. The mean charging rates are as indicated above, and complete safety is ensured by fusing of both input and output. Chargers supplied assembled and tested for 6/9 extra.



A PUSH-PULL 3-4 WATT HIGH-GAIN AMPLIFIER FOR £3/12/6, plus carr. 2/6. For mains input 200-250 v. 50 c/s. Complete kit of parts including point-to-point wiring diagrams and instructions. Amplifier can be used with any type of feeder unit or pick-up. Output is for 2-3 ohm speaker. (We can supply a very suitable 10in. unit by Goodmans at 31/-.) The amplifier can be supplied ready for use for 25/- extra. Full descriptive leaflet 9d.

COLLARO 3-SPEED AUTOMATIC RECORD CHANGERS (brand new), type RC521, complete with 2 plug-in Crystal P.U. heads. Mains input 200-250 v. Limited number available at only **£9/19/6**.

COLLAROGRAM MOTORS, TYPE AC37. Governor controlled at 78 r.p.m. Mains input 110-200-230-250 v. Shaded pole type, 35/-.

COLLARO TAPE DESK MOTORS. Shaded pole type. Clockwise or anti-clockwise. Mains input 110-200-250 v., 31/6.

PERSONAL SET BATTERY SUPERSEDER KIT.



Complete with case. Supplies 90 v. 10 mA. and 1.4 v. 250 mA. fully smoothed, from normal 200-250 v. 50 c/s. mains. For 4-valve superhet receivers. Price with circuit 35/9. Or ready for use 42/6. Size of unit 5-4-1 1/2 in.

BATTERY SET CONVERTER KITS. All parts for converting any type of battery receiver to all mains. A.C. 200-250 v. 50 c/s. Kit will supply fully smoothed H.T. of 120 v. 60 v. or 60 v. at up to 40 mA., and fully smoothed L.T. of 2 v. at 0.4 a to 1 a. Price complete with circuit and instructions only 48/9. Supplied ready for use for 7/9 extra.

H.T. ELIMINATOR AND TRICKLE CHARGER KIT. Consists of h.t. and l.t. transformer, h.t. and l.t. rectifiers, smoothing electrolytic, choke, and steel case. For mains input of 200-250 v. Output 120 v. 40 mA. and 2 v. 1/2 a. Price with circuit 29/6. Or in working order, 37/6.

WILLIAMSON AMPLIFIER KIT. Complete set of parts (exact to author's specification) for construction of the original amplifier.



PRICE COMPLETE 14 gns.

R.S.C. TONE CONTROL-PRE-AMP. UNIT. A complete set of parts for the construction of a very efficient but simple pre-amplifier and tone control unit. Suitable for use with any amplifier and pick-up. Fil. supply is self-contained. Overall size is 7 1/2-5-5 1/2 in. approx. Full descriptive leaflet 9d.

PRICE INCLUDING WIRING DIAGRAMS 37/6. Or ready for use 15/- extra.

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18 s.w.g. undrilled aluminium amplifier type (4 sided)	6/11
12in. x 9in. x 2 1/2in.	6/11
14in. x 9in. x 2 1/2in.	7/11
14in. x 10in. x 3in.	8/3
16in. x 10in. x 3in.	
18 s.w.g. aluminium, receiver type, 6in. x 3 1/2in. x 1 1/2in.	1/11
7 1/2in. x 4 1/2in. x 2 1/2in.	2/9
10in. x 5 1/2in. x 2in.	3/3
11in. x 6in. x 2 1/2in.	3/11
16 s.w.g. aluminium, receiver type, 12-8-2 1/2in.	
16in. x 8in. x 2 1/2in.	5/3
20in. x 8in. x 2 1/2in.	7/6
10 s.w.g. aluminium, amplifier type, 4 sided.	8/11
12in. x 8in. x 2 1/2in.	7/11
16in. x 8in. x 2 1/2in.	10/11
20in. x 8in. x 2 1/2in.	13/6
14in. x 10in. x 3in.	13/6

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SELENIUM METAL RECTIFIERS. Full-wave bridge, 24 v. 10 amp. at 37/6 each; 24 v. 8 amp., 25/- each; 24 v. 6 amp., 22/6 each; 24 v. 5 amp., 21/- each. 6 v. or 12 v. 2 amp., 12/6 each; 6 v. or 12 v. 1 amp., 7/6 each. Half-wave: 24 v. 4 a., 14/6 each; 24 v. 3 a. at 12/6 each; 24 v. 2½ amp. at 11/6 each; 12 v. 4 a., 10/- each; 12 v. 3 a., 7/6 each and 12 v. 2½ amp. at 5/6 each.

1132A RECEIVERS, 11-valve Superhet Receiver, covering 100 to 124 Mc/s., complete with all valves, tuning meter, S.M. drive, R.F. and L.F. gain control, etc. Brand new with circuit diagram. Price 45/- each plus 5/- carr.

194 I.F. STRIP. The well-known I.F. Strip for TV conversion, as mentioned in "Practical Television," and other publications. Complete with all valves, viz., 6 VR65, 1 VR92 (EA50), 1 VR53. A few only available at 35/- each, plus 2/6 postage.

BOMBSIGHT COMPUTOR, MARK XIV, with two 24 v. A.C./D.C. motors, a 24 v. repeater motor, Gyro unit, dozens of gear wheels, and anaroids, etc. Ideal for model makers, etc., 32/6 each, plus 7/6 carr.

GRAM MOTORS, A.C. mains (200-250 v.). This shaded pole inductance motor is ideal for rim drive turntable, wire and tape recorder work, fans, timing mechanisms, motion displays, driving small models, etc. Size (overall), 3½in. x 3in. x 3in. R.P.M. 2,800 (approx.). These motors are silent running, 8/6 each, plus 1/6 post.

INDICATOR UNIT TYPE 157. Has same line-up as INDICATOR TYPE 62. Complete with VCR97 C.R.T., mask and mu screen, and all valves, etc. BRAND NEW IN TRANSIT CASE. Price £37/6, plus 7/6 carr.

CRYSTAL MONITORS, TYPE 2 (less valves and crystals). Useful chassis, 7in. x 5in. x 5½in., with cover. Contains 6-way Yaxley, on/off switch, indicator lamp holder, large phone jack, res., cond., L.F. choke and transformer, etc. In strong wooden case, 6/6 each, post free.

R.F. UNITS, TYPE 24. The well-known unit used with the 1355 Receiver for TV. Complete with valves. Slightly soiled on outside. An absolute bargain at 14/6 each, plus 2/- post and packing.

LINE OUTPUT TRANSFORMERS, with EYS1 rectifier. E.H.T. 7 to 8 kV. Price 22/6, plus 2/6 post and packing.

POWER PACKS. A.C. mains input. Output 350 v. 80 mA., 6.3 v. 1.5 amp., 6.3 v. 1.5 amp. Complete with 5Z4 rectifier, transformer, choke, etc. Size 8½in. x 8in. x 9in. deep. Price 25/- each, plus 3/6 carr.

MAINS TRANSFORMER. 425-0-425 v. 200 mA. at 32/6 each, plus 2/6 post. 320-0-320 v. 80 mA. 6.3 v. 3 a., 5 v. 2a., at 13/6 each, plus 1/6 post. **HALF-WAVE TRANSFORMERS,** 200 v. 50 mA., 6.3 v. 1.5 amp. at 7/6 each, plus 1/- post.

AMPLIFIER UNIT, TYPE A1271. Containing EF36 valve, 400Ω relay (4 makes, 2 breaks), 10,000Ω Pot., resistors, condensers, etc., in black metal case 5in. x 5in. x 5in. Brand new at 7/6 each, plus 1/6 post.

MODULATION TRANSFORMERS AND AUDIO CHOKES for SCR522 Tx. at 8/6 per pair, plus 1/6 post.

P.M. SPEAKERS, 10in. ROLA (less transformer). Brand new at 22/6 each, plus 1/6 post.

VIBRATORS, 4 pin 12 volt (ZA4878), made by Mallory (Type 650)-also 6 volt 4 pin at 4/6 each, 48/- doz.

GERMANIUM CRYSTAL DIODES, wire-ended, 2/- each, 18/- doz.

VALVES, VR65 at 2/6 each, 24/- doz.; EF50 at 5/- each.

METERS. By well-known manufacturers. 0-200 mA. 2½in. circular brand new at 10/6 each, plus 1/- post. 0-250 Ov. D.C. at 12/6 each, plus 1/- post.

COAXIAL CABLE. 75 to 80Ω impedance. Brand new current stock, ¼in. dia. Available in the following lengths: 15 yds., 16 yds. 17 yds., 18 yds. and 19 yds. Price 6d. per yard, plus 1/- postage.

VALVEHOLDERS. Ceramic B7G, with screening cans at 1/3 each 12/6 doz. Ceramic EF50 (B9G) at 9d. each, 8/6 doz. **SPECIAL OFFER** of Govt. surplus BRAND NEW Int. Octal Amphenol Valveholders at 4/6 doz. Please add postage.

OCTAL PLUGS (with covers). Fits into int. octal holder to make a useful plug and socket, 9d. each, 8/6 doz.

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MIDGET 465 kc/s I.F. TRANSFORMERS. Dust core tuned, size 1½in. x 1in. dia. Price 6/9 per pair.

POTENTIOMETERS, ¼ megohm and 200,000Ω linear miniature pots., long spindle, 2/- each.

POLYTHENE RODS, ⅜in. dia., 12in. long at 6/- doz.

CARBON MIKE INSERTS, Mark IV at 1/6 each.

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32 mfd., 350 v., 15/- per doz.	25 mfd., 50 v., 12/- per doz.
32+8 mfd., 350 v., 18/- per doz.	12 mfd., 50 v., 12/- per doz.
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Volume Controls with switch, 50K and 500K and other values, 2/6 each.

All are BRAND NEW goods, C.O.D. or C.W.O. Reduced prices for large quantities. Orders for less than £2, add postage.

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CARBON. ¼ watt to 5 watt. All popular values. Standard Car Suppressors, 15,000 ohms.

Volume Controls MORGANITE "A" "H" type, "LH" type, "M" type and WIRE WOUND. Most values and popular makes in stock.

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I.F. STRIP 194. An easily modified strip recommended for T.V. constructors who want good results at moderate cost, or for those who have built televisions but are having trouble in the sound or vision receivers. Size 18in. x 5in. x 5in., it is complete with 6 valves VR65, 1 of VR92, and 1 of VR56 or VR53. Mod. data supplied. ONLY 45/- (postage, etc., 2/6). Less valves, 19/6 (post, etc., 2/6).

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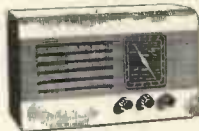
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16 mfd., 450 v.	3/6	8-16 mfd., 350 v.	3/11
32 mfd., 500 v.	4/11	4 mfd., 450 v.	1/6
50 mfd., 12 v.	1/6	32-32 mfd., 350 v.	3/11

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ACOS Mic. 22 (Crystal)	£4 4 0
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 Drop thro' 110-110 60 mA., 6 v. 0.5 amp., 8/6.
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 Drop thro', 270-0-270 80 mA., 6 v. 3 amp., 4 v. 1.5 amp., 13/6.
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	with trans.	less trans.
2 1/2 in.	15/6	13/6
3 1/2 in.	16/6	12/6
4 in.	16/6	12/6
5 in.	18/6	15/6

P. & P. on the above 1/- each.
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R. & A. 8 in. M.E. Speaker field coil, 1,600 ohms O.P. trans., 3,000 ohms. Imp., 18/6. P. & P. 2/-.
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Truvox BX11. 12 in. P.M. 3 ohm speech coil, 45/- P. & P. 3/6.
 6 1/2 in. M.E. Speaker, 1,000 ohm field coil, 15/- P. & P. 1/6.
 Extension speaker cabinet, in contrasting walnut veneers, size 15 x 10 1/2 in. Will take 6 1/2 or 8 in. speaker, 17/6. P. & P. 2/-.

Volume Controls. Long spindle less switch, 50K, 500K, 1 meg., 2/6 each. P. & P. 3d. each.
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 Trimmers, 5-40 pf., 5d.; 10-110, 10-250 10-450 pf., 10d.

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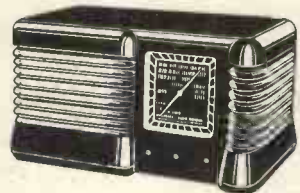
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change switch, 2/-; 32 x 32 mfd., 4/-; bias condenser, 1/-; resistor kit, 2/-; condenser kit, 4/-.
 M. & L. Superhet coils with circuit, 6/6; iron cored 465 IF's, 7/6; min. gang, 5/6; volume control with switch, 4/-; wave-changes with, 2/6; heater trans., 7/6; 4 v/1, 1/6; 4 obsolete ex-Gov't. valves, metal rectifier and Xtal diode with circuit, 14/6; 25 x 26 mfd., 1/- 16 x 16 mfd., 3/3; condenser kit (17), 7/6; resistor kit (14), 3/6.

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FULLY SHROUDED CHOKE 15 Henry 180 mills 15/- P. & P. 2/-.

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 These last 4 items by very famous manufacturer.

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CONSTRUCTOR'S PARCEL. Chassis 8 in. x 4 in. x 1 1/2 in. 5 in. P.M. speaker with transformer twin gang with trimmers, pair T.R.F. coils long and medium, four valveholders, 20 K. volume control and wave-change switch, 23/- P. & P. 1/6.

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AS ABOVE, with superhet chassis, 23/6. P. & P. 3/6.
AS ABOVE, complete with new speaker to fit, and O.P. trans., 35/- P. & P. 3/6, with superhet chassis, 36/- P. & P. 3/6.
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 100 mfd. 350 wkg. 4/-
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 Miniature wire ends moulded.
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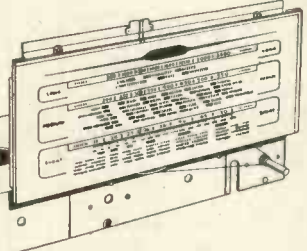
P.M. Focus Unit for any 9 or 12 in. tube except Mazda 12 in., with Vernier adjustment, 15/- P. & P. 1/6.

P.M. Focus Unit for Mazda, 12 in., with Vernier adjustment 17/6. P. & P. 1/6.
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Iron-Cored 465 Kc. Whistle Filter, 2/6.
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MAINS TRANSFORMERS. Input 200/240 v. Output 350-0-350 or 250-0-250 volt 80 mA. and 4 and 6.3 v. 4 a. and 4 and 5 v. 2 a. Price 21/6. Input 200/240 v. Output tapped 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30 volts, 2 amps., 21/6. All with one year's guarantee.

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With valves 37/6.

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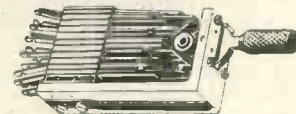
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SKY RIDER DEFIANT SX24 is similar to above but includes crystal I.F. filter and S meter, etc. Complete with valves and crystal for £27/10/-, plus 10/- carriage and packing. For further details send S.A.E.

COMMUNICATION RECEIVER RI155 for world-wide reception. Can be heard at any time during shop hours. Air tested prior to despatch. Brand new at £11/19/6. A few slightly used at £7/19/6.

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Type C. With 8 in. R.C.A. speaker, built in R.C.A. speaker cabinet as described below. Price £6/10/-, plus 3/6 carriage.

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VISUAL INDICATOR TYPE I Ref. 10Q/2—the cross-over Left/Right indicator for D.F. operation and Loop Aerials Type 4, ref. 10B/420. Both Brand new and boxed. We have these items in stock and those interested in complete D.F. installations should contact us for quotations.

R.C.A. SPEAKER. 8 in. P.M. unit in beautiful black crackle cabinet. Size 11 1/2 in. x 10 1/2 in. x 6 in. A de Luxe job. Brand new at 45/-, plus 2/6 carr.

U.S.A. DYNAMOTOR. 12 volts D.C. input, 250 volts 60 mA. output. Weight 2 1/2 lbs. Size 4 1/2 in. x 3 in. diameter. Ideal for car radio, mobile amplifiers, small transmitters, etc. All tested prior to despatch. ONLY 22/6, post paid.

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TRANSFORMER BARGAINS. 350-5350 volts at 180 mA., 6.3 v. 5 Amps and 5 v. 3 Amps. Standard 200/250 volt 50 cycle screened primary. Size 4 in. x 4 in. x 5 in. Brand new and unused 29/6 plus 2/6 post. Filament Transformers—Standard tapped primary, two types—Type "A" 12 volts 1 1/2 Amps., 6.3 volts 1 1/2 Amps. Type "B" 12 volts 1 1/2 Amp., 4 volts 1 1/2 Amp. Either type 7/6 each.

H.R.O. 6 VOLT VIBRATOR PACK gives 165 volts 80 mA. smoothed D.C. Uses Mallory vibrator, 6X5, heavy duty smoothing choke, etc. In black crackle cabinet size 7 in. x 7 in. x 6 in. Brand new only 29/6 plus 2/6 postage.

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4 mfd. at 1,000 volts. Size, 4 1/2 in. x 4 in. x 1 1/2 in., 5/- New and boxed.

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SPECIAL PRICE at 3 for 10/6. .25 mfd. at 1,500 volts. Size, 2 1/2 in. x 2 in. x 1 1/2 in. Price, 3 for 4/6, post paid. All the above are metal cased with paper insulation and fixing feet. .04 mfd. 12.5 kV. ONLY 6/- each.

BATTERY CHARGERS. Contained in black crackle case, size 6 in. x 7 in. x 12 in., 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.

METAL RECTIFIERS

Selenium 230 volts 60 mA. at 5/-; 300 volts 100 mA. at 7/6; RM2 at 4/3 or two for 8/-; RM4 at 17/-; Selenium Full Wave Bridge 6 or 12 volts—1 Amp. at 7/6; 2 Amp. at 11/3; 3 Amp. at 12/6; 4 amp. at 15/-. Heavy duty selenium rectifier, square fins, size 8 1/2 in. x 4 in. x 4 in. Two units in full wave bridge give 48 volts 10 Amps. D.C. Brand new at £4 per pair.

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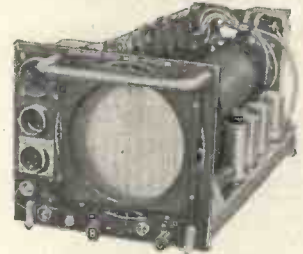
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contains 3 EF50, 1 5U4G, 4 SP61 and a 6Jn. C.R.T. type VCR517. This tube will replace the VCR97 without any alteration, is completely free from cut-off and has a more pleasant tube colour. Contains in addition a very large assortment of pots, resistors, condensers, etc. Tubes demonstrated. Supplied BRAND NEW (less relay) for only 67/6, plus 7/6 carriage in original transit cases. Original circuit supplied FREE with each order, or 1/6 separately.



NOTE PRICE REDUCTION

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RI355 RECEIVER. This justly famous receiver unit is specified for the "Inexpensive T.V." Valve line-up: 8 SP61, 1 VR92, 1 VU120, 1 5U4G. Slightly used, but in very good condition. BARGAIN PRICE 29/6, plus 5/- carriage and packing.

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45 Mc/s PYE STRIP Vision unit for London frequency, complete with 6 EF50 and EA50. Circuit provided. Price £3/10/-, plus 2/6 carriage.

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E.H.T. TRANSFORMER for the VCR97, etc. Mains input. Output 2,500 volts, 4 volts 2 amp., 2-0-2 volts 2 amp. Fully guaranteed at 35/-, plus 1/- post.

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Transformers of current manufacture. Two types, both standard tapped primaries. Universal mounting. (1) 350-0-350 volts 80 mA., 0-4-6.3 volts 4 amps, 0-4-5 volts 2 amps. (2) 250-0-250 volts 80 mA., 0-4-6.3 volts 2 amps, 0-4-5 volts 2 amps. Both these transformers are new and boxed, fully guaranteed at 18/- each, post paid.

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H.R.O. 6 volt Vibrator Power Packs. Output 165 volt 80 M/a., 6.3 volt at 3 amps., 6 x 5 rectifier. Choke condensers smoothed, complete in self-contained crackle cabinet size 7in. x 7 1/2 in. x 6in., battery leads with croc. clips supplied. Brand new, 39/6 each.

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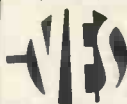
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It is constructed to take the chassis in the top part, dial being permanently visible through sloping front. Underneath, the gramophone unit is housed in a drawer which slides forward on steel runners—when required for use—Total Cabinet measurement is 36in. high, by 20in. wide by 16in. deep.—Our price for the cabinet only is £9/17/6—plus 10/- packing and carriage.

● The Collar changer listed above fits neatly in drawer of this cabinet! ●

We can supply the three units, cabinet, chassis and changer, if purchased together at one time, at a price of £32/10/- plus 20/- packing and carriage. May we suggest an 8in. Elac P.M. Speaker at 17/6. Fully assembled model being demonstrated at our shop premises!

REGARDING CABINETS, we have in stock attractive 5in. Extension speaker cabinets at 13/6, for 6in. at 17/6 and for 8in. at 22/6. All modern, walnut finish. We can also offer portable record player cabinets, from 55/-, T.V. Console Cabinets from £7/19/6, and Radiogram cabinets from £9/17/6. Sorry, we've had insufficient time to prepare literature. So, for the present, personal shoppers get the benefit of seeing them!

AMPLIFIERS. Continuing the policy of our predecessors, we offer the well-known super quality 8½-watt amplifier, built and tested at 16 guineas or available in kit form with fully illustrated instruction booklet, at £13/13/-—descriptive leaflet available on request. Also the "Junior" version, 4½ watts, at 10 guineas. Any of the above can be demonstrated!

SPECIAL OFFER.—Garrard AC/DC Model "E" Synchronous motors—Auto-stop and start for 78 r.p.m.—Speed regulator—Few only at £7/19/6 plus 2/6 packing and carriage. We also have in stock—Connoisseur 3 speed motors, pick-ups. Pick-ups and heads, by Garrard, Decca, Collaro, Acos, Chancery, etc., etc., all at current prices!

F.S.D.	Size	Type	Fitting	Price
200 microamp	D.C.	2½in.	M.C. F.R.	42/-
250 microamp	D.C.	2½in.	M.C. F.R.	40/-
500 microamp	D.C.	2in.	M.C. F.R. or F.Sq.	18/6
1 mA.	D.C.	2in.	M.C. F.Sq.	17/6
1 mA.	D.C.	2in.	M.C. F.Sq. (Scale Calib. 1.5kV.)	15/-
1 mA.	D.C.	2½in.	M.C. Desk type	27/6
5 mA.	D.C.	2in.	M.C. F.Sq.	7/6
10 mA.	D.C.	2½in.	M.C. R.P.	10/-
15 mA.	D.C.	2in.	M.C. F.R.	7/6
20 mA.	D.C.	2in.	M.C. F.R.	7/6
50 mA.	D.C.	2in.	M.C. F.Sq.	8/6
200 mA.	D.C.	2½in.	M.C. R.P.	10/-
500 mA.	D.C.	2in.	M.C. R.P.	8/6
0.5 amp.	R.F.	2in.	Thermo F.Sq.	4/6
2.5 amp.	AC/DC	2in.	M.I. F.R.	12/6
3 amp.	R.F.	2in.	Thermo F.Sq.	7/6
5 amp.	D.C.	2in.	M.C. F.Sq.	13/6
10 v.	D.C.	2in.	M.C. R.P.	8/6
150 v.	D.C.	2½in.	M.C. F.R.	15/-

R.P. = Round projection.
F.Sq. = Flush Square.
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Thermo = Thermo-couple.
M.C. = Moving coil.
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THE "ECONOMY FOUR" T.R.F. KIT. A three valve plus metal rectifier receiver. A.C. mains 200/250 v. Medium and Long waves.—We can supply all required components right down to the last nut and bolt. Valve line-up, 6K7, 6J7 and 6V6. Chassis ready drilled—Cabinet size 12in. long, by 6in. high by 5in. deep—Choice of ivory or brown bakelite, or wooden, walnut finish cabinet. Complete instruction booklet with practical and theoretical diagrams. Each component brand new and tested prior to packing. Our price £5/15/- complete—Remember this set is being demonstrated at our shop premises! We proudly claim that our fully illustrated instruction booklet is the most comprehensive available for this type of receiver—Booklet available at 1/6 post free—This is allowed if kit is purchased later—Please, 2/6 packing and carriage for complete kit.

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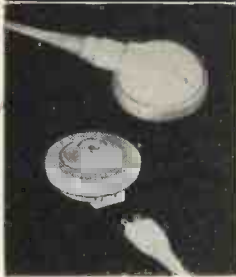
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Readers are warned that Government surplus components which may be offered for sale through our columns carry no manufacturers' guarantee: Many of these components will have been designed for special purposes making them unsuitable for civilian use, 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
12-watt high quality amplifiers, bass and treble boost; £12/15; lists.—Broadcast & Acoustic Equipment Co., Ltd., Tombland, Norwich. [0065]

RECEIVERS, AMPLIFIERS—SURPLUS AND SECONDHAND
R109, R111 & sets, good wkg. order; offers.—Box 1542. [2033]

B.C.342 with 115/230 volt autotransformer for sale, £18/10; less than 50 hours' use.—Perrin, 106, Boscombe Rd., Worcester Park, Surrey. [2008]

HALLICROFTER Skyrider S.X.28, complete with speaker and phones, just returned from check over and retrim.—Peaty, Old Manor House, Ditchling, Sussex. [2061]

HRO Rx's and colls in stock, also AR58, BC549R, CR100, etc.—Requirements please to R. T. & I. Service, 254, Grove Green Rd., London, E.11. Ley. 4936. [0053]

HALF-WIRED 30w H-F1 amplifier, integral T.R.F., 3 mic., 2 gram, inputs, 2-30 ohm output; £25 or offers; details and photo.—G3JMG, 104, Bentley Lane, Leeds, 6. [1954]

EDDYSTONE 507 receiver complete with speaker and signal meter, just overhauled, £45; also Sound-Mirror Tape recorder with mike and three tapes, £40.—R. L. Simpson, Elmhurst, Alnwick, Northumberland. [2055]

LOUDSPEAKERS—SURPLUS AND SECONDHAND
LOUDSPEAKER, moving coil, B.T.H., R.K. type, No. 85618, field 200v.—Offers to 29, Glendon Gdns., Mill Hill, London, N.W.7, Mill Hill 2167. [2062]

LOUDSPEAKERS—SURPLUS AND SECONDHAND WANTED
WANTED horn speakers, complete, any type, offers to—Radioequipment Co., Brook St., Raunds, Wellingborough, Northants. [1949]

TEST EQUIPMENT—SURPLUS AND SECONDHAND
AVO all-wave oscillator, A.C. 1946; £9.—Willmot, 6, Albert Park Rd., Malvern. [1970]

COSSOR signal generator, 6-52 M/C A.M. type 52A, as new; £15.—Willis, The Limes, Boreham, Essex. Tel. 319. [2052]

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. 4936. [0056]

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FOR SALE AND WANTED ADVERTISEMENT FORM
TURN TO PAGE NO. 149



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DYNAMOS, MOTORS, ETC.—SURPLUS AND SECONDHAND

H.F. alternators, 80v, 25a, 1,500 cycles; also hot wire ammeters, 0-1, 2 amps.—E.W.S. Co., 69, Church Rd., Moseley, Birmingham. [1613]

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HARDING ELECTRONICS, 120a, Mora Rd., London, N.W.2. [1858]

FERROGRAPH magnetic tape recorder, model 2A now available; price 76gns.; demonstration daily by appointment. SOUND DISCS (SUPPLIES), Ltd., 178, Bisham Rd., Southport. Tel. 88153. [1802]

HIGH-FIDELITY FM, the very best RF signal converted to AF. See display advert on page 146.—Bel Sound Products Co., Marlborough Yard, N.19. [0185]

C.J.R. ELECTRICAL & ELECTRONIC DEVELOPMENT, Ltd., manufacturers of high quality portable and console magnetic tape recorders for professional and amateur use; full details on application.

BICKFORD Rd., Witton, Birmingham, 6, East 0822. [2056]

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GRAMOPHONE AND SOUND EQUIPMENT -SURPLUS AND SECONDHAND

WEARITE Tape-Deck, £25; Ferragraph 2A. new, 76gns.—Plant, Asfordby, Melton Mowbray. [2040]

ORTOFON, Danish, moving coil P.U. two sapphires, twist head, 33 and 78, as brand new, makers' box.—Box 1560 [2043]

GRUNDIG two-speed reporter, as new, complete tape, mike, list £84; £65.—Taylor, 125, Manchester Rd., Denton, M/C. [1880]

TANNOP square horn L.S., £4; Collaro 78 r.p.m., var. speed gram. unit, with P.U., £3; 5-10in M.C. cabinet, L.S. £1 ea. Lane tape deck, £15 or offers.—Box 1402. [1988]

M.S.S. PMR/1 high-quality tape recorder for sale, price new £150, owner selling to obtain larger equipment, first-class condition; can be seen London; £110 or near offer.—Box 1564. [2048]

COMPLETE tape recorder, 2-speed using latest Clifton desk, quality amplifier, accurate equalisation, level meter, Monitor speaker; demonstrated North London; £35.—Box 1540. [2030]

ANY of you tape types building your own? Although we deal primarily in sub-standard cine equipment, it's quite possible that our "Bits and Pieces" list might be useful; s.a.e. please. We also wish to buy tape desks, recorder components, etc.—Burgess Lane & Co., Block J, Sunleigh Works, Sunleigh Rd., Weymouth, Tel. Wern. 2378. [10253]

FACTORY-BUILT magnetic tape recording amplifiers 4w R/P model, latest type, B.V.A. valves, £15; to Wearite specification, £25. 12-valve professional model with separate record and play channels, 10w output, meter level, £45; Wearite, Truvox, Lane tape units, Grundig and Ferragraph recorders.—J.B. Electronics, 47a, Bulwer Rd., Leicester. Tel. 74579. [2053]

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VALVES urgently wanted for export, types 813, 723A/B, 250TH, 833, any quantity; highest prices paid.—Write Pype-Hayes Radio, 606, Kingsbury Rd., Birmingham, 24 (Erdington 4942). [2016]

45/- paid for 813 valves, 60/- 723 A/B; also wanted, 805, 803, 807, 2432, 2K33, TZ40, 808, etc.; any quantity; write—Pype Hayes Radio, 606, Kingsbury Rd., Birmingham, 24, (Erdington 4942). [1861]

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JUST released by the Ministry.—All-dry H.T./L.T. batteries, 72 volt H.T.+1.5v L.T., layer type size, 6in×5in×2in; also 60v H.T.+1.5 L.T., ideal for deaf aids, personnel sets, models, etc., size 4in×3in×1 1/2in, all tested and guaranteed full voltages before despatch; our special price 4/6 each, post and packing 1/3, or two for 8/-, post and packing 1/6.—Walton's Wireless Stores, 48, Stafford St., Wolverhampton. [0061]

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CRYSTAL microphone inserts (Cosmocord Mic-6), guaranteed brand new; 15/6, post free.—Radio-Aid, Ltd. (Retail Dept.), 29, Market St., Watford. [0036]

S.T.C. 33A/100A twin trans triode S.T.C., 5B/300B, 40-watt trans pentode, not ex-Govt. brand new and boxed, limited quantity, 17/6 ea.—R.B. Radio, 393, Edgware Rd., W.2. [1968]

TELEVISION- New 3in canned formers 2/3 ea., coil sets, EE, VM, etc., from 18/6; FM. Rx. coil sets 7/-; 6mm cored formers 7/- doz., 8mm 10/-; 3W4B min. switches 15/- doz.—Bel Sound Products Co., Marlborough Yard, N.19. Arc. 5078. Trade supplied. [0186]

NEW the "High Q" C.5 TRF matched L and MW coils are now available; we claim the finest made for the price of 8/- per pair, inc. battery and mains circuit diagrams; if unobtainable locally send direct to: Cretton Radio, 349, Connor Rd., Portsmouth. [1899]

FOR really good results you can do no better than use Osamor coils and coilpacks, ask anyone of experience! Send 5d (stamps) today for beautifully-drawn free circuits, our new coil data leaflets, and latest lists of matched radio components. A speedy mail order department is at your service, and remember, all Osamor lines are guaranteed. (Trade enquiries invited.) Dept. G.W.I. [0046]

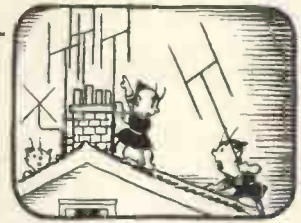
OSMOR RADIO PRODUCTS, Ltd. Bridge View Works, Borough Hill, Croydon. Tel. Croydon 5148-9. [0046]

FLUORESCENT 80 watt 230v complete ballast unit, 39/6; 80w brick choke and starter lamp, 14/6; 40 watt complete ballast 230v, 28/9; complete fluorescent fittings from 45/-; metal rectifiers, 12v 4amp f/w bridge, 18/9; suitable charger transformer, 18/6; 6ampmeter, 8/6; brand new small radio cabinets, 16/6; multi-ratio output transformers, Goodmans, 7/6; Diamond H switches, 4/6; 4-pole cooker switches, 5/-; charge your dry cell batteries with our special charger from mains, complete unit, 14/9; new G.E.C. 1/2hp electric motors, 230v 8/7p, 4/16.—Malden Transformer Supplies, Rear of 5, Coombe Rd., New Malden, Surrey, Mal. 2655 (Longside of Malden S.R. Station). [0038]

COMPONENTS—SURPLUS AND SECONDHAND

G. A. RYALL, "Utopia," Mayfield Rd., Herne Bay (Kent); please refer to previous adverts. [0025]

SOUTHERN RADIO SUPPLY, Ltd., 11, Little Newport Street, London, W.C.2. See our displayed advertisement, page 142. [0016]



THE "FLUXITE QUINS" AT WORK

"What's the matter? You're nothing but moans Get along and don't make any bones Thanks to good old FLUXITE We're doing all right."

Have you room there for old Mrs. Jones? See that **FLUXITE SOLDERING PASTE** 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.**

FLUXITE

SOLDERING PASTE

A Staunch Companion to Fluxite Soldering Fluid.

SIMPLIFIES ALL SOLDERING

Write for book on the Art of "SOFT" soldering and for leaflets on **CASE-HARDENING STEEL** and **TEMPERING TOOLS** with **FLUXITE.**

FLUXITE LTD.

BERMONDSEY STREET, LONDON, S.E.1.

Most types of coil winding undertaken. Very quick deliveries, small or large quantities. Transformers, Chokes, Solenoids, Relay Coils, etc., wound on your own bobbins or formers for your own assembly. Impregnating (varnish) on all work done if required. Best quality material used. Single prototypes made to high standards, regulation and cool running etc.

FOR CATHODE RAY TUBE FAILURES.

Special low capacity secondary winding for Heater/Cathode shorts to restore picture after this fault has occurred. All Primaries tapped, framed and tag panelled. 200/250, 2 v. at 2 a., 4 v. at 2 a., 6.3 v. at 2 a., 10.8 v. at 0.3 a., at 29/6 each. (Discount to trade)

EMISSION REJUVENATORS. 200/250

tapped output tapped in steps 2 v. to 2 1/2 v. to 2 1/2 v. at 2 a., at 35/6 each. Output 200/250 tapped in steps 6.3 v. to 7 v. to 8 v. up to 9 1/2 v. at 2 a., at 37/6 each. (Discount to trade)

Both space wound for Heater/Cathode shorts also

T.V. HEATER TRANSFORMERS, 200/250

6.3 v. at 7 a., 0.2-6.3 v. at 2 a., at 19/6 nett.

T.V. AUTO TRANSFORMERS. 0-190

210-230-240 at 6.3 v. at 7 a., 0.2-6.3 v. at 2 a., at 27/6 nett.

T.V. FRAME TRANSFORMER. 60 H.

magnetic deflection, suitable for most home constructed sets at 15/6 nett.

HALF SHROUDED, 200/250 Input, 250/0

250 80 mA, 6.3 v. 3 a. and 5 v. 2 a., 12/9 net plus 1/1 P. & P.

NORTHERN TRANSFORMER CO.

215 BARKEREND ROAD, BRADFORD, YORKS.

WIRE

on $\frac{1}{4}$, $\frac{1}{2}$ & 1 lb. reels

In stock for IMMEDIATE DELIVERY

per $\frac{1}{4}$ lb. reel

ENAMELLED COPPER WIRE

swg.	price	swg.	price	swg.	price
16-18	1/6	26	2/2	34	2/10
20	1/8	28	2/4	36	3/-
22	1/10	30	2/6	38	3/3
24	2/-	32	2/8	40	3/6

DOUBLE COTTON COPPER WIRE

swg.	price	swg.	price	swg.	price
16	1/9	24	2/8	32	3/8
18	2/2	26	2/11	34	4/2
20	2/4	28	3/2	36	4/8
22	2/6	30	3/6	38	6/2

DOUBLE SILK COPPER WIRE

swg.	price	swg.	price	swg.	price
16	1/9	26	3/6	34	5/4
18	2/2	28	3/10	36	6/-
20	2/8	30	4/2	38	6/8
22	3/-	32	4/8	40	7/8

TINNED COPPER WIRE

swg.	price	swg.	price	swg.	price
14	1/4	20	1/10	24	2/2
16	1/6	22	2/-	26	2/4
18	1/8				

ENAMELLED SINGLE SILK

swg.	price	swg.	price	swg.	price
20-22	2/6	32-34	3/9	38	6/-
24-26	2/9	36	5/-	40	7/6
28-30	3/3				

Intermediate gauges available.

per 1oz. reel

EUREKA ETC.

swg.	price	swg.	price	swg.	price
16-22	1/2	30	1/8	36	2/2
24	1/4	32	1/9	38	2/7
26-28	1/7	34	2/-	40	3/3

NICKEL CHROME

swg.	price	swg.	price	swg.	price
16-22	3/7	30	5/2	36	6/5
24	4/-	32	5/4	38	7/9
26-28	4/9	34	6/-	40	9/7

Wholesale enquiries invited.

ORDERS 21 UP POST PAID

HYGRADE

WIRE CO.

Telephone: GERrard 0293
16 Gerrard Street, London, W.1

COMPONENTS—SURPLUS AND SECONDHAND

RADIO CLEARANCE, Ltd., 27, Tottenham Court Rd., London, W.1. Tel. Museum 9188.

ELECTROLYTICS, capacity, voltage, size, type of mounting, price post paid; 400, 6v, 1X2in. lug, 1/9; 250+250, 6v, 1X2in. lug, 2/-; 500+500, 6v, 1X3, lug, 2/6; 40+40, 150v, 1 1/2X2, clip, 2/9; 40, 150v, 1X2, clip, 2/6; 20+20, 275v, 1X2, lug, 3/5; 16+32, 275v, 1X2, lug, 3/5; 16+16, 275v, 1X2, clip, 3/3; 32+32, 275v+50mf 25v, 1X3, lug, 3/6; 60+100, 275v, 1 1/2X3, lug, 4/6; 100, 275/350v, 1 1/2X3, clip, 3/6; 32+12, 350v, 1 1/2X2, clip, 4/-; 16+16+16, 350v, 1 1/2X2 clip, 1 1/2X2, 4/9; 40+40+20, 350v, 1 1/2X3, lug, 5/-; 16, 350v, 1 1/2X2, lug, 1/9; 40+40, 300v, 1 1/2, lug, 7/6; 10, 450v, 1 1/2X2, lug, 1/6; 16, 450, 1 1/2X2, tag, 2/9; 20, 450v, 1X2, lug, 2/3; 32, 450/525v, 1 1/2X2, clip, 3/9; 32+32, 450v, 1 1/2X3, clip, 5/6; 30+30, 450v+20mf 25v, 1 1/2X3, lug, 5/-; 15+15, 450v+20mf 25v, 1 1/2X3, lug, 4/6; 200, 6v, 1 1/2X1 1/2, clip, 1/6; 100, 12v, 1 1/2X1 1/2, clip, 1/9; 8, 450v, 1X2, clip, 2/-; 50, 12v, 1 1/2X1 1/2, tag, 1/6; 150, 25v, 1 1/2X1 1/2, clip, 2/-; 250, 12v, 1 1/2X1 1/2, wire, 2/3; 350, 25v, 1X2 1/2, clip, 2/6; 16+16, 450v, 1 1/2X2, clip, 4/-; 40+40, 275v, 1 1/2X2, clip, 3/3; 16+32, 450/525v, 1 1/2X2, clip, 5/-; 24+24+16, 450/425v, 1 1/2X2, lug, 8+16, 4/9; 60+200, 275/350v, 1 1/2X4 1/2, clip, 6/6; 4, 150v, 1 1/2X1 1/2, clip, 1/1; 500, 12v, 1 1/2X2 1/2, clip, 2/-; 8, 350v, 1 1/2X2 clip, 1/9; 6,000, 12v, 1 1/2X4 1/2, lug, 4/6; 100+200, 275/350v, 1 1/2X4 1/2, 6/6; 100+175, 275/350v, 1 1/2X4 1/2, clip, 6/6; 32+32, 350/425v, 1 1/2X2, clip, 5/-; 8+16, 450/525v, 1X2, clip, 4/-; 2, 450/525v, 1 1/2X1 1/2, tag, 1/6; 2, 350v, 1 1/2X1 1/2, tag, 1/3; 1,000, 6v, 1X2 1/2, clip, 2/9; 3,000, 6v, 1X3, clip, 3/6; 8, 450v, 1 1/2X2, clip, 1/9; all all cans, some with sleeves all voltages W/K/G, surge where marked, new stock guaranteed.

TELEVISION! Set of 3 components, comprising line output trans., with E.H.T. winding to give 7kV, using EY51 (heater winding for EY51 also included), and fitted with width control scanning coils, low impedance line and frame, focus coil (res. 10,000), current approx 20 mA; the set of 3 for 42/-, plus 2/- post, diagram of line trans. supplied.

PERSONAL receivers, 3 valve T.R.F. using IT4s, contained in handsome bakelite case with lifting lid, size 7X9 1/2X5 1/2 in. 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 hos, patients, etc., these receivers are not Govt. surplus and are offered ready to play, carr. paid £4/10.

UNIVERSAL amplifiers, 2-valve 20watt A.C./D.C., black crackle chassis, and black and chrome cover, overall size 15 1/2 in X 7 1/2 in X 7 in. First-class components (Partridge O.P.T. and driver, Gardner choke, A.E.E. Mu-Metal input trans. for mike). Valves, 2XEF37, 4XCL33, 2XUR3C. Switched input for high or low imp., top cut and hiss out switches, V.C. mains switch, mains plug and socket, 220-250v, isolated chassis, 150 output. Wired and tested, ready for use, with valves, brand new, £10/19/6, carr. paid.

5 mA meters, moving coil, Bakelite case, 2in square, flush mounting, new, boxed; 8/- post paid.

RADIO CLEARANCE, Ltd., 27, Tottenham Court Rd., London, W.1. Tel. Museum 9188. 10015

SUPREME RADIO, 746b, Romford Rd., Manor Park, London, E.12. Tel. 11f. 1260, ext. 17 yrs.

SEASONAL bargains.
NEW stocks electrolytics: metal can 32+32 mfd 450v, 550v surge; bargain at 4/11 ea.
SMALL metal can types, 16-16mfd 350v, 2/3 ea., 32+32+16mfd 350v, 3/6 ea., 60+150mfd 275v d.c. w/g., large can, wonderful buy, 4/11 ea.

TUB/CARD w/end types 8mfd 450v, 1/11 ea.; or 8mfd 500v drylitle cond., 2/9 ea.; 4mfd 150v drylitle, 10d ea.
10in P.M. speakers 2-3ohm v/c amazing bargain, 17/6 ea.; also 8in p.m./s 2-3ohm v/c, 13/11 ea.; 6 1/2in type, 12/11 ea.; 5in, 10/6 ea.
METAL recs. R.M.I., 3/11 ea., R.M.2, 4/3 ea.; R.M.3, 5/11 ea.

ANOTHER winner! mains trans., by Parmeko, universal fixing primary tapped 0-200-220-240v, sec. 290-0-290v 80m/a, 6.3v 3amp and 6.3v tapped at 4v 2amp, with screen, our price 15/11 ea., inc. p/post.

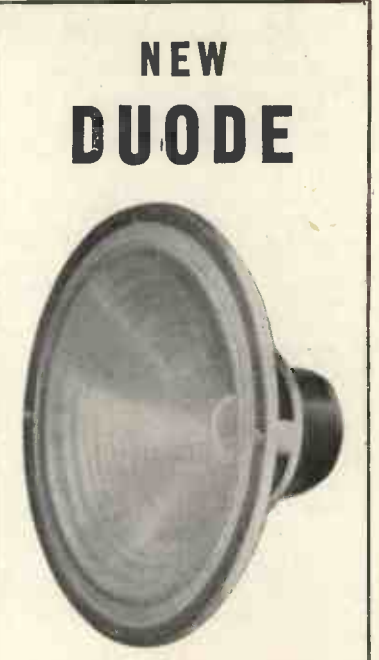
JUST arrived! mains trans with vol./panel tapped 200-210v, 220-230v, 240-250v primary; secondary 250-0-250v 60m/a with 6.3v tapped at 5v; our price 11/9 ea., incl. p.post.

DROPPERS, cement coated with sliders and fixing feet, 3 amp 800 ohms, 4/- ea.; 15 amp 1.5K ohms 3/9 ea.; 1 amp 2K ohms, 3/9 ea.; 2 amp open wire type, 4/- ea.; fixed type 1 amp 1K ohms, 2/6 ea.

SMALL vol/controls, 1 meg or 1/2 meg with 1/spindle and d/p switch, 3/- ea.; 1/2 meg or 2 meg v/controls, less switch, 1/6 ea., or 15/- doz.

SPECIAL offer! crystal diodes with crystal set circuit, 1/6 ea.
2p. 2 w/CHANGE switches, 1/- ea. or 10/6 doz.
TWIN gang, .0005 mfd tuning cond. with detachable fixing feet, 5/11.
1 F/TS 465 K/cs in small round all. can, 2 1/4 in X 1 1/4 in dia., with dust. cores, 6/6 pair.
OOR new season radio-televison list now ready.
TERMS c.w.o., no o.o.d.; send 9d extra for postage orders under £5; 2/4d s.a.e. all enquiries and list. [0021

10B tuning units, 10,000-12,500k/cs, new condition, without cases; 12/-, carriage paid.—Sirmcock, Beechfield Rd., Grappenhall, Cheshire. [2051



NEW DUODE

The New Duode 12-inch unit continues Barker supremacy in really high quality, satisfying NATURAL SOUND REPRODUCTION

The famous dual drive with built-in crossover and feedback are of course there, also the hand-made linen case with its graded compliance. These two unique and patented features, plus individual care and attention at every stage of manufacture, make the difference between really natural sound and normal "high fidelity."

A trained ear will hear this at once: a good musical ear will quickly pick out the truth of individual instrumental tones: technical men will appreciate the definite middle range; clean, non-resonant bass; smooth, extended top without added harmonics. And the average man will first like Duode quality better than most, then, as he hears more of his favourite music at home, begin to realise how much more real pleasure, interest and enjoyment his radio and records are giving him—through DUODE.

Very few Barker units are sold second-hand: they continue to please for so long. Also, unlike commercial units, they are brought up to date at quite low cost. If you have one of older vintage, write to us about this. If not, then, for your own sake

INSIST ON HEARING THE NEW DUODE

ASK A GOOD DEALER
or write for details to

BARKER

NATURAL REPRODUCERS
3, Newman Yard, London, W.1



SOLE SUPPLIERS OF THE WORLD'S CHEAPEST INSTRUMENTS

INDUCTANCE BRIDGE KIT, 42/6.
Continuous coverage from 50 micro/Hy to 100 Hy In 5 ranges.

Treble and Bass boost Chokes, R.F. Coils, Video Chokes, Whistle Filters, Smoothing Chokes, Scratch Filters, Audio. R.F. and A.C. Inductances in general. This instrument checks them all. **READY CALIBRATED.**
GUESS-WORK SELDOM. PAYS—MEASURE AND BE CERTAIN.

RES/CAP. BRIDGE KIT, 31/6.
5 Megohms—50,000 ohms. 50 mfd.—.2 mfd.
100,000 ohms—1,000 ohms. 1 mfd.—.01 mfd.
1,000 ohms—10 ohms. .01 mfd.—.0005 mfd.
READY CALIBRATED

The I.F. Aligner Kit still available at 15/-, tunable over the 465 Kc/s range of I.F. frequencies. Pre-tuned ready for use.

Full instructions and diagrams with all Kits. Post and Packing 1/6 in each case.

RADIO MAIL

RALEIGH STREET, NOTTINGHAM
Stamp with all enquiries please. Cash with order or C.O.D.

Free from distortion

cannot introduce hum

E.M.G. STEEP-CUTTING INFINITELY VARIABLE FILTER
No other filter combines all the advantages of this model which are, briefly, to cut response above any desired level between 4,000 and 8,000 c.p.s. at an average steepness of 30 db. per octave, easy fixing (connects between 15 ohm speaker and amplifier output), robust construction, no distortion or appreciable loss of volume. Recommended for reducing surface noise on '78' records, cutting 'edge' on some L.P. records, and eliminating high-pitched interference on radio. Price £4/10/0. Leaflet on request.

E.M.G. HANDMADE GRAMOPHONES, LTD.
6, Newman St., Oxford St., W.1
Telephone: Museum 9971-2-3

COMPONENTS—SURPLUS AND SECONDHAND

METERS, 100ma. 3a, 2.5a, set of three, 13/- p.f.; 8+8, 450v electrolytes, 2/6; mains transformers, tapped input, 300-0-300, 150ma, 5v 2a, 6.3v 6a, 30/-, p.f.; 230v input, 4v 5a twice, 2v 2.5a, 4-vh, 17/6, p.f.; free lists.—Annakin 25, Ashfield Place, Otley, Yorks.

RECEPTION set type R.109, 8-valve communications receiver, 1.8 to 8.5 mc/s, complete with vibrator power pack (6 volts) and built-in Goodmans speaker; fully tested and ready for use; 5gns; new valve/component list available.—Radio Unlimited, Elm Rd., London, E.17. Tel. Key. 4813. [0062]

CABINETS

LEWIS RADIO have the best selection and finest finish.—See page 42. [0224]

WALNUT radiogram cabinets; details.—Cabinetware, 1a, Heyes St., Blackburn.

WALNUT radiogram and television cabinets, soundly constructed; stamp for details.—R. Shaw, 69, Fairlop Rd., Leytonstone, E.11.

CABINETS made to order: send details for quotations: Bass Reflex cabinets: see display advertisement, page 148.—A. Davies & Co. (Cabinet Makers), 3, Parkhill Place, off Parkhill Rd., London, N.W.3. (Gulliver 5775) [1987]

WANTED, EXCHANGE, ETC.

VHF test equipment.

TS47AP, TS174, TS175/U, TS148 or **TSX-4SE**; analysers; **BC221** freq. meters, **TS69**, and any U.S.A. test gear; **Klystrons** type **723/AB, 2K33, 2K39, 2K41**; receiver, **APR4** and units **TN16, 17-18-19**; **RCA AR88D, S27** and **SX28s** and **S27CA**; microwave equipment; highest offers given by return.—Ger. 8410, Universal Electronics, 27, Lisle St., Leicester Square, London, W.C.2. [0229]

WANTED, Wilcox Gay V.F.O. units in new or modified condition.
McELROY-ADAMS MFG. GROUP, Ltd., 46, Greyhound Rd., London, W.6. Tel. Fulham 1138/9. [0194]

HEATER cathode s/c tubes urgently required, any quantity.—Box 1476. [2014]

WANTED, receivers A.P.R.4, also **T.N. 16, 17, 18, 19,** etc., and any radio test gear.
LESLIE DIXON & Co., 214, Queenstown Rd., Battersea, S.W.8. Macaulay 2159. [0176]

PHOTO cells, new, boxed (cine); exchange for E.F.50s, valves; s.a.e. please.—Box 1309. [1962]

WANTED, R.C.A. transmitters, all types or any R.C.A. components, including chassis and metal work.
McELROY-ADAMS MFG. GROUP, Ltd., 46, Greyhound Rd., London, W.6. Tel. Fulham 1138/9. [0196]

WANTED, TCS/6 or **TCS/12** transmitters in mint condition; also control boxes for same.
McELROY-ADAMS MFG. GROUP, Ltd., 46, Greyhound Rd., London, W.6. Tel. Fulham 1138/9. [0195]

WANTED, RCA 4331 transmitters.—P.C.A. Radio, Cambridge Grove, Hammersmith, W.6. Tel. Riverside 3279. [0093]

WANTED, disc recording equipment, M.S.S., E.M.I. or B.S.R.; must be in perfect condition and reasonable price.—Box 1310. [11967]

WANTED, radio console/table, Murphy, H.M.V., etc., good cond.—Details Box 1541. [2032]

WANTED, set manufacturers' or ex-Government radio equipment, large or small quantities of valves, electrolytics, speakers, meters, also components.
LOWE BROS., 5, Fitzroy St., London, W.1. Tel. Museum 4359. [9745]

WANTED, HRO coils, Rxs, etc., A.R.88s, BC348s, S27s, etc.—Details to R.T. & I. Service, 254, Grove Green Rd., London, E.11. Ley. 4986. [0163]

WANTED, platinum and mercury for spot cash.—A. Hamburger & Sons, Ltd., 57, Lower Tower Street, Birmingham 19. Tel. Aston Cross 1548-9. [1977]

WANTED, power supply units for No. 33 transmitters (Z.A. 10729).—Call or ring P.C.A. Radio, The Arches, Cambridge Grove, W.6. Riv. 3279. [0061]

NO. 10 headsets or **No. 13** microphones, large or small quantities required top prices paid.—Industrial Suppliers (Cambridge), Ltd., 15a-17, Brecknock Rd., London, N.7. Gulliver 5891. [2018]

ALTHAM RADIO Co. pay highest prices in the trade for all American equipment, including test sets, transmitters, receivers, tele-printing gear, etc.—Jersey House, Jersey St., Manchester, 4. Tel. Central 7834-6. [0228]

WANTED, R.C.A. speech amplifiers type MI-11220 J or **K** and **Aerial Tuning** units **BC 939 A.** Offers stating quantity and price to **P.C.A. Radio, The Arches, Cambridge Grove, W.6.** [0079]

Pre-Amplifier for TELEVISION



Brand New
£8.7.6 Crg. Extra

Gain 55 D.B. frequency response flat from 42/48 Mc/s, 6 D.B. down at 41.5 Mc/s. input and output impedance 80 ohms co-axial. Standard rack mounting, mains operated, switched milli-ammeter incorporated for monitoring purposes. Use 4 E.F.50 valves. Enclosed in ventilated steel case 18in. x 8in. x 7in. high. Suitable for Television refidused in blocks of flats, also ideal fringe areas. Brand new in Maker's Cartons.

A.C. METERS. 5in. 5/bd. type by Met-Vick. Ammeters 0-50 Voltmeters 0-300 all as new 70/- ea. 4in. M.I. Ammeters 0-15 Switchboard type 45/- G.E.C. Ironclad Voltmeters 4in. Sw/bd. type 0-60 volts, 55/-, 2 1/2in. Sw/bd. type M.I. Ammeters for circuit readings 0-5 amps and readings up to 30 amps. 17/6 ea.

D.C. METERS. 2in. panel meters 0-20 amps, 12/6, 0-20 volts 12/6, 0-40 volts 14/-, 0-50 amps, 15/-, Portable M.C. Voltmeters Ferranti in polished wood case 4in. x 4 1/2in. x 2 1/2in., knife edge pointer mirror scale 0-3 volts 35/- ea. Multi-range test set in leather case with Ferranti meter 0-3 and 0-30 volts 75 milli-volts with shunts or 30 amps. and 600 amps.

ELECTRADIX RADIOS

Dept. A, 214 Queenstown Road, London, S.W.8
Telephone: MACaulay 2159

BENSON'S BETTER BARGAINS

METERS.	Size	Type	Fixing	Price
30 mA	2in.	MC	Proj. E.	7/-
100 mA	2 1/2in.	MC	Flush R.	8/-
300 mA	2 1/2in.	MC	Flush R.	8/-
300 mA (100 mA)	2in.	MC	Square	7/-
500 mA	2 1/2in.	MC	Flush R.	8/-
1 A	2 1/2in.	TC	Fl. or proj.	8/-
1 A	2in.	TC	Square	6/6
20 A	2 1/2in.	MI	Flush R.	8/6
30 A	2 1/2in.	MC	Proj.	8/-
50 A	6in.	MI	Proj. Met.	30/-
20-0-20 A	2in.	MC	Square	8/-
Freq. 45-55c	7in.	230 v.	Proj. Met.	75/-
6 mA (500 µA)	2 1/2in.	MC/TC	Flush R.	17/6
15 v.	2 1/2in.	MI	Flush R.	10/6
18-0-18 v.	2 1/2in.	MC	Flush R.	10/6
150 v.	2 1/2in.	MC	Flush R.	10/6
3,500 v. (5 mA)	3 1/2in.	MC	Proj.	15/-
5 mA	2in.	MC	Square	7/-

AERIALS UHF with EA50, 3/6. **JACKS, Bakelite, DP closed, 1/-. BC610 Tank Coils, 5/-. POTENTIOMETERS** 3in. dia. 20k. 10 w., 7/-. **CONDENSERS** 15 v. w ceramic, 1 each 500pF and 750 pF, in sealed case, 5/-. **SINGLE STAGE PRE-AMP (VR1)**, with built-in 230 v. 50 c. power supply, 55/49 rec., smoothed, 50/- (carr. 7/6).

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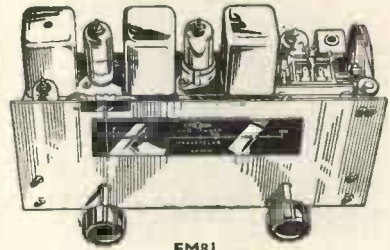
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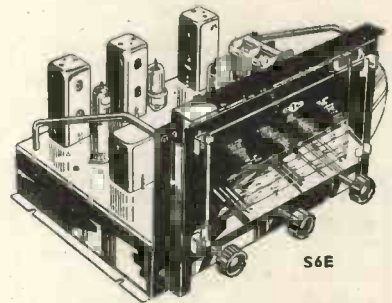


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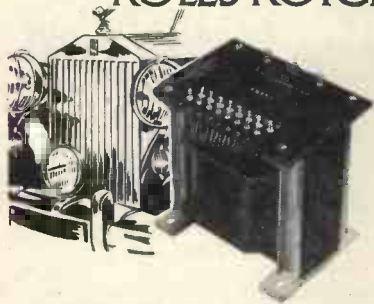
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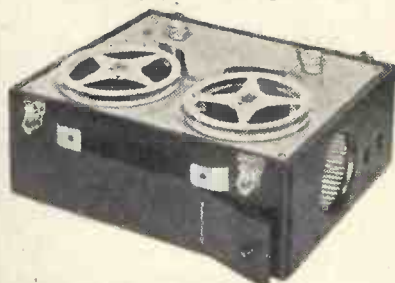
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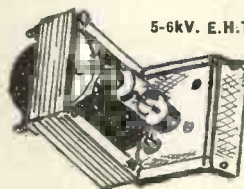
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MAINS TRANSFORMERS, input 200/250 volts, output 45/50 volts, 70 amps, suitable for arc welding, £15 each; another 70 volts, 50 amps, £15 each.

SITUATIONS VACANT

A HOUSE is available for a qualified

ELECTRONIC Engineer required by The English Electric Co., Ltd., Luton, to develop equipment and techniques for testing, measurement and analysis of vibration and shock phenomena on guided missiles; experience in allied fields would be suitable; write, stating age, qualification, experience and salary required to—Dept C.P.S., Marconi House, 336/7, Strand, London, W.C.2, quoting Ref. No. 1106C. [2000]

ELECTRONIC engineering appointments for:

1. INVESTIGATIONS and liaison engineer.
 2. SENIOR test room engineer.
 3. SENIOR test equipment design engineer.
- WILL exist in new production organization to be formed in a southern county by an old-established leading electrical company.
- SOUND** technical knowledge and experience of radar and microwave equipment is essential. Attractive salaries, superannuation and holidays available to first-class men of initiative, with ability to control staff and accept responsibility. **PLEASE** write full experience, qualifications and age to Box 1116. [1908]

SIGNALS assistant inspectors of police required by the

GOVERNMENT of Kenya for one tour of two years, extending to three years by mutual consent and with possibility of permanency; commencing salary, etc., according to previous experience in scale, £796 rising to £1,134 a year; gratuity (at least £162 after two years' service) payable on satisfactory final completion of service; outfit allowance £30; uniform allowance £10 a year; free passages, liberal leave on full salary; candidates aged 20-35 should be at least 5ft 7in without footwear, have normal vision without glasses and be of good education; they should possess a sound knowledge of the installation and maintenance of modern low and medium powered V.H.F. static and mobile equipment, H/F transmitters and receivers, petrol generators and diesel electric sets; previous police experience not necessary.—Apply in writing to the Crown Agents, 4, Millbank London, S.W.1, stating age, name in block letters, whether married or single, full qualifications and experience and quote M1/35931/WF. [2025]

VACANCIES are available in the Transmission Department for—

(1) **DEVELOPMENT** Engineers experienced in the design of multi-channel carrier telephone systems or in allied techniques, including amplifiers, filters and radio;

(2) **EQUIPMENT** Engineers with such knowledge of modern line communication practice as will enable them after training in the company's methods to prepare detail specifications of equipment requirements and to develop arrangements for rack-mounting of the apparatus.

(3) **TELEGRAMS** men to work with the engineers, preferably having experience in the telecommunications industry. The positions available are permanent, on full established staff status, with contributory pension fund and usual staff conditions.—Please write to Personnel Manager, Automatic Telephone & Electric Co., Ltd., Liverpool, 7, giving full details of experience, qualifications, age and approximate salary sought. [1912]

RAPIDLY expanding unit in the Cambridge

area have immediate vacancies for **QUARTZ** Crystal Engineer.—Must have had several years' experience in crystal development, engineering and manufacturing methods.

JUNIOR Engineer to assist in the engineering and process control of Quartz Crystal manufacture; knowledge of electronics, circuits and general physical chemistry essential.

ASSISTANT Engineer for interesting development projects associated with Quartz Crystals; should have qualifications up to Inter. B.Sc. standard and a good working knowledge of radio frequency circuits, physics, chemistry and mathematics.

TEST Set Engineer for routine electrical and mechanical maintenance of radio frequency test gear and allied equipment. **APPLY** in confidence to Box 1430. [2005]

APPLICATIONS are invited from senior development engineers with experience in any of the following fields:—

1. V.H.F. U.H.F. circuits, including tuners for television and for communications equipment.
2. TELEVISION receiver design.
3. VARIABLE capacitors.
4. RELAYS and switches for special circuit applications.

APPLICANTS should possess an engineering degree or equivalent qualification and have experience in industry or one of the technical establishments engaged on this type of work; initial salaries will be in accordance with qualifications, experience and age; the appointments are of a permanent and progressive nature, and a company pension scheme is in operation.

APPLICATIONS, which will be treated in strictest confidence, should be addressed, quoting reference WW/807, to—Box 1474. [2009]

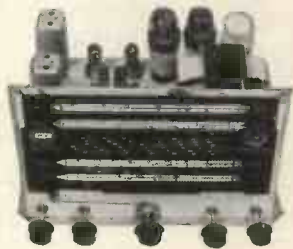
RADIO service engineer required for King's Lynn Branch, apply Felis, Head Office, Nene Quay, Wisbech. [2003]

EXPERIENCED TV engineers required for retail service; permanent positions at good salary.—Full details to Shenstones (op. Town Hall), Leyton, E.10: Lev. 1362. [9266]

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To come and hear for yourself the truly AMAZING performance of their fine Radio Chassis. Our showroom in WALTERS ROAD is open DAILY from 9 a.m. to 6 p.m. (SATURDAYS 5 p.m.) and we shall be delighted to demonstrate these outstanding Chassis—



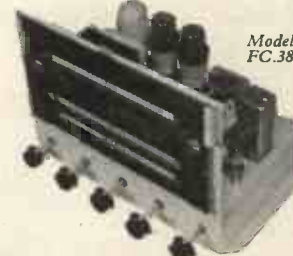
Model RF.41

MODEL RF.41

A 10-valve Superheterodyne chassis giving 10 watts push-pull output with negative feedback and separate BASS and TREBLE lift controls, also a highly sensitive R.F. stage before the mixer. Flywheel tuning and a magic eye. Four wavebands covering 12-90 metres, 190-550 metres and 800-2,000 metres.

PRICE £31/19/8, including tax.

★ ALL OUR CHASSIS ARE EMINENTLY SUITABLE FOR USE WITH THE NEW 3-SPEED RECORDS, BECAUSE OF THE INCORPORATION OF THE UNIQUE INDEPENDENT BASS AND TREBLE LIFT AND CUT CONTROLS ★



Model FC.38

MODEL FC.38

An 8-valve Superheterodyne chassis giving 8 watts push-pull output with negative feedback and separate BASS and TREBLE lift controls, Flywheel tuning and a magic eye. Three wavebands covering 16-50 metres, 190-550 metres and 1,000-2,000 metres.

PRICE £23/13/-, including tax.

MODEL EXP.125/A

A 14-valve Superheterodyne chassis giving 15 watts push-pull output with negative feedback, two I.F. stages with variable selectivity and Radio Frequency Pre-Amplifier. Separate BASS and TREBLE lift controls. Incorporating five wavebands, giving continuous coverage from 12.5 to 550 metres and 1,000 to 2,000 metres. Flywheel tuning and a magic eye.

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Telephone: NORth 3213/4

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Fidelia Standard 7-valve model £21 12 0
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with 7 watt Push-Pull output stage.

ALL MODELS have triode output stages, Variable Selectivity, Separate Bass and Treble Controls, Cathode follower detector, 10-20,000 cycle audio response.



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Type
B7



The type B7 unit is mounted in the standard B7G valve envelope and is hermetically sealed and fully evacuated.

Available for the frequency ranges from 100 kc/s. to 500 kc/s. and from 3 Mc/s. to 16 Mc/s. Gold electrodes applied by cathodic sputtering give permanence of calibration. Normal adjustment accuracy 0.01% Max. adjustment accuracy 0.003%

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NEW MALDEN, SURREY

Telephone: MALden 0334 Cables, etc.: QUARTZCO NEWMALDEN

SITUATIONS VACANT

THE Research Laboratories of The General Electric Co., Ltd., North Wembley, Middx. have the following male vacancies:—

(a) AN experienced workman for work on prototype electronic equipment; candidates should be used to complete assembly of chassis from theoretical diagrams.

(b) A technical assistant for work on cathode ray tubes, some knowledge of assembly work in this field would be preferable but is not essential; candidates must be not younger than 25 years of age and should have reached 2nd year of Ordinary National Certificate standard.

(c) A technical assistant for assembly work on heating element production; previous experience in this field is not necessary.

THESE are staff positions carrying full staff privileges.—Apply in writing to Staff Manager (Ref. RLO/4), quoting (a), (b) or (c) as applicable, and giving full particulars of age, qualifications and experience. [1964

DEVELOPMENT engineers (2) with electronic and electrical design experience; H.N.C. or degree in Physics or Electrical Engineering.
(A) **VARIED** work on laboratory instruments, e.g., r.f. oscillators, bridges, feed back amplifiers, recorders, etc.
(B) **INTERESTING** development work on facsimile and picture telegraph equipment.

OLD-ESTABLISHED firm in S.E. London; permanent position and pension scheme; apply with full details of age and experience and salary required to—Box 1400. [1964

THE Research Laboratories of The General Electric Co., Ltd., North Wembley, Middx. have the following staff vacancies:

(A) **ELECTRONIC** engineer with degree or Higher National Certificate and several years' experience, is required for work on under water acoustics.

(B) **ELECTRONIC** engineer with Higher National Certificate is required to work on the design and specifications of specialised radio valve testing equipment; candidates should have a good knowledge of valves and their applications and be able to take responsibility in a small team

APPLY in writing to—Staff Manager (Ref. RLO/6), quoting (A) or (B) as applicable, and giving full particulars of age, qualifications and experience. [1960

RADIO and television engineer required, fully experienced all makes, for bench and outside; good driver, clean licence; good salary, references.

ELECTRICAL SERVICE (EDGWARE) LTD., 117, Edgware Rd., W.2. Pad. 2342. [1726

ELECTRONIC designer required for work on radio and electronic component developments for use in radio vehicles and armament applications.

SOME experience in original design would be an advantage but not essential, provided a sound basic knowledge of electronics is held. **APPLY** in writing, stating age, experience and present salary to:—
AIRTECH Limited, Aylesbury & Thame Airport, Haddenham, Bucks. [2004

ELECTRONIC laboratory technician required, with some experience in transformer and choke design, an advantage; write, stating age, experience and salary required.—Box 1534. [2029

ELECTRONIC engineers required by The General Electric Co., Ltd., Brown's Lane, Allesley, Coventry, in their Development Laboratories for work on:—

- (a) **TRIALS** team in connection with guided weapons; 1 senior engineer also 3 engineers.
- (b) **SERVO-MECHANISMS**; 1 engineer.
- (c) **PULSE** circuitry; 3 engineers.
- (d) **MICROWAVE** circuits; 1 engineer.
- (e) **TEST** equipment; 2 engineers.
- (f) **GENERAL** radar circuit development; 2 engineers.
- (g) **POWER** units, including electronic stabilisers and rectifier systems; 1 engineer.
- (h) **MAGNETIC** amplifiers; 1 engineer.

APPLICANTS, preferably with a degree or an equivalent qualification, should have had at least two years' experience in the development and engineering of Service equipment as well as experience in one of the above.

HOUSES on the outskirts of Coventry, near our laboratories, are now available for offer to successful applicants and this offer can only remain open for a few months; applicants holding requirements will receive special attention.—Reply, stating age, qualifications and experience, to the Personnel Manager, Ref. R.G. [2037

RADIO/TV engineer required for Kilburn service department of Murphy dealer; permanency, good wages and conditions.—Singer's, 350, Edgware Rd., W.2. Pad. 7915 [2002

SITUATION vacant for competent radio/television engineer with progressive firm, superannuation scheme, good wages and good conditions.—Apply Signal Service, 461, Uxbridge Rd., Hatch End, Middx. [2026

RADIO service mechanics required by Smiths (Radiomobile), Ltd., for all parts of the country.—Write details of experience and qualifications to Personnel Officer, Goodwood Works, North Circular Rd., London, N.W.2. [0342

JUNIOR and Senior circuit engineers required capable of building and proving performance of specialised equipment; applicants should state age, qualifications and experience.—Box 1006. [1871

SPECIAL OFFERS

AMPLIFIERS. A high fidelity unit with separate Bass and Treble controls, constant impedance attenuator for setting volume level. In metal case with handles, 15 watt output, for 200/250 v. A.C. Mains operation. Although intended for use with the Gaumont British Projector, this fine amplifier is ideal for P.A. work, dances, etc.

SPECIAL OFFER. LESS VALVES, £12/10/- Or complete with all valves, £15/12/6. Carriage 10/-
SPEAKERS P.A. Goodmans P.M. 12in. 15 ohms. Type T.2. A high class speaker at a low price. Ideal for above amplifier. £2/10/-.

SPEAKER CASE, suitable for above. 19x17x13in. With lock, carrying handle, compartment for cable. £3/10/-, Worth double.

AMMETER. 2½in. Flush 0/25 amps. Moving Iron. D.C. 7/6, post 1/-.

MILLIAMMETERS. Moving Coil. D.C., 2½in. Flush 0/30, 0/200, 0/250, 1/2/6; 3½in. Flush, reading 150-0, 1,500, 22/6, post 1/-.

VOLTMETERS. 0-300 A.C. Moving Iron 3½in. Surface type, 25/-; 0-300 Flush D.C. Moving Coil, 10/6; 0-30, 2in. Flush Moving Coil, 7/6; 0-40 2in. Flush M.C., 10/6; post 1/-.

RECEIVER R.1355. As specified for "Inexpensive Television." In original packing, as new. Complete with all valves, 38/6, carriage 7/6.

EF50 VALVES. Red Sylvanian, guaranteed unused, ex-new equipment, 7/6. Or British, 5/-, Post 6d.

SLOW MOTION DIALS. 3in. Scaled 0-100, reduction 200 to 1 or direct, ideal for wavemeters, signal generators, etc. Our Price, while they last, 5/6, post 1/-.

POWER PACK. Type 3 specially made for the Receiver 1132A, input 200/250 v. A.C. Only a few left at £4/10/-, pkg. and carr. 7/6.

45 Mc/s. PYE STRIP vision unit for London; condition new, complete with 6 EF50 and EA50 valves. 65/-, carriage 2/6.

INSPECTION LAMP. Complete with battery case. Fits on forehead. Leaves hands free, 7/6, post 1/-.

"ELP" CIRCUIT BREAKER. Avoids blowing mains fuses if circuit is overloaded. Reset in an instant. Very useful on test bench. Size 3in. round, 9/6, post 1/-.

PYREX AERIAL INSULATORS. Glass dome type with threaded rod and terminals each end, 2½in. diam. with fixing flange. Ideal for all aeriels and in particular cabin walls or panels, etc. Price only 2/-, post 6d.

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42in. METAL EXPONENTIAL HORNS. New and unused, 1 1/2in. fitting. £2/19/6, carriage 7/6.

20-WATT GOODMAN'S PRESSURE UNIT HEAD, to suit the above, £4/15/-, carriage 5/-.

465 K/c QUARTZ CRYSTAL ON B7G BASE, 18/6, p.p. 1/-.

COLLAR 3-SPEED AUTOMATIC RECORD CHANGERS. Model RC3/521, complete with 2 heads. New and unused. £9/19/6, carriage 7/6.

R.1132A RECEIVERS. In very good condition. 50/- each, carriage 10/-.

WESTON ALL-PURPOSE A.C./D.C. TEST METER, MODEL E.695. New and unused, complete with batteries. A very limited quantity available at £8 each only. Also **WESTON BATTERY OSCILLATOR, MODEL E.692, Type 2.** Also new and unused. Coverage, 100 kc/s. to 26 Mc/s. Audio output approx. 400 c/s. Available at the ridiculously low price of only £5/19/6. If these two instruments are purchased together the two will be supplied for £12, plus 10/- p.p.

GOODMANS 12in. P.M. LOUD-SPEAKERS. 15 ohms speech coil. Special purchase of these famous speakers allows us to offer these new and unused goods at the very low price of £4/19/6 each, plus 5/- p.p.

RECEIVER TYPE 3121, I.F.F. New and unused, complete with all valves and relays, etc. Price £4/19/6.

AMPLIFIER TYPE 3583, Ref. 10UB/6061 Containing 12 valves, 45 Mc/s. Pye strip-Complete and unused. Price £5, p.p. 4/-.

INDICATOR TYPE 162. Containing VCR97 C.R.T., VCR139A, C.R.T. Klystron CV67. Valves, blower motor, resistors, etc., 0-1 m/ammeter, 2in. scale. A complete instrument for only £6/10/-.

TUNING UNIT, TYPE 207A. Containing type CV67 Klystron, new and unused. Price 45/-, p.p. 2/6.

POTENTIOMETERS. 20k., wire wound, 10 watts, 3in. dia. Complete with 2 1/2in. skirted instrument knob. Potentiometers tapped at 5k., 10k. and 15k. New and unused. Only 6/9 each, p.p. 1/-.

150 v. H.T. BATTERIES. Size 5 1/2in. x 6in. x 1 1/2in. (Ex-Govt. ex-38 set.) In very good condition, each one tested before despatch. Very limited quantity available, only 4/11 each, p.p. 1/3.

INDICATOR UNITS, TYPE 6C. Complete with 3 1/2in. C.R.T. (VCR138), mask, base, mu-metal shield. Condensers, resistors, wire-wound volume controls, valves (2 VR91s, 2 VR54s). Brand new in original crates. £3/19/-, carriage paid.

12 v. CAR RADIO VIBRATOR TRANSFORMER. 300 v. H.T. at 90 mA. ex-Philco. Only 8/6 each, p.p. 1/-.

813 CERAMIC VALVE HOLDERS. New and unused, 9/6 each, p.p. 1/-.

SOLON INSTRUMENT MODEL ELECTRIC SOLDERING IRON. Weight 3 1/2 oz. Length 9in. Suitable for 220/240 v. 25 watts. Only 19/8, p.p. 1/-.

TERMS: C.W.O., C.O.D. or pro-forma invoice.

15 LITTLE NEWPORT ST., LONDON, W.C.2
GERrad 6794/1453

SITUATIONS VACANT

TESTERS and electrical inspectors required for electronic equipment; experience of laboratory instruments desirable; 44-hour 5-day week.—Apply Personnel Officer, Airmec, Ltd., High Wycombe, Bucks. [2054]

ELECTRICAL and radio installation draughtsmen required for design work on new aircraft and guided weapons projects.—Apply Employment Manager, Vickers-Armstrongs Ltd. (Aircraft Section), Weybridge, Surrey. [1892]

DRAUGHTSMEN, senior, intermediate and junior are required by A.T. & E. (Bridgnorth), Ltd., in their mechanical development and drawing offices; experience in one of the following fields is preferable:—

(a) **ELECTRO-MECHANICAL** devices, light engineering radar, radio, electronic circuitry. **KNOWLEDGE** of workshop practice also O.N.C. advantageous.

POSITIONS are permanent and progressive; attractive superannuation scheme; five-day week.

APPLICATIONS stating age, experience and salary required should be addressed to: Chief Engineer, A.T. & E. (Bridgnorth), Ltd., Bridgnorth, Shropshire. [1957]

A. T. & E. (BRIDGNORTH), Ltd., a subsidiary of Automatic Telephone & Electric Co., Ltd., have a number of vacancies for senior and junior electronic engineers in their development and engineering laboratories.

APPLICATIONS are invited from engineers having experience in the following fields:—

(a) VHF/UHF radio telephone techniques.

(b) **BROAD BAND** (multi-channel) radio systems.

(c) **UHF** measuring equipments.

(d) **ELECTRONIC** instruments (general).

(e) **EQUIPMENT** engineering allied to electronics.

POSITIONS are permanent and progressive for those with suitable qualifications and experience; there is an attractive superannuation scheme and a five-day week.

APPLICATIONS, stating age, experience and salary required, should be addressed to Chief Engineer, A. T. & E. (Bridgnorth), Ltd., Bridgnorth, Shropshire. [1958]

RADIO/TELEVISION engineer, qualified, required by West End Murphy dealers, able to drive, permanent situation with top wages to suitable applicant; half-day Saturday.—Larg & Sons, Ltd., 77, High Holborn, W.C.1. [2035]

EXPERIENCED radar testers required for work of national importance; previous experience on airborne radar equipment essential.—Apply in writing to Personnel Dept., Mullard Equipment, Ltd., 51-55, Garratt Lane, S.W.18. [2057]

H.F. communications development engineer this type of engineering essential; send full details, including salary required, to—Labgear (Cambridge), Ltd., Willow Place, Cambridge. [2010]

ELECTRONIC Engineer required to work on development projects in small organization situated on South Coast; experience on design of communications receivers essential; E.N.C. standard; write full details and salary expected.—Box 8840 [0251]

AIRCRAFT radio mechanics skilled in workshop practice; previous installations to work at Stansted Airport, Essex; hostel accommodation available; minimum hourly rates 3/9.—Write to the Personnel Manager, Skyways of London, 7, Berkeley St., W.1. [0019]

EXPERIENCED radio testers and inspectors required for production of communication and radio apparatus, also instrument makers, wireners and assemblers, for factory test apparatus.—Apply Personnel Manager, E. K. Cole, Ltd., Ekco Works, Malmesbury, Wilts. [0298]

TECHNICIANS required for electronic circuitry; salary according to qualifications; from £360 p.a. plus London weighting.—Apply by letter to C. C. Mills, Superintendent, Electrical Engineering Department, City & Guilds College, London, S.W.7. [1956]

RADIO and television engineers of all grades required for new service factory in East London.—Please write in first instance, giving details of past experience and salary required, to Leytonia Radio, Ltd., Service Department, 828, High Rd., Leyton, E.10. [1969]

TEST set mechanic required for construction and maintenance of test equipment; good knowledge of radio circuits essential.—Write to: Personnel Manager, Standard Telephones and Cables, Ltd., Dowlish Ford Mills, Ilminster, Somerset. [1989]

ELECTRONIC Engineers with practical factory experience and technical training, preferably up to H.N.C. standard, reqd. for liaison and development work on radar and allied equipment.—Apply to Personnel Dept. (CE/18), E.M.I. Factories, Ltd., Hayes, Middx. [1995]

ENGINEER or Physicist with experience of problems associated with the design of electronic tubes is required for interesting development work in this field. Applicants should have a degree in physics or equivalent qualifications. Vacancies also exist for assistants.—Please write with full details to Personnel Dept., quoting ED/126, E.M.I. Engineering Development, Ltd., Blyth Rd., Hayes, Middx. [1996]

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The new "Stentorian" speakers offer exceptional performance at so low a price. The novel cambic surround allows unusually extended bass response, high flux magnets give high sensitivity and reduce resonances.

10in. 78/8, 9in. 87/-, 8in. 60/8, 6in. 50/8.

BARKER "DUODE" Each one checked by the designer for the perfection for "DUODE" which his name is renowned. The secret of that performance is due largely to the unique Duode moving coil reducing bass coloration, giving extended treble range.

12in., cast net, 14,500 gauss, handling 15 w., response 30-15,000 c.p.s., 15 ohms. 12 gns.

Special Offers . . .

10in. loudspeakers, famous make, cast chassis, 12,000 gauss, 15 ohm. Usually 69/- reduced to 52/6. Bass Reflex Console Cabinets, 30in. high, for 10in. speakers, heavy ply built, polished walnut veneer. Usually £9/5/- reduced to £7/18/6.

"The Gramophone" AMPLIFIER

Performance vies with the most expensive models, yet inherent simplicity makes it much lower in cost. We offer it either ready built or in kit form.

Amplifier 17 gns. Complete with valves, tested. Pre-Amplifier for magnetic p.u., 5 gns. Control Unit for crystal p.u., 45/-.

Extended Payment Terms

Amplifier and Pre-Amp. £7/14/- and 12 monthly payments of £1/8/3. Amplifier and Control Unit £6/14/- and 12 monthly payments of £1/4/6.

9 w. output, 20 dB. feedback, only 0.1 per cent. harmonic at 5 w., 20-20,000 c.p.s., latest Mullard valves, 3/15 ohm output, 200-250 v. A.C. mains.

Home Construction details 1/9 post free.

Decca 'H' L.P. Pickup

This smaller, lighter head attracted much interest at Earls Court. Interchangeable with earlier type with 3-pin fitting. Less record wear and better quality. Head only with sapphire 55/- With diamond £6/18/-. Complete pickup with two heads, £6/9/6.

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100
Watts peak power output.
50-20,000 cps ± 25dB
frequency response.
Price £37.10.0 carr. extra



Specification:
Electronic Mixing of two inputs; grid circuit for gram or radio and low impedance up to 300 ohms for moving coil or ribbon microphone.
Tone Control. Independent bass and treble controls.
Valves. 6J5, 6SL7, 6SN7, 6J5 (2), 6L6/KT66 (4), U18/20 (2), S130. (14 valves total).
Case. Fitted in grey wrinkle stove enamelled steel case with carrying handles as illustrated. Weight, 80 lbs.; Size, 19½ in. x 13 in. x 13 in. approx.
Suitable for any application where large A.F. power is required.
A similar model having an output of 25 watts is also available at £28/10/0.
Further details available from

Radford Sound & Vision
4 Acramans Road, Southville, Bristol, 3.

SITUATIONS VACANT

An electronic engineer with experience of adjusting and testing a comprehensive equipment functioning in the audio frequency spectrum, is required for a small laboratory of a large engineering company in the eastern suburbs of London.
PROSPECTIVE applicants should be capable of working from circuit diagrams and test specifications with a minimum of supervision.
BRITISH subjects only need apply.
PLEASE reply, giving full details of experience and salary required and quoting reference WW/814, to Box 1543. [2034]

35mm sound and cinematograph engineer required for overseas, single man preferred—married can apply but no married accommodation available.—State age, health, experience in cinema industry, to R.A.F. Cinema Corp., 10-12, James St., W.1. [2059]

WANTED, laboratory assistant, H.N.C. standard for television and radio coil factory, 44-hour, 5-day week; salary in accordance with experience.—Apply Miss K. S. Cowan, Personnel Officer, Mitcham Works, Ltd., Winchelsea Rd., Harlesden, N.W.10. [1983]

TRANSFORMER designer required by old-established company (South London area); candidates must be fully conversant with the design of all types of transformers up to 100 k.V.A. rating, progressive and permanent appointment; salary according to experience.—Box 1132. [1924]

DRAUGHTSMEN, experienced, required by Decca Radar, Ltd., for permanent posts in the expanding field of radar engineering; excellent opportunities for advancement exist, the salary ranges being well beyond A.E.S.D. rates; staff pension scheme; British nationality essential.
POSTS are to be filled in the following grades: Senior section leader; checker draughtsman and senior design draughtsman; intermediate draughtsman; circuit draughtsman; installation draughtsman.—Apply Ref. R.D.J., Decca Radar, Ltd., Radar Research Laboratory, 2, Tolworth Rise, Surbiton, Surrey. [2050]

FIELD engineer (radio and television service) London and Southern Counties area, experience of R.G.D. circuits preferable, able to drive, good appearance, rate of pay according to age, experience and qualifications.—Apply, full details, Personnel, R.G.D. Co., Ltd., Eastern Avenue, Romford, Essex. [1965]

BERRY'S (SHORT WAVE) Ltd., have vacancy for counter sales assistant; must have had previous retail experience of quality amplifiers and tape recording equipment; also bright lad for general work.—Write only stating age, past experience, salary required, to 25, High Holborn, London, W.C.1. [1835]

RADIO and radar testers, first-class men required for work on V.H.F. communication gear and Government contracts for radar and radar equipment by Midland manufacturers.—Men with wide experience of fault finding in any of the fields mentioned should write, giving full details, to Box 1562. [2046]

EXPERIENCED fault-finders wanted by Midland manufacturers of radio equipment; permanent posts in the Midlands area are offered to men with experience of radar, radio control, V.H.F. equipment.—Write, stating full experience and salary required, to Personnel Manager, Box 1563. [2047]

ELECTRONIC engineers to inspect and service AA Radar equipment in the Bedford area; O.N.C. or equivalent qualifications necessary; salary £517 (age 28 or over) × £20 to £597; generous paid leave.—Application forms from O.C. 1 AA Maintenance Unit, Veterinary Lines, Shrappnel Barracks, Woolwich, S.E.18. [1951]

ASSISTANT (Scientific). The Civil Service Commissioners invite applications for pensionable posts. Applications may be accepted up to 31st December, 1953, but an earlier closing date may be announced either for the competition as a whole or in one or more subjects.
AGE at least 17½ and under 26 years of age on 1st January, 1955, with extension for regular service in H.M. Forces, but candidates over 26 with specialized experience may be admitted.
CANDIDATES must produce evidence of having reached a prescribed standard of education, particularly in a science subject, and of thorough experience in the duties of the class gained by service in a Government Department or other civilian scientific establishment or in technical branches of the Forces, covering a minimum of two years in one of the following groups of scientific subjects:—
(i) Engineering and physical sciences.
(ii) Chemistry, bio-chemistry and metallurgy.
(iii) Biological Sciences.
(iv) General (including geology, meteorology, general work ranging over two or more groups (i) to (iii) and highly skilled work in laboratory crafts such as glass-blowing).
SALARY according to age up to 25: £235 at 15 to £363 (men) or £330 (women) at 25 to £500 (men) or £417 (women); somewhat less in provinces. Opportunities for promotion.
FURTHER particulars and application forms from Civil Service Commission, Scientific Branch, Trinidad House, Old Burlington Street, London, W.1, quoting No. S 59/53. Application forms should be returned as soon as possible. [1972]

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CHAMPION "AUTOMAT," the foolproof unbreakable small chargers and kits for car or radio cells.
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Truck charger 6v./12v. 5 amp. 117/6, carr. 5/-.

FOOLPROOF CHARGER KITS, trouble free using high grade transformers not cheap rubbish, 12/14 v. 2 amp. rectifier, 45 watt transformer, ballast bulb for 2 v., 8 v., 12 v. charger, 38/6, p.p. 1/8. Ditto, but with 12/14 v. 3 amp. Westalite rect. and 45 watt trans., for 2 v., 8 v., 12 v., 48/-, p.p. 1/10. Handsome steel case for either of these 12/6. Full instructions and data. 1 amp. kit as above 31/-, case 12/-, .6 v. 3 amp. rect. with 45 watt trans. and ballast res. for 6 v. 3 amp. charge, 36/-, p.p. 1/8. Case, 12/6. New 5 amp. kit, 120 watt trans., 12/14 v. 5 amp. 87/6, rect. ballast bulb, for 6 v., 12 v. charger, 66/-, p.p. 2/-.
Case, 25/- extra. Transformer and rectifier for 2v. ½ amp. trickle charger 12/6, p.p. 10d.

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18	1/6	1/6	30	2/2	2/6
19	1/6	1/6	31	2/3	2/8
20	1/6	1/6	32	2/3	2/9
21	1/6	1/6	33	2/4	3/-
22	1/6	1/8	34	2/6	3/1-
23	1/6	1/10	35	2/8	3/3
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PREDICTOR UNITS, made by Sperry's, type AA/5, fitted 4 variable speed gear boxes, 115 volts A.C., constant speed motor, numerous worm, right-angle gears, approx. 75 ball-races, cost over £300 each to make, net weight 78 lb., new, in original packing cases, £11 each.

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SPERRY'S CONSTANT-SPEED 115 volt, 50 cycles motors, 2,400 r.p.m., 3 1/2in. diam., 6in. long, 5/16in. spindle, 1 1/2in. long. Serial No. LB1931. 37/6.

MINIATURE CLOCK-WORK TIMERS. Variable, 10 seconds to 3 minutes. Ideal for model work, photographic timing, etc. With slight modification will run 15 mins. full wind, size 1 1/2 x 1 1/2 x 9/16in. 3/6 each.

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15 Amp. MERCURY SWITCHES. Fitted with saddle and clip. Price 4/- each. Post paid.

20-WATT POTENTIOMETERS. 200 k. Fitted slow motion dial with vernier control, 3 1/2in. diam., overall height 4 1/2in. Pattern 8419. Price 37/6 each.

CANADIAN FULLY SMOOTHED ROTARY TRANSFORMERS, housed in metal case 8 1/2 x 6 x 4 1/2in. Input 12 v. 2.5 amps. Output 220 v. D.C. 60 mA. Price 40/- each.

HOOVER BLOWER MOTORS, Ref. No. 10KB/115 for 12/24 volts A.C./D.C., ideal for car heaters, cooling, etc. 27/6 each.

STEP-DOWN TRANSFORMERS, input 180/230 volts A.C., 50 cycles, output 4.2 + 4.2 volts, 10 amps., ideal for soil heating seat welding, etc. 35/- each.

ROTARY RHEOSTATS, 7 1/2ohms, 6amps., 25/- each.

SANGAMO MOTOR UNITS, model 7, final speed one rev. 24 hours. 200/250 v. A.C. 50 cycles. Price 27/6 each.

SANGAMO MOTOR UNITS, Model 7, final speed one revolution per seven days, 200/250 v. A.C., 50 cycles. Price 30/- each.

"KLAXON" 24 v. D.C. SHUNT-WOUND MOTORS. 1/20ch h.p. 2,500 r.p.m. Price 40/- each.

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KENTS 24-VOLT D.C. 1-20 h.p. SHUNT-WOUND MOTORS, 3,500 r.p.m. at 24 volts. Will operate on 12-volt D.C. at approx. half speed, double spindle, totally enclosed. 22/6 each.

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MINIATURE IMPULSE MOTORS made by "Gents," size 3 x 2 x 1 1/2in. Suitable for operating models, switches, etc. Operates on 4/6 volts A.C./D.C. and is very powerful for its size. Price 8/6 each. Post paid.

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SITUATIONS VACANT

DESIGNERS required for work on electronic measuring instruments; modern factory in the West; Pension Scheme; assistance with housing; can probably be given; salary £600-£1,000; full details of experience and training to the Chief Electrical Engineer, Box No. 305 C.R.O., 6, Aldford St., London, W.1. [1993]

TRANSFORMER testing.—Assistant chief of test required, familiar with single- and three-phase transformers up to 100 kva; the post is one offering excellent future prospects in a rapidly expanding firm.—Apply Willesden Transformer Co., Ltd., 2a, Frithville Gardens, Shepherd's Bush, W.12. [1959]

PYE of Cambridge, invite applications from television engineer-writers, preferably with knowledge of transmission or allied equipment; salary within the range £550-£650 per annum according to experience.—Apply to Technical Publications Department, Pye, Ltd., Cambridge. [1987]

SENIOR Design Engineer—E. K. Cole, Ltd., Southend-on-Sea, require for television development laboratory, senior engineer experienced R.F. side of television receiver design; also junior engineer with laboratory experience.—Write stating age, qualifications and experience to Personnel Manager. [1999]

DEVELOPMENT engineer required by company situated in S. London for design and prototype production of audio office intercom equipment; should be capable of working under own initiative; please write giving details of qualifications, age and experience.—Box 1522. [2020]

CHIEF of test required to take charge of department engaged on the testing of a wide range of electronic equipment; applicants should have previous experience on similar work and possess a H.N.C. or equivalent; permanent, pensionable position.—Apply, Personnel Officer, Airsec, Ltd., High Wycombe, Bucks. [1986]

DECCA RADAR, Ltd., have vacancies for men with a sound knowledge of radio and/or radar as installation engineers and instructors; the work is interesting and varies and in all cases specialist training is given.—Write or 'phone for application form to the Manager, Decca Radar, Ltd., 50, Southwark Bridge Road, S.E.1 Waterloo 6944. [2049]

YOUNG man (completed National Service) required in the London area to promote and develop the application of well-known instruments to marine purposes, must have good knowledge of electronics, some general engineering practice and capable of working on own initiative, degree in physics would be an advantage.—Box 1533. [2028]

ENGINEER required to undertake the development of electronic instruments; the successful applicant must be capable of working substantially on his own initiative; salary will be in accordance with qualifications and experience; degree or equivalent preferred.—Apply in writing to Advanced Components and Back Rd., Shernhall St., London, E.17. [909]

PARTRIDGE TRANSFORMERS, Ltd., have vacancy for post of chief engineer; applicants must possess university degree or equivalent and have had considerable experience in the design and development of all types of audio and power transformers.—Written applications to Managing Director, Partridge Transformers, Ltd., Tolworth, Surrey. [1923]

TELEVISION engineer, first-class engineer required for Cardiff old-established dealer, holding all the necessary agencies; good opportunity to join reputable progressive house for the experienced man; salary £500 p.a. with progressive increments; accommodation available for married applicant; full particulars first instance.—Box 1272. [1955]

TRANSFORMER testing.—The position of chief of test is offered to a keen individual fully capable of acting on own initiative; consideration will only be given to applicants fully conversant with testing transformers and L.T. chokes up to 100 kva capacity; a knowledge of A.I.D. procedure will be an advantage.—Box 1276. [1960]

ELECTRONICS technician reqd. for work on 15 million volt linear accelerator; expnce. in pulse technique desirable; salary according to expnce. in scale £450 to £515, plus London Weighting.—Write, enclosing two copies of references by 8th Dec. Clerk to the Governors, St. Bartholomew's Hospital, London, E.C.1. marking envelope "Electronics." [1982]

TRANSFORMER designer required for development projects involving audio-frequency power transformers, pulse transformers, filled units etc. Clerk to house available for suitable applicant.—Apply stating age, qualifications and experience, to the Personnel Manager (Ref. R.G.), The General Electric Co., Ltd., Brown's Lane, Ashley, Coventry. [2036]

MEDICAL Research Council have vacancies at Radiobiological Research Unit, Atomic Energy Research Establishment, Harwell, near Didcot, Berks, for laboratory technicians experienced in physics laboratory practice, or nuclear research techniques, or operation of high-voltage apparatus; salary according to qualifications and experience.—Apply (giving names of two referees) to Director of Unit. [2044]

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ROTOR CONVERTERS. Ex-W.D. but brand new (unused) condition. Input 12 v., output 200 v. at 50 mA., and 13 v. at 1.8A., 12/6, post 2/6.

AERIAL COILS. For portable sets. Brand new. On aluminium frame measuring 4in. x 6in. BARGAIN at 2/6, post 6d.

AERIAL RODS. Copper-plated steel, 12in. long, ex No. 19 set. Interlock to any length. 2d. each. Post 6d. on 1 dozen.

MICRO-SWITCHES. Latest American midgets. 230 v. 3a., 1/2in. x 1/2in. x 1 1/2in. BARGAIN OFFER 2/6, post 6d.

TUNING 'CONDENSERS. Two gang, 0005 mfd., standard size. Store soiled, but all tested. CLEARANCE OFFER 2/9, post 9d. BARGAIN of 3 for 7/-.

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RADIO-TELEPHONES. All brand new. Made by Jefferson Travis (U.S.A.) for the Air Ministry, but never unpacked. Still in canvas covers, and packed in individual wooden transit cases. Model UR/1. Visual range. As used by many police and fire forces. Ultra high frequency band of 63-75 mc/s. Complete operation for normal telephone type handset. Runs completely off batteries, or from a vibrator powerpack off one 12 volt supply. Telescope aerial, non-utility black enamel finish over-all.

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CRYSTALS. Brand new Germanium crystals, made by R.T.H. Give first-class results. SPECIAL OFFER 2/3, post 6d.

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INDICATOR UNITS. Ex-W.D., but brand new condition. Valves and C.B. tubes only have been removed. Chassis, valve holders, resistors, condensers, etc., alone worth more than our price. Units include Design "L," type 62, Power Unit 657, etc. BARGAIN at 12/6 each. Carriage 4/6.

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Two-POLE TOGGLE SWITCHES. 5 amps. Each pole will operate independently 1/-. post 4d.

SELF-ENERGISED MICROPHONES. On stand with switch and lead. No batteries required. Sold elsewhere for 12/6. Our Price 8/6, post 1/6.

COIL SETS FOR ADMIRALTY TYPE TRANSMITTER No. 50. 12 contained in mahogany box size 11in. x 22in. x 4 1/2in. deep. 21/6, carriage 3/6. Box alone is worth the money.

AMERICAN TYPE BREAST MICROPHONE. Type T.28 S.C.6627A. Would make ideal adjustable microphone for office desks, etc., 7/6, post 1/3.

TELEPRINTER TAPE. As recently supplied with our Morse Tape Recorders, 8in. rolls 3in. wide. 2/6, post 9d.

SUNVIX CONTROL LAMPS. With 4 pin valve base, used but good condition. 5/8, post 1/-.

MINE DETECTOR. For ferrous or non-ferrous metals, underground, under water or in animals, timber or chemicals, etc., etc. Unused. Comprises a 3-valve battery amplifier in a steel case, shoulder harness and long search coil, short search coil, headphones, junction box, operating instructions and circuit diagram. As we have to clear our store, we offer these at only 39/6, carriage 7/6. Tested and in working order before being stored, but no guarantee in view of price. No batteries.

AERIAL COUPLING UNITS. Type G. Reference ZA 0843-Containing large inductances variable transmitter type condensers, 0-1mA, M.C. Meter 2in. dia., Indicator light, etc., with controls brought out to front panel 15 x 11in. in metal box 15 x 11 x 1 1/2in. deep with 2 1/2in. hinged lid, complete with circuit. Brand new condition apart from slightly scratched case. 29/6, carriage 2/6.

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SITUATIONS VACANT

UNIVERSITY COLLEGE, London (Gower St., W.1) has vacancy for technician in Dept. of Phonetics; knowledge of electronics essential and interest in acoustics preferred; wage scale £315-£15-£450 p.a., plus London weighting; initial wage according to qualifications.—Application forms from Secretary, 1208

RADIO and television service engineer required for work on domestic receivers by a progressive organization with central service depot in Bedford; vacancies also at branches in Hitchin, Northampton, Kettering and Luton; good working conditions; energy and initiative; financial compensation by bonus scheme; housing assistance provided for suitable applicant. **APPLY** David Robinson, Ltd., Service Manager, 47, St. Peters St., Bedford G1375. [1974]

DRAWING office staff required, draughtsmen and drawing office clerk, to take charge of print room and drawing office records, for a well-established firm, situated within half an hour of Waterloo Station; draughtsmen should have workshop experience and preferably a knowledge of electronics; good salary paid to suitable applicants; 5-day week.—Apply D.O., Box 1709, 15, Hill St., London, W.1. [0246]

FACTORY engineers are required for Cathode Ray tube factory in North London area; previous knowledge of electronics desirable but not essential; applicants should have at least Higher National Certificate in Electrical Engineering and some knowledge of chemistry; they must be capable of investigating and solving manufacturing problems on their own initiative.—Box 0982. [1867]

ENGINEERS required for (a) maintenance and design of electronic test equipment, and (b) for quality control and investigational work on radio valves and other electronic devices; Index B.Sc. or Higher National Certificate standard.—Write, giving experience and salary required, to Personnel Superintendent, The Edison Swan Electric Co., Ltd., Cosmos Works, Brimsdown, Enfield, Middlesex. [1966]

FERGUSON RADIO CORPORATION, Ltd. require engineers with initiative and sound technical background to work in their Spenny-moor, County Durham factory on the development of radio receivers. Permanent posts are available for men able to carry responsibility in a rapidly expanding department offering good prospects. Laboratories are well-equipped and the working conditions excellent. **SUCCESSFUL** applicants will be eligible for the Company's pension scheme.

HOUSING assistance considered. **APPLICATIONS** giving full particulars as to age, qualifications and experience, etc., in writing to Employment Manager, Ferguson Radio Corp., Ltd., Great Cambridge Rd., Enfield, Middx. [1938]

RADIO engineer, senior, required for research department of loudspeaker manufacturers in North London; experience of loudspeakers desirable but not essential provided applicant has had previous radio experience; the work is interesting and varied and the situation offers scope for advancement.—Write, giving full details of age, experience and salary required, to Box 1602. [2060]

ELECTRO-ENCEPHALOGRAPHY recordist, Grade II, is required at Royal Edinburgh Hospital for Mental and Nervous Disorders, Morningside, Edinburgh; qualifications necessary and salary to be paid will be as laid down by Whitley Council.—Applications, with references, should be sent now to the Physician Superintendent, stating age and details of previous experience. [2059]

SENIOR and junior engineers required for responsible work in radio and television laboratories, applicants for senior position should be able to undertake development work with minimum supervision; excellent conditions and salary available for applicants who are accepted.—Apply first case to Personnel Manager (Dept. R.D.), McMichael Radio, Ltd., Wexham Rd., Slough. Applicants must be of British nationality. [2021]

FIRM of consulting geophysicists have openings for young electronic engineers, preferably single, on oil prospecting parties overseas; commencing salary £45 per month plus allowances depending upon area of operations; free accommodation and messing provided when serving abroad; qualifications Higher National or C. & G. Certificates in Electrical Engineering or Telecommunications.—Apply, giving particulars of experience, to Box 1561. [2045]

DRAUGHTSMEN required, seniors and juniors, preferably experienced in light mechanical engineering, as applied to radio and radar equipment; knowledge of workshop practice essential; applicants should possess Ordinary National Certificate or the equivalent; salary, A.E.S.D. rates and over, according to ability; 5-day week; canteen facilities.—Write, giving full particulars, to R.D.J., Decca, Ltd., 2, Tolworth Rise, Surbiton, Surrey. [0247]

McMICHAEL RADIO, Ltd., require senior and junior engineers in their equipment division laboratory at Slough; training and experience in the field of applied electronics (including communications) and experience working with Government Departments are the chief qualifications required.—Write, stating age and full details of training, qualifications and experience, to the Chief Engineer, Equipment Division, McMichael Radio, Ltd., Slough, Bucks. [10198]

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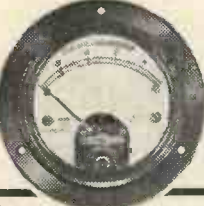
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BELLING & LEE, Ltd., Cambridge Arterial Rd., Enfield, Middlesex, require research assistants in connection with work on electronic components, fuses, interference suppressors and television aerials; applicants must be graduates of the I.E.E. or possess equivalent qualifications together with similar laboratory experience, salary will be commensurate with previous experience; 5-day week; contributory pension scheme.—Applications must be detailed and concise, and will be treated as confidential. [0230

ELECTRONIC development engineer required by a small company on the South Coast; qualifications, Degree or Higher National Certificate in electronics, or equivalent; experience of pulse techniques, d.c. amplifiers, etc.; man capable of accepting full responsibility for theoretical and practical design work; used to working to R.C.S. 000 etc. temporary accommodation will be found for selected applicant; state age, experience, salary required.—Box 1401. [1985

DECCA RADAR, Ltd., require a senior engineer to take charge of the testing of high-power centimetric radar equipment; previous experience of high-power radar, including receivers and A.F.C. systems, is required; a good salary, commensurate with experience, will be offered to the right man, for whom there are excellent prospects in this progressive and expanding company; please apply giving full details of experience and stating salary required to Ref. F.L.—Decca Radar, Ltd., 1-3, Brixton Rd., London, S.W.9. [0249

ASSISTANT Chief Mechanical Engineer.—Normal expansion requires appointment in S.E. London, Coventry or other 30 loc. with creative ideas, considerable experience mass production light engineering, domestic equipment or radio/television range. Degree or H.N.C. preferred, but right experience, initiative and ability might well be acceptable substitutes. First-class permanent and progressive opening with equivalent salary prospects. Write in confidence—Box D.7601, A.K. Adv., 212a, Shaftesbury Ave., London, W.C.2. [1997

ELECTRONIC engineers are invited to apply for senior posts of exceptional interest and opportunity with Decca Radar Ltd., to work in their laboratories on an extensive and expanding programme of microwave-link and radar development; applicants must have had several years' experience in development work in the electronic field; posts are permanent and pensionable; British nationality essential.—Write, quoting reference S.E., to The Research Director, Decca Radar, Ltd., Research Laboratory, 2, Tolworth Rise, Surbiton, Surrey. [0248

THE GENERAL ELECTRIC CO., LTD., Brown's Lane, Coventry, require Senior and Junior Electronic Development Engineers to work on Guided Weapons and like projects, particularly in the field of Microwave and Pulse Applications. Mechanical Development Engineers, Designer Draughtsmen and Draughtsmen, preferably with experience of radar type equipments, also required for the above projects; salary according to age, qualifications and experience; houses available to selected senior staff.—Apply by letter stating age and experience to the Personnel Manager (Ref. R.G.). [0259

ENGINEER required for laboratory of manufacturers of radio frequency magnetic materials; the work includes the development and application of these materials; applicants must be versatile and resourceful; sound theoretical training and several years industrial experience in design and development in the electronic field is essential; salary commensurate with qualifications and experience.—Write, stating age and full details of training and experience to the Managing Director, Neosid, Ltd., 33, Hyde Way, Welwyn Garden City, Herts. All applications will be treated in confidence. [1921

TELEVISION trouble shooters are offered an opportunity to train as maintenance and development engineers of electronic test gear with a large manufacturer in East London. The posts, which are permanent and pensionable, will provide experience on all types of test gear connected with radio, television and radar equipment and there are exceptional prospects of promotion; the company works a 5-day, 40-hour week and has excellent canteen and sports facilities.—Write quoting ref. WW/809, giving full particulars of previous experience, to Box 1521. [2019

B.B.C. requires limited number senior/laboratory technicians for research dept. at Kingswood, Surrey, and S. London; must have several years' practical laboratory experience of high standard in electrical/radio engineering; ability to construct and test electronic prototypes under supervision of research engineer; posts in field-strength measurement, electro-acoustics, television; salary according to qualifications and experience in range £415-£800 p.a.—Apply, stating salary required and ref. E.835, to E.R.O., B.B.C., London, W.1, within 7 days. [1963

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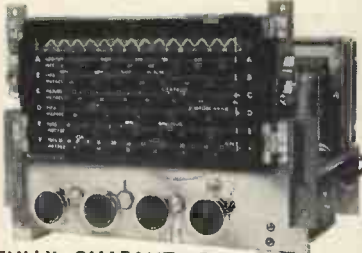
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MINISTRY of Transport and Civil Aviation.—Radio technicians required at aerodromes and radio stations; special training courses for keen technicians with basic qual.; interesting work in progress providing electronic aids to navigation; prospect of permanent pensionable posts; rates of pay (London) from £350 p.a. at age 19 to £445 at 25 rising, subject to qualifying test to £540; slightly lower for provinces;—Candidates aged 19 or over with practical experience in maintenance of radio or radar equipment should apply to Ministry of Labour and National Service, Barnsbury Rd., London, N.1, quoting Order No. 576. [2001]

A RADAR engineering appointment of exceptional importance has to be made in the rapidly expanding Decca Radar Company; this arises through the promotion of the head of the Service Division to manage an overseas company; a radar engineer of exceptional practical experience in the installation and servicing of centimetric radar equipment is required; the successful applicant must also possess sound administrative experience and a good knowledge of commercial practice; the appointment offers unique opportunities and a very adequate salary will be paid to the right man.—Applications to Box No. 2093, 15, Hill St., London, W.1. [2012]

THE LONDON HOSPITAL MEDICAL COLLEGE has a vacancy for an electronic technician (practical knowledge of pulse circuits and experience of construction and maintenance of electronic instruments necessary), on a salary scale £570/655 per annum, or for a research assistant in electronics (H.N.C. or equivalent qualification necessary), on a salary scale £600/760 per annum; either post is eligible for superannuation; applications, giving full particulars of age and experience, together with names of two referees, should be received by the Secretary, The London Hospital Medical College, Turner St., E.1, not later than 14 days after the appearance of this advertisement. [2015]

ELECTRON MICROSCOPES.—Engineer required, preferably graduate in physics or engineering, to operate from London headquarters on installation and regular periodical servicing of electron microscopes in United Kingdom and Western Europe; applicants must have skilled practical aptitude for electronic and vacuum physics, maintenance work and ability to deal with technical enquiries and sales matters in correspondence and personal contact with microscope users; experience in electron microscopy an asset, but not essential if scientific education and practical electronic background otherwise suitable; state age, and give complete details education, experience, languages, and salary required.—Box 1557. [2042]

AIR MINISTRY require Experimental Class Officers at establishment near Marlow, Bucks. Duties concern installation design of static and mobile radar and communication systems used by R.A.F. Work of engineering rather than laboratory type, covering wide range of application of electronic engineering to meet operational needs of R.A.F. with which very close contact is maintained. Membership of Officers' Mess open to accepted candidates offering all forms of recreation in congenial surroundings. Qualifications: at least Higher School Cert. (Science) or equivalent although higher qualifications in Physics or Electrical Engineering may be an advantage. Salaries within ranges: E.O. (min. age 26) £649-£799, or Asst. E.O. £264 (at age 19) to £551. Appointments unestablished. Application forms from M.L.N.S., Technical and Scientific Register (K), 26, King Street, London, S.W.1, quoting D.410/53A. Closing date 11 December, 1953. [2022]

ADMIRALTY—Royal Naval Scientific Service. Engineers and Physicists (particularly with electronics) required for appointments in Experimental Officer and Assistant Experimental Officer grades in Experimental Establishments in London, Portsmouth, Weymouth and Gloucestershire areas and Scotland. Candidates. British subjects, must possess one of the following qualifications: University degree in Science, Engineering or Maths., Graduate Membership of appropriate professional Institute, Higher National Certificate, Final Certificate of five-year grouped course in relevant subjects at City and Guilds of London Institute or comparable institution, Higher School Certificate, General Certificate of Education, Scottish Leaving Certificate, Scottish Universities Preliminary Examination, Northern Ireland Senior Certificate (all in appropriate subjects and at appropriate levels). London salary inclusive of pay addition (men) E.O.s £681-£838, A.E.O.s (according to age) £274-£607. All appointments unestablished, but with some opportunities to compete for established posts.—Application forms from M.L.N.S., Technical and Scientific Register (K), 26, King St., London, S.W.1, quoting A247/52/A. [1992]

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 - c) **ELECTRONIC TRIALS ENGINEERS** at a salary of up to £750 p.a.
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 - d) **TRIALS RADAR ENGINEERS** at a salary up to £750 p.a.
Applicants should have had experience of operating development radar equipment in the field and have a sound basic knowledge of radar principles and circuits. **VACANCIES ALSO EXIST FOR ENGINEERS IN AUSTRALIA.** Ref. 1190.
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- Housing accommodation is available to suitable applicants for posts (c) and (e) above.
Applications should be sent to Dept. C.P.S., 336/7 Strand, W.C.2, quoting appropriate reference.

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Resumes which will be treated as strictly confidential, should be addressed to the Research Director, 2 Tolworth Rise, Surbiton, Surrey. [10450]

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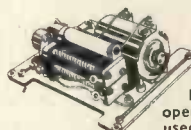
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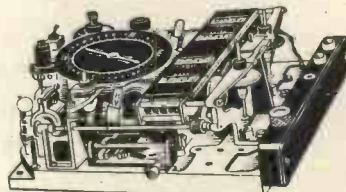
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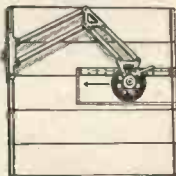
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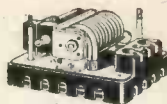
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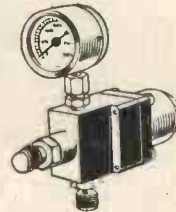
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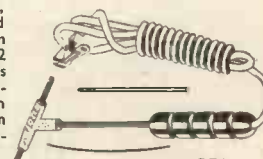
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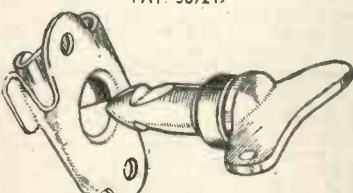
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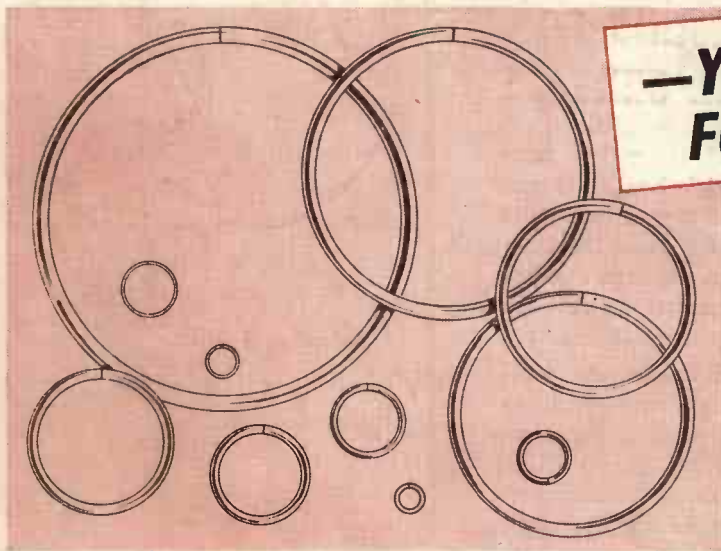
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