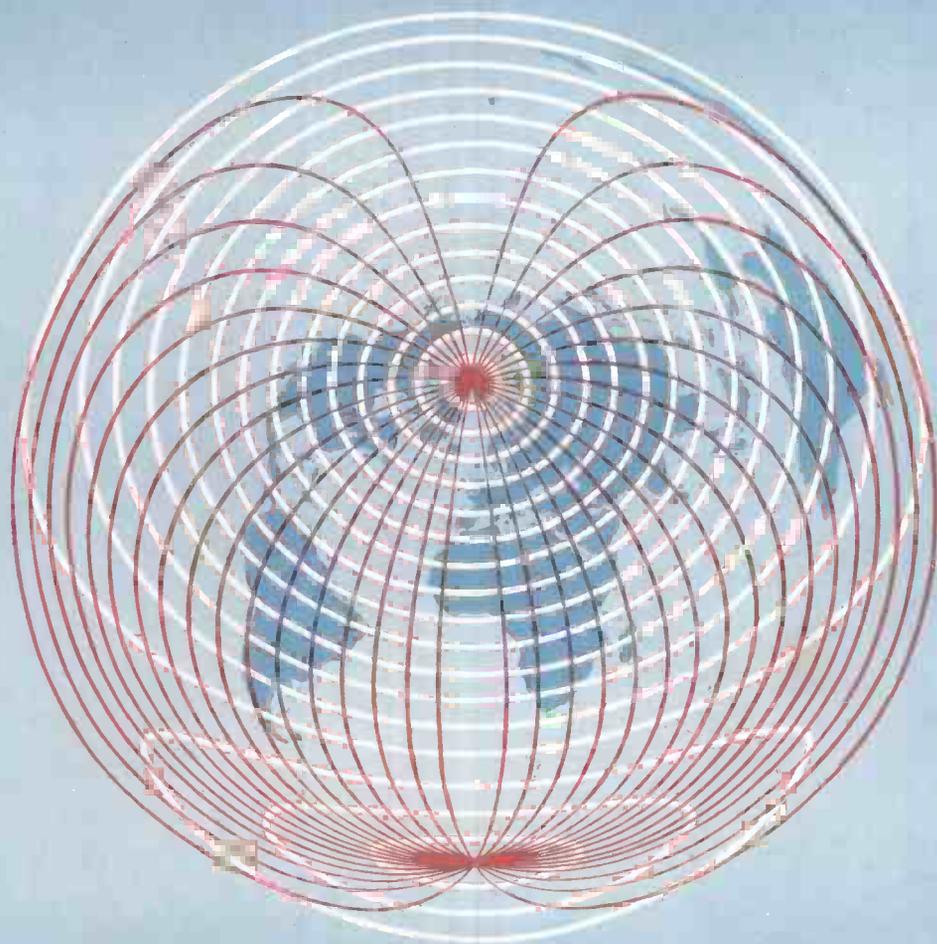


Wireless World

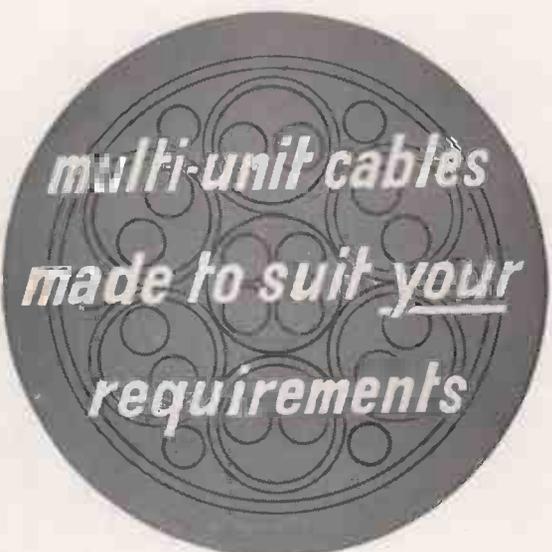
RADIO AND ELECTRONICS



Vol LVI No 6

Two Shillings

June 1950

*multi-unit cables
made to suit your
requirements*

Here's a unique opportunity for radio-equipment manufacturers needing special multi-unit low-loss cables . . . ! Let BICC design and manufacture them to meet your requirements. Our engineers have had extensive experience in this field and can also place at your disposal the vast research and production facilities of the BICC organisation.

BICC have designed and produced numerous multi-unit cables to meet specialised needs including flexible cables for electronic equipment. Some of these are shown below.

Write to us and let us assist you with your problems.



Multicore polythene-insulated and sheathed T/V Camera Cable.



Double-quad polythene-insulated audio-frequency cable.



Multicore polythene-insulated P.V.C. sheathed flexible T/V Camera Cable.



Polythene-insulated P.V.C. sheathed multicore cable for film studio use.



multi-unit
LOW-LOSS CABLES

BRITISH INSULATED CALLENDER'S CABLES LIMITED
NORFOLK HOUSE, NORFOLK STREET, LONDON, W.C.2

Wireless World

RADIO AND ELECTRONICS

40th YEAR OF PUBLICATION

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

Editor: H. F. SMITH

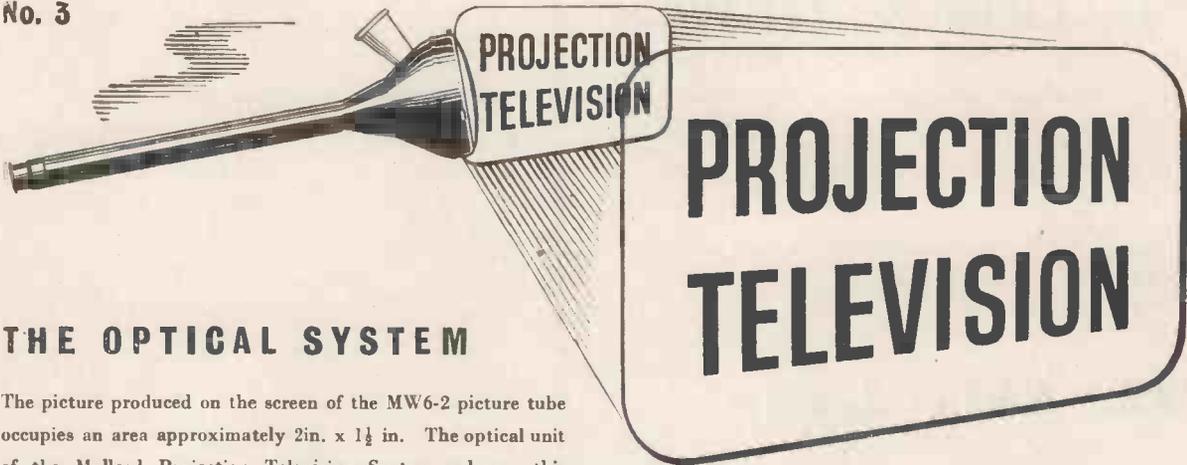
In This Issue

EDITORIAL COMMENT	201
NARROW-BAND PULSE COMMUNICATION.	
By <i>Thomas Roddam</i>	202
SHORT-WAVE CONDITIONS. By <i>T. W. Bennington</i> ..	205
TELEVISION MONITORS. By <i>J. E. B. Jacob</i>	206
SCREENING. By "Cathode Ray"	211
THAMES RADIO SERVICE	215
MODERN SOFT-SOLDERING TECHNIQUE.	
By <i>R. W. Hallows</i>	217
WORLD OF WIRELESS	220
ELECTRONIC CIRCUITRY. By <i>J. McG. Sowerby</i> ..	223
AMPLIFIERS FOR CARDIOGRAPHY. By <i>B. J. Shelley</i> ..	227
TRENDS IN COMPONENTS	229
UNBIASED. By "Free Grid"	236
RANDOM RADIATIONS. By "Diallist"	237
LETTERS TO THE EDITOR	238
MANUFACTURERS' PRODUCTS	240

JUNE 1950

PUBLISHED MONTHLY: Price 2/- (on last Thursday of preceding month) by ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1. Telephone: Waterloo 3333 (60 lines). Telegrams: "Ethaworld, Sedist, London." Annual Subscription: Home and Overseas, £1 6s. 0d.: U.S.A. and Canada \$4.50. BRANCH OFFICES: Birmingham: King Edward House, New Street, 2. Coventry: 8-10, Corporation Street. Glasgow: 26B, Renfield Street, C.2. Manchester: 260, Deansgate, 3.

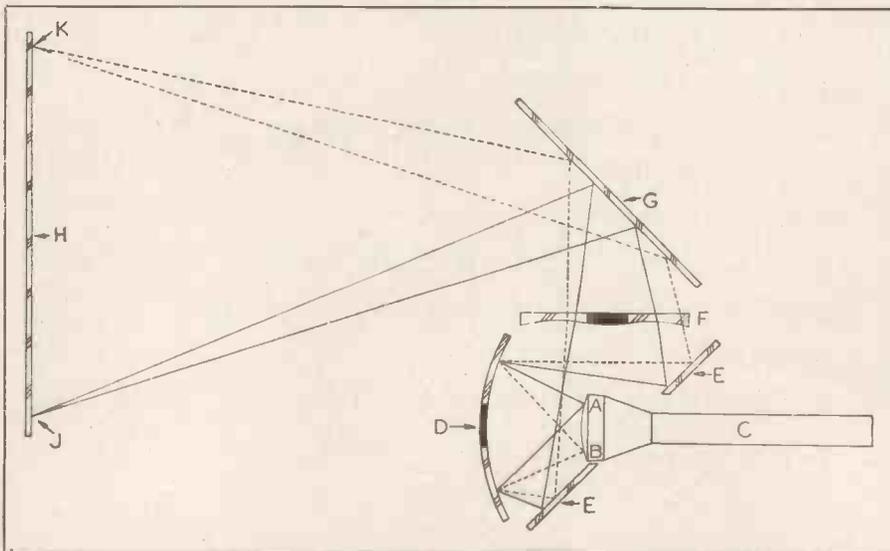
No. 3



THE OPTICAL SYSTEM

The picture produced on the screen of the MW6-2 picture tube occupies an area approximately 2 in. x 1½ in. The optical unit of the Mullard Projection Television System enlarges this picture so that an image of one of the standard sizes (ranging up to 16 in. x 12 in. for cabinet viewing or up to 48 in. x 36 in. for wall projection) is seen on the viewing screen.

Of the various methods of optical enlargement available, that in which a spherical mirror is used as the enlarging element has



been selected on account of its simplicity, its suitability for manufacture on a mass-production basis, and its high luminous efficiency.

The optical principle is indicated in the diagram where C is the MW6-2 picture tube, D a front-silvered concave spherical mirror, E a plane mirror mounted at an angle of 45° to the axis of the picture tube, F a lens of special contour to correct for spherical aberration, G a second plane mirror mounted at right angles to E, and H the viewing screen which for cabinet viewing is of the dispersive type and for wall projection of the reflective type.

A picture element A formed at the top of the raster emits light which is collected by the spherical mirror and is reflected as a convergent beam to mirror E and thence, via corrector lens F to mirror G from which it is again reflected, still as a convergent beam, to point J at the bottom of screen H, where

it is visible as a magnified image of picture element A.

Similarly a magnified image of a picture element B situated at the bottom of the raster is brought to focus at K at the top of screen H.

The length of the optical path, i.e. the combined distance from corrector lens F to mirror G and from mirror G to screen H must, of course, be such that the spot is correctly focussed on screen H. The correct distance is determined by the contour of lens F, and

the five standard models of the optical unit differ only in the design of the corrector lens, each model being suitable for a specified throw distance and corresponding picture size



Equipment manufacturers are invited to send their enquiries to:—
MULLARD ELECTRONIC PRODUCTS, LTD.,
SETMAKERS DEPARTMENT,
CENTURY HOUSE, SHAFTESBURY AVE., W.C.2

Wireless World

VOL. LVI. No. 6.

JUNE, 1950

Amenities and Necessities

RADIO communication has now reached a stage where the "amenity" use for non-vital purposes tends almost to overshadow its original functions. First accepted as an indispensable aid to the safety of life at sea, and then as an adjunct to existing methods of marine navigation, it soon became of equal—perhaps even greater—importance to aviation. Wireless in the service of many other human activities is now making a niche for itself.

In the past the Post Office has been accused of over-cautiousness in failing to encourage secondary uses of radio for purposes where its advantages are evident, but where some other form of communication would, at a pinch be made to serve the purpose, even if less effectively. Such accusations against the monopolistic power that rules our destinies are not entirely without foundation, but a good case can be made out for our national policy of making haste slowly in this matter. It is only quite recently that transmitting and receiving apparatus operating in the e.h.f. bands has reached a state of development where it could be entrusted to untrained policemen, taxi drivers, firemen and all the others who are today using it successfully. Reliable and easily operated gear is now made by a number of firms. Many technical obstacles to the growth of "amenity" radio have been overcome, and others are being tackled energetically. Organizational obstacles are similarly being overcome, and *Wireless World* is satisfied that the Post Office no longer refuses a sympathetic hearing to applicants for licences who can make out a good case for using radio communication for any new purpose.

Typical of the newer applications is the Thames Radio Service, described elsewhere in this issue, which provides for linking vessels in the Thames estuary with the inland telephone service. This radio link is primarily intended for small craft, and so has a limited traffic-handling capacity.

Somewhat similar services for large passenger ships inside the harbour limits of several of our seaports would certainly provide a much-appreciated radio amenity but, as the traffic handled would be compressed into a very short space of time, the organizational problem would probably be greater than the technical.

Studying Television

DURING the recent visit of the C.C.I.R. Study Group the delegates have been given a good picture of the technical progress of television in this country. No effort has been spared to show them everything that will help in their task of advising on transmission standards for Europe.

No secret has been made of the wish generally entertained here that the delegates' choice will fall on the British 405-line system, and so allow us to participate in international exchanges of programmes. It is unnecessary to repeat here the many arguments adduced as to the extreme practicability of our system. Demonstrations to the delegates have suggested that the 625-line system, towards which European opinion has tended to incline, is hardly worth the virtually doubled bandwidth which it requires. It has also been demonstrated to them that such transmissions, confined to a sub-optimum bandwidth, are clearly inferior to the 405-line standard.

We have gained the impression that some of the delegates fear the adoption by their countries of so low a definition as 405 lines would incur the risk of early obsolescence. That is natural enough, but the doubters may perhaps be reassured by knowing that more than one British television engineer has said that, if we were today starting the service *ab initio* in this country, we would be well advised to choose the present standard. With that opinion *Wireless World* agrees.

Narrow-Band Pulse Communication

New Method of Reducing Inter-channel Interference in Time Division Multiplex

By THOMAS RODDAM

THIS is not the first article on pulse modulation that has appeared in *Wireless World*. Judging by the amount of work which is being done on pulse systems it will not be the last. The chief interest of the pulse system to be discussed in this article is that it is the first narrow-band pulse system which has been described. All earlier systems have used bandwidths which were monstrously extravagant in terms of the actual information transmitted: ten channels of 4 kc/s would occupy 2 Mc/s video bandwidth, a ratio of 50:1. The return for this squandering of bandwidth is, of course, an improvement in signal-to-noise ratio, and in systems like pulse code modulation the theoretical improvement is almost achieved.

When engineers started to build pulse multiplex systems they made a most important discovery. It is very much cheaper to divide up one millisecond into ten equal time intervals than it is to divide up 40 kc/s into ten equal frequency intervals. Gating circuits for producing time allocation multiplex cost much less than crystal filters for producing frequency allocation multiplex. The full significance of this was not appreciated at first, but as the idea went home the telephone administrations and the firms which supply them realized that long-distance telephone circuits, especially those using coaxial cables, involved a huge amount of capital expenditure at the terminal stations, and that the filters for the frequency allocation multiplex systems represented an important part of this cost. If a pulse system can

be appreciably cheaper, the first firm to get on the market will scoop in quite a lot of orders.

The problem with which the engineer is confronted is that of applying a pulse system to a cable, the bandwidth of which is limited, in such a way that a maximum number of channels can be used. The microwave honeymoon is over, and indeed even the microwave people are beginning to watch the bandwidth price pretty closely. The aim has been to get the bandwidth down to 4,000 c/s for each speech channel, which means an efficiency of about 80 per cent (useful bandwidth/bandwidth occupied).

The solution which has been receiving the most attention, unless someone is hiding a surprise, was hinted in an article on *Communication Theory**. In that article I showed how a local circuit at the receiver could compensate for distortion caused by a restricted bandwidth. In Fig. 1(a) we see the very short pulse which we intend to modulate, and in Fig. 1(b) we see the train of oscillations produced by passing this pulse through a filter to limit the bandwidth. As soon as the pulse has risen to A, however, the local circuit generates a compensating wave. The result is shown in Fig. 2, and it will be seen that after the point C the output is cleared and ready to accept a new pulse. I have skimmed through this quickly because the article quoted does make it all quite clear.

Gaussian Pulses

In this discussion I assumed, for simplicity, that the compensating circuit was required to clear the base-line completely once the pulse had been established. Life becomes a great deal easier, however, if we use pulse amplitude modulation, because we need only clear the base-line for very short intervals corresponding to the middle of each pulse. Inside the receiver we can use as much bandwidth as we like, so that we could, if we knew how, arrange a new pulse centre to occur at each of the crossing points of the first diagram in Fig. 2. What has actually been done is formally equivalent to this, but differs in rather important practical details.

First of all, the short square pulses and the oscillating trains produced by ordinary filters are very inconvenient to work with. The short square pulse is not too bad, but as quickly as possible we convert it into what is called a Gaussian pulse. This is a very important type of pulse, and I cannot remember anyone explaining it, so we will digress for a moment. The Gaussian pulse has the equation $e^{-k^2t^2}$, and is, to use rather outmoded slang, a smooth job. It just gets bigger and bigger, and then gets smaller and smaller, as shown in Fig. 3(a). The frequency spectrum is shown in Fig. 3(b): the dotted part is what

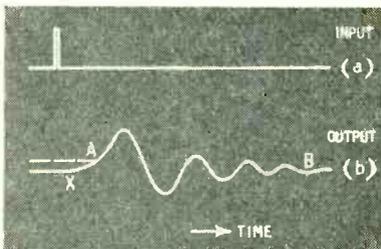
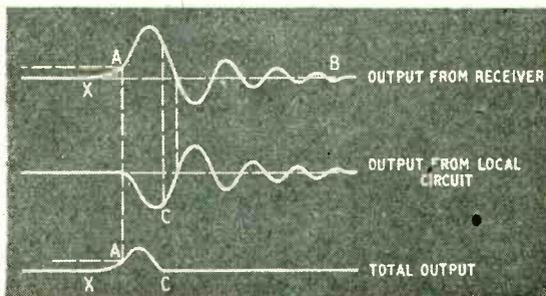


Fig. 1. (a) Short pulse and (b) after passing through filter to limit bandwidth.

Fig. 2. Cancellation of oscillatory distortion of pulse.



* *Wireless World*, May, 1949.

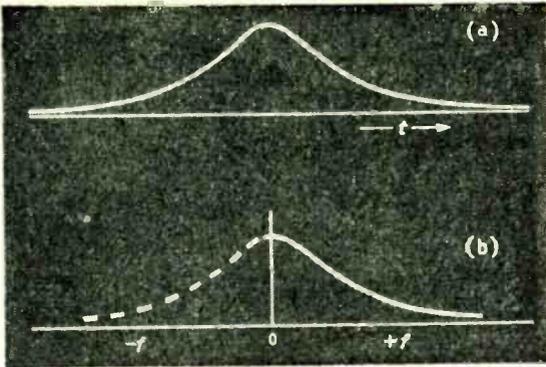


Fig. 3. Gaussian pulse and the corresponding frequency spectrum.

the mathematics says happens for negative frequencies. As you see, the time response and the frequency spectrum are the same shape. The simplicity does not end here. Suppose that a pulse like this is passed through a filter which cuts off quite smoothly and gently, and has a response which is also Gaussian, the output pulse is, as the enthusiasm

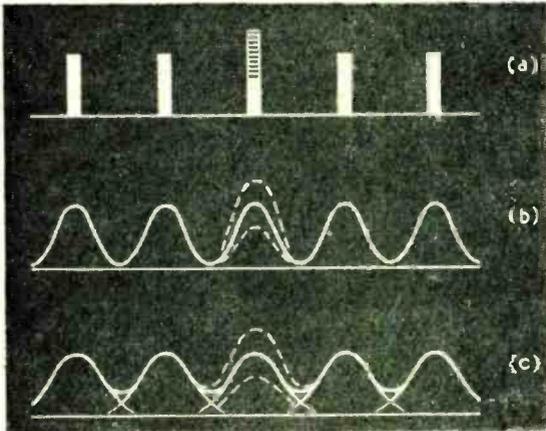
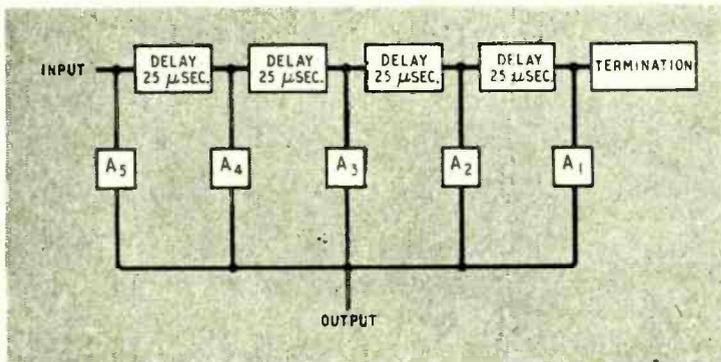


Fig. 4. Short pulses (a) are lengthened by passing through a wide Gaussian filter (b), and may overlap if the filter is made narrower (c).

Fig. 5. Corrector circuit for balancing cross-talk due to pulse overlap.



for this shape must have made you expect, a Gaussian pulse, longer than the original, but still that simple bell-like shape.

The reader may have noticed one awkwardness: the Gaussian pulse started at $t = -\infty$, and lasts, theoretically, for ever. There is another difficulty: the Gaussian filter, which must have a linear phase shift, cannot be obtained by means of a finite number of components. We seem to be staring into infinity on all sides. A good approximation to the right pulse shape can be obtained, however, either by using the curvature of a valve characteristic, which I mention only because that is the first method proposed, or by putting a short pulse through an amplifier with a lot of simple RC couplings. The third and most efficient way is to use an amplifier with several "maximal flatness"* stages and one plain RC stage. Once we have our Gaussian pulse we can arrange that all the amplifiers which we shall need along the length of the cable, and which we must call repeaters when we talk to the telephone men, are of this Gaussian kind. Then our pulses will be lengthened but will not be changed from their essential Gaussian shape.

Elimination of Cross-talk

Let us now take a look at Fig. 4. In row (a) we have a set of nice short pulses, which we shall assume belong to different speech channels. Only channel 3 is modulated, and the shading shows that the amplitude lies somewhere within the limits indicated. An n -channel system will have n pulses in about $1/8,000$ th second (125μ sec) and will then start a new train, because we need about 8,000 pulses per second for each speech channel. If we have 5 channels, as I have shown, the spacing between the circuit pulses is 25μ sec.

After these pulses have been passed through the Gaussian amplifier at the transmitter they will have the appearance shown in Fig. 4(b), and after traveling along the cable with its Gaussian amplifiers we shall have the shape shown in Fig. 4(c). It will be seen that the signal at the receiver is made up of pulses which are overlapping, so that the modulation on pulse 3 will have some effect on the amplitudes of the neighbouring pulses, 2 and 4. When we cram the pulses together by reducing the bandwidth still more, even pulses 1 and 5 are affected by the modulation on pulse 3.

At the receiver we want to eliminate the effect of the modulation on pulse 3 from channel 4. We therefore "gate" pulse 4 at its centre, and subtract a voltage obtained by delaying pulse 3 for 25μ sec and attenuating it suitably. The amount of attenuation is determined by balancing out the modulation produced in channel 4 from channel 3. We do not need to know the exact shape of the pulse, provided it remains constant. Obviously we can also get rid of the cross-talk from channel 3 into channel 5 by using a 50μ sec delay network..

The smooth shape of the pulses implies that channel 3 will produce cross-talk in channel 2. All we need is a network which produces a nega-

* V. D. Landon, *R.C.A. Review*, Jan., 1941, p. 354.

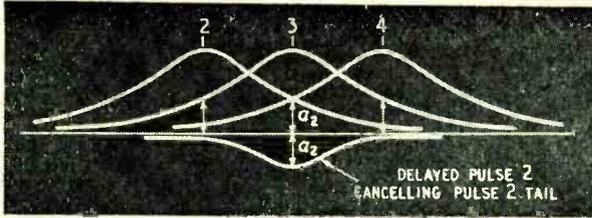


Fig. 6. Detail of Fig. 4 (c) to explain the cancellation process.

tive time delay of 25μ sec. The trick which is used is to tap off a little of pulse 2 and feed it in, with reversed sign, to a delayed pulse 3. The total circuit of the compensation system is shown in Fig. 5, with the values appropriate to the example we have chosen. The units marked A are attenuators, and may include reversing circuits. At the instant when the centre of pulse 3 is available at the output of A_3 , the centres of pulses 1, 2, 4 and 5 are also available at the outputs of A_1 , A_2 , A_4 and A_5 , and a suitable portion of each of these pulses is used to balance out the corresponding tail which is passing through A_3 . The shape of the pulses is shown more accurately in Fig. 6. The amplitude of the tail of pulse 2 which occurs at the epoch of the centre of pulse 3 is a_2 , and this is cancelled by the small delayed pulse obtained at the output of A_2 in Fig. 5. The other pulse tails are balanced out in the same way by the outputs of the other A's.

The reports so far available suggest that in experimental systems the balancing of the cross-talk can be made to be sufficiently good for commercial use, even when the pulses are so elongated that the bandwidth is only 4 kc/s per channel. It seems likely that successful operation is obtained because the balancing operation is fairly simple: not quite so simple as this account suggests, because there is interaction between the settings of the various attenua-

Fig. 7. Transmitting terminal equipment.

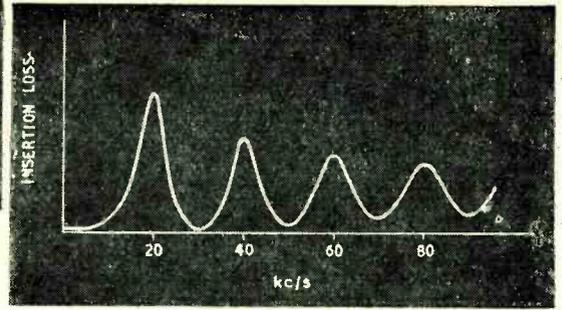
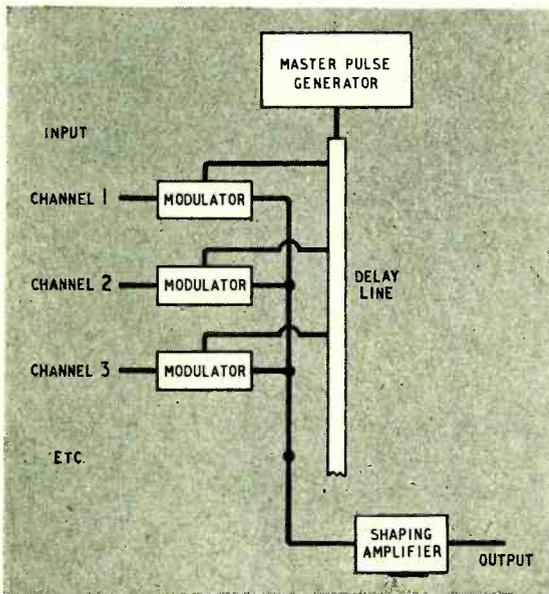
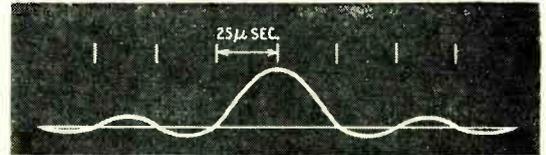


Fig. 8. Response of corrector regarded as a filter.

Fig. 9. Pulse after passing through corrector.



tors. The main problem is to make sure that the pulse shapes, which are not in themselves critical, do not alter as the equipment is running. I do not propose to discuss this problem because it is purely one of engineering refinement: can we make a system using a coaxial cable have exactly constant response? Can we make a perfectly constant f.m. system? The real problem is one of cost.

Fig. 7 shows the general arrangement of the terminal equipment at the sending end. The modulators are actually gating circuits, which are opened in turn by pulses produced in the master pulse generator, the order being maintained by tapping off the gate pulse along a delay line so that the pulse spacing is absolutely independent of valve characteristics. The receiving end is very much the same. Additional circuits are used to provide synchronization between the two ends, but these are not parts of the basic system. It will be seen that the complex filters of the frequency allocation multiplex systems have been replaced by the single delay line in this pulse system. Unless there are some exceptional difficulties, the pulse equipment should be very much cheaper.

Future Developments

The details cannot be discussed any further, because nothing has yet been published about systems of this type which will satisfy the standards needed for European telephone circuits. Lengthy field tests of a number of different arrangements will be needed before we can see just what performance can be achieved in practice, both on lines and using frequency-modulation links. It is even possible that in the final form the compensating device will be used in conjunction with pulse code modulation, because it must be noted that by using the arrangement described we do not gain anything in signal-to-noise ratio.

One very interesting point is probably mainly of theoretical interest. If we have a connection between the output of the transmitting terminal and the input of the receiving corrector circuit which is absolutely

linear, the corrector can be transferred to the transmitting end. We may then regard the corrector as a rather queer sort of filter which some readers may recognize as a sort of big brother to the re-entrant line filters used occasionally in feeders. The sort of response which this filter will have is shown in Fig. 8, and it is obviously what is sometimes called a "comb filter." When a pulse input is applied to such a filter the output takes the form shown in Fig. 9, and the amplitude is seen to be zero at all multiples of 25 μ sec before and after the pulse peak. Thus the use of the corrector at the transmitter amounts simply to the use of a special filter circuit which produces a pulse having zero amplitude where it can interfere with the other pulses. The reason why this arrangement, or rather this way of thinking, is not so useful in practice is that the operation of balancing cross-talk is very much easier to carry out

than the operation of adjusting the filter to the exact characteristic needed. This is an example of how it is sometimes better to think in terms of physical behaviour than in terms of standardized concepts like frequency response or transient response.

When I wrote, 12 months ago, that "the thoughts of a few philosophers will set in motion many men who have no understanding of their philosophy," I did not expect that we should be so soon within sight of a new system with such enormous application. I do not know how many frequency allocation multiplex systems are operating in Europe, but I would guess that there must be of the order of one hundred thousand channels altogether. Each new coaxial cable carries nearly one thousand channels. The system described here may make all the terminal equipment obsolete. It looks as though we should all be pretty busy.

SHORT-WAVE CONDITIONS

April in Retrospect : Forecast for June

By T. W. BENNINGTON (*Engineering Division, B.B.C.*)

DURING April the average maximum usable frequency for these latitudes decreased considerably during the day and increased somewhat during the night, these being the normal seasonal variations. Both by day and night they were considerably lower than during April of last year, due, no doubt, to the effect of the "decreasing" phase of the sunspot cycle.

Day-time working frequencies decreased appreciably, though, on the whole, they were higher than had been expected. U.S.A. stations on frequencies above 28 Mc/s were seldom heard during the month, and U.S.A. 28-Mc/s amateurs, though they were more or less regularly received during the first part of the month, were rarely heard towards the end. South and Central Americans on this frequency were, however, coming through well till the end of the month. Frequencies as high as 15 Mc/s were often usable till after midnight.

Sunspot activity was, on the average, somewhat lower than during the previous month.

April was a very disturbed month, and frequent periods of poor conditions occurred. The most disturbed periods were 1st, 6th, 13th, 20th, 24th and 30th.

No less than fourteen Dellinger fadeouts were reported during the month, the two most severe of these occurring on 14th; at 1242 and 1335 G.M.T.

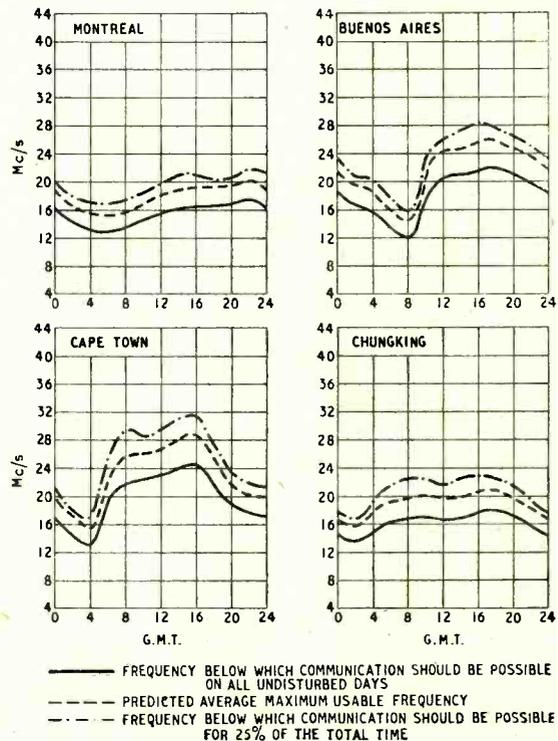
Forecast.—During June, day-time m.u.f.s in these latitudes should continue to decrease towards their lowest seasonal value, which should be reached towards the end of the month. Night-time m.u.f.s should reach their highest seasonal values at about the same time.

Working frequencies for long-distance transmission should therefore be generally lower by day, and higher by night, than during May. Over east-west circuits it is unlikely that frequencies higher than about 22 Mc/s will ever be usable, while even over north-south circuits 28 Mc/s is likely to be above the m.u.f. most of the time. 15 Mc/s should remain usable till well after midnight over many circuits, and the lowest night-time frequency for regular communication should be of the order of 12 Mc/s.

For medium distance transmission—up to about 1,900 miles—the E or F₁ layers will control transmission for long periods during the day, and in these cases, day-time, as well as night-time, working frequencies should

be higher than during May. Transmission by way of Sporadic E over medium distances is likely to be a frequent occurrence, and may often take place on exceptionally high frequencies. Trouble from ionospheric storms is not usually very bad during June.

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



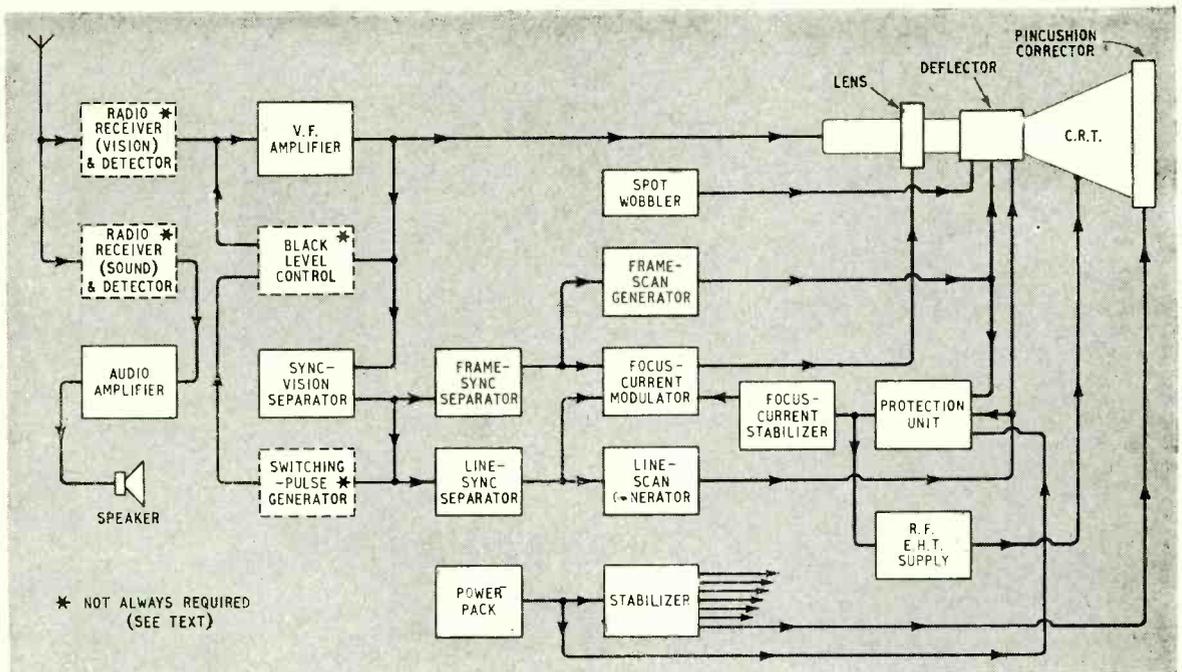


Fig. 1. Block schematic diagram of complete sound and vision monitor, including ancillary receiving equipment.

Television Monitors

Performance Requirements

By J. E. B. JACOB, B.Sc.Eng., A.M.I.E.E. (Cinema-Television, Ltd.)

IT has long been the practice in sound broadcasting to provide high quality reproducing equipment specifically designed for monitoring the transmitted signal. Little or nothing has so far been published about similar equipment for television, although there is evidence in the current literature¹ of the need for vision monitors specially designed for the purpose.

The station vision-monitoring equipment should be designed to furnish the quality-checking engineer with the best picture obtainable within the prescribed bandwidth of the particular television system in use. The equipment should, therefore, be of considerably higher quality than any likely to be in the possession of home viewers. The ideal to be aimed at is that the observing engineer should be able to detect and rectify any small loss of picture quality long before the ordinary viewer becomes aware of it at all.

The monitor should preferably receive the radio-frequency output of the transmitter in the normal

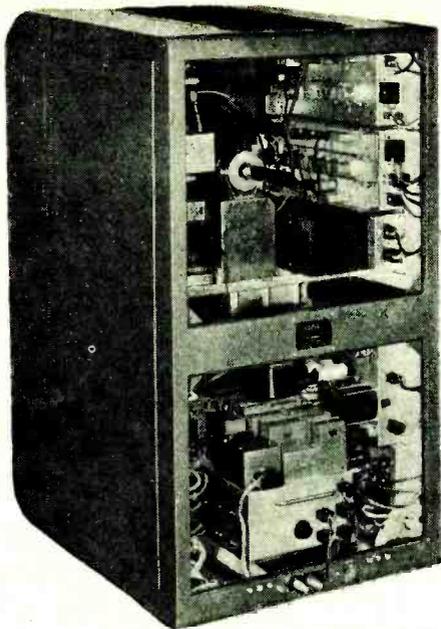
way so as to check the overall performance of the station, but if this is not convenient it should be connected to a point in the transmitting chain as near to the aerial as possible.

Recently two line-operated vision monitors, fitted with 20-in diameter direct-viewing cathode-ray tubes and capable of very good performance, have been supplied to the British Broadcasting Corporation. It is proposed to indicate in this article some of the measures required, as compared with an ordinary television receiver, to provide the improved performance.

Fig. 1 shows a detailed block schematic diagram of such a monitor. In general, of course, it embodies the same equipment as is required in any television receiver, but each part is designed from the performance point of view, cost being a relatively secondary consideration.

The degree of complexity of the monitor depends partly on the performance required and partly on the quality of the input signal. The signal may be subject in varying degrees to different types of interference and the various units comprising the monitor must be designed to minimize unwanted disturbances of the picture.

¹ D. G. Fink, "Avenues of Improvement in Present-day Television." *Proc. Inst. Radio Engrs.*, July 1948, Vol. 36, pp. 896-905.



Interior view of a monitor made by Cinema-Television.

The cathode-ray tube used in a high-performance monitor is perhaps the most important single component. The ability of the monitor as a whole to reproduce the required quality picture depends finally on the tube, however good the performance of the circuits may be. The magnetically-focused and deflected tube, when so designed, is eminently suitable for this particular purpose.

The dimensions of the monitor picture should be such that it can be examined in sufficient detail at a reasonable viewing distance and experience has shown that for a 405-line system a 12-in (30 cm) diameter tube is just adequate though a 15-in (38 cm) tube is to be preferred. The screen should be of the largest possible radius of curvature consistent with the necessary mechanical strength.

The tube should be capable of a picture highlight brightness of at least 25 foot-lamberts with a contrast range of 100:1 or better. An aluminized screen operated at 12-15 kV, and 200-300 μ A in the highlights is quite satisfactory for our purpose and has the additional advantage of preventing negative-ion burn.

The electron gun must be so designed that (1) it can provide the necessary beam power, with a reasonable expectation of life, for exciting the fluorescent screen to the required brightness and at the same time the size of the focused spot must be such that, in relation to the picture size, the full definition of the picture can be reproduced, and (2) the gamma of the tube, which may be defined as the slope of the curve connecting the logarithm of the brightness with the logarithm of the driving voltage from the beam-current cut-off point, should be of the same order as that of the average picture tube in a typical home receiver.

This latter factor is of considerable importance, for if the monitor tube has a gamma markedly

different from the average, the picture-quality checking engineer at the transmitting station will gain a false impression of the tone quality of the picture as it appears in the average home.

The majority of current tubes designed for use in the home have a gamma which lies between 2 and 3 and a good average value is 2.5.

The 20-in diameter cathode-ray tube which has been used in high performance monitors is fully capable of meeting these requirements.

The Magnetic Lens

The magnetic lens must be designed to focus the relatively large diameter beam without introducing appreciable spherical aberration. One of the necessary conditions to achieve this object is that the beam should pass centrally through the lens and, subsequently, the deflector. In case the gun is misaligned in the tube, means must be provided, therefore, to deflect the beam before it is focused or deflected so that it passes along the common axis of the lens and deflector.

An additional desirable feature in the design of the lens is that it shall be so constructed as to enable its power to be varied in a suitable manner in synchronism with the line- and frame-scanning waveforms.

Distortion of the picture can arise from two main sources. In the first place the television picture would ideally be presented on a flat surface as we have all, in the course of our lives, developed the ability to appreciate perspective in a flat representation of a three-dimensional scene. Unfortunately, due to other considerations, the screen of the cathode-ray tube is usually a spherical surface and some distortion is bound to occur when an ideal flat picture is reproduced on it. The distortion can be made to occur in a form which is, for our particular purpose, the least objectionable by the use of a suitable geometrical projection to relate the flat picture to the spherical one.

If the spherical and flat surfaces are imagined to be in contact at the centre of the picture and corresponding points in the two pictures are joined by projection lines, a stereographic projection will be obtained when the projection lines pass through the opposite pole of the sphere. The recommendation for this type of projection is the accuracy with which shapes are reproduced all over the picture. An object moving outwards from the centre of the picture will become slightly smaller in size, but its shape will be accurately maintained. The corner angles and indeed all angles all over the picture are correctly reproduced.

A second form of distortion arises because in modern cathode-ray tubes, using wide-angle deflection, the centre of curvature of the screen is not coincident with the centre of deflection and consequently the distance moved by the spot from the centre of the screen is not proportional to the angle through which the beam is turned. This results in pin-cushion distortion which can be corrected by means of a suitably positioned static 8-pole magnetic field. As applied to a cathode-ray tube, the field is arranged to pull out the edges of the picture in the horizontal and vertical directions and to compress the picture in the intermediate 45° directions. The pin-cushion corrector is only part of the complete solution. It reduces the distortion in the 45° directions, but increases it in the horizontal and vertical directions.

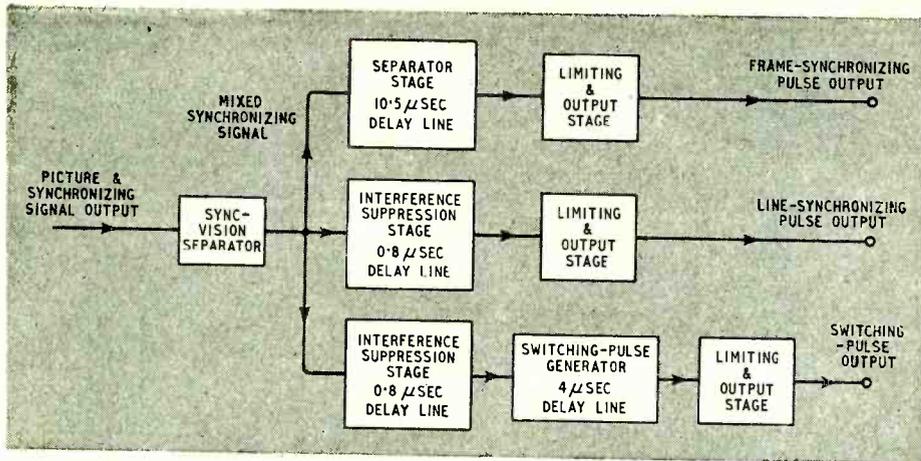


Fig. 2. Block diagram of synchronizing-signal separator giving protection against interference

Its usefulness arises from the fact that this redistribution converts all the distortion into a form which can be corrected by simple changes in the linearity of the scan generators. Without this facility it would be necessary either to intermodulate the two scanning waveforms² or to modify the scanning yoke in an empirical manner to provide a correction. Neither of these methods is to be recommended since intermodulation of the scanning waveform is impracticable for most purposes and modification of the scanning yoke necessarily implies non-uniformity of the deflection fields, which is certain to introduce more deflection astigmatism than can be tolerated in this case.

It follows that the scan generators must be designed to produce scanning currents of the correct waveform, in order that, when used with a deflection yoke designed to produce uniform deflecting fields (which introduce a minimum of astigmatism) and in conjunction with a pin-cushion corrector, the picture shall be a stereographic projection of the ideal flat picture. The waveforms should be correct to within $\pm 2\%$, since a 10% error is objectionable and 5% is still noticeable. In addition, the frame-scan generator must be designed to interlace accurately under all normal conditions of service.

Focus Modulation

The use of wide-angle deflection causes the picture to be defocused in the corners due to the depth of focus of the magnetic lens being inadequate to handle the variations of throw distance between the centre of deflection and the screen as the spot scans the picture area. The power of the lens can be varied in a suitable manner to correct this defect by adding two small alternating-current components of parabolic waveform, repeating at the line and frame frequencies respectively, to the main direct-current component required by the focus coil.

A cathode-ray tube which is designed, focused and scanned in accordance with the principles outlined above will require a "spot wobbler," but since this has been described in some detail elsewhere in this

journal (May 1950, p. 189) it will not be dealt with here.

Picture monitors fall into two general types, those which receive a radio-frequency signal and those which are fed by means of a transmission line at video frequency.

The first type will contain a radio receiver which must be designed to exploit to the full the quality of the transmission. It will need only a fairly simple video amplifier to raise the level of the signal from the detector to that re-

quired to modulate the cathode-ray tube. Normally the d.c. component present in the transmission will be preserved since its constancy or otherwise will be of interest to the observer.

The overall frequency response, including the aerial, should be level from zero to a frequency just above the maximum useful value radiated by the transmitter followed by a rapid cut-off.³ No useful purpose is served by extending the bandwidth beyond this value, as the home viewer cannot receive it and the monitor picture may have an undesirably high noise level in consequence.

The sharp cut-off will result in appreciable phase distortion which can, and should be, corrected.⁴ This will result in ripples being observable on close examination of the picture both before and after narrow vertical bars and sharp edges, but they are of small amplitude and do not detract from its quality at the normal viewing distance. In fact there is a net gain in picture quality since the maximum use is made of the prescribed bandwidth of the transmission.

The signal will probably be subject to some degree of impulse interference and some form of signal limiter should be fitted to the amplifier.

The design and complexity of the video amplifier required for the line-fed monitor will depend to a large extent on the quality and level of the signal presented to it. If the input signal is of the order of 1 volt overall, picture and sync, as seems likely as this is now an international standard, it is not practicable to use a directly-coupled amplifier even though the d.c. component may be present. The gain of the amplifier will necessarily be of such a value that drift of the d.c. level is likely to be troublesome. Moreover, if the transmission line is of considerable length it may happen that a 50-c/s sine-wave signal of considerable amplitude, as well as other forms of interference, become added to the signal.

³ H. A. Wheeler. "Wide Band Amplifiers for Television." *Proc. Inst. Radio Engrs.*, July 1939, Vol. 27, pp. 429-438.

⁴ T. C. Nuttall. "Some Aspects of Television Circuit Technique." *J. Television Soc.*, March 1949, Vol. 5, pp. 257-265.

² M. Bowman-Manifold. British Patent No. 417,103.

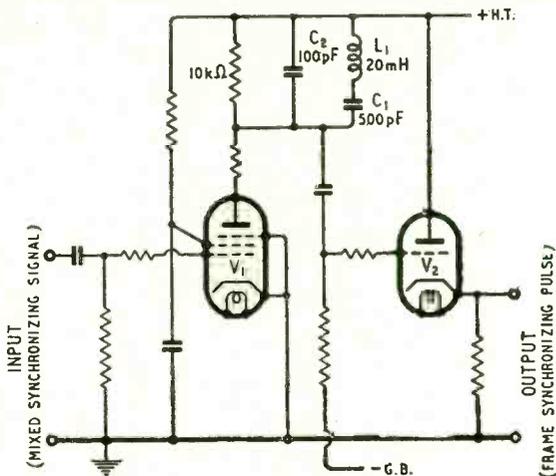


Fig. 3. Circuit of frame synchronizing-signal separator.

Thus it is necessary to use a.c. coupling at the input and to include some precise form of d.c. insertion which maintains the signal level constant during the "back porch"; i.e., the picture-suppression interval after the synchronizing signal.

The amplifier must be fitted with a gain control which should be so arranged that neither the black level of the signal nor the amplitude of the synchronizing signals change as the gain is varied.

The amplitude distortion introduced by the radio and video-frequency amplifiers should be kept to a minimum in order to avoid modifying the gamma of the picture to any appreciable extent.

One method, due to Nuttall,⁵ of controlling the black level in the picture is to feed the output vision

signal from the video amplifier into a circuit which compares its voltage level during the back porch with a reference voltage. The signal arising from the difference, if any, between the black level and the reference is fed back to the input stage of the main video amplifier with the required polarity to correct the error at that point.

By this means the black level in the picture can be maintained constant to a high degree of accuracy despite sudden changes in the picture content or the addition of a relatively large amplitude of low-frequency sine wave to the signal. Since this is a feedback circuit, with appreciable loop gain, any drifting of the black level due to the d.c. coupling in the amplifier is automatically reduced to negligible proportions.

The feedback circuit is only complete during the specified period and is brought into operation by a switching pulse derived from the synchronizing signal.

Synchronizing Signal Separation

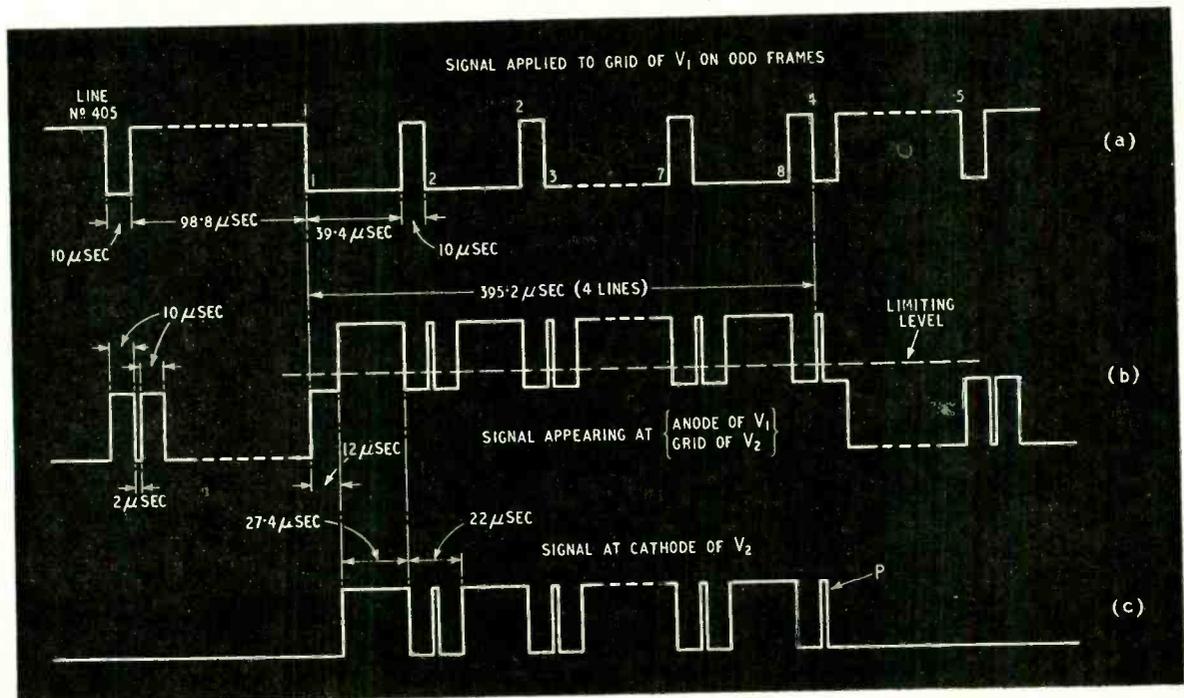
The synchronizing-signal separator must be designed with an eye to the conditions in which the monitor is required to operate. If the signal is free from interference of all kinds, the separator can be of conventional design with the proviso that the frame-synchronizing signal is of such a form that the frame-scan generator will interlace properly.

If, however, the monitor has to operate in conditions in which various forms of interference may be superimposed on the signal, the separator must be designed to ignore as far as possible such unwanted signals.

The separator described is one type which is suitable for a monitor and affords good protection against impulse interference.

⁵ T. C. Nuttall. British Patent No. 514,271.

Fig. 4. Waveforms appearing in frame synchronizing-signal separator, (a) grid of V_1 , (b) grid of V_2 , (c) cathode of V_2 .



The separation of the synchronizing signals is carried out in two stages. The first stage serves to separate the synchronizing signals from the vision signals and can be quite conventional. The second stage operates on the mixed synchronizing signals and provides the following outputs.

- (1) Frame-frequency synchronizing pulses.
- (2) Line-frequency synchronizing pulses.
- (3) A 4- μ sec switching pulse for the Black Level control unit (not necessarily required in the radio-frequency monitor).

A block diagram of the complete separator is shown in Fig. 2 and the basic circuit of the frame-frequency separator in Fig. 3. The mixed synchronizing signal, Fig. 4(a), is fed to the grid of V_1 which has in its anode circuit an artificial delay line, comprising L_1 , C_1 and C_2 , open-circuited at the end remote from the valve. The total time taken for a signal to travel to the end of the line, suffer a reflection and return to the sending end, is adjusted to be slightly longer than the duration of the line-synchronizing pulses, a suitable delay time is 12 μ sec. The effect of this arrangement is that, as the reflected signal is the same polarity as the original, the line-synchronizing pulses appear side by side with their reflections. In the case of the frame pulses, however, which are of longer duration than the "echo" time of the line, the reflected signal adds on to the original and produces a total voltage excursion at the anode of twice the original signal as shown in Fig. 4(b).

The modified signal is then fed to a limiter stage, V_2 , adjusted to pass only signals in excess of the amplitude of the original pulses applied to the delay line, with the result that only those parts of the waveform in which the pulse duration is longer than the echo time of the line appear at the output, Fig. 4(c).

The advantages of this type of frame-synchronizing signal separator are:—

- (1) Although the leading edge of the pulse is delayed by several microseconds, the delay is caused by a passive network and the timing of successive pulses is as accurate as in the original waveform.
- (2) Equalizing pulses are not required to obtain accurate interlacing as the leading edge is identical on odd and even frames. The only difference between the frames is that the pulse, P, Fig. 4(c), occurs only in the odd frames but does not affect the synchronizing.
- (3) A large proportion of the impulse interference which may be mixed with the original signal will be suppressed since the great majority of such pulses will be very short (approximately 0.33 μ sec if the overall bandwidth is 3 Mc/s) compared with the echo time of the line and they will only appear in the output if they occur during a frame-synchronizing pulse or if a second interference pulse occurs at the instant the echo of a preceding pulse returns to the anode of the valve.

The line-scan generator is synchronized from the mixed synchronizing-signal waveform and is designed to ignore the alternate double line-frequency pulses which occur during the frame-synchronizing interval.

The waveform is subjected to exactly the same process as that used for the frame pulses, in order to suppress impulse interference, except that the echo time of the delay line is reduced to 0.8 μ sec.

The use of the interference-suppression circuit results in the line pulses being delayed with respect to the picture signal by 0.8 μ sec and, although part

of this delay is cancelled out by the time taken for the picture signal to pass through the video amplifier, allowance must be made for it in the design of the line-scan generator.

Black Level Control Switching Pulse

The switching pulse is derived from the mixed synchronizing signal. The signal is first "cleaned" and is then fed to a valve having a short-circuited artificial delay line in its anode circuit. The echo time of the line is designed to be 4 μ sec and the signal polarity is arranged so that the pulse derived from the trailing edge of the line-synchronizing pulses (i.e., it occurs during the back porch) is passed to the output.

The artificial delay lines used in a synchronizing-signal separator of this type can be two-terminal networks designed in accordance with Foster's reactance theorem⁶ with the advantage that they are more easily made and adjusted than the corresponding four-terminal networks.

The remainder of the equipment in the monitor is in no way unusual and will only be mentioned briefly.

The performance of the sound channel, if required, should be in keeping with the quality of the vision equipment and requires no comment here.

The power supplies of the monitor can be of conventional design. All the d.c. supplies, including the e.h.t. supply, should be stabilized against mains input voltage and load-current fluctuations. The transformers and smoothing chokes should be orientated so that there is negligible stray magnetic field from them in the space occupied by the cathode-ray tube. The monitor must be capable of being operated when the frame frequency is not locked to the mains without brightness or focus modulation being visible in the picture and with deflection effects in any direction reduced to the absolute minimum.

A device for protecting the cathode-ray tube screen from damage in the event of failure of either or both scan generators should be incorporated.

So far, vision monitors have been built which incorporate all the features outlined above with the exception of a pin-cushion corrector and focus-current modulation, though these have been used in other equipment.

The quality of picture obtainable on the 405-line standard when full use is made of the 2.7-Mc/s transmitted bandwidth is considerably better than many people imagine. On seeing a first-class picture, received by radio in the ordinary way, reproduced on a high-performance monitor, it is clear that the decision to continue with the 405-line standard was the right one and that there is plenty of room for improvement in both transmitting and receiving equipment in the years to come before it can be said that the system is being exploited as fully as possible.

This article is based on a paper read by the author before the British Institution of Radio Engineers on March 23rd, 1950. The author's thanks are due to his colleagues for help and advice and in particular to Mr. T. C. Nuttall, who is responsible for many of the circuit techniques used and for the work on the reduction of scanning distortions.

⁶ R. M. Foster. "A Reactance Theorem." *Bell Syst. Tech. J.*, April 1924, Vol. 3, p. 259.

Screening

Back to First Principles When "Rules of Thumb" Fail

By "CATHODE RAY"

CERTAIN people pride themselves on being "practical," and can scarcely hide their contempt for "theorists." They joyfully quote the story of the Professor of Mathematics who came off worst in an argument with the bus conductor about the correctness of his change.

It is true that the learned are often found to be strangely out of touch with practical affairs, even in their own field of study; but that is no reason why knowing as much as possible about the theoretical basis of a job should not make the practical man better at it. I can think of nothing that illustrates this better than screening. It is a thoroughly practical subject, but its rules of thumb are complicated and liable to let one down when tackling anything a bit out of the usual. Lots of questions arise, and we cannot be sure that the answers for one application will fit another even when it seems similar.

There is a surprising vagueness about the subject in most of the books, and (it is to be feared) in many of the minds. This, I am sure, is due to vagueness about the underlying principles. It may possibly comfort a beginner to picture the screen-grid in a valve as a kind of sieve that lets the tiny electrons through and holds back the electric fields, or to suppose that a can round a coil protects it from stray fields much as a roof over one's head keeps out the rain. But when he comes to devising his own apparatus, that sort of idea isn't good enough. What he really needs is a clear picture of the theory of fields. Given that, he knows all (or nearly all) the answers.

This is hardly the place for a complete exposition of fields from the beginning. What I am about to do is to emphasize a few facts about them in relation to screening.

The first, which hardly needs emphasis, is that (so far as *Wireless World* is concerned) there are two kinds of field—electric and magnetic. The only point in mentioning it is in case someone says: what about an electromagnetic wave; is that a third kind? It is true that an electromagnetic wave has certain peculiarities not possessed by electric or magnetic fields considered separately; such as the ability to go on after whatever caused it has been switched off. But that is merely a matter of organization; the magnetic and electric fields of which electromagnetic waves consist are exactly the same in themselves as the fields around the loudspeaker magnet and the h.t. terminal in the power pack. It happens, however, that a moving magnetic field generates an electric field, and a moving electric field generates a magnetic field; this mutual back-scratching pact makes it possible for electric and magnetic fields to keep one another going without any visible (or invisible) means of support, once they have been started.

The starting process necessitates field movement or

variation, so no electromagnetic radiation results from a constant fixed field of either kind. Theoretically, there is radiation wherever there is a.c. (though it is negligible at low frequencies such as 50c/s). And since electromagnetic radiation consists of electric and magnetic fields in equal proportions, one can theoretically only have one kind without any trace of the other when it is quite steady, such as that produced by an electrostatic charge or a permanent magnet. But at low frequencies the radiation is generally so small that it is possible for one kind of field to predominate, even though it is alternating. The field close to a low-voltage coil carrying a heavy 50c/s current is almost entirely magnetic, and the field close to high-voltage open-circuited terminals is almost entirely electric. But at radio frequencies the tendency is for the production of a strong magnetic field to necessitate a high voltage across the coil (and hence an electric field); similarly, a high voltage can hardly exist without producing at least a capacitive current (and hence a magnetic field).

This matter of frequency keeps coming into the question of screening.

Now for methods of screening. There are two basic types of weapon in our armoury: diverting the

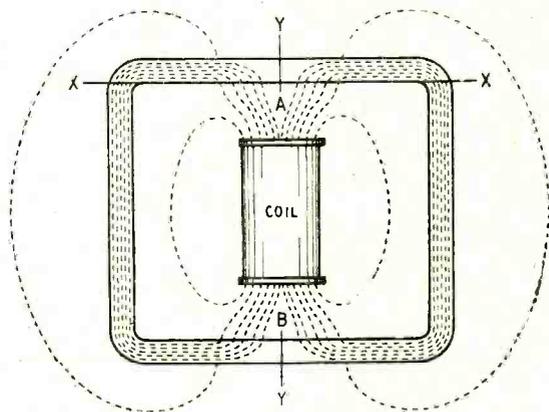


Fig. 1. For the lowest frequencies, the best protection against magnetic fields is a substantial cover made of special low-permeability metal, with no joints or gaps such as XX in the way of the flux.

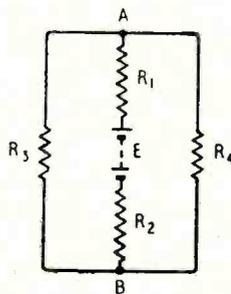


Fig. 2. Electrical analogy of Fig. 1.

course of the field; and cancelling it out with an opposing field.

Fig. 1 shows an example of the first method applied to the magnetic field from a coil. It consists in shutting it up in a box of high-permeability material, which provides such an easy path for the magnetic flux that very little spreads out into places where it would be unwelcome.

Magnetic Screening

Anybody who is not used to magnetic circuits may perhaps grasp the principle more clearly by studying the electrical analogy, Fig. 2. Here the electromotive force of the battery, E , corresponds to the magnetomotive force of the current-carrying coil in Fig. 1, and R_1 , R_2 are high resistances corresponding to the large magnetic reluctances of the air spaces at the ends of the coil. Before the low resistances R_3 , R_4 are connected, the full voltage E appears between the points AB ; but with R_3 , R_4 in place this voltage is more or less short-circuited. Similarly, the low reluctance of the screen reduces to a very small amount the magnetomotive force available for driving flux through the surrounding space. The single pair of dotted lines representing such flux in Fig. 1 does not mean, of course, that the flux consists of lines; it is spread throughout the space, but (if the screen is a good one) very thinly.

Just as any breaks in R_3 and R_4 would nullify their action, so one has to take care that the arrangements for opening the box do not introduce even the smallest gap in the flux path as seen from the outside—across XX , for example. It is all right to have a crack *along* the flux lines such as YY .

If the box is to be reasonably thin and light, it must have a very high permeability indeed to offer a far easier path for the flux than the much thicker chunk of space outside. Ordinary iron or steel is not really good enough; that is why a special high- μ alloy such as Mumetal is recommended.

Note that this kind of screen tends to increase the

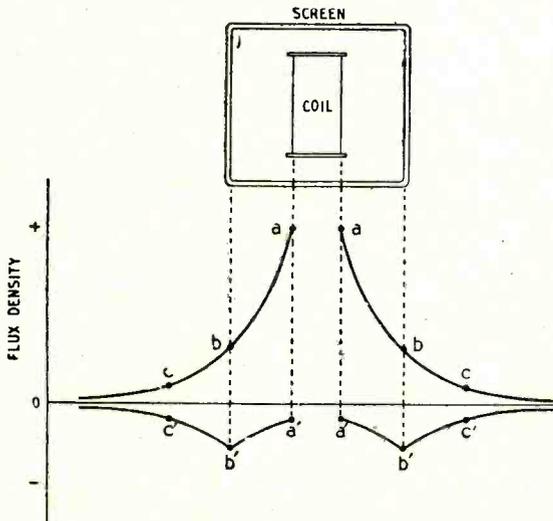


Fig. 3. The graph abc represents the field strength distribution around the coil; $a'b'c'$ represents the field strengths due to currents induced in the screen. When the two are added, the result is nearly zero outside the screen.

inductance of the coil by increasing the flux produced by a given current.

This method is at its best with zero- or low-frequency current in the coil. As the frequency is raised the μ drops, and at radio frequencies it is too little to be much help. That is where we bring out our other weapon. Suppose the box to be made of copper. As the μ of copper is practically the same as of air it is completely useless as a flux diverter. But what it does do is to act as a short-circuited secondary winding to the coil, and the current induced in it sets up a field that very nearly cancels out the field of the coil.

If the copper were to be wrapped closely around the coil winding, so as to be close coupled to it, as in a transformer, the inductance of the coil would be reduced nearly to zero, so that it would cease to be worth screening. To avoid this, the screen should be as large as space and cost will allow.

In Fig. 3, the lines abc are graphs showing how the flux density falls off rapidly the farther one gets away from the coil. Just outside the coil itself it is very intense, as indicated by the height of a . At the screen it is much less (b); and c denotes the density at some point outside the screen, where it is less still, but presumably more than is wanted. Since the flux is supposed to be alternating, and the copper screen forms a closed circuit around the coil, it generates currents in the screen which set up their own flux. And if the resistance of the screen is very low, a very much smaller flux than b is sufficient to generate enough e.m.f. to drive enough current through the screen to produce a reverse flux equal to b . (If you don't follow that at the second attempt, try reading on before going back to it!) What happens is that the reverse flux, b' grows until it *nearly* neutralizes b , the small difference between them being what is needed to generate b' . The screen can never neutralize the coil's field completely, because if it did there would be nothing to generate the neutralizing field. But it can be made to do so very nearly by making the resistance of the screen very low in the direction of the current. The direction of the current is quite different from the direction of the flux in Fig. 1; it is in a continuous ring parallel to the turns in the coil. So a gap at XX in Fig. 1 would be allowable, but one along YY (supposed to be continued right down the screen) would interrupt the screen currents and make it useless.

The Fig. 1 screen would not in any case work well as a neutralizing screen, because high- μ materials have a far higher resistance than copper.

The field strength and flux density due to the screen also fall off on each side, and Fig. 3 shows that outside the screen this is just what is wanted; for example, c' practically cancels c . But inside the screen the cancellation becomes less and less as one gets near the coil; which again is just what is wanted. If the screen is spaced well away from the coil, a' does little to cancel a , and the inductance of the coil is only slightly reduced. But if you draw a diagram like Fig. 3, for a screen fitting tightly round the coil, you will see how nearly it would neutralize the coil as well.

Obviously this type of screen is no good at all against a d.c. field, because d.c. can induce no screen currents. And it is not very good at low frequencies, because such a lot of screen current is needed to generate the neutralizing field, and the difference between b and b' is comparatively large. So the two

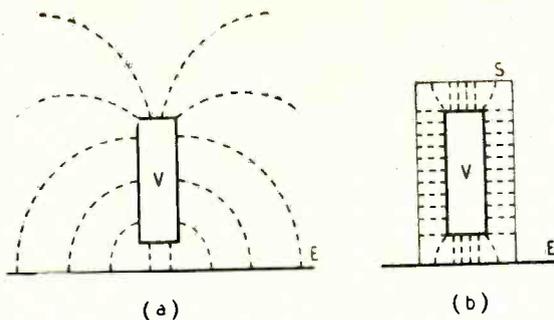


Fig. 4. (a) Unscreened object V at high potential relative to E. (b) Same object with screen, S. The electric flux is denser, but confined inside the screen.

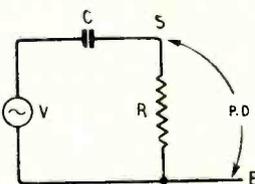


Fig. 5 (above). Equivalent circuit of Fig. 4(b) when the screen has appreciable resistance to earth.

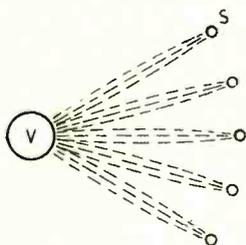


Fig. 6 (right). Showing how an earthed grid or cage is nearly as effective as continuous metal.

methods are complementary: Mumetal for a.f. and lower frequencies; copper for r.f. But remember to have the lids in the right places relative to the coil!

So far we have considered the problem to lie in shutting up a source of objectionable magnetic field, but, of course, the same methods work in reverse, if the interfering field is outside and the screen is for protecting the coil inside.

Electric Screening

You will have noticed that nothing has been said about earth, because earthing has nothing to do with magnetic screening. But it has everything to do with electric screening. The method corresponding most closely to Fig. 1, which would consist in enclosing the source of electric field in a high-permittivity box, is (so far as I know) never used, because even the latest titanium ceramics do not offer a κ anything like so high as the available μ ; and such materials are not very handy for screen-making anyway. If you regard metals as materials having practically infinite permittivity, that is different. But it is more usual to regard metallic screens as working by virtue of their conductivity. However they are regarded, the fact is that they do work, and very well too, especially at low and zero frequency. All one has to do is to shut up the offending (or offended-against) article in an earthed conductor.

In Fig. 4, V represents some component, such as a rectifier, having a high voltage to earth or other zero-potential structure such as the chassis, represented by E. The electric field, when there is no screen, is suggested by the dotted lines in diagram (a), which mean that every point in the space around is

at some potential between those of V and E, and therefore not zero. In (b) the offender is shown shut up in a metal box S, connected to E. All points on S are thus brought to the same potential as E, so there can be no electric field between S and E.

This is strictly true for unvarying fields, even if the resistance of S is not negligible; because any charge that the first switching-on may have set up on parts of S leaks off more or less rapidly to E, and there is nothing to renew it. But if the potential of V is varying at high frequency there will be capacitive currents induced in S, and unless S has a low resistance, these currents will cause a voltage drop in it. This situation could be represented as in Fig. 5, where C is the capacitance between any selected part of the screen and V.

Unless C is rather large and the frequency and voltage of V is very high, the current is not likely to be enough to set up an appreciable p.d. across the extremely low resistance of even a thin metal screen. But if these conditions exist, one does have to think of using thickish copper sheet. Or, better still, two screens, one inside the other. For most purposes, however, the thinnest tinfoil is good enough. It is not even essential to have continuous metal, so long as it makes a good contact to earth. A sort of parrot cage is quite effective. Suppose Fig. 6 represents V and a few wires of such a screen, looking down on it from above. If one maps out the field by the methods described in the books one finds very little of it exists much beyond the boundary of the screen, even when the gaps are fatter than the wires. But a vertical spiral or coil of wire would be bad, because it would place a comparatively large resistance—and inductance—between the upper part of itself and E.

For the same reason it is not a good idea to screen a wire by winding a spiral of wire around it, earthed at only one or two places.

In general, the need to avoid contact resistance is not so acute in an electric screen as in a magnetic, because it is usually a high-voltage low-current system, whereas a magnetic screen is exactly the opposite. So, although a push fit between a can S and its base E puts a contact resistance in the direct line of current, it is usually good enough.

As in Fig. 3, the farther the screen is away from the screened, the better. A close-fitting screen increases the capacitance to earth of its contents, which is often a bad thing in itself, and in so doing it also increases the screen currents and so reduces the effectiveness of the screening.

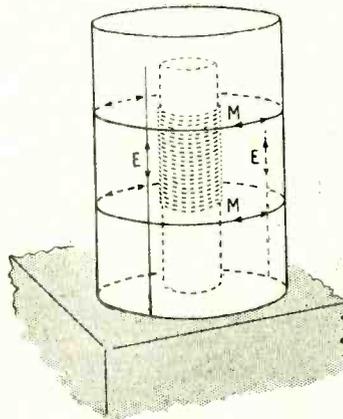


Fig. 7. An earthed metal can is effective against both fields, provided that the resistance is low throughout the paths of magnetically-induced currents (such as M) and electrically-induced currents (such as E). If there has to be a joint or seam, it is better for it to affect E than M.

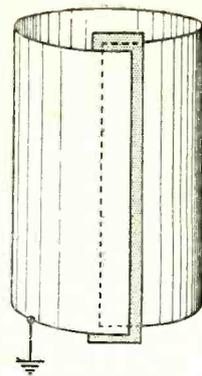
One advantage of knowing the underlying principles of screening, and thereby the directions in which screen currents or flux take, is that it enables one to contrive a screen so that it deals with either electric or magnetic field alone, or with both.

When the object to be screened is such a thing as a tuning coil, one usually wants to screen both fields, and an earthed copper can does both jobs very effectively, provided, of course, that there is nothing (such as a doubtful seam) to obstruct the currents induced in the screen. The circles marked M and the straight lines marked E in Fig. 7 are typical current paths necessary for screening alternating magnetic and electric fields respectively.

But sometimes one wants to stop electric (capacitive) coupling without interfering with magnetic coupling—between the windings of a transformer, for example. If the primary were completely enclosed in a copper cylinder before the secondary was wound on, it wouldn't be a very good transformer! All one has to do to remove the magnetic screening while retaining effective electric screening is to stop all the magnetically induced currents by slipping a strip of insulation between the overlapping edges of an earthed non-magnetic metal sheet (Fig. 8).

The reverse process—magnetic screening without electric—is not normally a requirement, but if it were it could be accomplished with a set of insulated rings, like hoops round a barrel, parallel to the wire in the coil.

Fig. 8. By breaking the M paths by a strip of insulating material, magnetic screening can be avoided while obtaining electric screening by earthing.



The only thing that need be said about screening against electromagnetic waves is that it must be of the combined type (Fig. 7) in order to deal with both electric and magnetic components, and the slightest hole or crack lets out enough leakage to be detected by a sensitive receiver.

Summing-up:

Magnetic Screening. *Method 1* (for zero and low frequencies): High permeability metal, giving continuous low-reluctance path for magnetic flux (Fig. 1). *Method 2* (for high frequencies): High-conductivity metal, giving continuous low-resistance path for induced currents (at right-angles to flux paths).

Electric Screening. Low-impedance conducting paths to earth. Easy to fulfil except at highest frequencies.

Electromagnetic Screening. A combination of both.

But it is better to remember the principles, which enable one to devise suitable screening for any situation—not just the simple examples shown here.

C.C.I.R. VISIT

Studying British Television Progress

SOME fifteen countries were represented in the delegation of the International Radio Consultative Committee which has been here to study television. They have also visited America, France and Holland.

During a visit to the E.M.I. works delegates saw the manufacture of Emitron camera tubes and had 405- and 625-line television demonstrated on a closed circuit. A direct comparison between the two was possible. A 3-Mc/s bandwidth was used for 405 lines and a 5.5-Mc/s for 625 lines. The difference of picture quality obtained was remarkably small. The sensitivity of the cameras was demonstrated by pictures of a scene illuminated by 1 ft candle.

The new vision transmitter for Holme Moss was shown by the Marconi Company at Chelmsford and an evening television party was given at Great Baddow. In addition to 405-line closed circuit demonstrations, which included

good pictures at dusk, a series of demonstrations of television effects was staged. Among these was an experiment showing that a 50-c/s frame frequency is no bar to the attainment of a flicker-free picture which is bright enough for viewing under conditions of high ambient illumination.

In their visit to the B.B.C. research station the delegates were shown 405- and 625-line pictures transmitted through a carefully equalized 3-Mc/s channel. Known amounts of delay and echo distortion could be introduced and their effect on the picture observed. It was clearly demonstrated that while a delay distortion of only 0.02 μ sec, which it is difficult to avoid in cable links, caused only moderate distortion of the 405-line picture it intolerably degraded the 625-line one. Cinema-Television, Ltd., demonstrated large-screen television, as reported on page 220.

Club News

Birmingham.—A talk on the radio control of models will be given to members of the Slade Radio Society on June 9th by Dr A. C. Dawes. The second discussion in the series on television fundamentals will be opened by W. E. Merrill on June 23rd. Meetings are held on alternate Fridays at 7.45 in the Parochial Hall, Broomfield Road, Erdington. Sec.: C. N. Smart, 110, Woolmore Road, Erdington, Birmingham, 23.

Bradford.—The Bradford Amateur Radio Society meets on alternate Tuesdays at 7.30 at Cambridge House, 66 Little Horton Lane, Bradford. Sec.: V. W. Soven, "Rushwood," Grange Park Drive, Cottingley, Bingley, Yorks.

Brighton.—Membership of the Brighton and District Radio Club (G3EVE) is now nearly 100. Meetings are held on Tuesdays at 7.30 at the Eagle Arms, Gloucester Road, Brighton. A series of lectures on the history of radio is being given by the secretary, L. F. Hobden, whose address is 17 Hartington Road, Brighton, Sussex.

Edinburgh.—Weekly meetings of the Edinburgh Amateur

Radio Club are held on Wednesdays at 7.30 at Unity House, 4 Hillside Crescent. A visit to the local R.N.V.(W)R. headquarters is being arranged. Sec.: D. A. E. Samson (GM3EQY), 56 Elm Row, Edinburgh, 7.

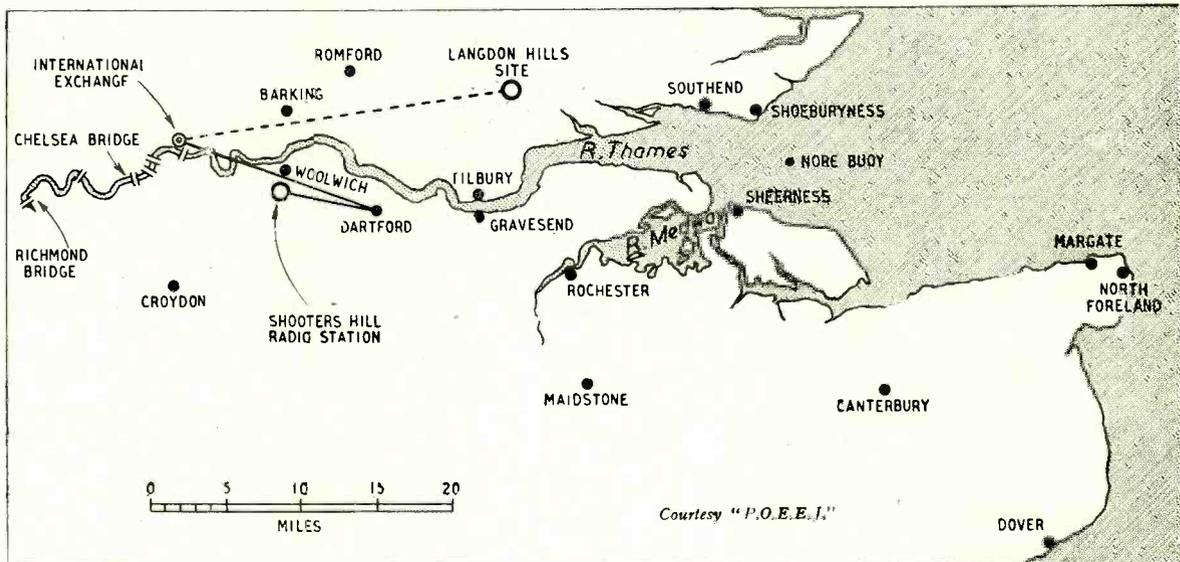
Middlesbrough.—A new club room and workshop has been secured for members of the Tees-side Amateur Radio Society in All Saints' Hall, Grange Road, Middlesbrough. To encourage junior members they are now admitted free of charge up to the age of 15. Sec.: J. H. Davies, 85 Cobden Street, Thornaby-on-Tees, Yorks.

Sweden DX Fan Club, which has its headquarters at 5 Aldred Street, Worksoop, is being re-organized. Details of this international club are obtainable from Eric Good at the above address.

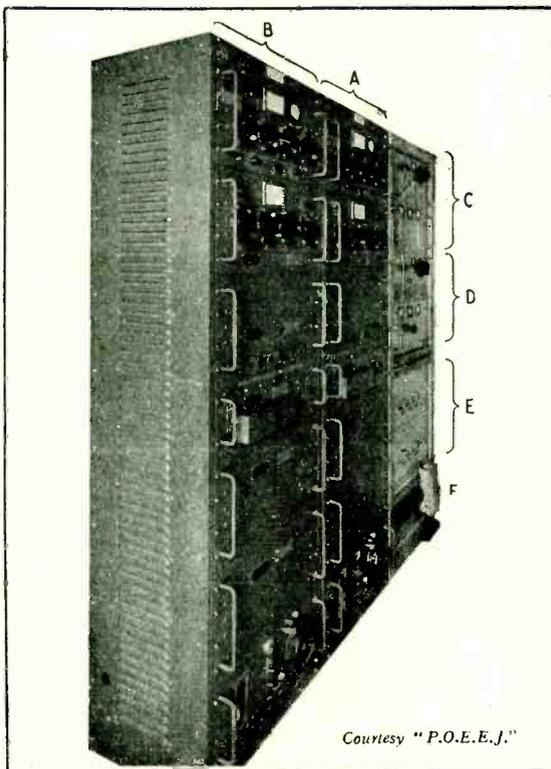
Walworth.—Meetings of the Walworth (Men's Institute) Radio Club are held on Wednesdays and Fridays at 7.0 in the L.C.C. Evening Institute, John Ruskin Street, London, S.E.5. The club's new technical instructor is H. Lambert. Sec.: B. E. Symons, 100 East Dulwich Grove, London, S.E.22.

Thames Radio Service

Introduction of 160-Mc/s Service Linking Public with River Craft



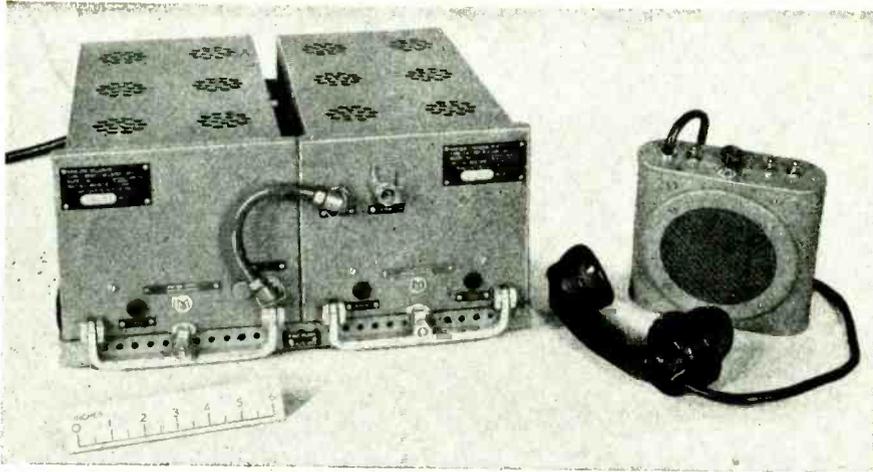
Location of the fixed station at Shooters Hill and the site of the proposed second station north of the Thames are shown on this map. The route of the cable link between the existing station and the exchange in central London is also shown. Equipment at the Shooters Hill station is shown below. A & B, main 50-watt transmitter and standby; C, main receiver and analyser; D, spare receiver and analyser; E, control unit; F, power equipment.



THE navigable stretch of the River Thames—a distance of some 50 miles—comes under the control of the Port of London Authority and it was as a result of their request for radio-telephone facilities to their patrol launches which led to the introduction by the Post Office of the service now linking small craft plying on the Thames with the public telephone service. An article giving a survey of the problems involved and a description of the equipment used for this service was given in the January issue of the *Post Office Electrical Engineers' Journal*.

Two-frequency working is provided, with transmission in each direction on frequencies separated by several megacycles; this allows full duplex operation as on the ordinary telephone. Six channels are planned with 100-kc/s spacings and a frequency separation between incoming and outgoing carriers of 4.5 Mc/s. The carriers of the first and second channels of the Thames Radio Service—as it is called—are 157 and 157.1 Mc/s (mobile to fixed) and 161.5 and 161.6 Mc/s (fixed to mobile). Amplitude modulation is being used in conformity with the recent decision to standardize a.m. for marine services in the U.K.

The lower reaches of the Thames flow through rather flat country and the number of sites on which it is possible to obtain the necessary height for the aerials of the fixed stations is very limited. After tests it was decided to utilize two water towers—one north of the river and the other south. Since the introduction of the service it has been found that the southern station at Shooters Hill (see map) gives adequate coverage and the second site—at Langdon Hills—is not being used, unless it is subsequently



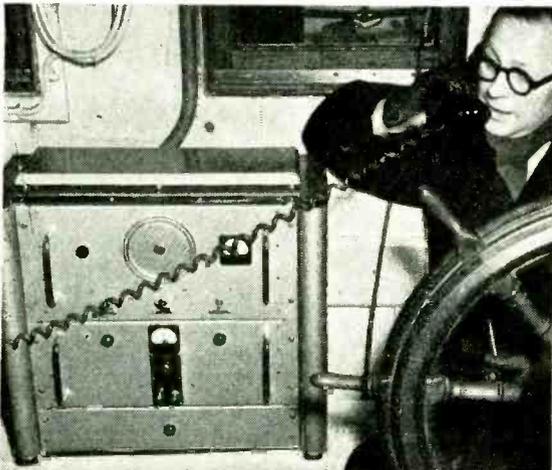
Courtesy "P.O.E.E.J."

Marconi equipment as installed on river craft for the initials tests for the Thames Radio Service.

decided to extend the scope of the service. Simple centre-fed vertical dipoles for both the transmitter and receiver are mounted on the top of the 530-ft water tower. The receiving dipoles are connected to a pre-amplifier installed at the top of the tower and filters are inserted in the feeders to prevent high voltages from the transmitting aerials—which are within a few feet—being applied to the receivers. The pre-amplifier consists of an earthed-grid triode with a broadly tuned anode circuit. Power for the amplifier is superimposed on the co-axial cable connecting the amplifier to the receivers which are at ground level.

The radiated power from the fixed station can usefully be greater than that of the mobile transmitters, but this increase can only be effective in improving range, or quality of service, if the receivers at the fixed station are correspondingly more sensitive than the sets afloat. The fixed receivers at present in use have a noise factor of approx. 5db and, with the simple aerials installed, their sensitivity is such that an average signal/noise ratio of 15db is obtained on

This Pye equipment was used to demonstrate how sea-going vessels may benefit from the Thames service when their deep-sea radio is closed down.



transmissions from 5-watt mobile equipment operated at distances up to 40 miles away. A signal analyser is incorporated in the receiving equipment, one function of which is to examine the quality of an incoming signal and to pass it on to the operators' switchboard only if it has a signal/noise ratio of 15db or more.

The radio station at Shooters Hill is connected by line to the switching centre for the Thames Radio Service at the International

Telephone Exchange in central London—a distance of 7 miles. The proposed site of the second station is, however, some 23 miles from central London. As a precaution therefore against difficulties which might have been encountered due to the difference in transmit time should two stations be used, the line from Shooters Hill is routed circuitously so that it is approximately equal to that from the second station.

Whilst the service is provided by the Post Office it is the responsibility of the owners of boats to equip and maintain the gear on board, which, however, has to conform to a P.O. specification. Two manufacturers are now producing the equipment and typical sets are illustrated. The sets are similar to those used for land mobile services—such as in police cars. The use of frequencies around 160 Mc/s is, however, comparatively new and the Thames Radio Service is the first mobile service in the U.K. to use full duplex working with a common T/R aerial.

The operating procedure for the service, which is available throughout the 24 hours, is as follows in the case of calls from river craft. On lifting the telephone handpiece from its hook the monitoring loud-speaker, which is used for calling the craft for incoming calls, is disconnected and the transmitter is brought into operation. The automatic signal radiated from the transmitter operates the calling lamp at the International telephone exchange and the operator on being asked for the required number completes the circuit. In the opposite direction—land to water—telephone subscribers served by any exchange in the U.K. may make a call to a boat. At the moment the operator broadcasts a call for the boat required and when a reply is received the correspondents are linked. A refinement—a selective calling system—is, however, being introduced.

EQUIPMENT AFLOAT

The mobile equipment supplied by Marconi's for the Thames Radio Service is the standard Type H16 adapted for use in the 156- to 184-Mc/s band. The receiver (shown on the left of the above illustration) and transmitter are separate units which, mounted together on a rack, measure 16 inches square by 8 inches high.

The Pye equipment used is shown in the photograph on the left. It is the high-band version (100-185 Mc/s) of the Type 703, slightly modified for the Thames Radio Service. R.F. output of the transmitter is up to 12 W.

Modern Soft-Soldering Technique

*Present-day Methods for
Obtaining Speed and Reliability*

By R. W. HALLOWS, M.A.(Cantab), M.I.E.E.



A switch unit for a Pye receiver has 75 soldered joints made entirely with a bench fixed iron. This unusual method of soldering enables a very fine bit to be employed and reduces fatigue on the part of the worker.

SOLDERING is amongst the most ancient branches of the metal worker's art, for soldered joints are found in the gold chains and in a considerable variety of the other jewels taken from the oldest Egyptian tombs, and from those belonging to other early cultures. Until comparatively recently, all of the three methods of soldering—brazing, silver-soldering and soft-soldering—remained parts of the "art and mystery" of skilled metal-working crafts. To a great extent this is still true of the first two; but the same cannot be said of soft-soldering, which is now regularly done, mechanically or by semi-skilled labour, in factories; and in an unknown number of workshops (and on a still less ascertainable number of kitchen tables!) by amateur craftsmen the world over.

Soft-soldering was mainly the speciality of the tin-smith until the advent of electrical power and lighting. Almost every kind of electrical apparatus must contain many soldered connections in its make-up. Means had to be found, and were duly found, of so simplifying the technique that it ceased to be the prerogative of expert craftsmen. With the coming first of radio and later of television, further simplification was needed, for the average broadcast receiver contains some 500 soldered joints and there may be from 1,500 to 2,000 or more in a combination television-radiogram.

At this point we had better, perhaps, settle just what we mean by soldering (hard, silver or soft) and by the term "dry joint."

Soldering of any kind may be defined as the process of uniting two pieces of metal by means of a thin layer of another metal of lower melting point than either; this last metal is the solder. The correct procedure is to apply the solder to the joint, then heat the latter until the solder becomes liquid. A sound joint can be made only if the solder "wets" the surfaces of both the metals to be joined. By "wetting" is meant that the solder penetrates each surface to molecular depth and forms a thin layer of "inter-metal," which is virtually an alloy. This condition is illustrated diagrammatically in Fig. 1 (a).

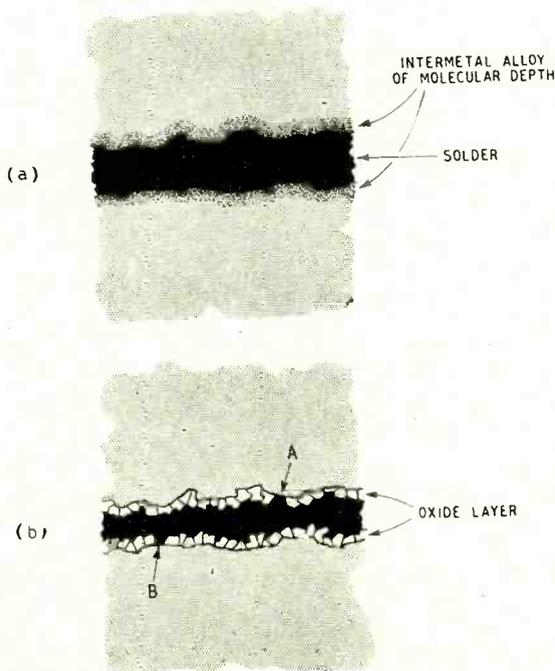


Fig. 1. (a) Magnified section of a well-soldered joint.
(b) Magnified section of a high-resistance dry joint.

Fig. 1 (b) shows what happens in the case of a dry joint. As the term suggests, a dry joint occurs when the solder fails to wet one or both of the surfaces to be joined. The solder adheres to some extent to the surface irregularities, and may penetrate between the particles of oxide to make contact with the metal at one or two places (A and B for instance), but there is no genuine union. Owing to the very small contact areas at such points as A and B, the joint would have a high resistance which would vary considerably with vibration or mechanical strain.

Another particularly deceptive dry joint sometimes occurs when a wire is being soldered on to a tag, using resin flux, and the tag has not been properly tinned. As can be seen from Fig 2, a layer of solidified flux collects on the tag and sticks the wire in position, whilst the solder simply forms a blob on top, giving every appearance of a well-soldered joint. Then again, even if the solder does wet the tag, it often happens that the wire is not properly wetted but is merely clamped mechanically by the solder solidifying around it.

Feeling that readers, both professional and amateur, would like to know something of the latest developments in the soft-soldering used in radio and television construction, I consulted Richard Arbib of Multicore Solders, Ltd., as an admitted authority on the subject, and from him I obtained a mass of interesting information.

The making of a successful joint of the kind used in electrical apparatus depends upon the use of:—

- (a) The proper quantity of the right kind of flux.
- (b) A solder which is a suitable alloy of tin and lead.

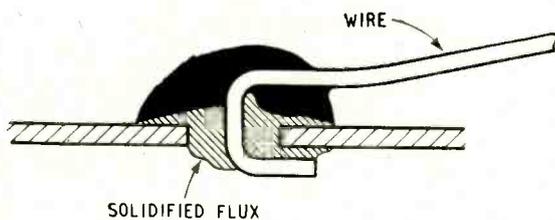


Fig. 2. Joint which has every appearance of being soldered but is actually held together by solidified flux.

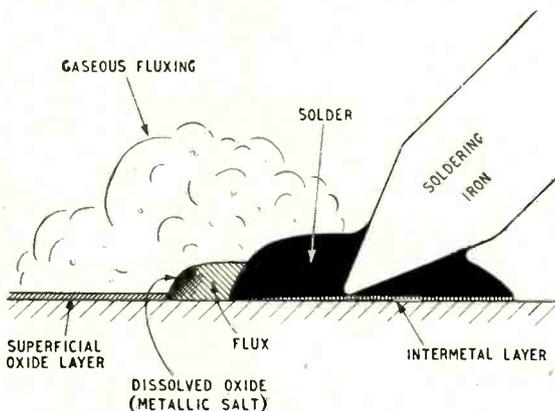


Fig. 3. Illustrating the process of fluxing and tinning.

(c) A temperature, applied by iron, blowpipe, or other means sufficient to ensure "wetting."

The main purposes of the flux are as follows. First, it removes any oxide coating from the surfaces of the metal to be joined. The oxide is dissolved by the advancing edge of the flux and forms a metallic salt in solution, as shown in Fig. 3. As a result, the advancing edge of flux often becomes highly viscous and stops flowing—which may explain the failure of some materials that are *theoretically* good fluxes. Sometimes a phenomenon known as "gaseous fluxing" takes place as well. When the flux material is heated, certain substances in it are volatilized into gas, which attacks the oxide before the ordinary liquid flux can get to it. The effect can be seen by a bright corona of cleaned metal surrounding the advancing edge of the flux.

Secondly, a flux serves to lower the surface tension of the molten solder, enabling it to flow readily. In fact, some fluxes, which are not chemically strong enough to dissolve the oxide, act by virtue of this alone, always provided that the oxide coating is not thick enough to prevent the solder from wetting the metal. Thirdly, it goes without saying that the molten flux acts as a very effective seal against the atmosphere, and so prevents the formation of any more oxide whilst the soldering-iron is heating up the metal.

Resin-cored Solder

Metals such as copper and tin are known as "easy" from the soldering point of view, since there is comparatively little difficulty in wetting them with solder. But there are "difficult" metals, of which aluminium is the outstanding example. The trouble with aluminium is that oxidation occurs almost instantly after the surface has been cleaned and that ordinary fluxes cannot keep pace with it. The Mullard supersonic soldering tool, designed particularly for dealing with aluminium, tackles this special problem in an entirely new way; the vibrations set up literally shake off the oxide film as it forms.

In radio work we are concerned mainly with "easy" metals and the problems are to some extent simplified. There is, however, only one generally available basic flux which satisfies all electrical requirements. This is resin. The main constituents of resin are abietic or pimaric acids which, in the molten state, do the work of dissolving the oxide, but have the great virtue of being non-corrosive when the resin has set once more into the solid and the soldered joint is made. In the early days of radio, many of us tried our hands at soldering, using powdered resin as a flux—and didn't we make some nasty looking messes! Powdered resin is definitely not an easy flux to use, at any rate for fine work. Later, fortunately, somebody conceived the idea of dissolving the powder in industrial spirit, which made it very much more convenient to use.

The advent of resin-cored solder brought about something like a revolution in electrical soldering methods. With a well-designed resin-cored solder, reasonably clean surfaces and an iron at the right temperature, it is next to impossible to fail to make good joints with "easy" metals.

One essential of a cored solder is that the resin should be chemically "activated" in order to ensure speedy action, since resin by itself is a slow-acting flux—at any rate, far too slow for modern radio pro-

duction. Moreover, there are one or two difficult surfaces, such as on nickel- and cadmium-plated components, for which activated resin is the only answer, since plain resin will not remove the oxides. It is important, however, that the activating substance, whilst being strong enough in the molten state to dissolve the oxide, should leave a non-corrosive residue. Furthermore, the residue should have good insulating properties and be non-hygroscopic, for otherwise it would absorb water under humid conditions and so cause electrolytic leakage. Another point is that the residue should be hard and non-sticky to prevent the collection of dust and moulds, which again would lead to leakage. The activators used are various, but in general are the hydrochlorides of certain organic substances, for instance, amine hydrochlorides.

Cored solders are made with single and triple cores. Two arguments are put forward for triple-core solder: one is that there is less likelihood of a discontinuity occurring in the supply of flux, and consequently less likelihood of dry joints and wastage of solder, if there is more than one core in the solder wire. The other claim is that the triple-core principle of construction provides thinner walls of solder and thus allows more rapid melting.

Now a word about the composition of solder. In radio and electrical work the solders used most extensively are alloys of tin and lead. But there is more to it than this. The actual proportion of tin to lead is of great significance, for it makes all the difference to the way in which the solder is used, and most of all it affects the melting point. Alloys with different percentages of tin and lead have different melting points, as can be seen from the curve ACB in Fig. 4. At point A we see that a predominantly lead alloy (30 per cent tin, 70 per cent lead) has a melting point of about 255°C, whilst at point B a predominantly tin alloy (80 per cent tin, 20 per cent lead) has a melting point of about 210°C. The lowest possible melting point, 183°C at point C, is that of an alloy consisting of 63 per cent tin and 37 per cent lead. To give it the correct name, "eutectic" solder.

Now eutectic solder is a thing apart. It is the only tin/lead alloy which has no plastic or "pasty" range. It solidifies and liquefies at 183°C. All the other alloys *solidify* at 183°C, but become entirely liquid at different temperatures, depending on their composition. It might be thought, then, that the eutectic alloy would be the best for high-speed work, since its transition from the solid to the liquid state is the most rapid of all the alloys. Practical experience has shown, however, that for most work for which cored solder is used in the radio industry, there is an advantage in having a plastic range. Consequently 60/40 alloy is widely employed, as it obviates fractures which may occur owing to slight vibration whilst the solder is setting solid. The 6°C difference in melting point from that of the pure eutectic is so small that it is of little importance.

From the curve it will be seen that as far as obtaining a low melting point is concerned, there is no advantage in using a greater tin content than in 63/37 alloy, as the alloys with greater tin contents actually have higher melting points.

It may not be out of place to give one or two tips about the correct use of solder in various jobs. The wrong method is to take up a "blob" from the cored wire on the bit, for the flux is then "fried" where it has no chance of doing its proper work, and a dry

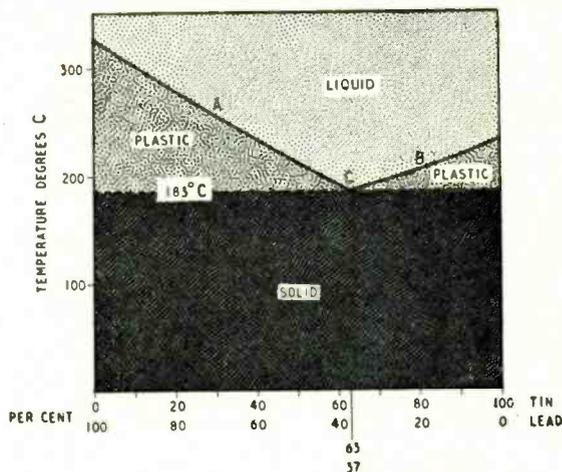


Fig. 4. Curve (ACB) showing the melting point in degrees centigrade for various alloys having different tin/lead percentages. The alloy with the lowest melting point (183°C) is shown at point C, and consists of 63 per cent tin and 37 per cent lead, i.e. eutectic solder.

joint is almost a certainty. Lay the end of the cored solder wire on the work and apply the point of the bit to it.

Next, it is of the greatest importance to use an iron that is sufficiently hot. Untold numbers of resistors, capacitors and other such components are damaged or even ruined by the use of insufficiently hot irons. If the bit is not hot enough, it has to be applied to the work for some little time before the solder runs, and during this time the body of a component may be heated up to an undesirable temperature. On the other hand, when the bit is hot enough (and the flux sufficiently active) the solder flows almost instantly. There is not time for the body of the component to be brought to an over-high temperature.

The quicker your work, the less the risk you run of injuring delicate components. The speed at which soldered joints can be made depends (given a quick-acting flux) upon the temperature of the iron and the melting point of the solder. My own practice for 60/40 solder is to let the iron warm up until the application of the bit to a piece of newspaper produces singeing in no more than five seconds.

Sweating is one of the most useful branches of soldering. It enables two metal surfaces which may be quite large to be firmly joined together. The principle is that each surface is tinned by the application of a thin and even layer of solder. The tinned surfaces are then brought together, heat is applied, the solder runs, and a firm union is made.

For making joints in this way we can use either a separate solder and flux or cored solder, or, alternatively, one of the brands of solder paste which consist of finely divided solder in a flux medium. However, perhaps the quickest method is to clamp the surfaces together, heat them, and apply cored solder to the junction; the flux and solder will then flow in between the surfaces by capillary attraction. Recently, Multicore Solders, Ltd., have introduced a cored solder using "Arax" flux, which enables these kind of jobs to be done very quickly on "difficult" metals. It is already being used by manufacturers and amateur constructors for assembling chassis and other metal parts of radio equipment.

WORLD OF WIRELESS

Exhibition Plans ♦ Cinema Television ♦ Atomic Research ♦ German Broadcasting

Birmingham Exhibition

TELEVISION demonstrations are not to be confined to the normal transmission hours of Sutton Coldfield during the National Radio Exhibition at Birmingham (September 6-16). The organizers are installing a studio in the exhibition and with this and a film scanner a continuous programme will be provided. B.B.C. transmissions will, of course, also be used at suitable times.

The studio will be open to inspection by the public. There will be a central demonstration room where the products of exhibitors will be seen in operation side-by-side; and receivers will be demonstrated on individual stands.

To this end, the r.f. sound and vision signals will be conveyed to each stand by cable and will be at a level of 1 mV at 70Ω. Great care is being taken to avoid interference; suitable suppressors are being fitted to the electrical equipment of the building and the use of certain types of apparatus on the stand is prohibited.

The vision and sound signals provided are to be at 45 Mc/s and 41.5 Mc/s—the London frequencies. As a result, all the receivers demonstrated will be London models. This is necessary because Sutton Coldfield programmes are not to be used all the time. Intolerable interference would result if the distribution were at Sutton Coldfield frequencies and this station started operation when

the exhibition studios were in use.

It is necessary that the distribution take place on different frequencies from those of the local transmitter and it is expected that at the next London radio show Birmingham model will be used.

Large-Screen Television

A DEMONSTRATION of large-screen television was given by Cinema-Television, Ltd., at the Odeon Theatre, Penge, on 29th April, to a private audience.

The B.B.C. transmission of the Cup Final at Wembley was shown on a screen 20ft by 15ft, being projected by a Schmidt optical system from a c.r. tube operating at 50 kV. The average beam current of the tube is 1.2 mA with a peak current of 15 mA. In order to maintain good focus with such a large current, the focus current is modulated by the line- and frame-scanning circuits (see "Television Monitors" on p. 206). The tube face is cooled by an air blast. The projection mirror is of 27-in diameter with an 18-in plastic correcting plate; a metalized-fabric directional-viewing screen is used, and a high-light brightness of 7ft-lamberts is obtained.

The picture obtained during the demonstration was extremely good. The detail and tone gradation were excellent and the brightness quite adequate. Judging by the reactions of the audience to events in the

game, the viewers quite lost consciousness of the medium by which they saw it. Indeed, one viewer, who repeatedly exhorted Liverpool to "come on," was obviously at Wembley in the spirit.

Harwell Linear Accelerator

THE Ministry of Supply announce that a linear accelerator of the travelling-wave type, similar to that developed by the Atomic Energy Research Establishment at Malvern, has been installed at Harwell and is being used for the production, indirectly, of neutrons for research into the behaviour of materials in nuclear reactors.

A 10-cm pulse generator is used as the source of energy in the wave guide, and successive short bursts of electrons are produced with energies of 3.5 Mev and speeds approaching the velocity of light. These impinge on a metal target to produce gamma rays, which are absorbed in heavy water and release neutrons from the hydrogen nuclear at the rate of 10⁹ per sec.

Development and construction was undertaken by Mullard Electronic Research Laboratories, to the basic design of a group at Harwell.

E.H.F. Broadcasting

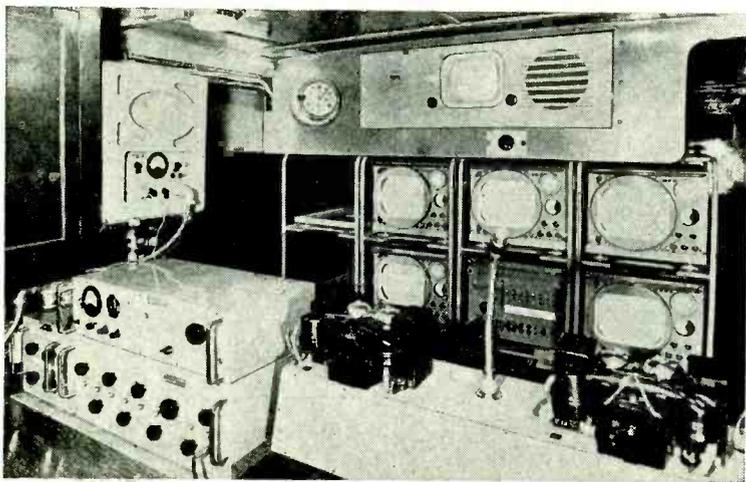
A NETWORK of extra-short-wave broadcasting stations was introduced on the 30th April by the broadcasting organization in the British Zone of Germany—the Nordwestdeutscher Rundfunk.

Four stations will at first form the chain but will be increased later this year to six. The first stations are at Hamburg and Langenburg (88.9 Mc/s, 10 kW), Cologne (89.7 Mc/s, 1 kW), and Hanover (89.3 Mc/s, 0.5 kW—later to be increased to 10 kW). The additional transmitters will be at Etzhorn, near Oldenburg, (88.5 Mc/s, 10 kW) and Teutoburger Wald (89.7 Mc/s).

Danish Television

WITH the resumption of tests in April the schedule of transmissions from Denmark's experimental television station has been revised and extended. Test patterns are now transmitted as follows: Monday, 1100-1600; Wednesday and Friday, 1100-1600 and 2000 to 2100; Saturday, 1100-1200 B.S.T.

According to our Danish contemporary, *Radio Ekko*, the frequencies used are 62.5 Mc/s vision, and 67.75 Mc/s sound, with powers of 100 watts and 50 watts respectively. Scanning rate is 625 lines with 25 pictures per second. Double side-band transmission is employed with positive picture modulation on Wednesdays and Saturdays and negative modulation on Mondays and Fridays. Sound is frequency-modulated with a maximum frequency deviation of ± 75 kc/s.



Interior of the television mobile central control room supplied to the B.B.C. by Emitron Television Ltd. It provides for the control of up to four O.B. units each of which uses three cameras. The picture selected for transmission to the station, either by radio or line, is displayed on the centre c.r.t.

Colour Television

DEMONSTRATIONS of colour television were given by Pye, Ltd., in Hilversum, during the recent Utrecht Fair, and at the Milan Fair. The system, which was demonstrated at Radiolympia last year, and more recently at the Dental School of Guy's Hospital, London, is being developed mainly for use on a closed circuit. The scanning rate is 405 lines with 150 frames. Colour presentation is by sequential additive colour scanning using three-colour rotating discs on both the camera and the receiver. The bandwidth required is 9 Mc/s. Delegates of the C.C.I.R. Television Study Group also saw demonstrations during their recent visit to this country.

PERSONALITIES

Lord Reith, who was the first Director-General of the B.B.C., gave oral evidence before the Broadcasting Committee at the invitation of Lord Beveridge, the Chairman. Lord Reith is now Chairman of the Commonwealth Communications Council.

I. J. St. A. Crawshaw, B.Sc.(Eng.), M.I.E.E., informs us that he has resigned from the board of Airmec Laboratories, Ltd., of High Wycombe, one of the companies in the Radio and Television Trust group. He joined the company in 1944, shortly after its formation, as Patents Manager for the group and later was appointed Sales Manager and Director of the Laboratories.

John Dyer, who was with the Philco organization as Sales Promotion Manager prior to joining Philips in 1937, has now been appointed general sales manager of Philco (Overseas), Ltd., the British subsidiary of the Philco Corp., of Philadelphia, U.S.A. The company is responsible for the design and production of British-made Philco sets.

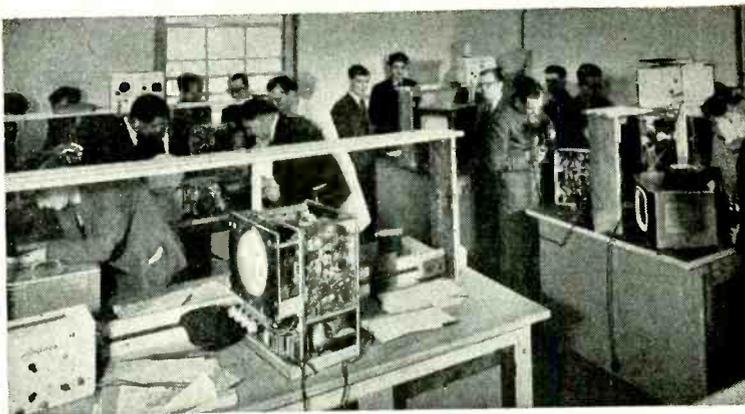
J. B. Kaye, M.A., A.M.I.E.E., has relinquished the post of head of Philips' Technical Commercial Department (Radio and Television) in order to join Painton & Co., of Northampton, as chief engineer. Prior to joining Philips Electrical in 1937, he was for fourteen years in the London office of the International Standard Electric Corporation.

J. S. Smith, N.W. Area manager of the Marconi International Marine Communication Co., has retired after 40 years' service with the company. After serving for some years as a radio officer he was placed in charge of the Marconi Marine Depot in New York and then appointed Liverpool Depot manager. He has been manager of the N.W. Area since 1947. **H. C. Maguire** is taking over all contracts work in the Merseyside area upon Mr. Smith's retirement.

IN BRIEF

Television Licences in the United Kingdom increased by over 105,000 during the first quarter of this year, bringing the total at the end of March to 345,100. The total number of licences—both sound and vision—in force at that date was 12,243,500.

Wired Television.—In reply to a question in the House, the P.M.G., Mr. Ness Edwards, stated that he was pre-



Students in the laboratory at the new college of E.M.I. Institutes at 10 Pembridge Square, London, W.2., where full-time courses are provided.

pared to issue licences to television rediffusion companies on terms corresponding to those applicable to sound broadcast relay services. He added that detailed arrangements were not yet complete and that the industry is to be consulted on technical matters.

Consol.—The Bushmills, Northern Ireland, Consol station has changed its frequency to 266 kc/s as its old frequency of 263 kc/s was allocated to Moscow under the Copenhagen Plan. A revised edition of the Ministry of Civil Aviation publication "Consol—An Aid to Navigation," which will give the revised Counts/Bearing Tables for Bushmills, is in course of preparation.

T.I.D.U.—The Technical Information Documents Unit of the Board of Trade, which disseminates reports on German wartime industrial developments and research reports made available by the U.S. Government and also acts as the national centre for the Documents' Exchange Scheme of O.E.E.C., has moved to Lacon House, Theobalds Road, London, W.C.1 (Tel.: Chancery 4411).

"**Navigator**," the Decca Company's motor yacht, left her Thames berth near Blackfriars Bridge at the end of April for a 5,000-mile tour of Scandinavian and Northern European ports. Demonstrations of Decca radar equipment and the Decca Navigator System will be given to marine interests in some twenty centres. Equipment for both these navigational aids has recently been installed under operational conditions on Scantlin Pier, Blackfriars, to provide facilities for training Merchant Navy officers and for demonstration purposes.

Radio Facilities.—A revised series of charts showing the radio navigational facilities operating at aerodromes throughout the U.K. has been issued by the Ministry of Civil Aviation. Each of the eight charts in the series (GSGS4694) measures 8½ in x 10½ in, costs 3d, and is printed in two colours.

Ship-Shore Service.—The Post Office coast stations communicated with 367,000 ships during last year. The fourteen stations round the coasts of the British Isles also handled 790,700 radio-telegrams and 16,400 radio-telephone calls, received 598 messages from aircraft, 302 distress calls and gave advice to 241 ships through the service known as Medical Advice to Ships at Sea.

Radio Industries Club.—At the nineteenth annual general meeting of the Radio Industries Club it was announced by the retiring chairman, W. E. Miller (Editor, *Wireless and Electrical Trader*), that the fourth Radio Industries Club Ball will be held on September 29th. Membership of the club is now 684. Norman Collins, B.B.C. Controller of Television, was elected president, Guy R. Fountain (Tannoy) chairman, and J. G. G. Noble (Regentone) vice-chairman, at the first meeting of the new committee.

Radio Mechanics, especially those experienced in the assembly or repair of instruments, are required for the Cumberland establishment of the Ministry of Supply's Atomic Energy Production Division. Applicants should have a sound theoretical knowledge of radio and be educated to School Certificate standard. Enquiries should be sent to the Superintendent, Windscale Works, Sellafield, Cumberland.

"**Safety at Sea**" was the title adopted for two recent functions—an exhibition in the booking hall of Charing Cross L.T. station and a gathering of international marine officials. During the latter twenty officials from five European countries took part in a series of meetings arranged by the British Council which included lectures on and demonstrations of radio aids to marine navigation. The exhibition, which closed on May 20th, was held as part of the Marconi Marine Co.'s jubilee.

"**Temgas**" is the name given by the North Thames Gas Board, which serves an area of 600 square miles, to the recently inaugurated radio-communication system linking its service vans with headquarters. Initially five vans, operating in two of the Board's six areas, are equipped. The main 50-watt transmitter is at Hampstead with its aerial 500 feet above sea level. It is remotely controlled by line from the central control office in Westminster. Frequency modulation is employed and the frequencies used are 71.775 Mc/s, mobile and 85.275 Mc/s, fixed. All the equipment was supplied by G.E.C.

Mechanical Handling.—The second Mechanical Handling Exhibition, which is being organized by our associate journal *Mechanical Handling*, opens at Olympia, London, on the 6th June. Some 160 exhibitors will be taking space and among them are a few—

including B.T.H. and Metrovick—who will be demonstrating electronic control gear. During the exhibition a convention will be held at which a number of papers dealing with various aspects of mechanical handling will be read. Tickets for both the exhibition and the convention are obtainable from *Mechanical Handling*, Dorset House, Stamford Street, London, S.E.1.

Jamaican Police Force is to be equipped with Marconi v.h.f. radio-telephony gear. The installation includes seven 10-watt transmitter-receivers, five of which will be in cars and two in launches. The main 50-watt transmitter will be erected on a hill providing complete coverage of the island and will be linked by radio with the police headquarters.

Commonwealth Communications.—In conformity with the provisions of the Commonwealth Telegraphs Agreement, signed by representatives of the Commonwealth governments in May, 1948, Canada has formed the Canadian Overseas Telecommunication Corporation to acquire the external telecommunication assets operating in the Dominion. This new Crown-owned company will take over some of the equipment and services at present operated by the Canadian Marconi Co. and Cable & Wireless, Ltd.

Canada's Television stations in Montreal and Toronto, the first of which will not be in operation until the autumn of 1951, have already been allocated frequency channels. Because it is anticipated that eventually the Canadian Broadcasting Corporation will operate two stations in Montreal—one English- and one French-speaking—two channels have been allocated to the city: 54 to 60 and 76 to 82 Mc/s. Toronto has been assigned 186 to 192 Mc/s. Although the stations will be operating on American standards, the equipment for the two studios in each city, the control rooms and film-projector rooms has been ordered from Marconi's and includes ten image-orthicon cameras.

Mexican Television stations will operate on American standards—525 lines, 60 frames, horizontal polarization—in thirteen channels each 6 Mc/s wide between 44 and 216 Mc/s. The vision carrier will be amplitude modulated and i.m. will be employed for the sound signal. The picture modulation will be negative.

Canadian Enquiry.—The United Kingdom Trade Commissioner at Montreal states that information regarding radar and microwave electronic components made by British manufacturers is required by Harry H. Schwartz, of Electrodesign, 445, Saint Peter Street, Montreal.

Directories of North American a.m. and i.m. stations and U.S. television stations are included in the 1950 issue of the "Broadcasting Year Book." This 544-page directory of broadcasting information is issued to subscribers to *Broadcasting*, our Washington contemporary.

Brazil's largest broadcasting network, Emissoras Associadas, is equipping Sao Paulo's first television station with an R.C.A. transmitter; it will operate on American standards in the 60-66 Mc/s band. The three-tier cruciform aerial will be installed on the State Bank Building 520 feet above the ground.

BUSINESS NOTES

Alloys made by the Telegraph Construction and Maintenance Co., and now available in Canada, are being exhibited by the company at the Canadian International Trade Fair which is being held in Toronto during May and June. They will be exhibiting magnetic alloys—such as H.C.R., a high-permeability alloy with rectangular hysteresis loop, and Hysat, a cobalt-iron alloy—and a range of Telcoseal glass sealing alloys.

Licensing Arrangements for the manufacture of metallized paper capacitors in the U.S.A. and Canada under Hunt's patents have been investigated by Sydney H. Brewell, M.B.E., chairman and managing director of A. H. Hunt, Ltd., during his visit to North America.

RCA Photophone, Ltd., notifies us that, whilst technical advice on RCA cathode-ray tubes is obtainable from the London office, 36, Woodstock Grove, London, W.12, sales are restricted because the tubes are of American manufacture. Where, however, there is no British-made equivalent, arrangements can be made to import tubes under licence if they are for development or research work or for incorporation in equipment for export. A 16-page booklet giving operating data and physical features of RCA tubes is obtainable, price 1s 6d, from the above address.

"Autoselector" automatic tuning and selecting mechanism is to be manufactured and sold in this country by Mullard Electronic Products under an arrangement made with Philips Telecommunications Industries. The accuracy claimed for these units, which have industrial as well as radio applications, is ± 0.050 deg from the pre-determined setting. Two types are available, the smaller type, SZT101, is suitable for aircraft radio gear and has provision for twelve pre-set positions.

Resistors.—The largest single export order despatched in one consignment by Morganite Resistors, Ltd., was recently shipped to Brazil. It comprised 52,000 potentiometers which were produced in the firm's new factory at Jarrow, Co. Durham.

Conversion Kits are to be produced by Belling & Lee to make "Sutton Coldfield" aeriels erected in the Holme Moss service area usable for the latter's transmissions when radiated.

Ekco radio and gramophone equipment is being installed in a further nineteen schools in the County Borough of West Ham.

Schools' Radio Equipment is being developed by the Aerotron Radio Co., of Peel Street, Chadderton, Lancs, in collaboration with the local education authority.

Mullard Overseas, Ltd., has been formed to co-ordinate the export activities of the Mullard company.

Thermionic Products, Ltd., manufacturers of the Soundmirror magnetic-tape recorder, announce that G. Trevor-Johnstone has resigned from the position of divisional sales manager and that E. M. Gamble has been appointed sales superintendent.

Appointment of E. P. Harris, G3GFN, as technical manager is announced by Mail Order Supply Company.

International Aeradio, Ltd., which is now handling marine radar in addition to its normal aeronautical radio and radar activities, has opened an office at 65, Chulia Street, Singapore.

"Baird Journal" is the title adopted by Scophony-Baird, Ltd., for the new house journal of the Baird Television Division of the company.

NEW ADDRESSES

Radio Heaters, Ltd., manufacturers of Radyne radio-frequency heaters, have moved to Eastheath Avenue, Wokingham, Berks. (Tel.: Wokingham 1030/1.)

Acoustic Products, Ltd., manufacturers of Lectrona speakers, have moved from North London to Stonefield Way, Victoria Road, South Ruislip, Middlesex. The sale of the equipment is handled by Edstone, Ltd., who are now at 15, Buckingham Place Gardens, S.W.1 (Tel.: Sloane 6621-3).

MEETINGS

Television Society "Modern Developments in Phosphors for Television," by Leonard Levy, M.A., D.Sc., at 7.0 on 26th May at the Cinema Exhibitors' Association, 164, Shaftesbury Avenue, London, W.C.2.

Institution of Electronics *North-West Branch.* — "Television Pick-Up Tubes," by a member of the staff of E.M.I. at 6.30 on 9th June in the Reynolds Hall, College of Technology, Manchester.

MANUFACTURERS' LITERATURE

DESCRIPTIVE leaflet dealing with the new range of neon indicator lamps, from the Acru Electric Tool Manufacturing Co., 123, Hyde Road, Ardwick, Manchester, 12.

Leaflet describing amplifiers and sound equipment, from Aerotron Radio, Peel Street, Chadderton, Lancs.

"Choosing the Right Loudspeaker" — guide to Ardente Units for outdoor, indoor and diffusion applications, from Ardente Acoustic Laboratories, Guildford, Surrey.

"A Comprehensive Guide to 'Avo' Electrical Instruments," from The Automatic Coil Winder and Electrical Equipment Co., Douglas Street, London, S.W.1.

Catalogues, "Radio Materials" and "Radio-frequency Cables"; and leaflets, "Television Download Cables" and "Cables for Public Address Systems," from B.I. Callender's Cables, Norfolk House, Norfolk Street, London, W.C.2.

Illustrated leaflet giving details of the latest "CDP" disc recorder, from Bourne Instruments, Bourne, Lincs.

Details of Ekco car-radio aeriels, from E. K. Cole, Southend-on-Sea.

Current catalogues and stock lists of radio components, from Coulphire Radio, 53, Burscough Street, Ormskirk, Lancs.

ELECTRONIC CIRCUITRY

SELECTIONS FROM A DESIGNER'S NOTEBOOK

By J. McG. SOWERBY (Cinema-Television, Ltd.)

Selective RC Circuits at Low Frequencies

FOR some purposes selective amplifiers are very useful at low frequencies, and they are used in bridge measurements, distortion measuring gear, servo-mechanisms and so on.

At frequencies of 10 kc/s upwards selective circuits are usually resonant combinations of inductance and capacitance. It is usually assumed that all the losses in the circuit—which are detrimental to selectivity—lie in the resistance of the coil, and this is nearly true at low frequencies. The selectivity of a tuned circuit is determined, at low frequencies, by the Q factor of the coil which is

$$Q = \frac{2\pi fL}{r} \dots \dots \dots (1)$$

where

- f = frequency
- L = inductance
- C = capacitance
- r = resistance

or the ratio of reactance to resistance in the coil. From (1) it is seen that for a given coil of known inductance and resistance the Q factor becomes smaller as the frequency is reduced, so that if a coil has a Q of 20 at 1 kc/s it will have a Q of only one at 50 c/s. In order to obtain a reasonably high Q of 10 or more at 50 c/s the inductance has to be increased for the same resistance, or the resistance has to be reduced for the same inductance. Either way this leads to a larger coil of thicker wire, and at frequencies of 0.1 to 1 c/s the design of a suitable coil becomes quite out of the question and other methods have to be adopted.

Effort has therefore been devoted at various times to the design of selective circuits (in particular, selective amplifiers) using only resistive and capacitive components. Such circuits are not only useful at very low frequencies outside the range of inductances, but also at audio frequencies up to 5 or 10 kc/s because of the weight and space saved by their use. Such selective amplifiers fall into two main classes, one of which uses a bridge network—or a network derived from a bridge—and it is this class of circuit the derivation of which will be considered in some detail here.

All these RC bridge selective amplifiers depend on the use of a frequency-sensitive bridge in the feedback network of a negative feedback amplifier. The overall amplification, A, of a negative feedback amplifier, in terms of the amplification, A₀, without feedback, is given by

$$A = \frac{A_0}{1 - \beta A_0}$$

or, if there is a phase reversal in the amplifier we may write this

$$A = \frac{A_0}{1 + \beta A_0} \dots \dots \dots (2)$$

If we can find an RC network to determine the feedback factor β , such that $\beta = 0$ at one frequency only, there will be no feedback at that frequency and so the full amplification will be obtained. If at all frequencies, other than this one, there is some feedback the amplification will be reduced, so that a form of resonance will be obtained in the amplifier. It turns out that—as has already been suggested—the required RC feedback network can take the form of a bridge, so that perhaps a short digression on bridges will not be out of place.

Fig. 1 represents a perfectly general bridge network composed of four impedances Z₁, Z₂, Z₃, and Z₄. A supply voltage V₀ is applied, and when the bridge is balanced the p.d., V_D, across the detector terminals is zero. The condition for balance can be found by considering the bridge to be made up of two potential dividers across V₀, each composed of two impedances. By this means the potential across Z₂ is found to be V₂ = V₀Z₂/(Z₁ + Z₂) = V₀/(1 + Z₁/Z₂), and similarly that across Z₄ is V₄ = V₀/(1 + Z₃/Z₄). Now at balance V₂ = V₄, so that

$$\frac{V_0/(1 + Z_1/Z_2)}{V_0/(1 + Z_3/Z_4)} = 1 \text{ or } \frac{Z_1}{Z_2} = \frac{Z_3}{Z_4} \dots \dots \dots (3)$$

If each impedance consists of a resistor the network becomes the well-known Wheatstone bridge. In an a.c. bridge at least two of the impedances must contain reactive components otherwise a balance cannot be obtained. These reactances may be capacitive or inductive, but here we are concerned only with the former. The capacitances are sometimes arranged in the bridge so that the balance is independent of frequency, but such arrangements will not serve the present purpose.

It has been found that the Wien¹ bridge of Fig. 2 is quite suitable for the purpose, because a balance can only be obtained at one frequency. This is the case because capacitance enters two arms (Z₃ and Z₄) in different ways, being of a series combination in Z₃, and a parallel combination in Z₄. The frequency of balance is that at which the phase shift in Z₃ is

¹ Hague, B. "A.C. Bridge Methods." Pitman, 5th Edn., pp. 336, 344.

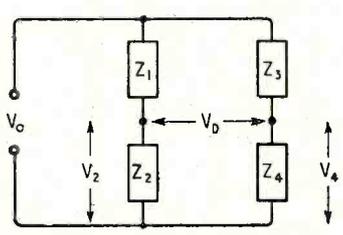


Fig. 1. General bridge network.

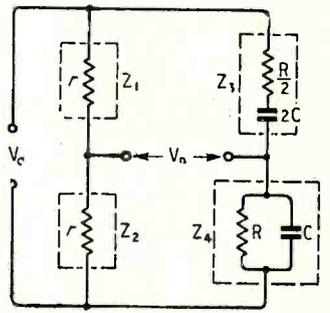


Fig. 2. (Right) Wien bridge.

equal and opposite to that in Z_1 , so that at the balance frequency Z_3 and Z_4 behave as a resistive potential divider. This balance frequency is given by

$$f_b = \frac{I}{2\pi RC} \quad \dots \dots \dots (4)$$

when

$$V_D = 0,$$

provided the circuit proportions of Fig. 2 are maintained.

Now consider the combination of amplifier and bridge to form a selective amplifier² as shown in Fig. 3. The output voltage, V_o , of the amplifier is here applied to the Wien bridge and the p.d. obtained across the bridge detector terminals is fed back to the input of the amplifier. The general operation can be seen in a qualitative way by considering what happens at a very low frequency, and a very high frequency compared with that at balance.

² Valley, Walluan. "Vacuum Tube Amplifiers." McGraw-Hill. 1st Edn., p. 384.

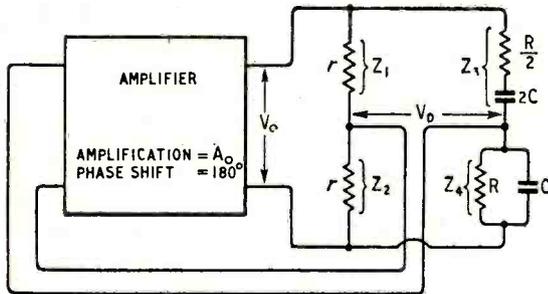


Fig. 3. Amplifier with feedback via Wien bridge.

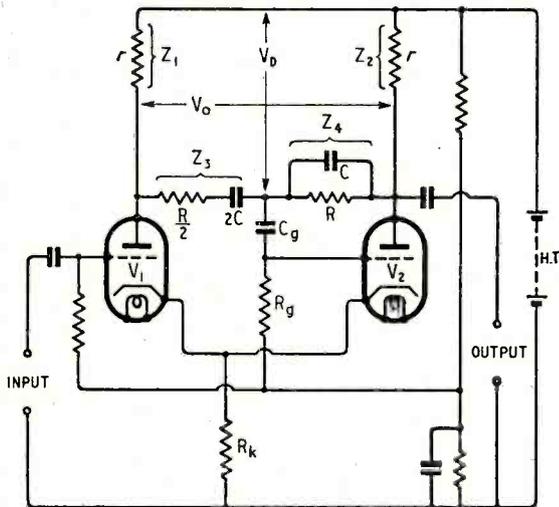


Fig. 4. Selective amplifier using a Wien bridge.

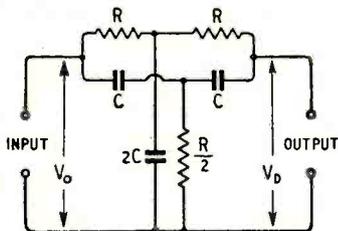


Fig 5. (Left) The parallel-T circuit.

At the balance frequency there is no feedback and the full amplification, A_0 , is obtained. At some very low frequency the bridge reactances become very large and approximate to an open circuit. Under these conditions Z_3 is effectively an open circuit, so that no potential appears across Z_4 . It follows that V_D —the fed-back signal—must be half the output voltage, V_o , as it is divided in this ratio by the resistive Z_1 , Z_2 arms. Under these conditions, if A_0 is very large the overall net amplification will approximate to 2. At some very high frequency the capacitive reactances, will become very small, and approximate to a short-circuit, so that again there will be no potential across Z_4 , and the fed-back signal will again be $V_o/2$, leading to a net amplification of 2 if A_0 is large. If, in fact, $A_0 = 50$ (a reasonable value) than at resonance $A = 50$. Very far from resonance the amplification (by (2)) will be $50/(1 + 25) = 1.92$. Therefore the discrimination between wanted and unwanted frequencies can never be better than 26 : 1 or 28.3 db. If we had started with $A_0 = 100$ we should have obtained a maximum discrimination of 51 : 1 or 35.2 db, and so on.

Effectively we have now deduced the amplification at three points on the resonance curve. To find further points it is necessary to calculate the ratio $V_D/V_o (= \beta)$ for all frequencies and, taking account of the phase shifts introduced at different frequencies, calculate the net amplification obtained. A different curve will be obtained for each new value of initial amplification A_0 , and curves for various values of A_0 have been computed and are shown in Fig. 7. It will be seen that these curves bear a strong resemblance to the resonance curve of a tuned LC circuit. It is possible, by analogy, to find an expression which gives—roughly—the equivalent Q of an amplifier with Wien bridge feedback, and this is useful in doubtful cases as it gives a quick means of comparison with coils that may be available for the same resonant frequency. It turns out that the equivalent Q of a Wien bridge feedback amplifier is

$$Q_w = \frac{A_0 + 1}{4} \quad \dots \dots \dots (5)$$

with an error not exceeding 1 per cent, provided A_0 is 25 or more.

Before the Wien bridge can be used as the feedback path in a practical amplifier, one difficulty—perhaps not very obvious—has yet to be overcome. All amplifiers have at least two input and two output terminals, but usually one in each pair is common, so that there are effectively only three terminals—one of which is usually "earthy." As the bridge has four terminals, such amplifiers will not be of any use. The difficulty could be avoided by coupling the bridge to the amplifier with a transformer, but apart from the phase shift troubles this is likely to introduce, a coupling transformer to work (say) at 1 c/s is just as difficult to make as the original coil we abandoned in favour of the RC circuit.

There is, however, a class of amplifier which can be pressed into service here, of which the cathode-coupled phase-splitter is an example. In such amplifiers a push-pull output is obtained when an input is applied to either of two pairs of input terminals. As the resistive arms of the bridge are equal, they may be used as the anode loads of the phase-splitter, and the detector terminals of the

bridge may be connected to one pair of input terminals as shown in Fig. 4.

The circuit of Fig. 4 is fundamentally a cathode-coupled phase-splitter with equal anode loads. An accurate push-pull output for an input to one grid is obtained only when R_k is very large, and consequently the grids are returned to a positive source of supply as shown, so that R_k can be made large. In further discussion of this circuit it will be assumed that the anode signal voltages are equal and opposite in phase, as this simplifying assumption leads to theoretical results only slightly at variance with practice. The time constant $C_g R_g$ is long enough to ensure that even at 1/10th of the resonant frequency there is negligible loss in this coupling; R_g must be large compared with R so that the grid circuit of V_2 imposes negligible loading on the reactive arms of the bridge.

At the balance frequency V_D is zero, so that the input to V_2 is zero and the circuit behaves as a cathode-coupled splitter as if the bridge were not present. At frequencies very low or very high compared with the balance frequency, voltage negative feedback is applied from anode to grid of V_2 in the manner already described, and at extreme frequencies all the anode signal of V_2 is fed back

directly to its grid provided the reactance of C_g is very low, and that R_g is very large compared with R . At high frequencies the resistance ($R/2$) in Z_3 is effectively connected between the two anodes (the capacitors being a virtual short-circuit) so that r should be small compared with $R/4$ to preserve the amplification at high frequencies. The input is applied to the grid of V_1 and the output taken from the anode of V_2 , as shown.

The amplification at resonance is approximately,

$$A_0 = \frac{\mu r}{2(r_a + r)}$$

where μ = amplification factor of V_1 or V_2
 r_a = anode resistance of V_1 or V_2

from input to output, but for calculating the equivalent Q of the circuit, an amplification of twice this value must be taken. This is because the signal input, V_0 , to the bridge is twice the amplitude of the signal at either anode, owing to the push-pull output obtained from the two valves.

The circuit of Fig. 4 behaves well in practice, but it suffers from one snag. If, due to variations in the bridge network components, the conditions for balance call for a larger output from V_2 than from V_1 , then instability can take place in extreme cases. Nevertheless, experience indicates that if the bridge components are built to a tolerance of 1 per cent, or, better, adjusted on test, no trouble need be expected with any of the double-triodes currently available. This difficulty can be overcome in another way, however, by the use of another RC circuit which also has other advantages. This is called the parallel-T circuit^{3, 4} and is now in widespread use.

The parallel-T circuit is shown in Fig. 5 and is particularly advantageous because it is essentially a three-terminal network, one input and one output terminal being common. It is derived from the Wien bridge and the equations describing its behaviour are identical in form to those for a Wien bridge, with one merely numerical difference. It will be remembered that in considering the output at the detector terminals of the Wien bridge at high and low fre-

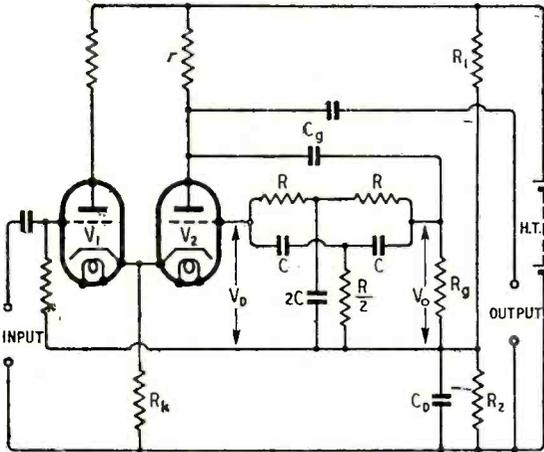
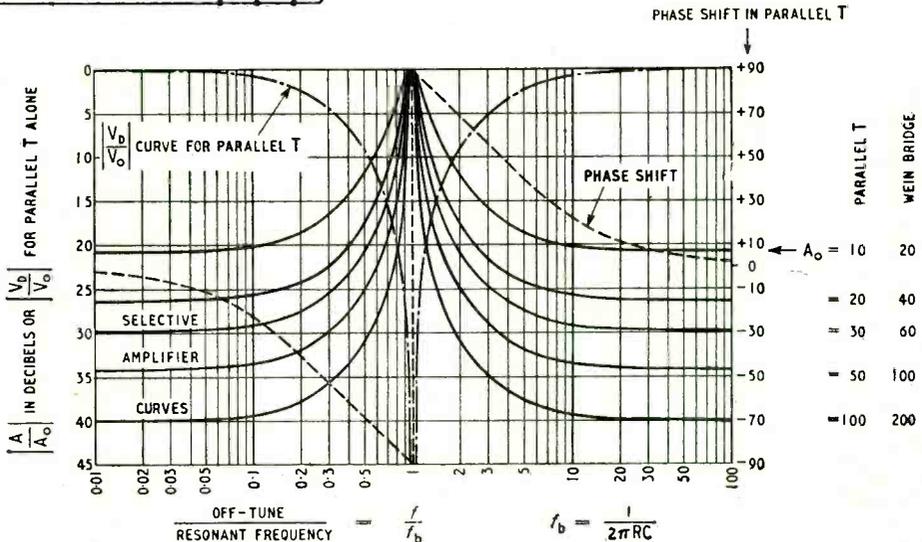


Fig. 6. Selective amplifier using a parallel-T. Typical values ($f_b = 500/s$): $V_1, V_2 = ECC33$; $r = 47k\Omega$; $R_k = 12k\Omega$; $R_1 = 330k\Omega$; $R_2 = 68k\Omega$; $C_g = 0.25\mu F$; $R_g = 1M\Omega$; $C = 2\mu F$; $R = 1M\Omega$; $C = 3180pF$; H.T. = 300V. For selectivity see curve in Fig. 7 labelled $A_0 = 10$.

Fig. 7. Selectivity and phase shift curves for amplifiers with parallel-T feedback circuit. Equivalent Wien bridge amplifier values included for reference.



³ Scott, H. H. *Proc. I.R.E.* Vol. 26, p. 226, 1938.

⁴ Tuttle, W. N. *Proc. I.R.E.* Vol. 28, p. 23, 1940.

quencies it was found that V_D could never exceed $V_0/2$. In the parallel-T this is not so, and a little consideration will lead to the conclusion that at frequencies very remote from the balance frequency V_D approaches V_0 . The balance frequency for the parallel-T is, as for the Wien bridge

$$f_b = \frac{1}{2\pi RC}$$

and the network may be used in the feedback path of a cathode-coupled phase splitter as shown in Fig. 6.

The performance of the amplifier of Fig. 6 is the same as that of Fig. 4; this can be seen by the following chain of reasoning. In the case of Fig. 6 V_D is equal to V_0 at frequencies remote from the balance frequency, so that the feedback factor here is twice that in Fig. 4. On the other hand the overall amplification to the Wien bridge of Fig. 4 is twice that to the parallel-T in Fig. 6. These effects conveniently cancel so that the same result is obtained in each case. The possible instability in Fig. 4 is avoided in Fig. 6, however, so this must be regarded as the preferable circuit. The permissible tolerances on the components of the parallel-T are, as might have been expected, no wider than on the Wien bridge.

The selectivity obtained from the amplifier of Fig. 6 depends, like the previous circuit, on the initial amplification obtainable. It can be shown that the equivalent Q of an amplifier with a parallel-T is given by:

$$Q_T = \frac{A_0 + 1}{4} \text{ approximately}$$

Selectivity curves for amplifiers with amplifications between 10 and 100 are shown in Fig. 7 from which results to be expected may be estimated. The transmission and phase shift curves of the parallel-T alone are also shown, from which it can be seen that the network may be used as a coupling between amplifier stages to suppress a given frequency.

In these rather brief notes it has only been possible to describe the general operation of RC selective amplifiers and numerous detailed circuits have been described at various times. One of the most interesting² makes use of the 'cascode' circuit and is especially convenient when it is desired to cascade several selective amplifiers to obtain greater selectivity (as in r.f. practice), or to arrange a number of stagger-tuned amplifiers to yield a bandpass characteristic.

Tuned amplifiers along the foregoing lines have been used for many purposes, some of which have been mentioned. Probably readers new to these circuits will see further applications of their use. Networks other than the Wien bridge and parallel-T have been described,⁵ and some of these may be especially useful when it is required that the resonant frequency of the amplifier be variable.

Appendix

The parallel-T of Fig. 5 may be analysed by considering each of the T's separately, and deriving for each the equivalent π network. If these derived networks are then placed in parallel a composite parallel- π network is obtained. The first shunt arm of this composite π may be ignored since it merely shunts the input which is assumed to be supplied from a source whose internal impedance is small compared with the network. The remaining two arms of the composite π then form a

potential divider. This method of analysis leads to the expression for the transmission:

$$\frac{V_D}{V_0} = \frac{1}{1 + \frac{4ja}{1-a^2}} = \beta \quad \dots \quad (A1)$$

where $a = \omega RC = \omega RC$ and $\omega = 2\pi f$.

Using this value for β in (2), and finding the absolute value, or modulus, of the ratio of amplifications with and without feedback:

$$\left| \frac{A}{A_0} \right| = \sqrt{\frac{1 + \left(\frac{4a}{1-a^2}\right)^2}{(A_0 + 1)^2 + \left(\frac{4a}{1-a^2}\right)^2}} \quad \dots \quad (A2)$$

From which the curves of Fig. 7 are plotted. When $a = 1 = \omega RC$ then $\beta = 0$ in (A1). Hence the balance frequency is

$$f_b = \frac{1}{2\pi RC} \quad \dots \quad (A3)$$

The transmission and phase shift of the parallel-T alone are found from (A1).

$$\text{Transmission} = \left| \frac{V_D}{V_0} \right| = \frac{1}{\sqrt{1 + \left(\frac{4a}{1-a^2}\right)^2}} \quad \dots \quad (A4)$$

and

$$\text{Phase shift} = \phi = \tan^{-1} \frac{4a}{a^2 - 1} \quad \dots \quad (A5)$$

The curves corresponding to (A4) and (A5) are also plotted in Fig. 7. The equation for the Wien bridge of Fig. 2 is the same as (A1) except that the numerator is $\frac{1}{2}$ instead of 1. In (A2) this leads to a change in the term containing A_0 which becomes $\left(\frac{A_0}{2} + 1\right)$.

The equivalent Q factor of an RC selective amplifier may be based on the bandwidth obtained about off-tune frequencies where $\left| \frac{A}{A_0} \right| = \frac{1}{\sqrt{2}}$, by analogy with an LCR tuned circuit. This leads (for the parallel-T) to

$$Q_T = \frac{\sqrt{(A_0 + 1)^2 - 2}}{4} \approx \frac{A_0 + 1}{4} \quad \dots \quad (A6)$$

and, for the Wien bridge,

$$Q_W = \frac{\sqrt{\left(\frac{A_0}{2} + 1\right)^2 - 2}}{4} \approx \frac{A_0}{2} + 1 \quad \dots \quad (A7)$$

HIGH-POWER TRANSMITTING VALVE

WHAT is believed to be the world's most powerful transmitting valve, a "super-power beam triode" capable of 500 kilowatts continuous output, has been announced by R.C.A. This is the type 5831, a compact valve for its high power, standing 38½ in high and weighing 135 pounds. It is intended primarily for use as a class C r.f. power amplifier, but is also useful as a class B a.f. power amplifier and modulator. For unmodulated class C working, it has a maximum anode voltage of 16 kV, a maximum anode consumption of 650 kW and a maximum anode dissipation of 150 kW. Because of electron-optical principles embodied in the design, it draws low grid current and only requires about 900 watts drive to produce an output of 500 kW on class C working.

The principle of construction has been to divide the valve into 48 independent electron systems, arranged cylindrically so that, in effect, there are 48 parallel triodes concentrated within a small space. Each electron system consists of a thoriated tungsten filament in a slot in the common beam-forming cylinder, tungsten grid rods, and the common anode. Even though the grid may be positive, few electrons reach it because of the focusing effect of the beam-forming cylinder. An internal water-cooling system is provided for the beam-forming cylinder and the anode.

² Harris, G. R. *Proc. I.R.E.* Vol. 37, p. 882, 1949.

Amplifiers for Cardiography

Simplified Input Circuit for Balancing Out Interference

AS pointed out by Dr. Parnum in his review of biological amplifiers (*Wireless World*, Nov. 1945), the input circuit is perhaps the most important feature of such amplifiers, and the two chief difficulties concern the elimination of interference pick-up and the elimination of interaction between amplifiers connected to the same patient.

The solution of these difficulties has resulted in the development of special balanced amplifiers which effectively discriminate against interference, and admit of connection to more than two electrodes on the same subject.

In the present article a balanced input circuit is described which is particularly suitable for cardiography and has the merits of single-ended simplicity. The operation of the circuit will be better appreciated after a brief consideration of the electrical conditions involved in the patient circuit.

An electrocardiogram is obtained by attaching leads to certain agreed parts of the body and recording the potential changes between these leads as a result of the activity of the heart. A typical connection, for example, is to right arm and left leg. The potentials developed are of the order of 2 mV and take the form of triangular pulses repeated at the same rate as the heartbeat, together with certain smaller waves. The spectral composition is from about 0.1 c/s to 100 c/s, the intensity diminishing rapidly with frequency. A resistance of about 2,000 Ω is measurable between the electrodes and this constitutes the internal resistance of the equivalent generator circuit, as far as cardiac potentials are concerned.

Patients are usually placed in a lying position upon a couch and may be regarded as earth-free. The disturbing effects of mains wiring and apparatus are almost wholly attributable to the action of electrostatic induction upon the subject, the interference potential assumed by a patient corresponding to his position in the disturbing field.

The intensity and configuration of such disturbing fields will vary widely according to the nature and

By
B. J. SHELLEY

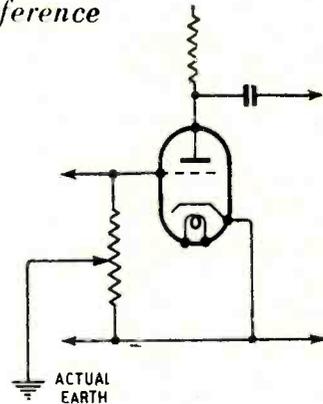


Fig. 3. Practical input circuit.

distribution of wiring and apparatus. Measurements of the open circuit voltage induced in a subject within a laboratory, having plenty of the usual equipment operating (cathode-ray tube, generators, soldering-irons, fluorescent lighting, etc.) have shown values of about 500 mV. Fortunately, however, the equivalent generator impedance of the body—as far as interference is concerned—is that of a capacitor of about 500 pF to earth, so that the actual voltage appearing across a resistance load may be very much smaller. Thus, for example, in Fig. 1 the voltage which appears across the resistor R is $E_r = E_g \cdot R / \sqrt{(R^2 + X_c^2)} \doteq E_g \cdot R / X_c$ when $R \ll X_c$. Taking $C = 500$ pF, $X_c = 1/2\pi fC = 6.3$ M Ω at 50 c/s, if $E_g = 0.5$ V and $R = 12$ k Ω , then $E_r = 0.001$ V, a reduction of 500 times as compared with the induced voltage pickup, and thus, of the same order as the cardiac potentials.

Equivalent Circuit

The simple equivalent circuit of the cardiac generator must now be modified to include the effects of the interference, and the situation may be represented as in Fig. 2. E_c is the cardiac potential it is desired to record, E_{g1} and E_{g2} are the open-circuit voltages due to interference pick-up, and C_1 and C_2 are the capacities to earth from the two electrodes on the body.

In general, E_{g1} and E_{g2} are closely equal and in phase, and likewise C_1 and C_2 are also equal, although under some conditions these equalities may not hold, particularly where the subject is very close to an interfering source. The phase equality, however, appears to be quite constant under all conditions, which is to be expected.

Now consider the patient circuit connected to the amplifier input circuit of Fig. 3. A potentiometer of 10k Ω is connected between grid and cathode, and the slider is taken to earth (i.e. actual earth). It will be evident that by moving the slider a position will be found where the interference voltages across the two portions of the potentiometer can be made exactly equal. Also, since $R \ll X_c$ the phases will be practically equal and the two voltages will balance,

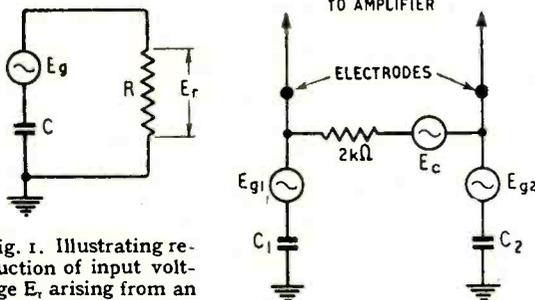


Fig. 1. Illustrating reduction of input voltage E_r arising from an unwanted e.m.f. E_g .

Fig. 2. (Right) Equivalent circuit of cardiac generator with interference sources.

so that only the cardiac voltage appears across the potentiometer. For example, in the diagram of Fig. 4 the phase angles of the voltages E_{r1} and E_{r2} are given by

$$\beta_1 = 90 - \tan^{-1}R_1/X_c$$

$$\beta_2 = 90 - \tan^{-1}R_2/X_c$$

and Suppose that for voltage equality the values of R_1 and R_2 are $6k\Omega$ and $4k\Omega$ respectively, and that $C_1 = C_2 = 250 \text{ pF}$, then at 50 c/s $X_c = 12.7 \text{ M}\Omega$ and the phase angles become $\beta_1 = 89.97^\circ$ and $\beta_2 = 89.96^\circ$. The difference is therefore quite negligible. This result is due, of course, to the fact that $R \ll X_c$, so that the phase angles of the voltage across the resistors is always very close to 90° and any difference between the two will be the difference between two angles $(90 - a)$ and $(90 - b)$ where a and b are both extremely small. Hence quite considerable variations in the values for E_{g1} , E_{g2} , C_1 , and C_2 will produce no important difference between the phases of the two voltages. This holds good even for the harmonics of the 50 c/s mains.

By using a potentiometer of $10k\Omega$ the actual interference voltages developed across each section are quite small, while a load of $10 \text{ k}\Omega$ is presented to the cardiac generator, permitting $5/6$ of the cardiac signal to appear at the amplifier input. This is quite a favourable condition (the Eindhoven galvanometer string presents some 3 or $4 \text{ k}\Omega$ only) and any polarizing effects due to the load current are quite small.

In practice the whole of the amplifier may be built on an insulated sub-chassis which constitutes

Fig. 4. The phase angles of E_{r1} and E_{r2} are not seriously disturbed in practice by alteration of the ratio R_1/R_2 .

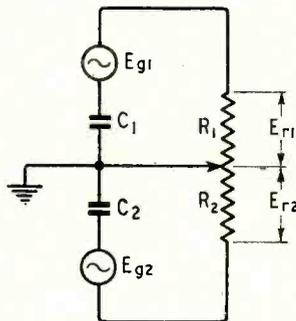
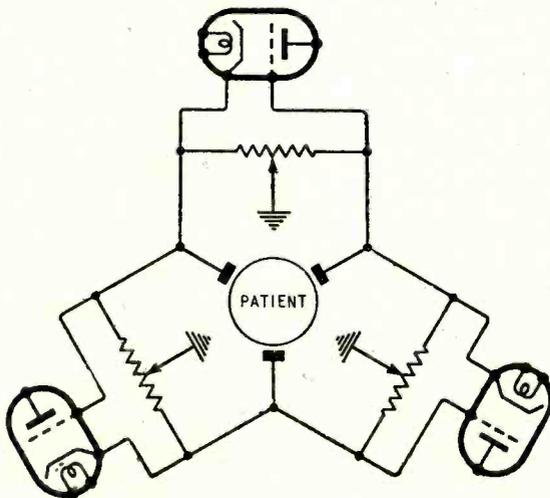


Fig. 5. (Below) Connections for more than one circuit. Swamping resistors are in practice connected between each slider and earth to preserve independence of adjustment.



the h.t. negative line, and this is enclosed in a metal case directly earthed, with the slider of the input potentiometer connected to this outer case. The output must not be directly earthed in order to prevent the flow of feedback currents through the lower portion of the potentiometer. A mirror galvanometer forms a most suitable indicating device, balance for d.c. being provided in any conventional manner. An interference balance indicator is a most useful adjunct and permits fine adjustment of the input circuit. This may be very simply a leaky-grid detector with anode current meter, coupled to one of the later stages, where any interference unbalance would be amplified.

Fig. 5 shows the situation which arises when several amplifiers using this input circuit are connected to the same subject. Three electrodes are shown, providing three simultaneous records. Obviously the three inputs cannot be separately balanced since the movement of any one slider will upset the inputs of the other two amplifiers. This, however, is easily remedied by the insertion of swamping resistors of about $100 \text{ k}\Omega$ in each of the three separate earth leads, so that the movement of any one slider produces a quite negligible change in the condition of the other two input circuits, and all three may now be independently balanced. The insertion of the swamping resistor produces no change in the absolute values of the interference voltages in the potentiometers, since the resistor is still very small compared with X_c , and is in the neutral lead.

The writer has not used the circuit described in a mains-operated amplifier, but there seems to be no serious reason why it should not be applicable, provided that certain precautions are taken; for example, the mains transformer should be fitted with an electrostatic screen to eliminate unwanted capacity coupling from mains to power supply.

As stated above, the circuit is particularly useful for cardiographic work, and it is possible that workers in the field of encephalography may find that it has possibilities of development to suit the special requirements of their own field, too.

Published Report

Measuring Radio-frequency Voltages

AN up-to-date presentation of fundamental principles and techniques used in radio-frequency voltage measurement is given in a booklet recently published by the U.S. National Bureau of Standards.

The subject matter has been selected to give professional workers and students a more comprehensive picture of these measurement methods than is generally available in current text-books. It is, however, limited to techniques that have proved successful in practice, with emphasis on those developed for standardization work at the National Bureau of Standards. High-precision methods based on d.c. measurements are dealt with first, then moderate-precision methods involving thermionic and other rectifiers, and finally pulse-peak voltage measurements and miscellaneous methods. The frequencies concerned range from the l.f. band to part of the e.h.f. band.

"High-frequency Voltage Measurement" is available from the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C., price 20 cents, plus 7 cents postage. Remittances must be in U.S. currency.

Trends in Components

Review of the R.E.C.M.F. Exhibition

The annual private exhibition of components and accessories, organized by the Radio and Electronic Component Manufacturers' Federation was held in London from 17th—19th April. Our survey of exhibits in each category is followed by a list of makers. A general list of exhibitors, with addresses, is given at the end of this review.

CAPACITORS

Variables.—In order to meet the extended medium-wave coverage now needed under the Copenhagen Plan for broadcasting either a larger tuning capacitor must be used or the stray capacitance in circuit must be reduced. Catering for the first alternative, Plessey have increased the capacitance swing in some of their gang condenser assemblies to 580 pF; this has been achieved with practically no change in minimum capacitance or increase in overall dimensions. The extra capacitance is obtained by employing slightly thicker vanes for the rotor sections. Actual vane spacing, centre-to-centre, is unchanged, but the dielectric spacing is reduced and the rigidity is improved so that no more risk of microphony is entailed.

Concurrent with this change, Plessey have bonded the tips of the rotor vanes in the short-wave sections of the bandsread models to the main rotor vanes as a means of combating microphony on short waves.

Elsewhere, few changes were seen in the design of variable capacitors; Cyldon still cater for the instrument designer with a comprehensive range of high-precision variables, while Polar had, among other models, a wide selection of v.h.f. tuning and miniature air trimming capacitors. One minor change introduced by this firm is the inclusion of a locking device on one of their miniature models. This effectively locks the capacitor without the slightest change in its adjustment. The model, which measures just over $\frac{1}{8}$ in \times $\frac{1}{8}$ in over the ceramic base, is available in sizes of 2-20 pF and 3-30 pF.

Fixed.—In addition to minor improvements, T.C.C. have introduced three new types of ceramic capacitor, two being fully insulated and the third a metal-cased miniature. For one type the insulating coating is applied by dipping in a special hard-drying compound, while in the other the capacitor is enclosed in a glass tube with Neoprene end-seals. Since the outer case is glass, the use of synthetic rubber end-seals does not degrade the power factor of the ceramic element. A silver-plated

copper sheath is used for the screened variety, and one end is swaged over and soldered to the lead-out wire connected to the outer silvering on the ceramic body. At the opposite end the "live" connection passes through a PTFE seal. This super-tropical model is an improved version of the existing "Metalicon."

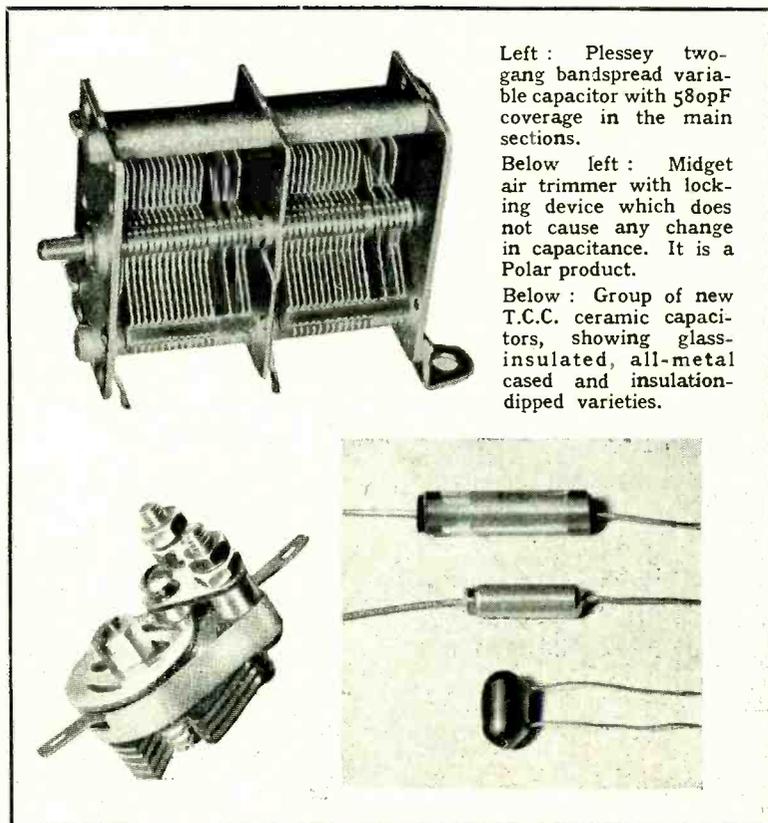
Hunt has now largely eliminated cardboard tubes for paper capacitors and the latest models of this type are encased in a hard wax moulding which will also pass tropical tests. Most of the standard sizes are now available in this form, which is known as "Moldseal." Overall size is practically unchanged; indeed, in some cases the capacitor is smaller than hitherto.



Group of Hunt's latest moulded cased tubular capacitors. They are suitable for use under tropical conditions.

For example, a 0.1- μ F, 350-V working tubular measures $\frac{3}{8}$ in dia \times $1\frac{1}{8}$ in long, while an 0.01- μ F size in the W99 range, also 350-V working, is $\frac{1}{8}$ in dia and $\frac{1}{8}$ in long. The new models are also non-inductive.

Silvered-mica capacitors in un-



Left: Plessey two-gang bandsread variable capacitor with 580pF coverage in the main sections.

Below left: Midget air trimmer with locking device which does not cause any change in capacitance. It is a Polar product.

Below: Group of new T.C.C. ceramic capacitors, showing glass-insulated, all-metal cased and insulation-dipped varieties.

usually high values were shown by L.E.M. Using plates of 1,000pF each, capacitances up to 0.5 μ F have been produced but as the reliability of the component will be governed by the weakest plate in the stack, the larger capacitors in the series are rated at 200 V instead of 350 V working.

Many varieties of tropical capacitors were seen at the exhibition, but particular interest centres round a new range shown by S.T.C. Designed especially for very high working temperatures—100°C is the figure given—they are assembled in drawn metal containers having a single seam only. The case is in two halves fitting snugly together and the edge of the outer is swaged over before soldering. The swage takes all stresses caused by expansion and contraction, and so the soldered joint is subjected to practically no strain. Oil-impregnated paper foil capacitors are employed and normal values range from 0.5 μ F to 8 μ F and for working voltages up to 5 kV.

Some additions have been made to the varieties of electrolytic capacitors available, but few new developments could be traced. B.E.C. had some large dual-capacitance models in various combination; one, for example, being 100+200 μ F. These will handle quite large ripple currents, and values up to 0.5 A are permissible in some cases. Hunt showed also a range of large capacitance dual models, this style being intended for use in the transformerless type of television receivers using half-wave mains rectification, but they have other applications as well.

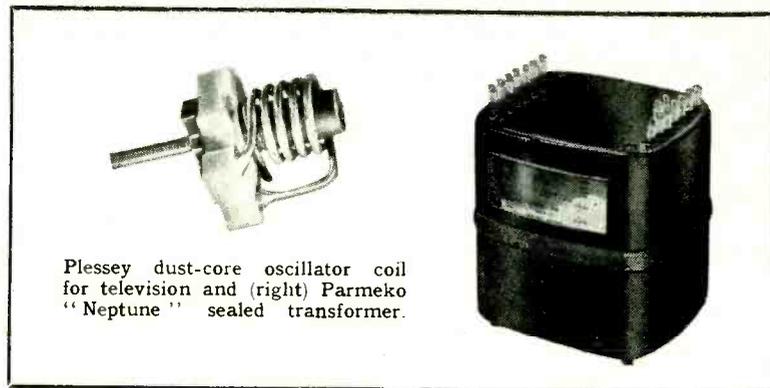
Makers*: B.E.C. (E); B. I. Callenders (E, M, P); Bulgin (T); Cydon (T, V); Daly (E); Dubilier (C, E, M, P, T); Erie (C, T); Ferranti (E, P); Hunt (C, E, M, P); J.B. (T, V); L.E.M. (C, M); Mullard (T); N.S.F. (P); Polar (T, V); Plessey (T, V); S.R.C. (M); S.T.C. (E, M); Static Condenser (P); T.C.C. (C, E, M, P, T); T.M.C. (M, P); Walter Instruments (T); Wego (C, M, P); Welwyn (T).

*Abbreviations: C, ceramic; E, electrolytic; M, mica; P, paper; T, trimmers and pre-set; V, air dielectric variables.

COILS and TRANSFORMERS

Radio Frequency.—Examples of both air-core and dust-iron core r.f. tuning coils and i.f. transformers were exhibited by Advance, while Plessey showed a wide range fitted with Caslite cores. These included television types, the i.f. transformers of which are designed for operation at 13.5 Mc/s and are screened. They are intended for use in sets designed either for London or Birmingham. The oscillator coil is self-supporting and wound with silver-plated wire; by changing the dust-iron core for one of different characteristics, the coil can be used for London or Birmingham frequencies.

Highly stable inductors for v.h.f. were exhibited by Steatite; they comprise a "coil" made by a silver



Plessey dust-core oscillator coil for television and (right) Parmeko "Neptune" sealed transformer.

deposition in a groove in a steatite former.

Makers: Advance, Avo, Igranie, Plessey, Steatite, Varley.

Mains and A.F.—Transformer design has not changed much in recent years, so far as the ordinary types are concerned, but for special purposes great improvements have been made. The Ministry of Supply showed models designed for operation at a temperature of 150°C which are about 66 per cent lighter than equivalent normal types. The core is of Hypersil Cut-C, and glass and silicore insulation is used.

Parmeko showed a range of hermetically sealed transformers and chokes the Neptune series also using a C-core wound from a continuous strip of grain-oriented high-permeability steel. A reduction by 50 per cent of the external field is claimed. Ratings of 5 VA to 2 kVA are made.

Partridge exhibited push-pull audio transformers as well as mains types. There are three PPO types rated for 12 W at 0.5 per cent distortion at 50 c/s, and there are the WWFB models intended particularly for the Williamson amplifier.

Potted mains transformers and smoothing chokes, including swinging chokes, were shown by Woden; and Ferranti exhibited a range of miniature hermetically-sealed types.

Makers: Advance, A.E.E., Avo, Bulgin, Bereo, Elac, Electronic Components, Ferranti, Goodmans, Igranie, Lectrona, Mullard, Parmeko, Partridge, Plessey, R. & A., Rola, Taylor Electrical, Truvox, Varley, Vitavox, Woden.

RESISTORS

Variable.—The greater variety of pre-set variable resistors attracted attention this year and most of them have been designed for use in television sets. They generally take the form of a strip-wound element with a simple sliding contact. This style of construction enables several units to be accommodated side-by-side in a small space and they form convenient banks of pre-set controls.

Some examples of the sliding contact wire-wound variety were shown by Colvern, while Egen favours a sliding contact actuated by a rotary

control at one end. The control knob is knurled and slotted for either finger or screw-driver adjustment. These components take up very little panel space and the normal values extend from 1 k Ω to 40 k Ω .

Pre-set resistors with sliding contacts and fitted with carbon elements were seen among the Welwyn exhibits. In this form much higher values are possible; the normal types range from 25 k Ω to 1 M Ω . They are made in single and multiple assemblies.

Of interest to designers of precision apparatus were the newest types of cam-corrected wire-wound potentiometers made by Colvern. Much smaller models are now available, but the high accuracy and number of correcting points of the larger sizes are retained by fitting smaller correcting screws (8BA in place of 6BA). One of the new type measures 2½ in in diameter and 1 in deep. The moving contact has continuous rotation although the resistance element occupies 300° only. It can be centre-tapped if needed and values up to 100 k Ω are available. A linear accuracy of better than ± 0.1 per cent is attainable.

Another Colvern development is a wire-wound potentiometer fitted with a helical resistance element. Its external diameter is 1½ in and its depth 2½ in. The helix has 10 turns and the moving contact makes 10 revolutions, giving an effective travel of 3,600°. Resistance values extend to 100 k Ω and the linear accuracy is of the order of ± 0.1 per cent.

Another unusual potentiometer was a midget carbon-track type, designed for hearing-aids and small personal portables, shown by Morganite. Known as type DA, it can be had with or without a switch (10 V at 0.25 A) and is available in values up to 3 M Ω (0.1 W dissipation). The overall size is 29/32 in diameter and 9/32 in deep, the projecting contacts adding another ¼ in. Knobs of the full diameter, or larger, can be fitted and various colours are available.

A number of new miniature potentiometers of orthodox design were seen on Morganite's stand and elsewhere; for example, N.S.F. had one of only 15/16 in dia. The Plessey pattern is 1 1/8 in, fitted with a moulded track of high stability and durability. Dubilier showed a range of small hermetically-sealed tropical volume controls known as type "Q," rated at 0.5 W, Berco a wire-wound 5-W sealed type and Erie a tropical carbon-track model rated at 0.5 W and made in values up to 3 MΩ.

Sealing of the case of these miniatures is relatively simple, but various ingenious devices are employed to obtain a perfect seal in the spindle housing. In most cases annular grooves cut in the spindle are fitted with Neoprene washers, which, being under compression, effectively bar ingress of moisture. Berco use two such seals in cascade, with an oil ring between, while Erie have three Neoprene seals in tandem.

Fixed.—Vitreous enamelling of wire-wound resistors continues to find further adherents. A new range was shown by Painton, including types of 4-W and 5-W rating which were actually smaller in size than an average 1/2-W carbon type. Another new entrant in this field was Electronic Components whose range of "Elcohm" miniature vitreous resistors exhibit a number of interesting features, such as secure junction of lead-out and resistance wires and satisfactory operation up to 300°C.

Hitherto specialists in wire-wound resistors of all kinds, Painton this year have turned their attention to the production of high-stability resistors using the cracked carbon technique and a ceramic base. They are fully insulated and range in size from 1/4 W to 2 W and from 10 Ω to 18 MΩ, but the highest

values are limited to the higher ratings. They can be supplied with tolerances of from 1 to 5 per cent. Protection is given by a multiple coating of a hard-drying heat-resisting varnish.

The Welwyn range of high-stability resistors has been extended to include a variant of the more orthodox design with wire ends. Their special e.h.t. types are retained for use as attenuators in waveguides. The new types are made in 1/4-, 1/2- and 1-W sizes and with resistance ranging from 10 Ω to 2.5 Ω.

Makers: Advance (A); Belling & Lee (S); Berco (P, V, W); Bulgain (P, W); Colvern (P, W); Dubilier (C, HS, SP, S, V, W); Egen (P, W); Electronic Components (A, V, W); Erie (C, P, S, W); Igranic (W); Morganite (C, P, S); Mullard (HS, NC); N.S.F. (P); Painton (A, HS, P, W, V); Plessey (P); S.T.C. (A, NC); Taylor Electrical (W, P); Varley (W); Welwyn (HS, V, W).

Abbreviations: A, attenuators; C, composition; HS, high stability; NC, negative coefficient; P, potentiometers; S, suppressor; V, vitreous; W, wire-wound fixed and pre-set.

VALVES

THE trend towards miniaturization continues, with emphasis on B7G and B9A bases. Mullard showed a number of 1.4-V battery miniatures on B7G bases and had two valves of particular interest in their B9A range, a high-slope r.f. pentode EF80 and a triode-pentode ECL80. Also on view were two flat subminiatures for use in lightweight hearing-aids, an amplifier pentode DF66 and an output pentode DL66. G.E.C. had complete ranges of B7G Osram valves for 1.4-V battery operation, a.c. operation and d.c./a.c. operation; whilst their range of miniatures for television included a new line-scan pentode KT36 and an e.h.t. rectifier U37. Another firm concerned with television valves was

Ediswan, who showed a twin-triode time-base valve 20L1 with series-run heaters (6L1 being the version with a 6.3-V heater), a rectifier U25 suitable for e.h.t., and a time-base amplifier 20P2.

Cathode-ray tubes were exhibited by the above firms and by Ferranti and Brimar. The last-mentioned, as well as producing a 15-in aluminized tube, has entered a new field with a 2 1/2-in projection tube for use with the Schmidt optical system; it requires an anode voltage of 20 kV and has a beam current of 1 mA. Mullard also showed their 2 1/2-in projection tube MW6-2.

Miniaturization was the rule in quartz crystals of the plug-in type shown by S.T.C. and Salford. One of the latest S.T.C. types measures 3/4 in x 5/16 in x 1/16 in and can be supplied for a range of frequencies between 2 and 20 Mc/s fundamental or 20 and 60 Mc/s on overtones. A new miniature crystal shown by Salford can be supplied for 6, 8, 10 and 14 Mc/s and has an accuracy of 0.01 per cent. The latter firm also demonstrated an interesting 100-c/s crystal, which was built up with a two-valve battery oscillator into a portable unit to act as a replacement for a tuning-fork. The crystal itself was constructed of overlapping plates of quartz in three sections, and had an accuracy of about 20 parts in a million.

Makers: Brimar, Ediswan, Ferranti, G.E.C., Mullard Electronic Products, Salford Electrical Instruments.

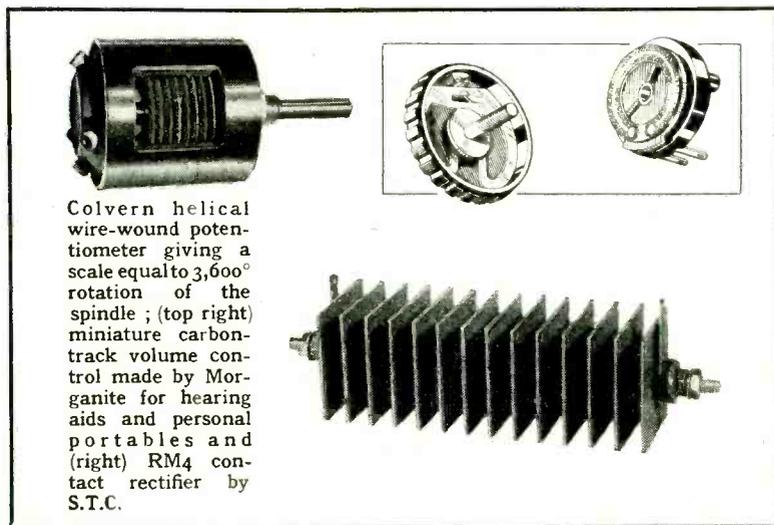
METAL RECTIFIERS

THE copper-oxide type of metal rectifier now finds its main application as an instrument rectifier and the selenium pattern is more common in power applications. The trend towards a.c./d.c. operation in television sets, in particular, has caused a demand for a heavy-duty rectifier capable of withstanding very large peak currents. Standard Telephones showed types capable of an output of 290 V at 250 mA for an input of 250 V, 625 mA, with a 60-μF reservoir capacitor. The peak current is unlimited and operation can be at an air temperature of 40°C.

Similar types are also made by Westinghouse who, in addition to the well-known 36 series of e.h.t. rectifiers, now have a range designed for operation as "damping diodes" in economy line-scanning circuits. This is the 14D series and includes units of up to 4.47 kV peak-inverse rating with mean-current ratings of 50-100 mA; higher current patterns can be supplied, but as cooling fins are needed they become physically larger.

This firm also features the use of metal rectifiers for spark suppression in switch contacts, and claims that they enable this to be done while retaining fast operation.

Makers: Salford, S.T.C., Westinghouse.



Colvern helical wire-wound potentiometer giving a scale equal to 3,600° rotation of the spindle; (top right) miniature carbon-track volume control made by Morganite for hearing aids and personal portables and (right) RM4 contact rectifier by S.T.C.

TELEVISION COMPONENTS

EXCEPT for a yoke-type frame coil for a self-oscillating current generator which was shown by Plessey, the deflector coils on view were of the bent-up-end type. The Plessey models have an external m-metal ring, but Igranice use a stack of laminations. There is a tendency, however, to adopt special materials, and a one-piece slotted-ring made of Ferroxcube was shown by Mullard and is of particular interest for the production of coils combining high efficiency and high Q.

The same material was also shown in shapes suited to line-scan coupling transformers. The Plessey transformers embody "Caslam" cores. This material not only gives a high Q but is claimed to give a great reduction of acoustic noise. Salford showed dust-iron, three-piece cores for transformers. The advantage of these special materials lies mainly in improved circuit efficiency when using the so-called economy circuits—in particular, the ones providing h.t. boost.

Focus coils of conventional pattern appeared on the Igranice and Plessey stands, but development in focusing methods lies chiefly in permanent-magnet types. The Plessey unit has a front plate which can be tilted by three screws for picture centring, the unit as a whole sliding along the tube neck for focusing. The Elac model is similarly arranged as far as centring is concerned, but the focus is adjustable by varying the air gaps by the same three screws. Elac also showed an exceedingly compact focus unit for projection tubes, and centring magnets for use with c.r. tubes having ion traps.

Rubber masks for tubes were exhibited by Long and Hambly and thermoplastic types by Thermo-Plastics. These have a transparent front which replaces the usual safety glass.

Makers: Elac, Igranice, Long and Hambly, Mullard, Plessey, Salford, Thermo-Plastics.

SWITCHES AND RELAYS

NO startling changes were to be seen in the design of switches this year. Bulgin showed a new micro-switch capable of breaking 10 A peak, and A.B. Metal Products had what is claimed to be the smallest rotary switch in the world, but manufacturers, on the whole, kept to their standard types. There were, however, two switch-driving mechanisms of considerable interest. One of them, shown by N.S.F. and described as a rotary relay, works on the screw principle reversed, in that a lateral movement produced by an electromagnet is converted into a powerful rotary movement suitable for driving a bank of rotary switches. The other mechanism, by Salford, was a fully sealed stepping

motor arranged to drive, in steps of 30 deg, a bank of six ceramic wafer switches. It requires an average input power of 16 watts and weighs 10 oz, whilst the rate of stepping is 10 ± 4 impulses per second.

Several types of Carpenter polarized relay were shown by T.M.C., and one of the latest, for use in proximity to a radio receiver, incorporates an anti-interference filter. The frequencies suppressed are in the range 5-150 Mc/s, and the filter is physically small enough to fit inside the standard cover of any of the existing Type 3 relays.

Makers: A.B. Metal Products, Berco, Bulgin, Clix, Electronic Components, Electrothermal Engineering, Erie Resistor, N.S.F., Painton, Plessey, Salford Electrical Instruments, Sangamo Weston, S.T.C., Taylor, T.M.C., Varley, Walter Instruments.

CHASSIS FITTINGS

MOST of the new valveholders this year were for B7G and B9A valves, as might be expected. Of particular interest was a non-microphonic B7G valveholder effective up to 800 c/s, shown by McMurdo. The valveholder proper is held in a flexible PVC moulding, which is fitted with metal eyelets to take the fixing bolts so that the PVC cannot be squashed when the assembly is bolted to a chassis. Another feature is that the spacing of the fixing holes has been made the same as for B8A and B9A valveholders, thereby simplifying chassis drilling and interchanging of valves. The valveholder can be supplied with or without screening. A B9A valveholder shown by Cinch has a new type of contact giving improved grip on the valve pins.

Possibly with an eye to the high voltages used in television, two anti-corona devices have made their appearance; an anti-corona tag by Clix and an anti-corona clip by Cinch, the object in both cases being to make a connection with no sharp edges. Amongst various fittings shown by Belling & Lee was a polythene-bushed terminal with the extremely high leakage resistance of 20 million megohms. New items on the Bulgin stand included a bayonet neon holder, a signal flasher and a fuseholder that unscrews like a fountain-pen and can be conveniently inserted in a conductor without being chassis mounted. A multi-way socket for connection to printed circuits on glass plates was shown by Painton, together with an unbreakable two-pin plug and socket and a high-voltage six-point plug and socket suitable for anything up to 10 kV.

Considerable interest was aroused by two new techniques in the housing of radio and electronic apparatus, demonstrated by Widney. One of them was the use of telescopic mountings to enable chassis to be slid out of their cabinets in the same way as drawers are slid out of a filing-cabinet, a smooth action being

ensured by the use of steel ball-bearings throughout. The other technique was that of the pre-fabricated cabinet. A variety of formed sections, corner diecastings and connecting brackets are available, rather on the "Meccano" principle, so that engineers and home constructors can, with the minimum of tools, assemble their own cabinets in whatever shape or form they please.

Makers: Antiference, Associated Electronic Engineers, Belling & Lee, Bulgin, Cinch, Clix, Colvern, Electronic Components, Electrothermal Engineering, Igranice, Imhof, J.B., Long & Hambly, McMurdo Instruments, Painton, Plessey, Polar, Resosound, Ripaults, S.T.C., Telcon, Thermo-Plastics, T.M.C., Tucker Eyelet, Walter, Widney.

AERIALS

TWO outstanding features of the television aerials on view this year were greater mechanical strength and improved directivity for fringe-area reception. Most of the aerials on view were designed to stand up to 80-100 m.p.h. gales, and had alternative methods of fixing, usually either wall-brackets or chimney lashings.

An unusual aerial configuration in the shape of a cross was exhibited by Antiference, two of the elements acting as a director and the other two as a dipole. Compared with an ordinary "H"-type dipole and reflector, this "X" arrangement possesses greater mechanical strength and gives an increase in forward gain of 2 db. It has an input impedance of 70-80 Ω , forward gain of 5 db, front-to-back ratio of 22 db, and weighs, without its mounting, 1½ lb. An advantage in construction is that the four aluminium-alloy rods can be screwed into the central bakelite insulator after the aerial has been assembled and wired. By connecting the director to the lower element of the dipole, a depression is made in the base of the vertical polar diagram, thereby decreasing the amount of interference received from immediately below.

Another aerial for fringe areas was the "Multirod" by Belling & Lee. This has four elements in all—two directors, a dipole and a reflector—giving a forward gain of 8 db on a simple dipole and a front-to-back ratio of 24 db. A demonstration television aerial was also shown, in which a bracket supporting the pole could be clamped to an upstairs window whilst the bottom of the pole rested on the ground. A.B. Metal Products exhibited, amongst other television aerials, a fringe-area array consisting of a folded dipole and three reflector elements arranged to give parabolic focusing.

Makers: A.B. Metal Products, Antiference, Belling & Lee.

VIBRATORS

IT was noticeable this year that the makers of vibrators were aiming at higher power ratings than have

been achieved in the past. One outstanding example was the heavy-duty model shown by Wimbledon. This was a non-synchronous type, intended to operate from 220-V d.c. mains and having a power rating of 440 W. It has a double-pole double-throw action and heavy tungsten contacts. To prevent frequency drift as a result of heat, the vibrating parts are arranged to have compensating expansions and contractions, and the frequency stability claimed is 50 ± 1 c/s. Plessey showed another heavy-duty non-synchronous vibrator which can be supplied for 6-V, 12-V and 24-V working and power ratings up to 60 W; with an output power of 45 W, its life would be in excess of 1,000 hours. A model shown by the Ministry of Supply was capable of handling approximately 100 watts at voltages up to 24 V.

Two miniature vibrator power packs, working at 400 c/s and 250 c/s, were also on view at the Ministry of Supply stand, whilst Wimbledon displayed their standard

range of vibrators and power packs for input voltages of 2-24 V.

Makers: Plessey, Wimbledon.

SOUND REPRODUCTION

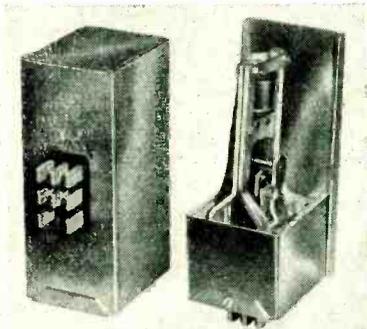
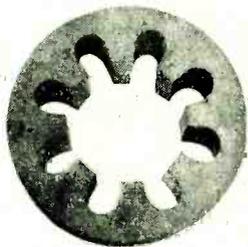
THE general impression remaining after a tour of the principal loudspeaker manufacturers was of a marked extension in the range and variety of types now available to the set maker. This is due not only to the home demand for new designs for small portables and television receivers, but also to a willingness to supply special types with frequency characteristics modified to meet the preferences of the overseas markets. Elliptical loudspeakers for use in car radio receivers were much in evidence.

A versatile new pickup, for standard or long-playing records has been introduced by Goldring. The cartridge (Type 150), which is available separately to manufacturers, is of the needle-armature magnetic type and has an output of 150 mV (at 3.16 cm/sec r.m.s.

lateral groove velocity). Interchangeable sapphire-tipped styli are colour-coded and are provided with a neat housing moulded in conjunction with the tone-arm rest. Tip radii of 0.001, 0.0025, 0.003 and 0.0035 inch are available. The stylus pressure is variable by means of an adjustable counterbalance in the tone arm, from 7 gm for long-playing records to 14 gm for standard 78-r.p.m. records. A coupling unit giving a 1:2 step up of output voltage and providing equalization for the alternative systems of recording is available as an accessory, and provides enough output for the gramophone side of the average table-model radio receiver.

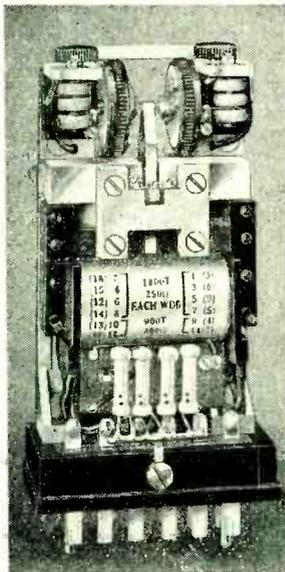
Piezo-electric devices shown by Acos included a new lapel microphone (Mic28), a vibration pickup for industrial applications, (VP3), and an inertia-type pickup cartridge (VP1) designed for attachment to musical instruments. The VP1 is protected by a moulded rubbered case and has an output of the order of 0.1 V with a range of frequency

1

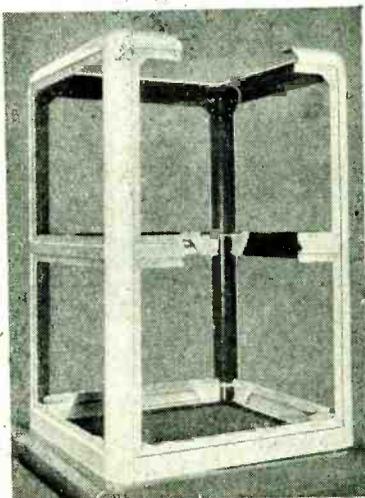


1. Mullard Ferroxcube "iron-circuit" for deflector coils.

3



4



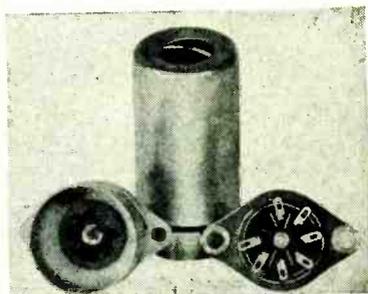
2. Wimbledon heavy-duty vibrator with (right) casing cut away, (left) model for horizontal mounting.

3. Carpenter relay type 3S showing coils and resistors comprising the anti-interference filter.

4. Demonstration Widney-Dorlec pre-fabricated cabinet.

5. Non-microphonic valveholders by McMurdo, shielded on the left and unshielded on the right.

5



response from 30 to 6,000 c/s.

An ingenious adaptation of a standard dialling telephone instrument to the control of tape recording machines in a multi-channel message recorder known as the "Teletape," was demonstrated by Astronic. The system is suitable for the dictation of letters, and the user, by dialling an appropriate number, can erase mistakes without calling on the services of the operator. Channels in use are safeguarded by an "engaged" signal and the system is provided with numerous other devices for fool-proof operation. The same firm also demonstrated a self-contained laboratory instrument (Type A1216) with variable a.f. oscillator, metering and calibrated equalizer circuits for investigating the properties of wire recording media.

Makers: Acos (M, PU); Astronic (MR); Celestion (LS); Ediswan (LS, PU); Elac (LS); Garrard (DR, GM, GU, PU, RC); Goldring (PU); Goodmans (LS); Lectrona (LS); Plessey (LS, GM, GU, RC, PU); R. & A. (LS); Reslosound (LS, M); Rola (LS); Truvox (LS); Vitavox (LS, M).

Abbreviations: DR, disc recorders; GM, gramophone motors; GU, gramophone turntable units; RC, record changers; M, microphones; MR, magnetic recorders; PU, pickups.

MATERIALS

AMONG insulating materials the products of firms specializing in small and intricate ceramic mouldings continue to earn general admiration. Bray have added to their already extensive range some microscopic bushes for electrode assem-

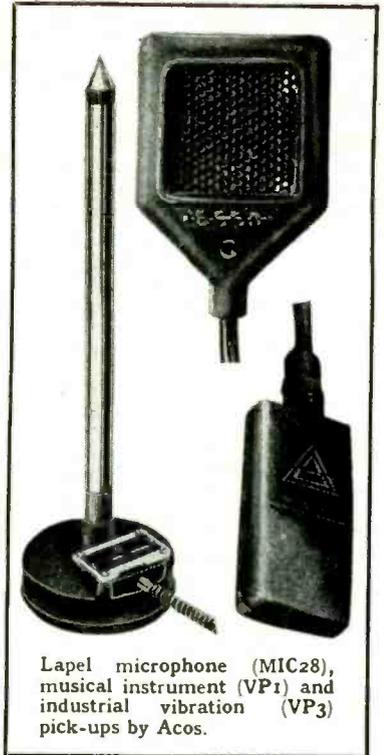
blies in miniature valves and Steatite and Porcelain were showing new multi-point hermetic seals. The latter firm also exhibited examples of precision grinding in ceramic materials.

The wide range of transformer bobbins and other built-up parts in impregnated laminated paper and other insulating materials made a noteworthy exhibit on the stand of H. Clarke & Co. (Atlas).

Ferromagnetic powder materials for use in dust cores now include Mumetal, which was shown by Telcon in 150- and 300-mesh grades. This firm is now producing laminations in HCR alloy for magnetic amplifiers and was also showing "Hysat," an alloy, which, as the name implies, has a very high saturation value and is suitable for polepieces.

A new brazing technique has been developed for the manufacture of composite permanent magnets of soft and active materials, and examples, including magnet assemblies for ribbon microphones, were shown by the Permanent Magnet Association. The method facilitates accurate machining and considerably reduces the cost of production.

Cables can be regarded as one of the basic materials of the radio engineer, and there is no doubt that the industry is well served in this category. Telcon were showing some fine examples of coaxial aerial feeders for high-power transmitters, including a polystyrene disc insulated type in a seamless aluminium



Lapel microphone (MIC28), musical instrument (VP1) and industrial vibration (VP3) pick-ups by Acos.

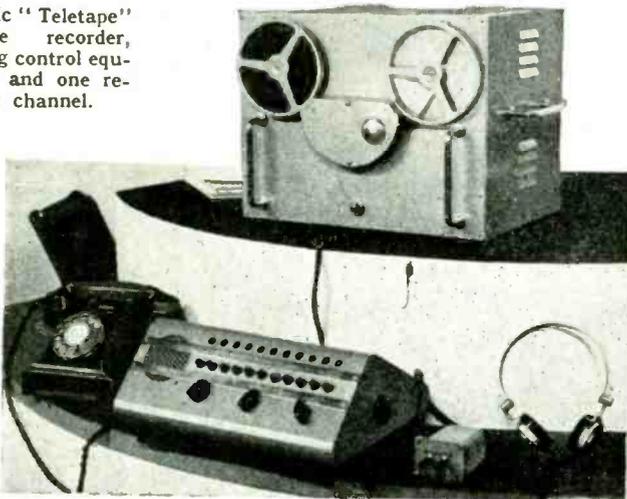
outer conductor, and a helical-membrane cable, employing polythene insulation, which is not subject to the frequency limitations inherent in disc-spaced designs.

The range of television downloads made by B.I. Callender's Cables, which includes low-attenuation types for fringe areas, has been extended and includes a coaxial semi-airspaced type.

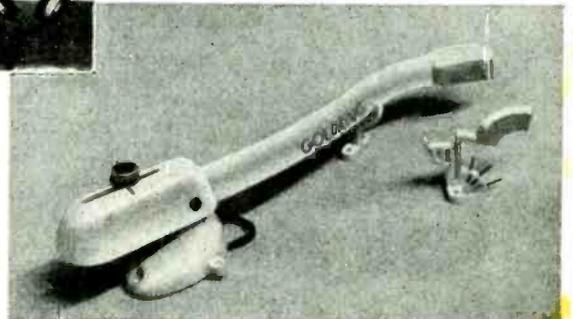
An interesting multi-strand cable with internal water-cooling pipes for coupling r.f. heaters to the work circuit was shown by Reliance.

Once again the arguments in favour of core sections of various shapes were put forward by the makers of resin-cored solders. Du Bois adopt a trefoil section, while Enthoven claim that a six-flue star section accelerates the collapse of the solder and spreading of the flux—an important point in r.f. induction soldering techniques. Multi-core adhere to their original three-

Astronic "Teletape" message recorder, showing control equipment and one recording channel.



Right: Goldring "Three-Way" pickup. Interchangeable styli are housed in the tone-arm rest. Below: Telcon helical-membrane cable.



cored method in which it is claimed that the independent channels greatly reduce the possibility of flux discontinuity at any given point. The new N-type Ersin activated flux has enabled an appreciable reduction to be made in the percentage of flux required, and most Multicore Ersin solders now contain only 2.2 per cent flux. For use in the assembly of sub-miniature components in electronic equipment gauges down to 22 s.w.g.—still with three cores—are available.

Magnetic recording tape is now being manufactured in quantity by the G.E.C. Two grades are available: Type A with the latest high-coercivity mix giving "radio quality" at 7½ in/sec, and Type B for use on Continental equipments based on German designs giving radio quality (6 kc/s) at 15 in/sec and "studio quality" (12 kc/s) at 30 in/sec. The tapes are not interchangeable and must be used with equipment having the required characteristics for each type of coating. Standard reels, with or without aluminium spools, are available in 1,250-ft (7 in dia.) and 1,000-metre (11 in dia.) sizes.

Makers*: Astronic (CF), Associated Technical Manufacturers (C. CO. IS, PVC, W); Atlas (CF, IM, IS); Bray (CE); B.I. Callender's (C. IS, W); Bullers (CE); De La Rue (IM, IS, W); Du Bois (S); Duratube and Wire (C. IS, PVC, W); Ediswan (C); Electrothermal Engineering (CO); Enthoven (S); G.E.C. (MT); Hellermann (IS); Lewcos (IS, W); Long and Hambly (RP); Magnetic and Electrical Alloys (M. L.); McMurdo (CF); Mullard (M.DC); Multicore (S); Murex (M); Mycalex (IM); Permanent Magnet Association (M); Plessey (DC); Reliance (B, C, CO, IS, PVC, RP, W); Ripaults (B, C, CO, IS); Salford Electrical Instruments (DC); Scott (L); Steatite and Porcelain (CB); Suflex (B, C, CO, IS, PVC, W); Symons (IM, V); T.M.C. (DC); Telex (C, CO, IM, M, W); United Insulator (CE).

***Abbreviations:** B, braiding; C, cables; CE, ceramics; CF, coil formers; hobbins; CO, cores; DC, dust cores; IM, insulating materials; IS, insulating sleeving; L, laminations; M, magnets and magnetic alloys; MT, magnetic recording tape; PVC, polyvinyl chloride tapes, wires, etc.; RP, rubber products; S, solder; V, varnished materials; W, covered wires.

LIST OF EXHIBITORS

A.B. Metal Products, Ltd., 107, Fleet Street, London, E.C.4.
AVO (Automatic Coil Winder & Electrical Equipment Co., Ltd.), Winder House, Douglas Street, London, S.W.1.
Acos (Cosnocord, Ltd.), 700, Great Cambridge Road, Enfield, Middx.
Advance Components, Ltd., Back Road, Sherrinall Street, London, E.17.
Antiference, Ltd., 67, Bryanston Street, London, W.1.
Associated Technical Manufacturers, Ltd., Vincent Works, New Islington, Manchester, 4, Lanes.
Astronic (Associated Electronic Engineers, Ltd.), Dalston Gardens, Stanmore, Middx.
Atlas (H. Clarke & Co., Ltd.), Atlas Works, Patricroft, Manchester, Lanes.
B.E.C. (British Electrolytic Condenser Co., Ltd.), 52, Vicarage Lane, Ilford, Essex.
Belling & Lee, Ltd., Cambridge Arterial Road, Enfield, Middx.
Bray, Geo., & Co., Ltd., Leicester Place, Blackman Lane, Leeds, 2, Yorks.
Berco (British Electric Resistance Co., Ltd.), Queensway, Ponders End, Middx.
B.I. Callender's Cables, Ltd., Surrey Pouse, Embankment, London, W.C.2.

Brimar (Standard Telephones & Cables, Ltd.), Connaught House, Aldwych, London, W.C.2.
British Moulded Plastics, Ltd., Avenue Works, Walthamstow Avenue, London, E.4.
Bulgin, A. F. & Co., Ltd., Bye-Pass Road, Barking, Essex.
Bullers, Ltd., 6, Laurence Pountney Hill, Cannon Street, London, E.C.4.

Celestion, Ltd., Ferry Works, Summer Road, Thames Ditton, Surrey.
Cinch (Carr Fastener Co., Ltd.), Brantwood Works, Tariff Road, London, N.17.
Cls (British Mechanical Productions, Ltd.), 21, Bruton Street, London, W.1.
Colvern, Ltd., Mawneys Road, Romford, Essex.
Cydon (Sydney S. Bird & Sons, Ltd.), Cambridge Arterial Road, Enfield, Middx.

Daly (Condensers), Ltd., West Lodge Works, The Green, Ealing, London, W.5.
Dawe Instruments, Ltd., 130, Uxbridge Road, Hanwell, London, W.7.
De La Rue, Thomas, & Co., Ltd., Imperial House, 84/86, Regent Street, London, W.1.
Dubilier Condenser Co. (1925), Ltd., Ducon Works, Victoria Road, North Acton, London, W.3.
Du Bois Co., Ltd., 15, Britannia Street, King's Cross, London, W.C.1.
Duratube and Wire, Ltd., Faggs Road, Feltham, Middx.

Ediswan (Edison Swan Electric Co., Ltd.), 155, Charing Cross Road, London, W.C.2.
Egen Electric, Ltd., Craven Avenue, Canvey Island, Essex.
Elac (Electro Acoustic Industries, Ltd.), Stamford Works, Broad Lane, Tottenham, London, N.15.
Electronic Components, Weedon Road, Industrial Estate, Northampton.
Electrothermal Engineering, Ltd., 270, Neville Road, London, E.7.
Enthoven, H. J., & Sons, Ltd., Enthoven House, 89, Upper Thames Street, London, E.C.4.
Erie Resistor, Ltd., Carlisle Road, The Hyde, Hendon, London, N.W.9.

Ferranti, Ltd., Hollinwood, Lanes.

G.E.C. (General Electric Co., Ltd.), Magnet House, Kingsway, London, W.C.2.
Garrard Engineering and Manufacturing Co., Ltd., Newcastle Street, Swindon, Wilts.
Goldring (Erwin Scharf), 49/51, De Beauvoir Road, London, N.1.
Goodmans Industries, Ltd., Lancelot Road, Wembley, Middx.
Guest, Keen & Nettlefold, Ltd., Box No. 24, Heath Street, Birmingham, 18, Warwicks.

Hellermann Electric, Ltd., Tinsley Lane, Crawley, Sussex.
Hunt, A. H., Ltd., Bendon Valley, Garratt Lane, London, S.W.18.

Igranic Electric Co., Ltd., Elstow Road, Bedford.
Imhof, Alfred, Ltd., 112/6, New Oxford Street, London, W.C.1.

J.B. (Jackson Brothers, Ltd.), Kingsway, Waddon, Surrey.

L.E.M. (London Electrical Manufacturing Co., Ltd.), 459, Fulham Road, London, S.W.6.

Lectrona (Acoustic Products, Ltd.), Stonefield Way, Victoria Road, South Ruislip, Middx.

Lewcos (London Electric Wire Co. & Smiths, Ltd.), 24, Queen Anne's Gate, London, S.W.1.

Long & Hambly, Ltd., Empire Works, Slater Street, High Wycombe, Bucks.

Magnetic & Electrical Alloys, Ltd., 101/103, Baker Street, London, W.1.
Mazda (Edison Swan Electric Co., Ltd.), 155, Charing Cross Road, London, W.C.2.
McMurdo Instrument Co., Ltd., Ashtead, Surrey.

Morganite Resistors, Ltd., Bede Trading Estate, Jarrow, Co. Durham.
Mullard Electronic Products, Ltd., Century House, Shaftesbury Avenue, London, W.C.2.

Multicore Solders, Ltd., Mellier House, Albemarle Street, London, W.1.

Murex, Ltd., Rainham, Essex.
Mycalex Co., Ltd., Ashcroft Road, Cirencester, Glos.

N.S.F. (British N.S.F. Co., Ltd.), Ingrow Bridge Works, Keighley, Yorks.
Painton & Co., Ltd., Kingsthorpe, Northampton.

Parmeko, Ltd., Percy Road, Aylestone Park, Leicester.
Partridge Transformers, Ltd., Roebuck Road, Tolworth, Surbiton, Surrey.
Permanent Magnet Association, 301, Glossop Road, Sheffield, 10.

Plessey Co., Ltd., Vicarage Lane, Ilford, Essex.
Plessey International, Ltd., Vicarage Lane, Ilford, Essex.

Polar (Wingrove & Rogers, Ltd.), Polar Works, Old Swan, Liverpool, Lanes.
Pullin (Measuring Instruments, Ltd.), Electric Works, Winchester Street, London, W.3.

R. & A. (Reproducers and Amplifiers, Ltd.), Frederick Street, Wolverhampton, Staffs.

Reliance Electrical Wire Co., Ltd., Staffa Road, Leyton, London, E.10.
Resolound, Ltd., 359, City Road, London, E.C.1.

Ripaults, Ltd., Southbury Road, Enfield, Middx.

Rola (British Rola, Ltd.), Ferry Works, Summer Road, Thames Ditton, Surrey.

S.R.C. (Stability Radio Components, Ltd.), 14, Norman's Buildings, Central Street, London, E.C.1.

S.T.C. (Standard Telephones & Cables, Ltd.), Connaught House, Aldwych, London, W.C.2.

Salford Electrical Instruments, Ltd., Peel Works, Silk Street, Salford, Lanes.
Scott, Geo. L., & Co., Ltd., Cromwell Road, Ellesmere Port, Cheshire.

Static Condenser Co., Ltd., Tontley Works, Wokingham, Berks.

Steatite & Porcelain Products, Ltd., Stourport-on-Severn, Worcs.

Suflex, Ltd., 35, Baker Street, London, W.1.

Symons, H. D., & Co., Ltd., Park Works, Kingston Hill, Surrey.

T.C.C. (Telegraph Condenser Co., Ltd.), Wales Farm Road, North Acton, London, W.3.

T.M.C. (Telephone Manufacturing Co., Ltd.), Hollingsworth Works, Martell Road, West Dulwich, London, S.E.21.

Taylor Electrical Instruments, Ltd., 419/424, Montrose Avenue, Slough, Bucks.

Taylor, Tunncliffe (Refractories), Ltd., Albion Works, Longton, Stoke-on-Trent, Staffs.

Telex (Telegraph Construction and Maintenance Co., Ltd.), 22, Old Broad Street, London, E.C.2.

Thermo-Plastics, Ltd., Luton Road Works, Dunstable, Beds.

Truvox Engineering Co., Ltd., Truvox House, Exhibition Grounds, Wembley, Middx.

Tucker, Geo., Eyelet Co., Ltd., Walsall Road, Birmingham, 22, Warwicks.

U.I.C. (United Insulator Co., Ltd.), Oakcroft Road, Tolworth, Surbiton, Surrey.

Vartley (Oliver Pell Control, Ltd.), Cambridge Row, Woolwich, London, S.E.18.
Vitavax, Ltd., Westmoreland Road, London, N.W.9.

Walter Instruments, Ltd., Garth Road, Lower Morden, Surrey.

Walter, J. & H., Ltd., Farm Lane, Fulham, London, S.W.6.

Wego Condenser Co., Ltd., Bideford Avenue, Perivale, Greenford, Middx.

Welwyn Electrical Laboratories, Ltd., Bedlington Station, Northumberland.

Westinghouse Brake & Signal Co., Ltd., 82, York Way, King's Cross, London, N.1.

Weston (Sangamo Weston, Ltd.), Enfield, Middx.

Widney (Hallam, Sleigh & Cheston, Ltd.), Widney Works, Bagot Street, Birmingham, 4, Warwicks.

Wimbleton Engineering Co., Ltd., Garth Road, Lower Morden, Surrey.

Woden Transformer Co., Ltd., Moxley Road, Bilston, Staffs.

UNBIASED

By FREE GRID

Telearchic Tuners

RADIO manufacturers expend a lot of time, energy and money in producing new types of receiver intended to incite us to break open the children's money boxes in order to possess them. Some makers tempt us with high sensitivity and the ability to pick up strange sounds from Samarkand. Others pander to our possessive instinct by giving us expensive and expansive cabinets containing not only a combined radioteleceiver (copyright reserved) but also cocktail shakers and other



"The necessary mellow mood"

adjuncts to the Waters of Lethe with which we can impart to our friends and ourselves the necessary mellow mood to appreciate some of the B.B.C.'s uplift programmes.

No manufacturer, however, really gives us the set which, if it were marketed, would sweep the board. I refer, of course, to a set having associated with it a small radio control unit for the adjustment of tuning and volume from our fire-side chair. Please note that I said *radio* control unit. We don't want any more of those units which are linked to the set by an old-world multi-wired cable over which, sooner or later, somebody trips and breaks his neck. The fact that such radio units would be popular is shown by the tremendous number of mains-powered portables that are now marketed for placing beside one's armchair.

These portables naturally fall short of the large set in the matter of quality of reproduction, partly because of the necessarily small and boxed-in loudspeaker and partly because the sound from them is at foot level. Also they possess a mains lead with its neck-breaking potentialities, whereas a radio control unit could be operated by batteries since its use would only be intermittent. The P.M.G. couldn't quarrel with it any more than he did with the r.f.-generating gramophone unit which was once produced

for shooting ether-borne recordings across the room to the wireless set. Any objections, please?

Ex-Cathedra

MR. H. BISHOP, the Chief Engineer of the B.B.C., is a person of no mean achievements in the realm of radio engineering and his views on any matter in this particular branch of applied science are worthy of attention and respect by all. Like many another great man, however, he fails to remember the proverb about the shoemaker and his last; he sets forth on uncharted seas without even a second mate's certificate when he tries to interpret for us the views of the listening public on stereophonic broadcasting in his recent letter to the Editor (April).

With truly episcopal authoritarianism well befitting his name, he tells us that this system of broadcasting would interest only a relatively small number of listeners.

This is to my mind only another way of saying that few people are interested in getting as near to the goal of perfect reproduction as is scientifically possible. How does he know this so definitely? Has he been conducting a private Gallup poll of his own or has he been infringing the law by using one of his crystals for occult divination instead of for its more legitimate purpose of de-wobbling wavelengths.

Mr. Bishop's technical and financial arguments, as well as his people-don't-want-it attitude, remind me strongly of those used in the very early 'twenties by people who were opposed to the introduction of broadcasting. The firm stand which he makes is strangely reminiscent of the stubborn attitude of the Inland Revenue officials in 1752. They joined the ignorant masses with their parrot cry of "Give us back our eleven days," and refused to adopt the New Style Calendar, which, of course, accounts for the tax year still being calculated from Lady Day O.S. or, in other words, April 6th N.S.

Maggie and All That

I WAS very interested in the exhibition held by the Marconi Marine Co. to mark its jubilee. It consisted of a series of ships' wireless cabins, one for each decade since the beginning of the century. Quite frankly, I feel all at sea

where the modern ship's wireless rooms are concerned. I was, however, singularly fortunate in bumping into an ex-wireless operator—they call them radio officers nowadays—who explained these modern maritime mysteries to me.

His chief comment on the whole show was its lack of realism. The exhibition, he complained, just didn't smell like a ship, and—still more unlike reality—one could sit in comfort in any of the operator's chairs without the cabin lurching about all over the place. To my astonishment, he declared this was sometimes the case even in port when coming aboard in a place like B.A.: wherever that may be. Also, so he explained, ship's wireless cabins weren't always so clean and comfortable as those on show, especially after bunkering, when I gathered there was apt to be a layer of coal dust over everything, despite tightly closed ports.

His complaints made little impression on the exhibition officials, however, until in the cabin representing the early 'twenties he suddenly pounced with a whoop of triumph on the aerial tuning inductance of the receiver—a slider instrument looking like a giant reel of cotton standing on end—which,



"To my astonishment"

he explained, had not the necessary hole bored in the top as required by H.M. Customs. The officials hastily summoned a charm-exuding individual obviously learned in the law and steeped in the lore of tactfully wriggling out of awkward situations. I removed my hat in silent tribute to his genius and departed while the going was still good.

RANDOM RADIATIONS

By "DIALLIST"

Television and Co-ax

INFORMATION REACHES ME from one who knows what he is talking about, that, instead of their present 2.4—2.8-Mc/s coverage, the coaxial cables of the future will be able to handle 4.2 Mc/s. The reason is that a cable of this kind can comfortably deal with a 405-line television transmission with one sideband partly suppressed in the most modern way. The G.P.O., though, would not have gone in for wider-band coaxial cables purely for the purpose of improving television. It was found that the bandwidth increase to 4.2 Mc/s has enormous advantages for multi-channel telephony working. As you may know, in multi-channel telephony individual speech channels, each 4 kc/s wide, are combined at the sending end into groups by the first stage of modulation. Subsequent modulation stages twine groups into super-groups and super-groups into a "system." At the receiving end the system is disentangled into super-groups, the super-groups into groups and the groups into individual channels. Present cables can handle 600 speech channels apiece; with 4.2-Mc/s cables the number is increased to over 900.

One to Fetch and One to Carry

What a remarkable thing a coaxial cable is! Those used by the G.P.O. are under one inch in overall diameter. Inside the outer casing are two "tubes",* each consisting of an outer cylindrical conductor which encloses an inner conductor, maintained in an exactly central position by low-loss insulators. One tube (or pair of tubes in a large cable) carries the outward system; the other the inward—the arrangement brings to mind the White King's two messengers in "Through the Looking Glass": one to fetch and one to carry! Each cable contains also two ordinary pairs used for control purposes. Did you know that the 50-c/s a.c. for the repeater power packs was also carried by the cable, without any additional wires? A kind of push-pull arrangement is used, with the inner conductors of tubes acting as

* Large cables have four tubes.

phase leads and the outers as neutrals.

Good Show

THIS YEAR'S R.E.C.M.F. exhibition was even more interesting than the last—and that is saying a lot. The exhibits included not only the components of which radio sets and other electronic appliances are made up, but also the things of which the components are made—wires, solders, insulators, magnetic materials, and so on. It's a pity in some ways that it has to be a private exhibition, with admission by invitation only, but business is business.

Radio Slimming

As an old hand, what interested me most was to observe the quite amazing reduction that time has brought in the sizes of radio components of every kind. Memory went back to my first three-valve receiver, built somewhere about thirty years ago. In this the grid of the r.f. valve received its input from the aerial by means of a device known as the loose-coupler. This consisted of an outer solenoid about five inches in diameter and twelve inches long with an inner coil, some four inches by six, which could be moved inwards or outwards along quarter-inch round brass guide-rods. The two 0.0005 μ F tuning capacitors (not ganged) were each about as large as small saucepans. The three "R" valves had much the same dimensions as the 25-watt glow lamp of to-day. The a.f. transformer weighed something like three pounds. With its batteries the set (hailed in its day as the acme of compactness) was fitted on the two tiers of a dumb-waiter, which made the receiver transportable. To-day tuning coils, capacitors and transformers have become small, light things. The miniature glass-based valve is rapidly ousting the larger types, and a very efficient little valve it is. A battery set, for instance, containing four miniatures (including a power valve) requires a total of only 250 mA at 1.4 V from the l.t. source.

Soldering Economy

As an enthusiastic solderer one of

the first stands I visit at the R.E.C.M.F. show and Radiolympia is that of the Multicore people. This time they'd no novelty so spectacular as the Arax core-flux of last year; but they were showing over 300 types of cored solder wire, each designed with some particular job in view. For example, it wouldn't perhaps strike everyone that the increasing use of miniature components means that smaller "blobs" of solder are needed to make the required joints. It struck the Multicore people, who were quick to realize that in the circumstances sound joints could be made with solder wire of considerably smaller gauge.

A Conductivity Problem

IT IS RELATED, this time on completely unreliable authority, that there was in America a hot-tempered bus conductor who became so annoyed with one of his passengers that he pushed him off the rear platform of the bus onto the road. The unfortunate passenger was killed and the conductor was convicted of murder and sentenced to the electric chair. As he took his seat he was asked whether he had any last request to make. "Why yes," he said, "I'd like a banana." This having been provided and consumed, the final adjustments were made and then the switch was closed. At the end of a full two minutes he was completely unaffected. All efforts to carry out the sentence having proved vain, he was informed that he was a free man. He soon obtained a job with another bus company; but the ejection of a passenger whilst the bus was travelling at speed resulted in a broken neck for his victim and a second murder charge against himself. Again he was brought to the chair. Again he asked for a banana. Again the closing of the switch was ineffective. Again he was set free. "It seems," they said to him, "that those bananas somehow render you immune. Our research department is baffled; would you tell us the secret?" "See here," said he, "I've a kind of passion for bananas; but they don't signify. Surely you've read about a bad conductor? Well, that's me! Yes, Sir."

LETTERS TO THE EDITOR

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

British and American Television

IN your issue of April, 1956, it is stated in the column "Random Radiations" that "the B.B.C.'s technique is immeasurably superior to that behind the bulk of U.S.A. television transmissions" (my italics). Such a sweeping statement would appear to require some qualification, if your contributor is not to lay himself open to criticism of the same kind as that which he makes elsewhere.

Perhaps "Diallist" would tell us in what particular respects the techniques of transmission used in the U.S.A. are so immeasurably inferior to those used in Great Britain? The quality of the received picture in this country has nearly always compared favourably with that to be seen in Britain as I remember it, and I have no reason to believe that my perceptive qualities are inferior to those of the "average viewer" in either country. Neither do I recall any occasion on which the non-linearity has been sufficiently bad to send me running to the telephone. In fact, the quality of picture from a good studio transmission looks slightly superior to the British equivalent. The American system appears to have a slight but definite advantage in immunity from impulsive interference.

There is obvious justification for past complaints that American authors have failed to acknowledge British work, although this has been attributed in some cases to the difference in speeds with which the two countries released information for publication after the war. But during an extended stay in the U.S.A. I have met many, both inside and outside the engineering profession, who have shown interest in and awareness of work done outside this country, and I do not believe that the attitude of which "Diallist" complains is typical.

D. R. A. MELLIS.

Passaic, New Jersey.
U.S.A.

Pre-amplifier Circuit

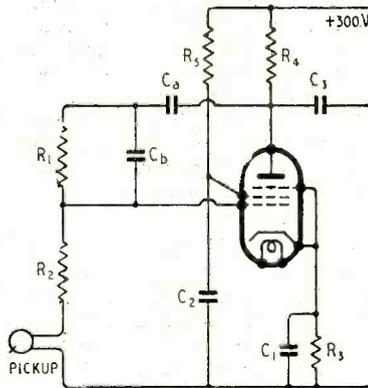
AFTER reading the article by D. T. N. Williamson on the design of a pre-amplifier in your November issue, I should like to make the following comments:—

Many pickups in use to-day are designed for direct connection to grid and earth without a coupling transformer, and I suggest the following circuit as an alternative

since it permits one side of the pickup to be earthed.

It is not new, but has not been given the attention it deserves.

If the circuit constants are chosen to give a middle frequency gain of about three, and no capacity is placed in series with the lower arm of the "see-saw," then a nice "very-low-frequency" roll-off is



Pre-amplifier circuit for high-impedance pickups. Suitable values, using an EF37 valve are: $R_1=1\text{ M}\Omega$, $R_2=0.33\text{ M}\Omega$, $R_3=3.3\text{ k}\Omega$, $R_4=0.22\text{ M}\Omega$, $R_5=0.39\text{ M}\Omega$, $C_1=25\text{ }\mu\text{F}$ electrolytic, $C_2=0.25\text{ }\mu\text{F}$, $C_3=0.1\text{ }\mu\text{F}$, C_a & C_b , see text. The pickup must provide a path to complete the grid circuit.

achieved, which is adequate for normal requirements.

Bass correction is controlled by C_a and "top cut" by C_b ; these approximately are 600 pF and 25 pF respectively, but I advise the use of "trimmer" capacitors and these adjusted to give correct response when playing a frequency record. Worthy of mention is the importance of correct record speed; I have seen frequency runs taken without even a glance at a stroboscope.

Any further gain can be obtained from another anode-follower after this stage, adjusted to give the required level.

H. G. WARREN.

Luton, Beds.

Pickup Design

IN your report in the April issue on H. J. Leak's lecture-demonstration before the B.S.R.A., I see it stated that Mr. Leak expressed his preference for a multi-turn moving-coil pickup rather than a single-turn ribbon, on the grounds that the latter was, he thought, liable to hum pick-up. I contend

that hum pick-up is not influenced by number of turns on the coil.

If we take, for example, a single turn of coil having an impedance of 1 ohm and cut it spirally to produce 10 turns, we find that both the "signal" voltage output and induced hum voltage increase $\times 10$ across an impedance of 10^2 ohms, and therefore for a given output load the output voltage and signal/hum ratio are unaltered. If, on the other hand, we add nine more turns equal in size to the original, we shall get $\times 10$ the output voltage into $\times 10$ the impedance or $\times \sqrt{10}$ the voltage into a given output load, whereas the voltage due to stray magnetic fields will have increased by only a small amount depending on the coil dimensions.

All other things being equal, the signal/hum ratio varies in the proportion of rather less than $\sqrt{\text{change in coil mass}}$. Furthermore, since for a given coil and magnet system the signal output varies in direct proportion to coil velocity, the signal/hum ratio varies directly with coil velocity.

Since both coil mass and coil velocity are reflected as point impedance, we see, first, that the signal/hum ratio can be improved solely at the expense of increased point impedance, and, secondly, that if we are considering only this aspect of design, there is an optimum proportion for the location of the moving conductor and the point, relative to their common fulcrum.

I would point out—in case it is not immediately self-evident—that since the signal/hum ratio is to some degree proportional to point impedance for a given set of external circumstances, then the ribbon design, utilizing the principle that the moving conductor is either self-supporting or substantially so, will obviously have, for a given performance, a better signal/hum ratio than a moving coil, since the "waste" mass of the supporting coil former can be transferred to the effective working mass of the moving conductor.

J. H. BRIERLEY.

Liverpool.

IN his lecture-demonstration before the British Sound Recording Association on February 24th (reported in your April issue), H. J. Leak, in discussing gramophone pickups, commented that "tungsten carbide styli were also open to the objection that the surface often showed pitting as a result of imperfections in the sintering process by which they were formed."

As manufacturers of cemented tungsten carbide, we feel that Mr. Leak must have been unfortunate in his choice of carbide needles for test. We should, of course, be the first to agree that it does at times happen that imperfections in the

sintering process, or for that matter other processes appertaining to powder metal production, may cause a slight porosity. We maintain, however, that such surface porosity can be detected when the needle is being polished, and faulty material can be rejected at this stage. We would also point out that incorrect polishing technique can be the cause of an uneven and pitted surface even when the hard metal as such is perfect.

We have recently studied the methods of grinding and polishing these needles, in the light of our experience in the finishing of carbide dies, and have established a small production unit for this purpose in our carbide die shop. Needles made under these conditions have given very favourable results on performance tests.

For Murex, Limited.
B. E. BERRY.

Rainham, Essex.

Physical Society Electronics

TO the conscientious technician in search of knowledge, a visit to the Physical Society's Exhibition represents a day of exhaustion, both mental and physical. Not only does he have to expend a large part of his energies in tramping the labyrinthine corridors and stairs of the Imperial College to find what he wants, but he is then faced with the task that somebody should have done for him, of sorting the wheat from the chaff.

The blame rests partly with the organizers and partly with the exhibitors. One condition applied to the exhibitors, I believe, is that they shall have something new to show, but this does not prevent them from bringing along a mass of their standard products which are already well known. The result is congestion, and many of the new and interesting items are crowded into dark corners and corridors where they are least likely to be seen. If the exhibitors showed more restraint and the organizers more discrimination in selecting the exhibits, this would not happen. Why, for instance, cannot components and test gear be left to the R.E.C.M.F. exhibition?

Electronics being largely "a lot of uninteresting tin boxes with knobs on," as one visitor put it this year, I feel that exhibitors should be at more pains to show the insides of their "tin boxes" (dare they?) and arrange more practical demonstrations for the benefit of the non-specialist in their particular art. I am aware that the exhibition is not intended to be a fun-fair, but visible, tangible and moving things are as readily appreciated by the super-intelligent as by the infantile. Science is not degraded by being made more attractive.

"RADIOPHARE."

WIRELESS WORLD, JUNE 1950

More than a SWITCH— a SERVICE!



List No. S404



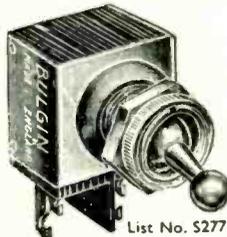
List No. S478



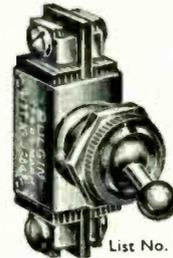
List No. S258 P.D.



List No. S365



List No. S277



List No. S264

The experience of 25 years behind every switch!

Famous 2-pole M.-B. long bush Toggle Switch. This model is suitable for 6-250V. circuits; max. 1A., for all panels up to 9/16in. thick. List No. S.404.

Pear dolly for easy operation; for circuits as above. All BULGIN switches are obtainable with a wide variety of dollies, fixing nuts, bushing rings and finishes, on request. List No. S.258 P.D.

Double-pole general purpose M.-B. for similar circuits at 3A. max. Silver plated roller-action contacts. List No. S.277.

New version of long-popular single-pole M.-B. model, for 6-250V., 3A. circuits. Note the insulated front ring, available on all switches at request. List No. S.478.

Press ON; biased OFF. A popular model for 6-250V. circuits; max. 3A. List No. S.365. (Reversed action; List No. S.366).

Change-Over switch, single-pole. New version with terminals, for 6-250V. circuits; max. 2A. Guaranteed—as all BULGIN switches—for at least 25,000 operations! List No. S.264.



ILLUSTRATED
COMPONENT
CATALOGUE

Price 1/-
Post Free

"The
Choice
of
Critics"



A. F. BULGIN & CO., LTD.
BYE PASS ROAD, BARKING, ESSEX
Telephone: RlPpleway 3474-8

Manufacturers' Products

New Equipment and Accessories for Radio and Electronics

Television Accessories

TO combat the sporadic impulse type of interference on their television receivers, G.E.C., of Magnet House, Kingsway, W.C.2, have introduced two picture interference inverters, BT150 and BT151. These reverse the phase of the incoming impulses, so that black spots appear on the screen instead of the usual white ones and the beam does not suffer defocusing. The units, which derive their power supplies from the receiver and are designed to mount on the existing chassis, cost £2 5s each.

For use in areas of low signal strength, G.E.C. have also produced a television pre-amplifier. Model BT 161/L for London transmissions has a gain of five over a bandwidth of 6 Mc/s, whilst model BT 161/M has a gain of twelve over a bandwidth of 4 Mc/s; both obtain their power supplies from the main receiver and are priced at £2 5s. Where fading is prevalent, a remote armchair gain control can be added for an extra £1 10s.

In addition, the firm has an H-type dipole aerial and reflector with provision for altering the polar diagram, at £3 10s; a demonstration aerial for dealers at the trade price of £15 12s; 10-ft and 6-ft aerial masts in light alloy, a chimney mounting, and a wall mounting.

Television Knobs

A RANGE of moulded knobs with special television engravings has been introduced by A. F. Bulgin and Co., Bye Pass Road, Barking, Essex. They are 1½ in diameter, have flat faces, straight sides and knurled edges to ensure a firm grip for precise adjustments. They fit ¼-in spindles and have 4BA



Specimens of the new Bulgin knobs with television engravings.

Type 155 cable eccentricity gauge, made by the Addison Electric Co., showing gauge head, control and oscillator units.



steel grub screws threaded into brass insets with the heads of the screws sunk deep into the body of the knob for protection against high voltages.

Five engravings have been selected; they are: brightness, contrast, focus, switch and volume, the lettering being carried out in gold on a brown background. Black knobs are also available. The price is 1s 6d each for either colour.

Television Converters

NON-TECHNICAL viewers who wish to adapt their London television receivers for reception of Sutton Coldfield with the least possible trouble will be interested in two new converters now on the market. These are both self-contained units for insertion between the aerial and the aerial socket of the receiver, and have their own power supplies.

Model AC/4, by Spencer-West, of Quay Works, Great Yarmouth, has five valves, enables either of the two stations to be selected, and costs £15 15s. Model S.C. "88," by Sphere Radio, of Heath Lane, West Bromwich, has one 6A8GT valve and costs £6 6s. Both are fitted with coaxial input and output connections.

Cable Eccentricity Gauge

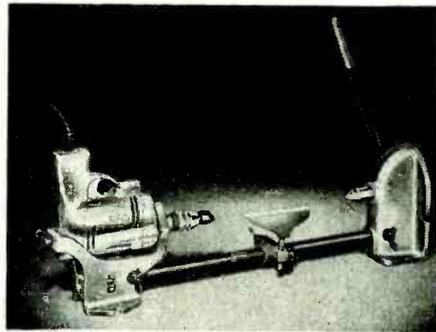
DESIGNED for the non-destructive determination and control of the eccentricity of extruded cables and wires, this instrument (Type 155) made by the Addison Electric Company, 163 Holland Park Avenue, London, W.11, gives a direct reading of eccentricity over a minimum range of -0.5 to +0.5

mm. An internal polarized relay can be set to operate an indicator alarm, or automatic die re-setting mechanism, when the eccentricity exceeds ± 0.1 mm.

The principle of operation is the exploration of the field produced by current in the central conductor, supplied from a local oscillator. Pairs of coils arranged on X and Y axes at right angles are selected alternately by a switch and their voltages are applied to a differential amplifier and calibrated output meter.

Multi-Purpose Electric Tool

MAINLY for the benefit of amateurs, Wolf Electric Tools, Ltd., have produced an inexpensive



Amateur's lathe assembled from a "Wolf Cub" kit.

and versatile tool which can be adapted for drilling, turning, sawing, grinding and polishing. The basic unit is a "Wolf Cub" electric drill, costing £4 10s 6d, which can be incorporated as the driving unit in a number of different kits. For instance, one kit will convert the hand drill into a bench drill, and this, when laid flat on the bench, becomes the lathe illustrated, for an additional sum of 13s 6d. The electric drill can be seen clamped upside down, whilst the long handle used for raising the drilling platform here becomes a means of moving the back centre of the lathe. Alternatively, the bench drill can be converted into a circular-saw kit for an extra £2 8s 6d.

There are, in fact, many ways in which the amateur can ring the changes on these kits, and he is not obliged to buy them in any particular order. If all the available items are purchased, the total cost is in the region of £11. The firm is at Pioneer Works, Hanger Lane, London, W.5.

A particularly useful Instrument

for

TELEVISION WORK...

A Signal Generator of wide range and accuracy of performance, designed for use in the laboratory or by the service engineer. Turret coil switching provides six frequency bands covering 50 Kc/s to 80 Mc/s:—

50 Kc/s—150 Kc/s	1.5 Mc/s—5.5 Mc/s
150 Kc/s—500 Kc/s	5.5 Mc/s—20 Mc/s
500 Kc/s—1.5 Mc/s	20 Mc/s—80 Mc/s

Note these Attractive Features:

Stray field less than $1\mu\text{V}$ per metre at a distance of 1 metre from instrument. General level of harmonic content of order of 1 per cent.

Direct calibration upon fundamental frequencies throughout range, accuracy being better than 1 per cent. of scale reading.

45in. of directly calibrated frequency scales with unique illuminated band selection giving particularly good discrimination when tuning television "staggered" circuits.

Of pleasing external appearance with robust internal mechanical construction using cast aluminium screening, careful attention having been devoted to layout of components with subsidiary screening to reduce the minimum signal negligible level even at 80 Mc/s.

Four continuously attenuated ranges using well designed double attenuator system.

Force output 0.5 volts.

Internal modulation at 400 c/s., modulation depth 30 per cent., with variable L.F. signal available for external use.

Mains input 100-130 V. and 200-260 V., 50-60 c/s. A.C.

Battery Model available having same general specification and covering 50 Kc/s—70 Mc/s., powered by easily obtainable batteries.

Fully descriptive pamphlet available on application



Mains Model

£25

Battery Model

£24

Sole Proprietors and Manufacturers:

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

SG. 1

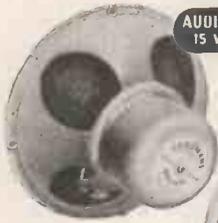


GOODMANS

AUDIOM Loudspeakers

REGISTERED TRADE MARK

The unrivalled series of medium and heavy duty P.M. reproducers.



AUDIOM 60
15 WATT

£6.15
LIST



AUDIOM 70
20 WATT

£11.
LIST



AUDIOM 80
25 WATT

£18.10.
LIST



AUDIOM 90
50 WATT

£25.
LIST



Heavy duty
multi-ratio
transformer
Model MR/T4



AL/5 CABINET LOUDSPEAKER

Incorporating
Goodmans 12" Audiom 60.
Finish natural polished
seasoned mahogany.
Size : 17" x 17" x 8 1/2".
List Price : £11 5s.

Connection : two-way moulded plug and socket.
Available with transformer, £2. 10s. extra.

GOODMANS INDUSTRIES LIMITED

Lancelot Road, Wembley, Middlesex. Telephone : Wembley 1200 (8 lines). Telegrams : Goodaxiom, Wembley

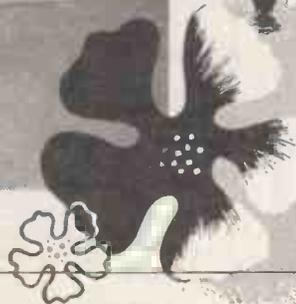
YOU CAN MAGNETICALLY RECORD using your Gramophone Motor as a Drive



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

Also Constructional Data for Wire and Tape Recorders 5s.

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



WILCOX ... FIRST CHOICE of HAWAIIAN AIRLINES

VHF AIR-BORNE COMMUNICATIONS

Hawaiian Airlines selected the WILCOX TYPE 361A COMMUNICATIONS SYSTEM for all aircraft. This consists of a 50 watt transmitter, a high sensitivity receiver, and a compact power supply, each contained in a separate 1/2 ATR chassis. Transmitter and receiver contain frequency selector with provisions for 70 channels . . . ample for both present and future needs.

VHF GROUND STATION PACKAGED RADIO

Hawaiian Airlines selected the WILCOX TYPE 428A FACTORY PACKAGED STATION for all ground stations. This consists of the WILCOX 406A fixed frequency 50 watt transmitter, WILCOX 305A fixed frequency receiver, WILCOX 407A power supply, WILCOX 614A VHF antenna, telephone handset, loudspeaker, desk front, typewriter well, and message rack.

DEPENDABLE COMMUNICATIONS FOR THE WORLD'S AIRLINES

During recent months, many of the world's foremost airlines, UNITED, EASTERN, TWA, MID-CONTINENT, BRANIFF, PIONEER, ROBINSON, and WISCONSIN CENTRAL have placed volume orders for similar communications equipment. No greater compliment could be paid to the performance, dependability, and economy of WILCOX equipment than to be "FIRST CHOICE" of this distinguished group.

Write Today for complete information on the Type 361A VHF Air-borne Communications System and the Type 428 Packaged VHF Ground Station.

WILCOX ELECTRIC COMPANY

KANSAS CITY 1,



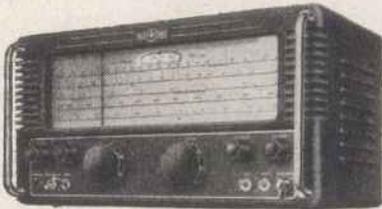
MISSOURI, U.S.A.

Webb's RADIO

PRECISION WORKMANSHIP

plus

**HIGH PERFORMANCE OF
DOUBLE SUPERHETERODYNE CIRCUIT**



EDDYSTONE '750'

COMMUNICATIONS RECEIVER

with four wavebands covering 32 Mc/s to 480 Kc/s continuous except for a small gap around 1,600 Kc/s. Eleven valves, majority of miniature types. Separate oscillator, supplied with stabilised H.T. Independent R.F., I.F. and A.F. gain controls. Linear frequency scales, directly calibrated. Mechanical bandspread, with high reduction ratio geared tuning mechanism.

Price £45 0s. 0d.

Ask Webb's for full specification.

COME TO WEBB'S FOR COMPARATIVE DEMONSTRATIONS OF HIGH FIDELITY REPRODUCERS

Hear such outstanding apparatus as:—

Mordaunt "Duplex" Reproducer, a loudspeaker unequalled for realism Price 98 guineas

Wharfedale "Corner Assembly," gives excellent balance of bass and treble Price complete £52 5 0
(also available as separate items, including concrete non-resonant corner baffle, £3.)

Leak "Point One" Amplifier, which cannot be faulted on workmanship or electrical specification Price £32 10 0

Cosmocord "GP 20" Pick-up, a really good high fidelity pick-up at a reasonable price... .. £3 11 5

Leak "Dynamic" Pick-up, must be heard before your final critical choice Price £14 10 8

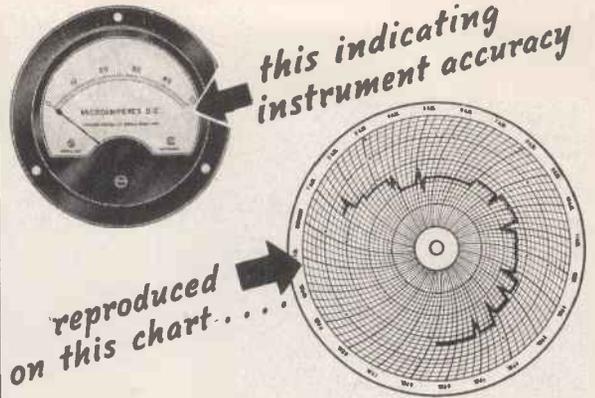
"Ventex" Loudspeaker Cabinets, the answer to the cabinet problem. Available in a variety of beautifully finished woods and designed on scientific lines for use with high fidelity units Price 14 guineas

Also Speakers by BARKER, WHARFEDALE, ROLA, B.T.H. etc. Amplifiers by CHARLES, SOUND SALES, ACOUSTICAL, etc. Pick-ups by DECCA, WILKINS and WRIGHT, CONNOISSEUR, etc.

**WEBB'S NEW COMPREHENSIVE CATALOGUE NOW
READY, 9d. TO CALLERS, OR 10d. POST FREE.**

Webb's Radio, 14, Soho St., Oxford St., London, W.1.

Phone : GERrard 2089. Shop Hours : 9 a.m.—5.30 p.m. Sats 9 a.m.—1 p.m.



this indicating instrument accuracy

reproduced on this chart...

by the

Fielden

Servograph

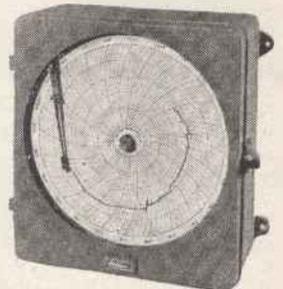
SERVOGRAPH OPERATES DIRECTLY FROM VERY LIGHT CURRENT SOURCES, consuming but a few Micro-watts for full scale deflection. Its working principle is unique and sets up a new high standard of accuracy and robustness for graphical recording meters. SERVOGRAPH's accuracy is to BSS.89 for Grade 1 Indicating Instruments—because its servo-driven pen arm removes all load from the instrument movement, admits a robust and trouble-free pen, and maintains this accuracy with full or empty ink reservoir. Needing no levelling, it operates correctly in any position and can be connected directly to tachometers, thermo-couples, resistance thermometers, CO₂ indicators, pH meters and so on, repeating their accuracy on the chart. Equally useful, too, as an ammeter, voltmeter, etc., it may embody a moving iron, moving coil, dynamometer or electrostatic movement.

Please write for technical leaflets 100/M.

Movements available from 50 micro-amps. or 15 millivolts upwards.

Prices (British Isles) from

£65



FIELDEN (ELECTRONICS) LTD.

PASTON ROAD : WYTHENSHAW : MANCHESTER
FIELDEN ELECTRONICS (AUSTRALIA) PTY. LTD.
409 COLLINS STREET : MELBOURNE : AUSTRALIA
Specialists in Industrial Electronic Equipment

Where excellent quality reproduction is essential . .

. . the Metrovick

AUDIO AMPLIFIER

is the instrument to use

This instrument is designed to give excellent quality reproduction with the added advantages of being a self-contained unit, portable and attractive in appearance. Thus it will prove ideal for Public Address work, educational authorities and similar organisations.

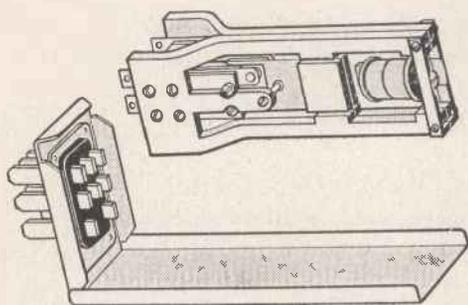
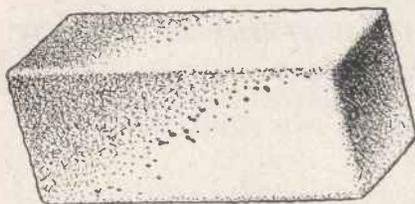
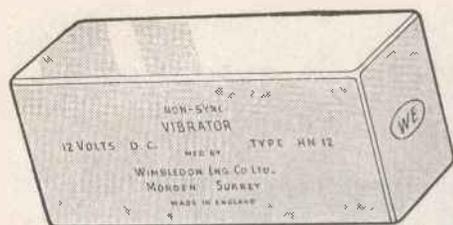
SPECIFICATION

- Supply :** 200/250V 50 c/s single-phase ; consumption approximately 170 VA for full output.
- Input :** Gramophone 0.2V for full output. Microphone 0.02V for full output. The two circuits can be mixed as required.
- Impedance :** 7 ohms, 15 ohms and 45 ohms.
- Output :** 20 watts with negligible distortion.
- Tone Control :** Continuously variable.
- Response :** ± 1 db from 30 to 15000 c/s at zero position of tone control.
- Controls :** These are recessed to avoid damage and are illuminated when in operation.
- Dimensions :** $18\frac{1}{2}'' \times 8\frac{1}{2}'' \times 10\frac{1}{4}''$.
- Finish :** The instrument is housed in an attractive steel case, stove enamelled in cream or blue as desired. A leather carrying handle is fitted.



METROPOLITAN-VICKERS ELECTRICAL CO. LTD.

TRAFFORD PARK, MANCHESTER 17



NEW! Heavy Duty VIBRATOR



Introducing, after a lengthy period of research, a "big brother" to the popular standard WIMBLETON Vibrators. It has all their desirable qualities, but is produced specially for heavy work. Note these advantages.—

1. Carefully designed and tested.
2. Made throughout from selected high grade materials.
3. Will give satisfactory service over a long period.
4. Reliable in operation under rated conditions of use.

Available in both SYNCHRONOUS and NON-SYNCHRONOUS Types; POWER UNITS to suit.

Write for illustrated leaflet to

WIMBLETON

ENGINEERING COMPANY LIMITED

GARTH ROAD · LOWER MORDEN · SURREY · TEL.: DERWENT 4814-5010

CRC 4



18 TOTTENHAM COURT ROAD, LONDON, W.1

Tel: MUSEum 2453

Shop hours: Monday-Friday 9—5.30.

Tel: MUSEum 4539

Saturday 9—1

FULL MAIL ORDER FACILITIES Please add postage

"VIEWMASTER" (post free)

Complete booklet on "Viewmaster" including constructional details and blueprints 5/-.

Complete set of T. C. C. Condensers as specified, 28/15/0.

Complete set of Whitley components including L/S, 28/5/0.

Complete set of Plessey components as specified, 25/12/6.

Complete set of Westinghouse components as specified, 23/2/6.

Complete set of Wearite coils and choke as specified, 21/2/0.

Complete set of Morganite fixed resistors as specified, 21/6/9.

Complete set of Carbon Potentiometers type Q as specified, 9/-.

Complete set of Bulgin components as specified, 12/6.

Complete set of Belling & Lee components including fuses, 8/6.

G.E.C. Neon Lamp type G, 2/6.

9in. Cathode Ray Tube Mullard MW22/14C, Mazda CRM92, or G.E.C. 6504 (carton extra), 211/6/10.

Mullard EF50, 21/4.

Mazda 6K25, 12/10.

Mullard EB91, 12/10.

Mazda 6P28, 21/4.

Mullard EBC33, 11/7.

Osram KT61, 12/10.

Mullard EL33, 12/10.

QUALITY COMPONENTS A.D.S. QUALITY AMPLIFIER

Full constructional details of our 4½ watt inexpensive quality amplifier are now available including circuit diagram layout pictures. Post free, 10d.

Complete set of components for above amplifier including drilled chassis, cabinet knobs, etc. Carriage free, 27/0/0.

Complete amplifier constructed and tested. Carriage free, 29/9/0.

LOUDSPEAKERS

Wharfedale super 8 C/8 speech coil impedance 2/3 ohms or 12/15 ohms. Suitable for refined quality up to 4 watts (post 1/3), 24.

Wharfedale Golden Unit. Peak input 8 watts, cone dia. 10in. The most popular of the better quality reproducers (post 1/6), 24.

As above with cloth surround post 1/6), 24/10/0.

Wharfedale W10/CS. The well known 10in. Speaker with the cloth suspension. Power handling capacity 5/8 watts dependent on mounting (post 1/6), 27/5/0.

Goodmans 12in. 15 watt P.M. dust proof speaker. Ideal for small halls, etc. (carriage 2/6), 28/15/0.

Goodmans Axiom 12, 12in. Twin cone high fidelity speaker (carriage 2/6), 28/8/0.

Goodmans Axiom 22. The latest 20 watt High Fidelity 12in. Loudspeaker (carriage 2/6), 212/13/0.

PICKUPS

Connoisseur Pick-up, a high impedance pick-up giving approx. .5 volts at the secondary of the special coupling transformer. Level frequency response from 50 to 1,000 cps. Below 50 cps. a rising frequency response gives a bass resonance near 25 cps. Above 1,000 cps. the output falls steadily giving a loss of approx. 5 db at 8,500 cps. and 9 db at 12,000 cps. Price complete with transformer incl. P.T., 24/10/5.

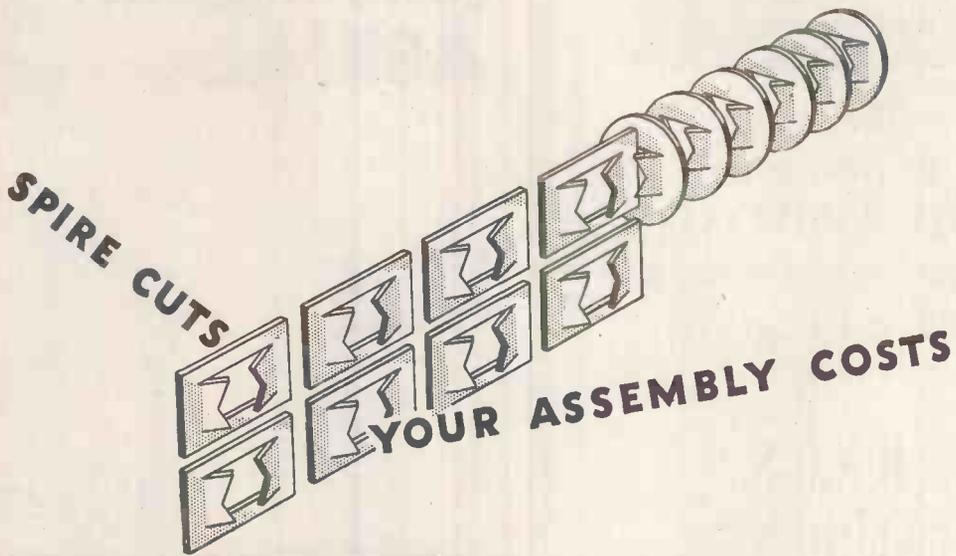
Wilkins & Wrig: Pick-up. A light weight moving coil pick-up with an overall response of 5 cps to 15,000 cps flat within 3 db from 30 cps to 9,000 cps. Collimpedance 5 ohms. Output impedance from special transformer 100,000 ohms. Approx. needle pressure ¼ oz. adjustable within ¼ oz. to 1 oz. Price complete with transformer, 27/10/7.

NEEDLES (all prices include P.T.)

Connoisseur miniature needles 20 per pkt., 2/10.

Columbia Chrome (normal size), 10 per pkt., 1/9.

Columbia 9½ Miniature needles, 10 per pkt., 3/7.



PROBLEM:

Secure top of talc container so that it can be rotated under spring tension for alignment of sifter holes.

SOLUTION:

Type SFW Spire fix inside container is pressed over integrally moulded stud. Top rotates under spring tension and is permanently secured.

THAT'S FIXED THAT - FASTER, CHEAPER

It just shows how Spire, in one simple operation, can solve what threatens to be an assembly headache. Very few awkward locations or blind assemblies present much of a problem to Spire these days. And once a Spire is on it stays put—the unique double-spring action sees to that. We'd like to know if you think Spire, the fastest thing in fasteners, can help you—will you write to us?

Spire
Regd.

SPEED NUTS

Enquiries to:—

SIMMONDS AEROCESSORIES LTD. BYRON HOUSE, 7-8-9 ST. JAMES'S ST., LONDON, S.W.1

HEAD OFFICE AND WORKS: TREForest, GLAMORGAN

Also BIRMINGHAM · STOCKHOLM · MELBOURNE

THE
**BRITISH NATIONAL
 RADIO SCHOOL**
 ESTD. 1940

This month
 we celebrate our
TENTH ANNIVERSARY
 and confess to a feeling of
 pride in the fact that

NO
B.N.R.S.
STUDENT
HAS EVER FAILED

to pass his examination
 after completing our appropriate
Study Course.

Whether this constitutes a record
 we do not know, but it is true and that
 is what matters.

●
Our Syllabus includes:

A.M.I.E.E. (in approved cases), Brit. I.R.E.,
 City and Guilds, P.M.G. (Theory only),
 Maths, Examination Courses, also what
 we sincerely believe to be the best
 RADAR Course ever written. TELE-
 VISION ready soon.

●
 We specialise in the **INDIVIDUAL
 COACHING** of aspirants to the more
 responsible positions in the Telecommu-
 nications and Electronic Engineering
 professions.

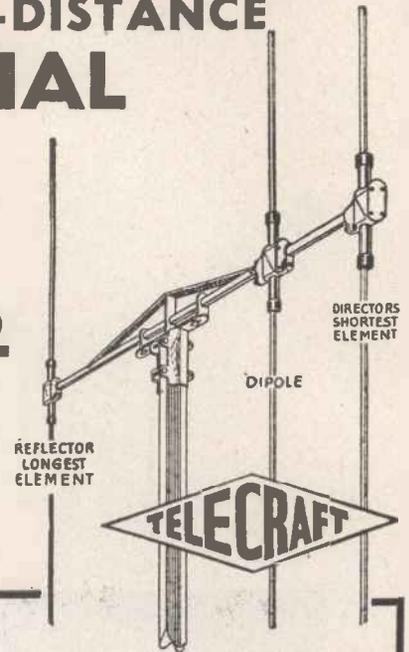
●
 Arrangements can be made for most
 examinations to be taken anywhere
 aboard ship or the furthestmost outpost.

Write for full particulars to:

STUDIES DIRECTOR
BRITISH NATIONAL RADIO SCHOOL
66, ADDISCOMBE ROAD, CROYDON
 Phone: Addiscombe 3341

THE LONG-DISTANCE AERIAL

TYPE FA22



Specially designed for long-distance reception. In actual tests greater signal strength has been received than from any standard aerial, due to the fact that the FA22 is an engineered array which can be safely erected in the most exposed positions and has many other unique features. The special TELECRAFT pole-mounting device gives perfect balance, together with easy rigid fixing at almost any point. All connections guaranteed waterproof. Mast clamp is adjustable to fit any mast $1\frac{1}{2}$ "-3" diameter. No extra struts are necessary as the unit provides its own 'Cantilever' supports.

AERIAL COMPLETE
 less Mast & Lashings - - - **£5 . 12 . 6**

LONDON AND MIDLAND FREQUENCY

L8 Lashings for 2" Mast 30/- per pair.

Dealers Report GOOD RECEPTION
from these areas with this Aerial

LEEDS	SWINDON	HASTINGS
BURNLEY	IPSWICH	WORTHING
LIVERPOOL	MONMOUTH	CHICHESTER
COLWYN BAY	DOVER	PORTSMOUTH
LLANDUDNO	MARGATE	PETERBOROUGH
SWANSEA	ROSS-ON-WYE	SOUTHWOLD
BRISTOL	WELSHPOOL	DONCASTER
BRIGHTON	DEAL	ETC., ETC.
BATH	FOLKESTONE	

**DEFINITE PROOF THAT THE FA22 IS A TV
 AERIAL OF OUTSTANDING MERIT**

ASK YOUR DEALER ABOUT IT
 or in case of difficulty write to:—

HEAD OFFICE & SALES:

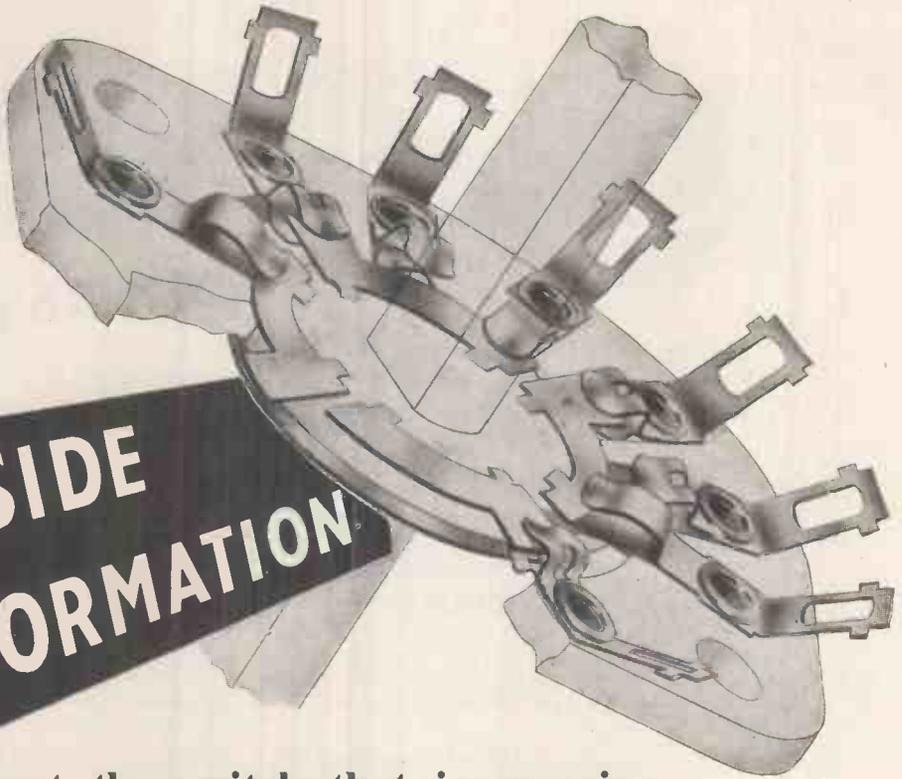
TELECRAFT

Specialists in the Manufacture and Design of TV
 Aerials since 1937

QUADRANT ROAD
THORNTON HEATH, SURREY

THORNTON HEATH 2985

Branches: BRISTOL, BIRMINGHAM, MANCHESTER



INSIDE INFORMATION

— about the switch that is superior

'OAK' switches—both rotary and push button types—were embodied in the majority of receivers displayed at Radiolympia.

Throughout the radio world, the time-tested basic 'OAK' principles are recognised and acknowledged as superior. They form the basis for the standard inter-service wafer type switch to Specification RCS.151 of the Radio Components Standardisation Committee.

The new miniature types, embodying all 'OAK' basic features, bring the range available in line with today's requirements for miniaturised equipments.

- Self-aligning floating rotor.
- Dual contact surfaces ensure low contact resistance throughout long life.
- Fixed contacts of special spring alloy, heavily silver-plated as standard; silver alloy available if required.
- Single or multiple wafer construction.
- High grade S.R.B.P. or low-loss ceramic insulation.



OAK SWITCHES



Other British N.S.F. Products Include:

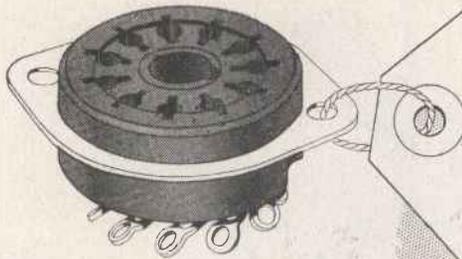
Cutler-Hammer appliance switches; Carbon and wire-wound potentiometers for television and radio applications; Paper tubular capacitors; Wire-wound resistors.

SOLE LICENSEES OF OAK MANUFACTURING COMPANY, CHICAGO

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

BRITISH N.S.F. CO · LTD · KEIGHLEY · YORKS · London Office : 9 Stratford Place, W.1 · Phone : MAYfair 4234

Recognised as the Most Reliable Valveholders



McMURDO
Moulded
Valveholders

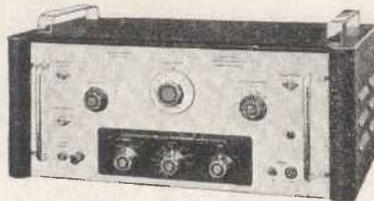
B11A—Sub Magnal

Ref. No. S.P.11U moulded in Phenol-Formaldehyde with moulded-in metal mounting plate
 " " A.P.11U " " Alkathene " " " " " " "
 " " A.A.11U " " Alkathene with integral Alkathene mounting flange

THE McMURDO INSTRUMENT COMPANY LTD., VICTORIA WORKS, ASHTEAD, SURREY · ASHTEAD 3401

INSTRUMENTATION BY SOLARTRON

PRODUCERS OF WIDE RANGE
INSTRUMENTS FOR RESEARCH
AND TEST DEPARTMENTS.

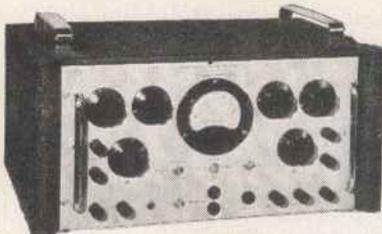


FULL DETAILS OF THESE
AND OTHER INSTRUMENTS
ON REQUEST.

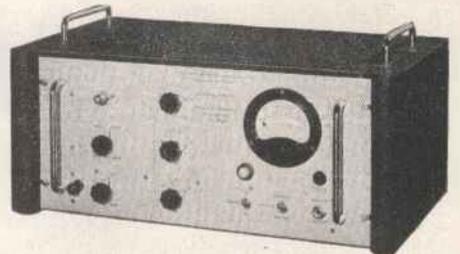
REGULATED POWER SUPPLIES
From 0-500 volts up to 300 MA.
Types SRS 150 and SRS 151.

PULSE GENERATORS
With Variable Time Delay.
Type OPS 100.

WIDE BAND AMPLIFIERS
10 c/s—250 kc/s. FSD 100 μ V.
Types AWS 50 and AWS 51.



UNDER DEVELOPMENT
WIDE BAND
AMPLIFIER
100 c/s—20 mc/s
Gain 50 db output 120 v
ENQUIRIES INVITED



SOLARTRON LABORATORY
22 HIGH STREET, KINGSTON-ON-THAMES

INSTRUMENTS LTD
KINGSTON 1787

The New Valve Technique for v.h.f.

Mullard have now introduced a modern range of small, Hard-glass Valves, outstanding features of which are :—

- ★ Hard-glass Bulb
- ★ Low-inductance Anode Lead
- ★ Double Helical Filament—Low Hum
- ★ Zirconium Coated Carbon Anode
- ★ Shield to Ensure Low Anode-Filament Capacitance
- ★ Low-loss Powdered Glass Base
- ★ American Giant 5-Pin Base —for Communications & Industry

For their size, these valves are among the most efficient in existence and are particularly recommended for equipments operating in the V.H.F. range. Other features include small size, low drive power and low power consumption for the rated outputs.

The triodes TY2-125, TY3-250 and TY4-500 form a series with increasing anode dissipations from 135 to 500 watts, and are designed for use as R.F. amplifiers, grounded-grid amplifiers or oscillators in both communications and small, compact R.F. heating equipments.

The tetrodes QY3-125 and QY4-250 are rated respectively for maximum anode dissipations of 125 and 250 watts, and are characterised by high power gains and high efficiencies at V.H.F.

MAXIMUM OPERATING CONDITIONS (CLASS C TELEGRAPHY) at 50 Mc/s

Valve	Type of Service	V _a (V)	V _{g2} (V)	V _{g1} (V)	I _a (mA)	I _{g2} (mA)	I _{g1} (mA)	V _{in} (pk) (V)	P _{out} (W)	η (%)	Max. frequency (Mc/s)
TY2-125	osc.	2500	—	—200	200	—	40	350	360	72	200
TY3-250	osc.	3000	—	—250	363	—	70	380	830	76	150
TY4-500	osc.	4000	—	—350	550	—	100	625	1670	76	120
QY3-125	ampl.	3000	350	—150	166	35	10	280	375	75	220
QY4-250	ampl.	4000	500	—225	312	50	8	315	970	78	150

GOVERNMENT PREFERRED TYPES

The QY3-125 and the QY4-250 have now been selected for inclusion in the new Government list of preferred valves for the services.

Mullard

THERMIONIC VALVES AND ELECTRON TUBES

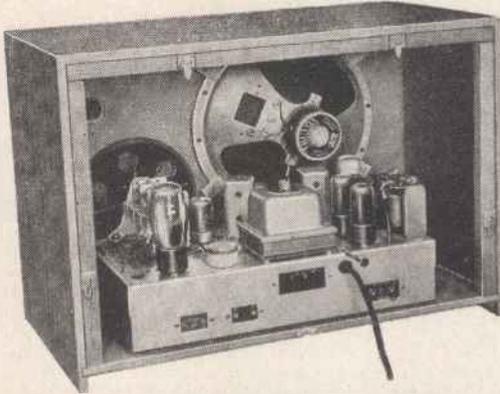
MULLARD NEWS LETTER If you are not already on the mailing list for this service of advance information on new valves, please write to us for full particulars on your business letterheading



INDUSTRIAL POWER VALVES · THYRATRONS · INDUSTRIAL RECTIFIERS · PHOTOCELLS
 FLASH TUBES · ACCELEROMETERS · CATHODE RAY TUBES · STABILISERS AND
 REFERENCE LEVEL TUBES · COLD CATHODE TUBES · ELECTROMETERS, ETC.

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

MVT 74



**It's the BACK VIEW
that's most important
—to you**

We've turned this Sobell model back-to-front because we know that your knowledge of radio is not confined to knob-twiddling. You know exactly what you are buying.

This set is Sobell Model 610, 6 valve all-wave superhet receiver. Like all radios in the Sobell range it is sound value for money. We don't flinch from your expert and thorough examination. Take your time. Check everything—circuits, signal rectification, I.F. selectivity, tuning controls. You'd find that workmanship and the materials are both first rate—really wonderful value for money. It has to be so. Our 2-year free maintenance plan means that our sets—sound or vision—*have* to be good . . . or else!

You can examine this set—or any other in the Sobell range—at any Sobell dealer. We feel sure that, whatever Sobell radio you choose, you'll get technical efficiency and value for money—and a set you'll be proud to own. And for your wife's sake of course here is the good-looking side of the Sobell picture.



SOBELL



with 2 years
free service
in the home*

RADIO & TELEVISION

SOBELL INDUSTRIES LTD.,
LANGLEY PARK, SLOUGH, BUCKS.

TEL: SLOUGH 22201/5

* Valves and Cathode Ray Tubes are subject to BVA makers' guarantee of 90 days and 6 months respectively.



★ *Excerpts from recent reviews of the*
CORNER RIBBON LOUDSPEAKER

The Gramophone (Jan. 1950)
This loudspeaker must, I feel, be considered as one of the most advanced designs so far made available to the public anywhere in the world. . . . the Corner Ribbon gave the most natural reproduction I have so far encountered.

Wireless World (Jan. 1950)
Transients. . . . One does not need to wait for loud and dramatic passages in the music to demonstrate this. It is there all the time, in the bowing attack of strings in pianissimo passages and in other subtle ways that will be appreciated by those who have ears to hear.

★
For all reviews and all public demonstrations of the Corner Ribbon Loudspeaker the following equipment was used:—

AMPLIFIER Type QA12/P—capable of the finest quality of reproduction yet achieved, the performance being determined by the limitations of the loudspeaker employed. As supplied to the B.B.C. £30.0.0

PICK-UP
Type C/500 with elliptical reproducing point and connected via type CQA/R Compensator unit. Complete pick-up and compensator £9.6.0

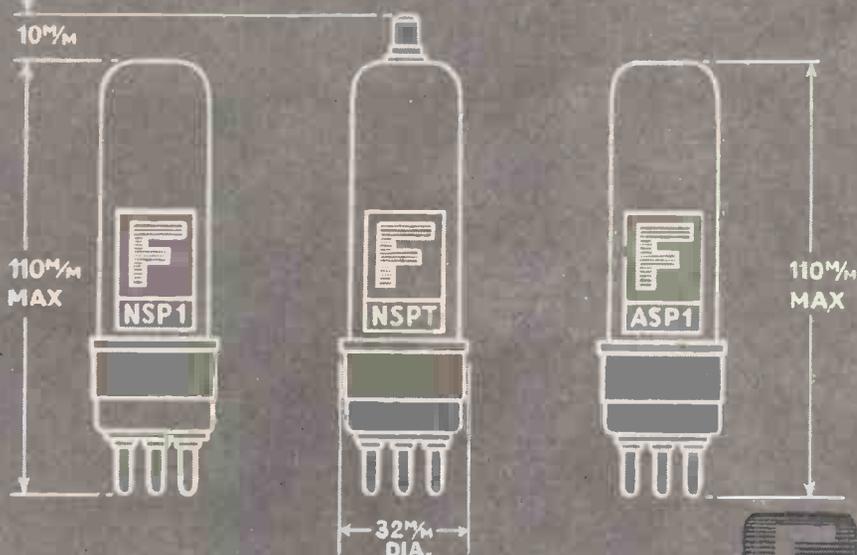
CORNER RIBBON LOUDSPEAKER
£83.0.0



Other loudspeakers for those with less to spend but who still require the best performance for the available outlay include the SL.15 Labyrinth at £19.10.0 and the Concert Labyrinth at £48.0.0.

ACOUSTICAL
MANUFACTURING CO LTD
HUNTINGDON · HUNTS · TEL: 361

Neostron COLD CATHODE TETRODES



IMMEDIATE DELIVERY



The Ferranti Neostron is a cold cathode tetrode filled with neon, designed for use as a stroboscopic light source, a flashing indicator, or an electronic relay.

The discharge in the anode is started by initiating a glow discharge between the screen and grid electrodes, the screen being at a fixed positive bias, a negative impulse being applied to the grid

Operating Characteristics	NSP1	NSPT	ASP1
Max. Anode Voltage	400	650	400
Normal Anode Voltage	300	600	300
Mean Anode Current	40-100* mA	40-100* mA	40-100* mA
Peak Anode Current	250 Amps.	250 Amps.	250 Amps.
Max. Operating Frequency	250 c.p.s.	250 c.p.s.	300 c.p.s.
Anode Connection	in base	Top cap	in base
Gas Filling	Neon	Neon	Argon

*Dependent upon frequency of operation

All types can be supplied with English 4 pin or American 4 pin bases.

FERRANTI LTD ELECTRONICS DEPT. MOSTON MANCHESTER 10

Before deciding on a Magnetic Tape Recorder— hear the "CLIFTON" MODEL M.Q.1

PRICE
£45
Microphone extra
Delivery 14 — 28 days

THREE MOTORS
HEAVY CAPSTAN
SEPARATE SUPERSONIC ERASE HEAD
TWO SPEED — QUICK REWIND
RECORD/PLAY INDICATOR LAMPS
SPECIALLY DESIGNED AMPLIFIER WITH
SEPARATE BASS and TREBLE CONTROLS

also The "CLIFTON" TAPE DESK

We are now in a position
to supply—

Oscillator Units
Matching Transformers and
Complete Amplifiers designed for
use with the above Desk

Specification as above

Complete with 1,200 ft. Tape

£25 Immediate Delivery

Write for particulars:—

BRISTOL CINE SERVICE
33, ALMA VALE RD. Phone: 33243
TRADE ENQUIRIES INVITED



As specified for
conversion of the
Type 25 unit of the
T.R. 1196

OSMOR 'Q' COILPACKS

Size 1 1/2 in. x 2 1/2 in. x 3 1/2 in. Superhet. (405 kc/s) and T.R.F. Pre-aligned with full circuit supplied.

Only five connections to make, with one-hole fixing, and your coil problems are solved quickly, efficiently and at low cost.

This Midget Coilpack has a terrific performance. If in doubt, ask those who have an OSMOR!

Send stamp for free Circuits and details of the latest types available (including Superhet Portable Battery Model) and lists of dials, matched radio and television components, etc., also our latest Bargain Bulletin, "Viewmaster" constructional drawings, 5/-, post free. (State if London or Midlands version required.)

WAVELENGTH CHANGES

Replacement scales for our glass dial assembly Type "A," 8/- each.

Trade and Export enquiries invited.

OSMOR RADIO PRODUCTS LTD. (Dept. W.7.)
BRIDGE VIEW WORKS, BOROUGH HILL, CROYDON, SURREY
Telephone: Croydon 1220.

"REPRODUCTION OF RECORDS—1"

by J. H. Brierley

Booklet. Price 3/6 (by post 3/11).

This booklet is the first of a series of practical booklets dealing with specialised high fidelity equipment

After touching on some aspects of fundamental design, a preamplifier is described incorporating all necessary equalising, variable tone control and filter circuits, which requires 5 mV. at the grid of the input for an output of 2 v.—the hum and noise level not being higher than -60 dbs.

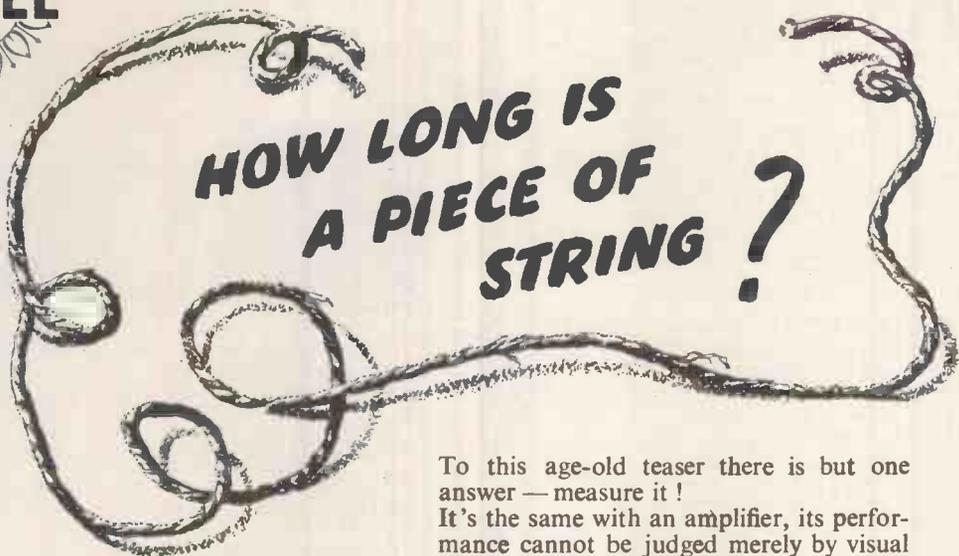
Twenty-one drawings and photographic illustrations are employed in giving precise wiring and constructional details: in addition the reasons *why* certain things must be done are fully discussed so that the reader is left with a knowledge of *how* to do things rather than an ability to copy slavishly some standard design.

The scope of this booklet covers also the connecting of pick-ups to pre-amplifiers, the connecting of pre-amplifiers to amplifiers, the construction of a "Rumble Filter" and advice on general layout.

Order from your local radio or book shop or direct.

**J. H. BRIERLEY (Gramophones &
Recordings) LTD.**

46, Tithebarn Street, Liverpool, 2



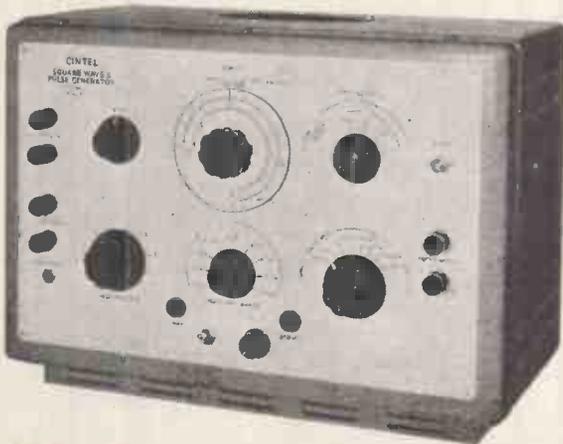
**HOW LONG IS
A PIECE OF
STRING ?**

To this age-old teaser there is but one answer — measure it !
It's the same with an amplifier, its performance cannot be judged merely by visual inspection; measurements must be made which are far more involved than the measurement of string . . .

The 'CINTEL' SQUARE WAVE & PULSE GENERATOR

enables the response and transient characteristics of an amplifier to be determined in a matter of minutes.

For full technical details and further applications of this instrument, please write for leaflet No. S.W.G.1/1.



CINEMA - TELEVISION LIMITED

A Company within the J. Arthur Rank Organisation

FOREMOST IN THE MANUFACTURE OF

- Counters & Chronometers • Metal Detectors • Oscilloscopes • Photo-Electric Cells
- Cathode Ray Tubes • Geiger-Muller Tubes • Electronic Instruments

WORSLEY BRIDGE ROAD · LONDON · S·E·26

Telephone: Hither Green 4600

Northern Agents:
F. C. ROBINSON & PARTNERS LTD.
287 Deansgate, Manchester 3

Scottish Agents:
ATKINS, ROBERTSON & WHITEFORD LTD.
100 Torrissdale Street, Glasgow. S.2



REGISTERED TRADE MARK

SOUND & VISION KIT

21 Valves. Suitable for 9in., 10in. and 12in. Magnetic Tubes. Less Tube, cube holder and Mask. Chassis all stamped out. State whether for Sutton Coldfield or Alexandra Park. Complete with booklet, instructions, etc. £21 12s. 6d. carr. paid. **Pre-Amplifier de Luxe**. Consisting of power pack and two R.F.s. Built up and enclosed in case. £7 12s. 6d. carr. paid.

MAINS TRANSFORMERS, FULLY INTERLEAVED, SCREENED AND IMPREGNATED. ALL PRIMARIES ARE 200/250 v. Half Shrouded.

HSM63. (Midget) Output 250/0/250v. 60 m/a. 6.3v. at 3 amps. 5v. at 2 amps.	15/-
HS63. Output 250/0/250v. 60 m/a. 6.3v. at 3 amps. 5v. at 2 amps.	15/6
HS40. Windings as above. 4v. at 4 amps. 4v. at 2 amps.	15/6
Output	
HS2. 250/0/250v. 80 m/a.	17/6
HS30. 300/0/300v. 80 m/a.	17/6
HS3. 350/0/350v. 80 m/a.	17/6
HS2X. 250/0/250v. 100 m/a.	19/6
HS75. 275/0/275v. 100 m/a.	19/6
HS30X. 300/0/300v. 100 m/a.	19/6
HS3X. 350/0/350v. 100 m/a.	19/6

Fully Shrouded

Output	
FSM53. (Midget) Output 250/0/250v. 60 m/a. 6.3v. at 3 amps. 5v. at 2 amps.	15/6
FS2. 250/0/250v. 80 m/a.	19/6
FS30. 300/0/300v. 80 m/a.	19/6
FS3. 350/0/350v. 80 m/a.	19/6
FS2X. 250/0/250v. 100 m/a.	21/6
FS75. 275/0/275v. 100 m/a.	21/6
FS30X. 300/0/300v. 100 m/a.	21/6
FS3X. 350/0/350v. 100 m/a.	21/6

All the above have 6.3-4-0v. at 4 amps. 5-4-0v. at 2 amps.
FS43. Output, 425/0/425v. 200 m/a. 6.3v. 4 amps. C.T. 6.3v. 4 amps. C.T. 5v. 3 amps. Fully shrouded 42/6
FS50. Output, 450/0/450v. 250 m/a. 6.3v. 2 amps. C.T. 6.3v. 4 amps. C.T. 5v. 3 amps. Fully shrouded 62/6
F30X. Output, 300/0/300v. 80 m/a. 6.3v. 7 amp. 5v. 2 amps. Framed, Flying leads 26/6
F35X. Output, 350/0/350v. 250 m/a. 6.3v. 6 amps. 4v. 8 amps. 4v. 3 amps., 0-2-6.3v. 2 amps. Fully shrouded 59/6
FS160X. Output 350/0/350v. 160 m/a., 6.3v. 6 amps. 6.3v. 6 amps. 5v. 2 amps. Fully shrouded 37/6
FS43X. Output, 425/0/425v. 250 m/a. 6.3v. 6 amps. 6.3v. 6 amps. 5v. 3 amps. Fully shrouded 57/6
HS6. Output, 250/0/250v. 100 m/a. 6.3v. 6 amps. C.T. 5v. 3 amps. For receiver R1355. Half shrouded 24/6
HS150. Output, 350/0/350v. 150 m/a. 6.3v. 3 amps. C.T. 5v. 3 amps. Half shrouded 25/9
F36. Output, 250/0/250v. 100 m/a. 6.3v. 6 amps. C.T. 5v. 3 amps. Half shrouded 25/9
FS120. Output, 350/0/350v. 120 m/a. 6.3v. 2 amps. C.T. 6.3v. 2 amps. C.T. 5v. 3 amps. Fully shrouded 27/6
PR1/1. Output 230v. at 30 m/a., 6.3v. at 1.5/2 amps 19/6
 The above have inputs of 200/250v.

FILAMENT TRANSFORMERS

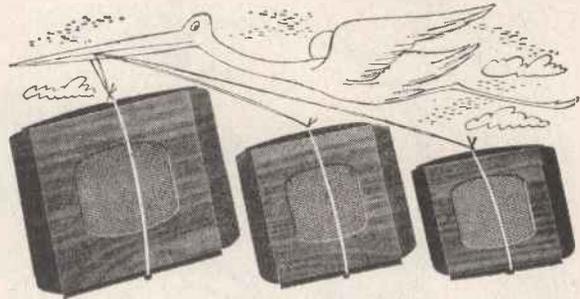
F4. Output, 4v. 2 amps.	7/6
F6. Output, 6.3v. 2 amp.	7/6
F66. Output, 6.3v. 6 amps.	5/3
F6X. Output, 6.3v. 3 amps.	5/-
F12. Output, 12.6v. tapped 6.3v. at 3 amps.	15/6
F24. Output, 24v. tapped 12v. at 3 amps.	21/6
F12 and F24 framed with Flying Leads.	
FU6. Output, 0-2-4-5-6.3v. at 2 amps.	9/-
F29. Output, 0-2-4-5-6.3v. at 4 amps.	15/-
FU6 and F29 clamped with Flying Leads.	
F5. Output, 6.3v. at 10 amps. 5v. at 10 amps. 12.6v. at 5 amps. 10v. at 5 amps.	31/6
F6/4. Output, four at 6.3v. tapped at 5v. at 5 amps. per winding, giving by suitable series and parallel connections 24v. at 5 amp., 20v. at 5 amp., 18v. at 5 amp., 15v. at 5 amp., 12.6v. at 10 amp., 10v. at 10 amp., 6.3v. at 20 amp., 5v. at 20 amp.	47/6
F5 and F6/4 framed with Flying Leads	

OUTPUT TRANSFORMERS

MOPI. Ratios 26, 46, 56, 66, 90, 120-1 50 m/a. max. current. C.T. for Q.P.P. Class B, etc. Secondary 2/4 ohms. Top panel and clamped each	5/-
OPI. Midget Power Pentode, ratios 30, 60, 90-1, 40 m/a., Secondary 2/3 ohms. each	3/2
OP2. Midget Pentode, ratios 45-1, Secondary 2/3 ohms. 40 m/a. per doz.	33/-
OPI0. 10/15 watts output. 20 ratios on Full and Half primary	16/3
OP30. 30 watts output, 20 ratios on Full and Half primary.....	23/9
Williamson's O.P. Transformer to Author's specification £3/12/6	
Chokes for Williamson's Amplifier. 30H at 20 m/a., 15/6 ; 10H at 150 m/a.	29/6
Choke C4. 60 m/a., approx. 8 H., 350 ohms.....	4/3
Choke C5. 40 m/a., approx. 5 H., 360 ohms.....	3/3
Choke C6. 50 m/a., 50 H., 1,500 ohms.....	18/6
C.W.O. (add 1/- in £ for carriage), all orders over £2 carriage paid. Trade enquiries invited.	

H. ASHWORTH
 (Dept. W.W.)
676 GT. HORTON ROAD
BRADFORD, YORKS.

Three new arrivals . . .
Baby—Minor—Major
—all doing fine



Another step forward in Extension Speaker Design is taken with these new models. Bafflette Baby 39/6. Bafflette Minor 52/6. Bafflette Major 65/-. All fitted with out of sight volume control. Finished in walnut veneers. Transformers extra. Baby and Minor 6/-, Major, 8/6.

Supplies are now reaching distributors.

Richard Allan

RADIO LTD · BAFFLETTE HOUSE · BATLEY · YORKS

M.R. SUPPLIES Ltd

(Established 1936.)

Selected material only—all new and perfect. All prices nett.

SOLENOIDS. Powerful model exerting approx. 40lb. pull. Pot 8 1/2in. by 2 1/2in. with rocking arm mounted on 6in. bracket. Designed for 24 v. D.C. but powerful with 12 v. D.C. Many applications for these very well-made instruments. Attractive offer at 10/6 each (despatch 1/-).

GEARED MAINS MOTORS (Capacitor-Induction) 220/240 v. A.C. Size 7in. long by 4in. dia. 1,500 r.p.m. with 5/1 reduction gear box giving final shaft speed of 300 r.p.m. at great torque. These are substantially built to a precise standard for continuous duty and full load starting. Reversible. Supplied with capacitor and diagram. 24/10/- (des. 1/6)

MAINS MOTORS, 230 v. 25/65 c/s. (Will also run on D.C.—series motor). 4,000 r.p.m. These are not converted rotary transformers but mains motors made for the G.P.O. Body 6in. by 4in. with 1/2in. shaft. Well-made with grease caps each end. Suitable for sewing machines, pumps, cine projectors, etc. Approx 1/30th H.P., 32/6 (des. 1/6). Also SHADED POLE MOTORS (Hoover) 200/250 v. A.C. Suitable for Wire and Tape Recorders, Cooling and Extractor Fans, Cine Projectors, etc. 1,200 r.p.m., very silent running. Torque 400 gram/cm/s. Body 3 1/2in. by 3 1/2in. Shaft each end, 29/8 (des. 1/-).

HIGH DUTY SELENIUM RECTIFIERS (S.T.C.), D.C. delivery up to 30 v., 20 amps, full-wave, tunnel cooled. In original cartons, 72/6 each (des. 1/6). A pair of these in bridge will deliver up to 30 v., 80 amps, full-wave (current list price £18). We offer a pair at 27 nett (des. 3/-).

BATTERY CHARGERS (ex-A.M.). For use on 200/250 v. A.C. mains. Charging 2 to 12 v. batteries up to 5 amps. Metal rectified, fitted sliding resistance, ammeter fuses, etc. in steel housing 1 1/2in. x 1 1/2in. x 7in., with wall-mount lugs, ready for use, 26/15/6 (des. 3/6).

ROTARY SWITCHES (Sanont). Single-pole make and break, 20 amps, 3/6.

HOT-WIRE AMMETERS for R.F. or L.F. currents, 4in. dia. Brand new Admiralty instruments with magnetic damping and fuse. Two models, 0/1.2 amp and 0/2 amp. Either, 7/6 (pkgs./des. 1/6).

ELECTRIC DRILLS (Consolidated Tool Co.). Brand new standard model with heavy duty motor and 1/2in. chuck. 220/240 v. A.C./D.C. (List £17/10/-). Only a few at £11/10/- nett. (des. 2/6).

PRESSURE SPARKER UNITS. G.E.C. 1698 for 10 watts, 15 ohms coil, fitted multi-ratio 600 ohm line transformer within the weatherproof cowling. Standard F.A. thread to suit all horns. Here is an opportunity for this excellent 28 mm/coil P.A. unit for only 65/-, ew in makers' sealed cartons. (Des. 1/6).

STEEL TRIPODS to suit all P.A. Speakers—will carry two or more. Well known as the best type of P.A. tripod and one of our most popular offers. Extends to 13ft. with ample height selection, 55/- (des. England, 5/-, Scotland and Ireland, 8/6).

OUR NEW MULTI-PURPOSE TRANSFORMER. Primary tapped 200/220/240 v. Secondary tapped 0/5/12/20/30 v. 3 amps. This ingenious transformer provides the following sec. voltages: 5, 7, 8, 10, 12, 15, 18, 20, 25 and 30 v. at 2 amps, with further adjustment by mis-volting primary, 27/6 (des. 1/-).

IN STOCK: Variety of Electric Pumps, Synchronous Clock Movements, Rotary and Vibrator Converters. New B/1155 Receivers. VARIACS.

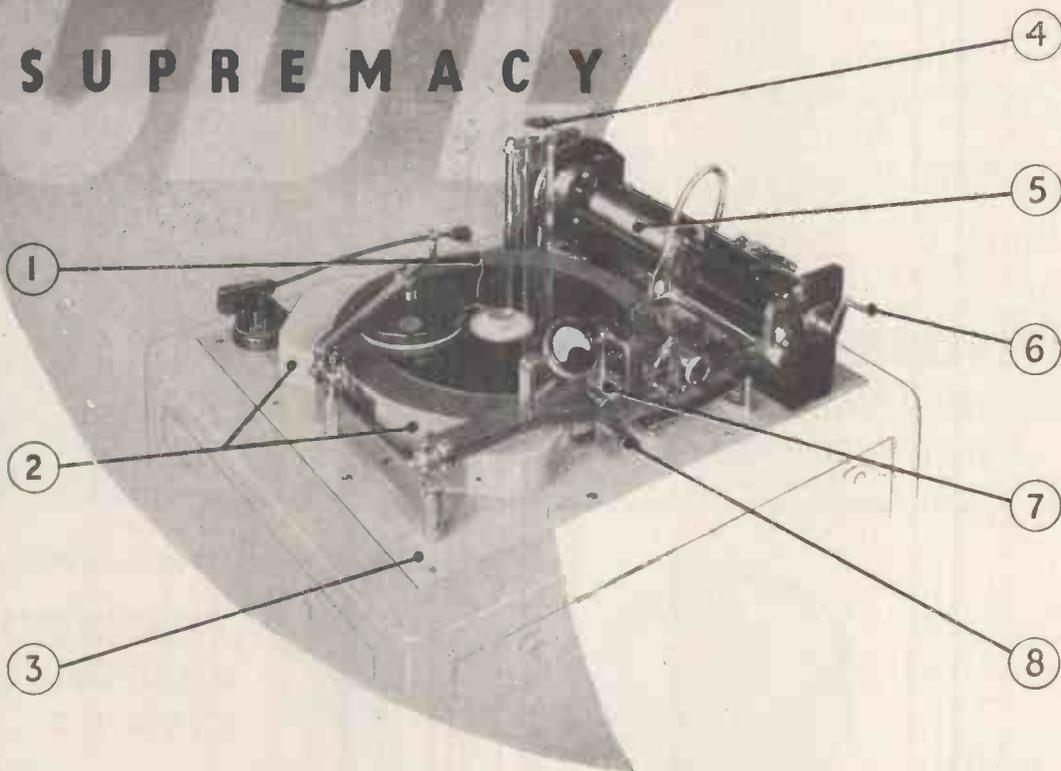
The diligent and enthusiastic service.

M. R. SUPPLIES Ltd., 68, New Oxford Street, London W.C.1
 Telephone MU5eum 2958

POINTERS



S U P R E M A C Y



DIRECT RECORDING ON DISK

Some points about the CB/E which have made this machine the considered choice of many discriminating broadcasting concerns throughout the world.

- (1) **HEAVY CAST IRON TURNTABLE**, accurately balanced, ensures freedom from wow'.
- (2) **TWIN DUAL SPEED FRICTION DRIVES** designed to reduce vibration and ground noise to a minimum.
- (3) **ROBUST MILD STEEL BASE PLATE** 1" thick ensures rigidity, stability and freedom from vibration.
- (4) **GROOVE SPACING CONTROL** gives continuous adjustment of pitch when cutting outside/in or inside/out.
- (5) **GROUND STEEL LEADSCREW HOUSING TUBE** provides a generous cutterhead arm bearing free from side-play.
- (6) **HAND OPERATED TRAVERSING CONTROL** provides easy scrolling off and scrolling on.
- (7) **PATENTED ELECTRO MAGNETIC CUTTERHEAD** with built in equaliser, possessing exceptionally stable characteristics.
- (8) **CHANGE SPEED LEVER** provides instantaneous change to either 78r.p.m. or 33½r.p.m.

Full details and technical data on request.

M · S · S · RECORDING COMPANY LTD

POYLE CLOSE · COLNBROOK · BUCKINGHAMSHIRE · TELEPHONE · COLNBROOK 87 & 115

MINIATURE I.F. Alignment unit . . . *but with "add-on" attachments*

The G.E.C. M863B. I.F. Alignment Unit — a most convenient "plug-in" unit makes possible thorough examination of the frequency response curve, width of the pass band and the peak separation in I.F. amplifiers.

Specification: Oscillator 400 Kc/s to 520 Kc/s—variable. Frequency deviation—Maximum ± 70 Kc/s—variable. Price £8 10. 0. Please ask for leaflet No. X475.

Double Beam unit . . .

With the addition of the M862B Double Beam Unit — the "Miniscope" is the most versatile and complete miniature oscilloscope available today. The Double Beam Unit employs a $1\frac{1}{2}$ " C.R.T.

Specification: Amplifier gain, maximum, X 40 approx. Frequency response, ± 1.5 db up to 40 Kc/s. Price £12. 0. 0. Full particulars are in leaflet No. X365.

Miniscope

Miniature Cathode Ray Oscilloscope by **G.E.C.**

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2



You are offering



*** PEAK**

PERFORMANCE

with the

**GRAMPHIAN
D.P.I.**

THE IDEAL MICROPHONE FOR P.A. WORK, BROADCASTING AND RECORDING

Here is a wide range high fidelity moving coil type Microphone which combines good sensitivity with a level response curve. Equally suitable for Auditorium or Outdoor Work, and its use can confidently be advised for Amateur as well as Professional use. Housed in modern streamlined die cast alloy case of great strength and finished in hammered metallic lacquer with chromium plated grille. Delivery from stock. List price £8.8.0

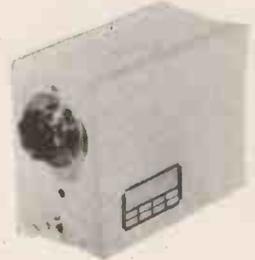
Dimensions 3" diam. $3\frac{1}{8}$ " back to front, Net weight 2 lb. Frequency response 60-9,000 c.p.s. Output impedance 15 ohms. Fitting 5/16" B.S.F. Connection 2-pin plug.

GRAMPHIAN
P.A. EQUIPMENT

Gramphian Reproducers Ltd., Hampton Road, Hanworth, Middx. Phone: Feltham 2657.

SPHERE TELEVISION ADAPTOR UNIT TYPE S.C. "88"

Adaptor Unit S.C. "88" eliminates costly troublesome conversions



IT ADAPTS THE "LONDON"-DESIGNED TELEVISION RECEIVER FOR SUTTON COLDFIELD RECEPTION — PERFECT SOUND AND VISION

Small and compact, the unit, embodying power-pack, and all the necessary "works," is simply fitted between aerial and set. Set itself is entirely untouched, and in its original state—thus retaining its full "design-efficiency." Of particular interest to "Fringe" viewers. Real saving of time, trouble and cost. Price 6 Gns. nett Full details supplied.

Manufacturers : **SPHERE RADIO LIMITED**
HEATH LANE, WEST BROMWICH, ENGLAND



Your career in **RADAR** starts in the R.A.F

First in the field with Radar, Britain still leads the nations in research into its future. That is why the Air Force is the finest Radar School in the world and offers such a wonderful opportunity to make Radar your career. You earn while you learn. You get an important job

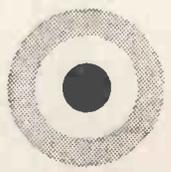
at the end of your training—as Radar fitter, mechanic, assistant. And Radar is only one of the many skilled trades open to men between the ages of 17½ and 33 who sign on for five years in the R.A.F.

Learn your trade in the
ROYAL AIR FORCE
 and be trained for life!

TO:—AIR MINISTRY
 DEPT. 3A, VICTORY HOUSE,
 KINGSWAY, LONDON, W.C.2

★
 Please send full details of
 R.A.F. careers.

NAME.....
 ADDRESS.....
 AGE.....



EX-AIRMEN SHOULD ASK FOR DETAILS OF £125 BOUNTY SCHEME

BUILD YOUR OWN E.H.T. UNIT

Send 6d.
for a copy of
"The All Metal
Way" containing
full details of this
and other radio
applications, to
Dept. W.W.6.

"The All Metal Way" tells you
how to build 4 simple, safe
and efficient E.H.T. units
with

WESTINGHOUSE **WESTALITE** **RECTIFIERS**

and also gives details of recti-
fiers for H.T. and L.T. supplies
and detection.

Three E.H.T. units are de-
scribed where E.H.T. up to 5kV
is obtained from the 350-0-350
volts winding of the normal
mains transformer; and one
unit which gives up to 6kV from
the line output transformer.

WESTINGHOUSE BRAKE & SIGNAL Co., Ltd.
82 YORK WAY, KING'S CROSS, LONDON, N.1

OKERIN

Waxes

FOR THE ELECTRICAL INDUSTRY

ASTOR BOISSELIER & LAWRENCE LTD.
Sales Dept.: Norfolk House, Norfolk Street,
Strand, W.C.2.
Works and Laboratories: West Drayton, Middlesex.

TELEVISION from 50 OR 110 VOLT D.C. SUPPLIES

BUILT TO MEET THE NEEDS OF
THE MOMENT BY VALRADIO—THE
CONVERTER PEOPLE.

This Power Unit is designed for driving
THE **PYE UNIVERSAL**
AC/DC TELEVISION RECEIVER

from Low Voltage D.C. supplies of 50 or
110 volts.

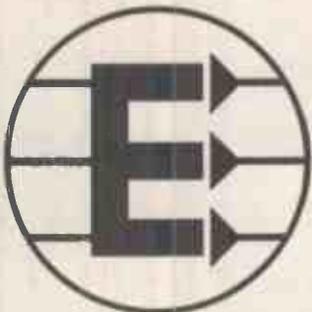
The output is D.C., with less than a ½-volt
ripple, resulting in an exceptionally steady
picture. The conversion efficiency is 80%
with a current consumption of 1.4 amps on
110-volts or 2.8 amps on 50-volts supply.

TYPE No. 240/125/110-A or
TYPE No. 240/125/50-A.

PRICE £16-0-0

Literature upon request to

VALRADIO LIMITED
57 FORTRESS ROAD, LONDON, N.W.5
GULLiver 5165

The magnitude  of **EKCO**

*This is the symbol of the Ekco organisation,
whose products are recognised throughout the world as
among the finest in their class*



Ekco Radio and Car Radio are already in service in many lands, and as overseas television transmission develops *Ekcovision* will follow. Valuable contributions to the safety and efficiency of civil aviation have been made by *Ekco VHF Aircraft Communications Equipment*, and will be made in the future by *Ekco Cloud and Collision Radar Equipment*. Famous ships of many nationalities, including the "Queen Mary" and the "Queen Elizabeth" employ the *Thermovent* system of electric space heating, as do the homes and offices of countries far and wide. Scientific research is aided by the wide and fast-growing range of *Ekco Nucleonic Equipment*, while industries of every kind turn for the solution of their moulding problems to *Ekco Plastics*.

Such is the magnitude of the Ekco organisation, whose long-standing reputation for quality and reliability is your assurance of satisfaction.

EKCO

E . K . COLE LTD . S O U T H E N D - O N - S E A



THE NEW

'ULTRA TWIN 50'

*two sets for *
the price of one!*

**AC/DC Mains and
Dry Battery Portable**

SOME DESIGN FEATURES

- ★ Built-in frame aerial.
- ★ Two Wave Bands—Medium Wave 190 to 550 metres, Long Wave 1150 to 2000 metres.
- ★ Equal performance on A.C. mains, D.C. mains or battery.
- ★ Separate H.T. and L.T. batteries for increased economy.
- ★ High Q coils and I.F. transformers with silver mica capacitors giving maximum stability, conversion gain and selectivity.
- ★ Specially cushioned detector valve and tuning condenser.
- ★ Automatic mains to battery change-over.
- ★ 5in. moving coil speaker.

- ★ Valves — V1, Mazda ICI low noise frequency changer; V2, Mazda IF3 high gain IF amplifier; V3, Mazda IFD9 high amplification diode pentode for A.V.C., detection and audio amplification; V4, Mazda IP11 output pentode. Metal Rectifier. These valves are button base miniature valves, giving very high performance with low current consumption.
- ★ New handsome design. Weight only 11lb. with battery.

See it . . . hear it . . . at your Ultra dealers . . . and walk out with it for

£15 . 16 . 6 tax paid
(including battery)

ULTRA ELECTRIC LTD., WESTERN AVENUE, ACTON, LONDON, W.3

ICS

HOME STUDY

**backs radio experience with
sound technical knowledge**

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

**Complete Radio Engineering · Radio Service Engineers
Radio Service and Sales · Advanced Short-Wave Radio
Elementary Electronics, Radar and Radio
Television Technology**

And the following Radio Examinations:

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

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

International
CORRESPONDENCE SCHOOLS

Dept. W.L.11, International Buildings, Kingsway, London, W.C.2

B.P.L. TEST SETS

NOW AVAILABLE

AT NET PRICES

B.P.L. UNIVERSAL TEST SET

£5 - 10 - 0

B.P.L. SUPER RANGER 1,000 Ω /v.

£12 - 5 - 0

B.P.L. SUPER RANGER 20,000 Ω /v.

£14 - 10 - 0

Prices include postage and packing.

Send your order direct to:—

**BRITISH PHYSICAL LABORATORIES
HOUSEBOAT WORKS, RADLETT, HERTS**

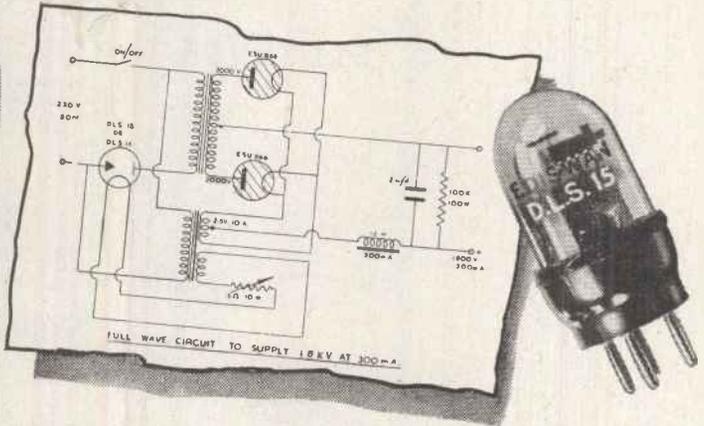
Tel: Radlett 5674-5-6

EDISWAN
SPECIAL PURPOSE
VALVES

Smaller Vacuum Thermal Delay Switches

These two new delay switches are recommended for use wherever a switching delay of 30-180 secs. is required. They have been developed for use in applications similar to those of the EDISWAN DLS10 but, in line with modern equipment design — which makes the physical size of the switches of prime importance — the dimensions have been reduced to the minimum compatible with reliability and ruggedness.

The DLS15 is intended as a plug-in replacement for the DLS10 while the DLS16 fulfils the demand for a delay switch with a 6.3v heater and an International Octal base.



DLS15 Rating.

Filament Voltage (volts)	4
Filament Current (amps)	0.75*
Delay time at 4 volts (secs.) ...	Min. 30 ; Max. 90

(Delay time may be increased to 180 secs. by variation of filament voltage)

Maximum Peak Current (low voltage rating)
5 amps at 240v.

Maximum Peak Current (high voltage rating)
100mA at 1 kv.

Maximum overall length (not including pins) 60 mm.

*at approximately 4 volts

DLS16 Rating.

Filament Voltage (volts)	6.3
Filament Current (amps)	0.48*
Delay time at 6.3 volts (secs.) ...	Min. 30 ; Max. 90

(Delay time may be increased to 180 secs. by variation of filament voltage)

Maximum Peak Current (low voltage rating)
5 amps at 240v.

Maximum Peak Current (high voltage rating)
100mA at 1 kv.

Maximum overall length (not including pins) 65 mm.

*at approximately 6.3 volts

EDISWAN

THE EDISON SWAN ELECTRIC CO. LTD., 155 CHARING CROSS ROAD, LONDON, W.C.2

8.A.191

**EFFICIENCY
and
ELEGANCE**

With the
**ANTIFERENCE
CAR AERIAL**

ROD DESIGN
ADJUSTMENT

A single mounting telescopic aerial of brass tubular construction with heavy chromium plated finish. The smartly styled mounting provides for adjustment of the angle of the telescopic rods to suit the body line of the car. This greatly improves the appearance of the angle when fitted. The insulator has a built-in standard co-axial socket enabling the lead to be easily plugged after mounting. The socket is fitted with a special retaining spring preventing any loosening of the plug through vibration. All parts of the aerial assembly are non-rusting and easy telescopic action is ensured by lubricated packing glands which also completely prevent rattling.

A longer aerial is available for export purposes. Details gladly submitted on application.

MODEL TCA 400/64
Three sections extending to 64 ins.
(Closed 28 ins.) including 3 ft. co-axial lead.

RETAIL PRICE **45/-**

ANTIFERENCE LIMITED · 67 BRYANSTON STREET · LONDON W.1

Why you should use ...



- | | |
|---|---|
| 1 Maximum "Wetting" Capacity. | 6 Residue sets hard, is non-corrosive, and of high dielectric strength. |
| 2 Accelerated Fluidity. | 7 No harmful fume deposits. |
| 3 Moderate soldering bit temperatures. | 8 Continuous, unvarying core. |
| 4 Mechanical bonding and perfect Electrical conductivity ensured. | 9 Even distribution of activator in core. |
| 5 Minimum amount of solder used per joint. | 10 Approved by Air Ministry and General Post Office. |

Supplied in a wide range of Gauges and Alloys on 1 lb and 7 lb reels, works coils, or as required. Prices an application.

Sole Manufacturers:

H. J. Enthoven & Sons, Ltd.

89, UPPER THAMES STREET, LONDON, E.C.4.
Phone: Mansion House 4533. Works: Rotherhitha, Croydon, Derbyshire.

Instruments  **for Research and Industry**

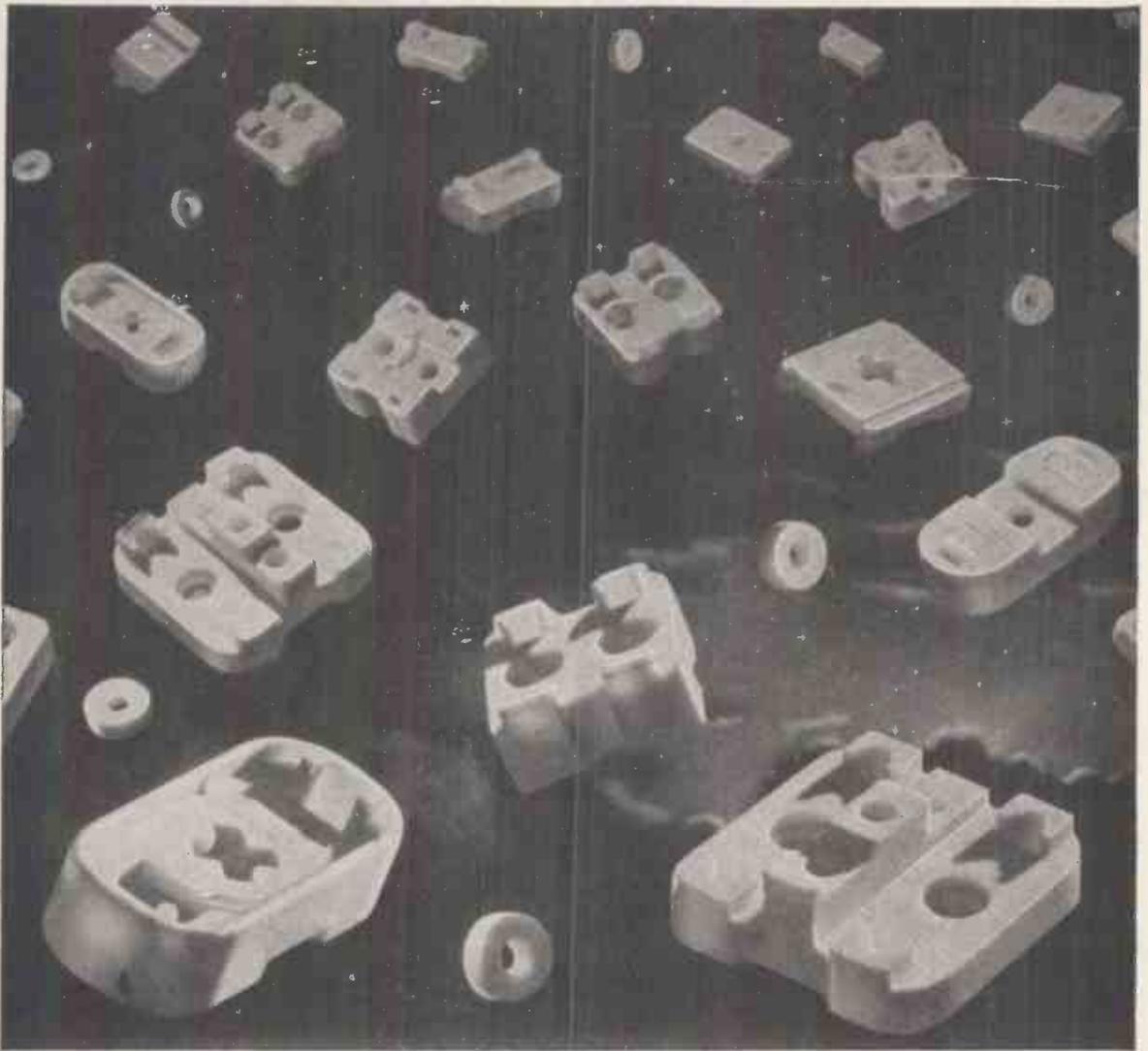
**The CONSTAC
Transformer**

A versatile constant voltage transformer which provides a fully stabilised heater supply in addition to a variety of stabilised H.T. outputs. Available in a range of types suitable for 110v. or 230v. 50 or 60 c/s supply and for loads of 20VA to 300VA. Output voltage maintained within 1% over working range.



★ Made under licence by The Banner Electric Co. Ltd.

ELECTRONIC INSTRUMENTS LTD
17, PARADISE ROAD · RICHMOND · SURREY · ENGLAND



CERAMICS

FOR TRIMMER CONDENSERS
and all radio components
FREQUENTITE-FARADIX-TEMPRADEX

STEATITE & PORCELAIN PRODUCTS LTD.



Stourport-on Severn, Worcestershire

Telephone : Stourport 111

Telegrams : Steatite, Stourport

THE RADIO TELEPHONE YOU
CAN TUCK UNDER THE DASH



**NOTE THESE
FEATURES**

Size T/R. 11½ in. × 8 in. × 4 in. (30 cm. × 21 cm. × 10 cm.)
Power Pack 8 in. × 5½ in. × 3½ in. (21 cm. × 14 cm. × 8 cm.)
Weight T/R 15½ lbs. (7 kg.), Power Pack 9½ lbs. (4.2 kg.)

The Transceiver is easily installed below the instrument panel with the small power pack in any convenient place. The remarkably low battery drain permits connection of the set to the car batteries, obviating the cost and weight of auxiliary accumulators or larger dynamo.

B.C.C. V.H.F. RADIO TELEPHONE EQUIPMENT

The B.C.C. Mobile Radio-Telephone illustrated here will give two-way communication with the Fixed Station up to a distance of 25 miles or with the portable Pack-set up to 5 miles.

This B.C.C. equipment sets a new standard in V.H.F. Communications Technique and has been approved by the G.P.O. The complete range consists of:

Fixed Stations ...Models L111 & H111
MobilesModels L67 & H67
Pack SetsModels L45V & H45V
Hand Portables ...Models L45AV & H45AV

This equipment can be supplied to cover any spot frequency in the 75-100 Mc/s or 150-185 Mc/s bands.

Write now for full details and outstanding features of this remarkable equipment.



BRITISH COMMUNICATIONS CORPORATION LTD. Gordon Avenue, Stanmore, Middlesex. Tel. GRimsdyke 1455

ACCELERATION of
production-line speed
means economy

Wherever heat applications are specified in production lines, consult Radiant Heating Ltd. Our special gas equipment can give optimum speed together with precision and economy . . .

Write to:

RADIANT HEATING LTD

for advice on heating problems

9 BARNSBURY PARK, N.I. Phone: NORth 1677/8.

TELEVISION KITS! £20

- 21 VALVES
- SUITS 9", 10" or 12" TUBES
- LONDON OR BIRMINGHAM
- POINT TO POINT WIRING
- ADVICE DURING CONSTRUCTION

Write for details

FOR LONG RANGE RECEPTION

High Gain Pre-Amplifiers

One Valve 30/-

Two Valves £2

Fully aligned and tested, with valves

HOUGHTON & OSBORNE LTD.
Electron Works, Thame, Oxon.

Telephone: Thame 182

designed

**with
your
specific
needs
in
mind**



MODEL 1035

The Cossor general purpose Oscillograph is designed and built by electronic engineers who are themselves familiar with the everyday problems which technicians have to face. The instrument consists of a Double Beam Tube operated at 2kV., a Time Base, Y Deflection Amplifiers and Internal Power Supplies. The 90mm. screen is flat, and traces

are presented over the full area. Signals are normally fed through the Amplifiers, and the calibrated Y-Shift controls provide a measurement of the applied voltages. The Time Base operates repetitively, or by external trigger (for single stroke operation), or at trigger pulse repetition frequency for continuous scanning. A calibrated X-Shift Control is provided for the measurement of Time.



**Model 1428
CAMERA**

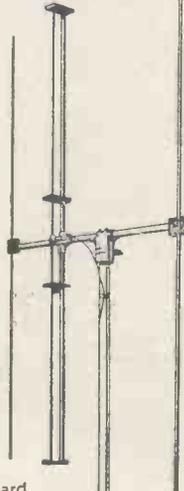
Specially developed for use with Cossor Oscillographs, it provides the simplest means of recording stationary or non-recurrent waveforms and slow transients by the moving film method on standard perforated 35 mm. film or paper. Of robust construction, it has provision for power drive by the Cossor Three-Speed Motor Attachment, Model 1429.

COSSOR
Double Beam
OSCILLOGRAPH

Further details obtainable on application to :—
A. C. COSSOR LTD., INSTRUMENT DIVISION, HIGHBURY, LONDON, N.5

IMPORTANT TO 'Fringe' VIEWERS

Where the "H" Type Aerial is not good enough — use the Model 63 High Gain "Fringe" Aerial. Gives more than 8 dbs. gain over a half-wave dipole, and 30 dbs. + back-to-front ratio. Spacing is 0.1λ and 0.15λ for the Director and Reflector respectively, reducing the input impedance to a very low figure. The impedance is then restored to the 80 ohm level by the use of a folded dipole. The Aerial is supplied with a 10ft. x 2in. Diameter Mast and double-lashing chimney fixing at £8 10s. retail.



Excellent results in Bristol and many other "fringe" areas. Suitable cables for above are:—

- Cat. 476. Twin Screen feeder, 1/6 yard.
- Cat. 341. Coaxial (Stranded Core), 1/- yard.
- Cat. 385. Low-loss Coaxial, 2/- yard.

MODEL 63

The well-tried Inverted "T" Loft Aerial can be relied upon to give excellent results within sight of the transmitter.

MODEL 53

Requires only two screws to fix and may be used as a "V" or "L" Aerial and can be mounted in a loft, attic or upper room. Taking standard coaxial cable, the aerial is entirely non-directional. Price 25/-.. Cat. 341 Coaxial Cable, 1/- yard extra.

AERIALITE LTD.

CASTLE WORKS,
STALYBRIDGE, CHESHIRE

SILVERED MICA CAPACITORS

SMALL SIZES
HIGH STABILITY
CLOSE ELECTRICAL LIMITS

STABILITY RADIO COMPONENTS LTD

14, NORMAN'S BUILDINGS,
CENTRAL STREET, LONDON,
E. C. 1
TELEPHONE: CLERKENWELL 5977

Widney Telescopic Mountings

PRODUCED IN 3 SIZES

Telescopic Mountings offer the most convenient means of obtaining complete accessibility of rack mounted equipment as each chassis can be withdrawn completely clear of its framework for easy examination.

WRITE FOR ILLUSTRATED CATALOGUE

Technical & Sales Agent
C. H. DAVIS
59, Brompton Road,
LONDON, S. W. 3
Phone KENSINGTON 4201

LIGHT

MEDIUM

HEAVY

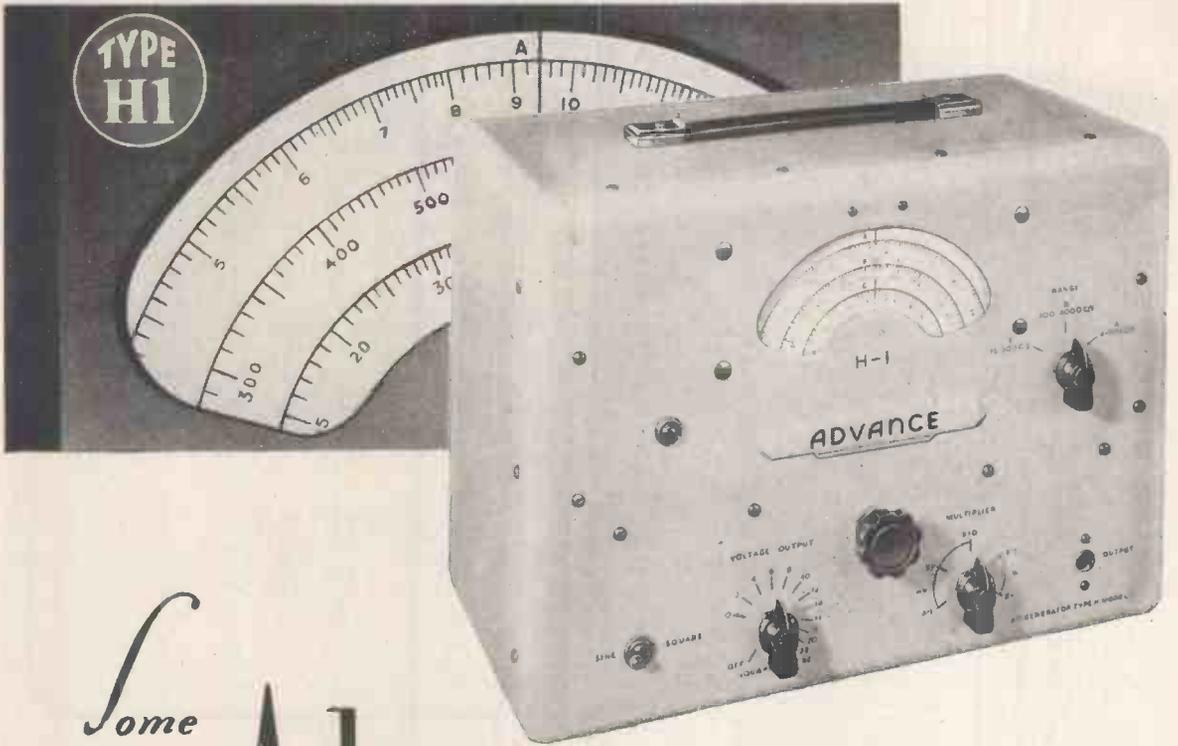
A Widney PRODUCT

ESTABLISHED 1898

MANUFACTURERS

HALLAM SLEIGH & CHESTON LTD
WIDNEY WORKS • BIRMINGHAM • 4

Phone: Aston Cross 0914 (4 Lines) • Grams Superfine, Birmingham 4



Some

Advance features in AUDIO GENERATOR design

THE combination of wide-range, high accuracy and low distortion will commend the Advance H.1 Audio Generator to all critical Service Engineers. The 15 c/s to 50 Kc/s coverage is achieved by the use of a bridge type resistance-capacity oscillator with three switched ranges. Stability throughout is attained by a highly efficient stabilizing circuit followed by two amplifier stages with heavy negative feedback.

Output : Sine wave 200 microVolts to 20 Volts, plus/minus 1 db, or Square wave 400 microVolts to 40 Volts (800 microVolts to 80 Volts peak to peak). Measured distortion is less than 1% at 1,000 c/s. In attractive cream enamel sprayed steel case, 13¼" x 10¼" x 8". Weight only 14 lbs.

LIST PRICE **£20**

**The Scale reproduced above is actual size.*

<p>COVERS</p> <p>15 c/s to 50 Kc/s in three stages</p> <p>ACCURACY</p> <p>plus-minus 1% plus-minus 1 c/s</p> <p>SINE & SQUARE WAVE OUTPUT</p>
--

A D V A N C E C O M P O N E N T S L T D
 BACK RD, SHERNHALL ST, WALTHAMSTOW, LONDON. E.17. 'Phone : LARKSWOOD 4366/7/8



Video Oscillator

Type. O.222 7 Kc/s - 8 Mc/s

Amplitude range of adjustment +10db to -55db on 1 volt peak to peak, adjustable -0.5db steps. Amplitude constant to ± 0.2 db at any frequency setting. Harmonic content better than 50 db below fundamental - output impedance 75 ohms $\pm 5\%$.

The instrument is built to meet a specification of the Design Department of the B.B.C. It can be mounted to a standard G.P.O. 19" rack or alternatively is supplied with a light transportable case as illustrated.



THE WAYNE KERR LABORATORIES LIMITED
NEW MALDEN, SURREY. PHONE: MALDEN 2202

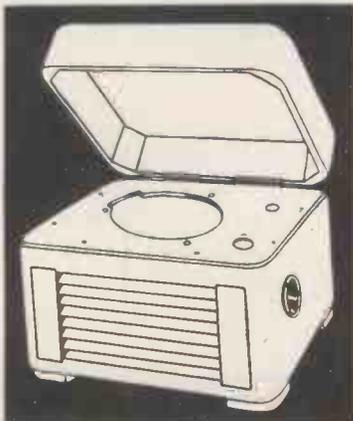
IDEAL BARGAINS FOR CONSTRUCTORS

Assemble your own

Table Electric Gramophone or Record Player

CABINETS

Beautifully polished Walnut with Rumanian Birch grille and feet. Lid interior felted. Top plate cut out for gramophone unit. Recessed escutcheon plate fitted in side for volume control. Access trapdoor in base. Rubber non-scratch feet. Sub-baffle for 6 1/2 in. loudspeaker. External 16 x 14 x 12 in. deep. Internal 15 x 13 x 7 in. below top plate, 3 in. above to lid. Solid and finely built.



£3. 10. 0.

Each, incl. Purchase Tax, Packing and carriage 7/-.

GRAMPHONE UNITS for top plate. Constant speed. Modern high output, perfect tracking angle pickup. Superb quality. A.C. Mains. £5/10/8, including Purchase Tax.

3w AMPLIFIER KITS On chassis 11 1/2 in. x 4 in. Less valves £3/10/-.

6 1/2 in. high Flux **LOUDSPEAKERS 17/6**

GROUP HEARING AIDS We designed and installed the famous equipment at the National Institute for the Deaf (see "W.W." Sept., 1948), and those of many Institutes and Public Buildings. Consult us for the BEST and CHEAP-EST communal hearing aids.

N. MIERS & CO. LTD., Telephone: EUSton, 7515.
115, Gower Street, London, W.C.1.

DURALUMIN

REGD. TRADE MARK

FOR T-V AERIALS

DURALUMIN, the aluminium alloy which combines great strength with lightness, is ideally suitable for television aerials. It is of good appearance, withstands wind and weather, will not rust and is non-magnetic. Moreover, DURALUMIN is easily workable without the aid of special tools.

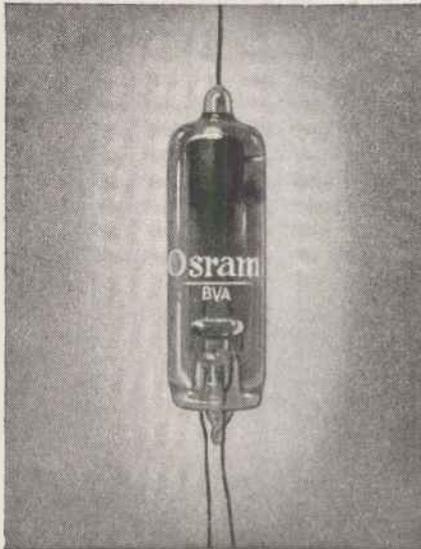
Our range of non-ferrous metals covers every requirement in the wireless field, whether it be aluminium alloys, brass or copper, and is available in a variety of forms including extruded rods and sections, tubes, sheet, strip and wire.



JAMES BOOTH & COMPANY LIMITED

ARGYLE STREET WORKS · BIRMINGHAM 7

NEW high efficiency



Actual size illustration

E.H.T. rectifier for Television Tubes

Osram

U37

MINIATURE BULB

RATINGS

Filament Voltage.....	1.4 volts
Filament Current.....	0.14 amp
Peak Inverse Voltage.....	15 max. kV *
D.C. Output Current.....	2 max. mA
Peak Anode Current.....	12 max. mA
Surge Anode Current.....	40 max. mA
Anode to filament capacitance...	0.65pF

* For circuits where anode and filament voltages rise at approximately the same rate, e.g., as in fly-back and R.F. oscillator circuits. Where used on power input circuits with full A.C. anode voltage applied on switching, the maximum P.I.V. is 10 kV.

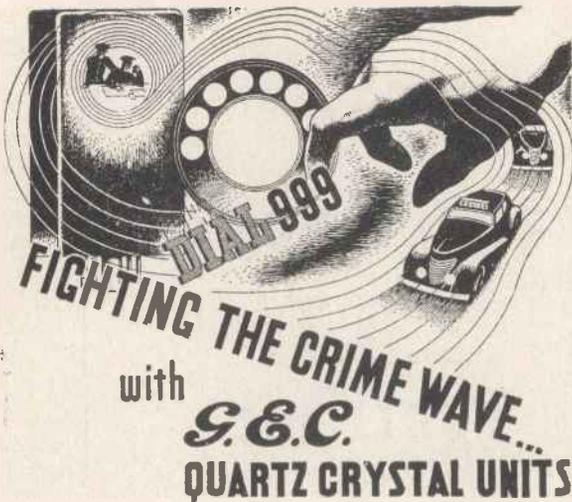
The Osram type U37, because of its low filament rating and capacitance, greatly improves circuit efficiency. This miniature directly-heated half-wave rectifier has been primarily designed to provide EHT for cathode ray tubes from an R.F. source or by rectification of the fly-back voltage. It is also suitable for use in peak reading voltmeter circuits where its low capacitance allows satisfactory operation at high frequencies and its 1.4 volt filament may be operated from a single unit cell. It is a soldered-in type valve, 48 mm. overall excluding connections.

Osram

VALVES



THE GENERAL ELECTRIC CO. LTD. MAGNET HOUSE, KINGSWAY, W.C.2



The Police "999" emergency call system depends for its successful operation on instantaneous radio communication between Police headquarters and the fleet of patrol cars. Radio equipment in the patrol cars is used under the most arduous conditions but it must be available for instant use 24 hours in the day.

No wonder then that more and more Police authorities throughout the country are using G.E.C. quartz crystals in their radio equipment.

Pioneering research and experience in making over a million units, ensure a product of the highest quality. For all your quartz crystal requirements be sure to specify G.E.C.

Quick delivery service for urgent requirements for experimental or replacement purposes.

Write for our leaflet QC.4904.



SALFORD ELECTRICAL INSTRUMENTS LTD
 PEEL WORKS, SILK STREET, SALFORD 3, LANCS.

A Subsidiary of

THE GENERAL ELECTRIC CO. LTD. OF ENGLAND

22,050
 22,250
 22,350

20 years ago, a high standard of reproduction was being set by Voigt high flux density speakers with over 16,000 gauss across a 2 mm. gap.

Later an improved diaphragm with speech coil operating in a 1½ mm. gap at higher density, effected a further advance.

Our new rematched diaphragm (which fits existing VOIGT Units) has a speech coil requiring a 1 mm. gap only. Our open type P.M. Units with revised pole tips* provide a flux density still higher in a 1 mm. gap.

The figures above give our measurement of 3 out of the first 5 P.M. open type 1 mm. gap Units assembled in 1950. They show that a density between 22,000 and 22,500 can be achieved under practical conditions. As this 40% increase over the original 16,000 provides a magnet well ahead of present day requirements, and is within 90% of the maximum obtained under "stunt" conditions, we are stabilising our design and making 22,000 gauss the 1 mm. gap poss. figure for our open type P.M. Units.

VOIGT SPEAKERS ARE INTENDED FOR HORN LOADING



VOIGT PATENTS LTD.

Price £40 ex-Works. Suitable horns (in the white), £19/10/- and £47/10/- ex-Works.

SEND YOUR ORDER TO:—

c/o **BCM/Voigt**
W.C.I.

(Trade supplied against pro forma)

*Patents granted and/or pending.

TELE-RADIO (1943) LTD.

177, EDGWARE ROAD, LONDON, W.2

COMPONENTS FOR QUALITY AMPLIFIERS.

Chassis punched and drilled.....	£1 7 6
Partridge mains transformer 425/150 mA.....	£2 17 0
Partridge mains transformer 425/200 mA.....	£4 8 0
Partridge smoothing choke 25H 60 mA.....	16 0
Partridge smoothing choke 13H 200 mA.....	£1 11 0
Partridge Williamson output transformer (wire ends).....	£5 0 0
Partridge Williamson output transformer (Tag Board).....	£5 13 0
Wharfedale L.S. W10/CS 10in. cloth suspension	£7 5 0
Wharfedale L.S. Golden 10in. Unit 2/3 & 15 ohms	£4 0 0
Wharfedale L.S. Super 8/CS. 2/3 and 15 ohms	£4 0 0
Goodman's single cone loud speakers Audio 60	£6 15 0
Goodman's double cone loud speakers Axiom 12	£8 8 0
Vitavox K 12/10 loudspeaker.....	£7 0 0
Partridge output transformer PPO/O 6,000 ohms A-A. Sec. 3.75 & 15 ohms	£2 12 6
Partridge output transformer PPO/1 8,000 ohms A-A. Sec. 3.75 & 15 ohms	£2 12 6
Partridge output transformer PPO/2 10,000 ohms A-A. Sec. 3.75 & 15 ohms	£2 12 6
Matched KT66 valves per pair.....	£1 16 6
Matched 6V6 valves per pair.....	£1 5 8
Matched 6F6 valves per pair.....	£1 5 8
Matched PX4 valves per pair.....	£1 13 0
Matched PX25 valves per pair.....	£2 14 10
Matched 6B4 valves per pair.....	18 4
Matched 2A3 valves per pair.....	£1 5 8

"The Williamson Amplifier" booklet as reprinted from "Wireless World," post free, 3s. 9d.

Williamson quality amplifier can be seen and heard at our premises in Edgware Road. When ordering please include sufficient for postage and packing. Shop Hours: Monday-Saturday 9 a.m.-6 p.m. Thursday, 9 a.m.-1 p.m. Phone: PAD 6116 or 5606

LONDON CENTRAL RADIO STORES

Government Surplus - Immediate Delivery from Stock



LIMITED NUMBER ONLY

4-VALVE USED SUPERHET UTILITY RECEIVERS

Every one guaranteed to be in working order. Medium Wave-band only. Four valves, P.M. Speaker, complete in pinewood cabinet size 13½ x 12 x 6½ in. A.C. mains 200/250 volts. In good condition.

PLACE YOUR ORDER NOW!

£3.19.6

Plus 5/- carr. and pkg.

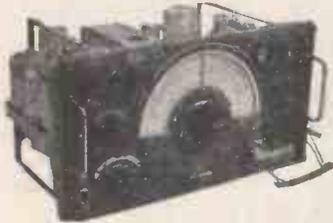


PHILIPS 6-VALVE COMMUNICATIONS RECEIVER

10-50, 200-550 and 800-2,500 metres. R/F, F/C, 2 I.F.s D.D.T. Pentode Output. Spin-wheel tuning. In black metal case with built-in speaker. Complete with power pack, A.C. 200-250 v. Can also be supplied with 12 v. D.C. power pack if required. **£17.10.0**
BRAND NEW—EX-GOVT.

SELF-ENERGISING TABLE MICROPHONE AND HEADSETS (Sound Power). The microphone is mounted on a fully adjustable stand with on/off switch. No batteries or current required to operate. UNUSED IN CARTONS. **10/6**

10-VALVE COMMUNICATIONS RECEIVER. Type 1155



EQUAL TO NEW

Freq. range 7.5 mc/s 75 kc/s in five wavebands. Complete with 10 valves including magic eye. Enclosed in metal case. Every receiver is aerial tested. Complete with Power Pack and Loudspeaker for A.C. mains 220/250 v.

£16.10.0

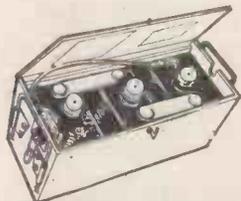
RECEIVER ONLY **£11.10.0**
(Carr. and pkg. 10/6).

FREE with each receiver! Complete circuit, description and modifications for civil use, reprinted from "W.W." July, 1946.

NEW MAINS TRANSFORMERS. 16/-
250-0-250 v. 4 v. and 6.3 v.

WALKIE-TALKIE (Transmitter and Receiver) CHASSIS, Type 38 Mk. II
Including four ARP12, one ATP4 valves. In metal case. Complete with components, except the Send/Receive switch. With wiring diagram. Price **27/6**

BRAND NEW ACCUMULATORS



Complete in strong case, as illustrated. British made. 6 v. 85 a. Size 12 x 9 x 7 in. Weight, 45 lb. **£3.10.0**
Carriage and packing 5/-.

CALL AND INSPECT OUR STOCKS OF RADIO SETS AT RIDICULOUS PRICES!

3.5 v. Bulbs unboxed. Ex-Govt., 17/6 per 100.

2-VOLT VIBRATORS, Type R76C. 7-pin self-rectifying. Output 200 v. at 60 mA. Made by Electronic Laboratories Inc., 7/6, also Mallory Type 650, 6 v., 4-pin American base, 7/6.

ELECTRO MAGNETIC COUNTERS

Ex-G.P.O., every one perfect, electro-magnetic, 500 ohm. coil, counting to 9,999, operated from 25 v., 50 v. D.C., many industrial and domestic applications. **7/6**

1/30th H.P. MOTORS. Constant speed. Double-ended spindles. 220-250 v. These motors are new, not surplus conversions and are suitable for 16 mm projectors and many other purposes. A.C./D.C., without feet, 37/6.

UNI-SELECTOR SWITCHES. With complete wipers, 4-bank, 37/6; 6-bank, 37/6; 3-bank, 22/6.

VISION UNIT, Type 162. Complete with 6in. 517 C.R. Tube, 2in. 139 C.R. Tube, one 807, three VR85, one 6J5 valves. 0.5 milliammeter, condensers, etc. Suitable for television, 55/-.

EX-R.A.F. TUNING UNIT TYPE 207A. BRAND NEW. Includes Clystron valve, 3 Neon tubes CV71, 1 5Z4G and other useful components. With metal cover. **21/6**

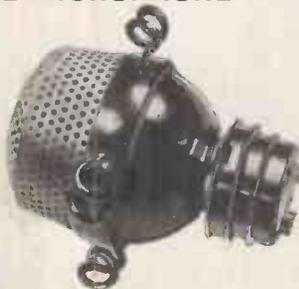
FIVE-WAY RUBBER COVERED CABLE. Suitable for lighting and other purposes. Per doz. yds., 6/-.

CO-AXIAL CABLE for T.V., 75 ohms, 12 yard lengths, 8/-.

MOVING COIL HAND MICROPHONE. Complete 5/6.

BALL MICROPHONE

Manufactured by Standard Electric. All in perfect condition. Suitable for broadcasting and recording. Moving Coil (Dynamic). Omni-directional. No energising necessary. High Fidelity. Coil Impedance 15 ohm and will work very well in conjunction with an ordinary speaker transformer. Is of the type used by many leading bodies, such as the B.B.C. and G.P.O. for high fidelity reproduction, **£4.17.6**



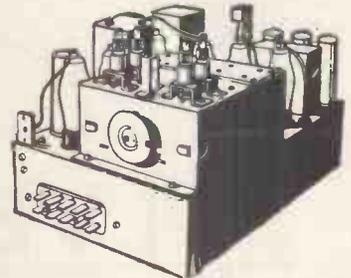
PLEASE NOTE

● All carriage paid unless otherwise stated. ● Carriage charges relate to British Isles only. ● We do not issue lists or catalogues. ● We have hundreds of items in stock too numerous to list, including Special Admiralty Transmitters, Receivers, etc., so when in Town pay us a visit.

CATHODE RAY TUBES
12in. VCR140 Blue Screen, Magnetic deflection, magnetic focus maximum 6 kv., heater 4 v., International octal standard connections 90/-, carr. and pkg., 5/-.

New VCR097 6in. tube, 37/6, carr. and pkg., 5/-.

R.A.F. 6-VALVE SUPERHET RECEIVER UNIT No. 25



All valves guaranteed. This unit is easily adapted for Short-wave reception for home use. In addition to two EF36, two EF39, one EK32 and one EBC33 valves, it contains 1 pr. 460 Kc/s iron dust I.F. Transformers, Mic. and phone output transformers, a number of resistances and fixed condensers of useful value, two 1 mfd. 500 v. wkg. and four .1 tubular condensers, pot/meters, Int. Octal Valve holders, Tuning Coil, etc., mounted on steel chassis 8½ x 6½ x 2½ in. FREE circuit diagram 6in. x 10in. showing all components, supplied with each set. In new condition. **22/6**

PHOTO-ELECTRIC CELLS, Type GS17. These cells are the gas-filled type with caesium Cathode. Made by Cintel. Minimum sensitivity 100 uA/lumen, working volts 100 D.C. or peak A.C. Projected cathode area 16 sq. cm. Suitable for 16 mm. Home Cinema Talkie equipment, Safety Devices, Colour and Photo Matching, Burglar Alarms, Automatic Counting, Door Opening, etc. Brand new in original cartons, **42/6**

MAP READING TORCH



Powerful magnifying lens, 3in. diam. In bakelite case. Fitted with dimmer switch. Takes 2 U2 cells. With bulb, less batteries. **22/6**

LONDON CENTRAL RADIO STORES, 23 LISLE ST. (GERrard 2969) LONDON, W.C.2

Closed Thursday 1 p.m. Open all day Saturday and weekdays 9 a.m.—6 p.m.

Sit back and enjoy the NEW—
'CONCERT MASTER'!

This latest high fidelity amplifier has all the features which you have asked for. Of impeccable performance, it is of compact size and includes a detachable control panel which is quite unique. It contains no valves, and has no H.T. or L.T. voltages. It is instantly removed by snap fasteners and makes the amplifier eminently suitable for fitting into a cabinet, the main amplifier being placed at the bottom and the control head on its six feet cable can be placed just where you want it. This last word in amplifier design will take high or low output pick-ups and has provision for radio and microphone inputs.



PRICE
£29.10.0
TWO YEARS' GUARANTEE

Write for your copy of our fully illustrated catalogue today!

DEFERRED TERMS AVAILABLE
ON ALL MODELS



**THE TRICORNE
SPEAKER
CHAMBER**

For optimum acoustic performance with any good 12-in. speaker. Labyrinth construction, walnut veneered and cross-braced.

Price 11 gns. plus 20/- deposit (returnable) for crate.

Phone :
WESTern
3350

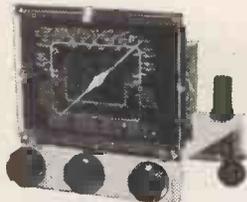
Charles
AMPLIFIERS

(SALES) LTD.

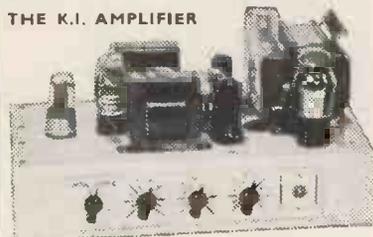
181 KENSINGTON HIGH STREET LONDON W.8
FOR THE UTMOST REALISM FROM RECORDS & RADIO

**R.A.
TUNING
UNIT**

A really fine design with lasting high performance. R.F. stage on all wave-bands High fidelity superhet or T.R.F. performance. Suitable for any amplifier. Price 10 gns., plus £2/6/8 tax. (2 years' guarantee).



THE K.I. AMPLIFIER



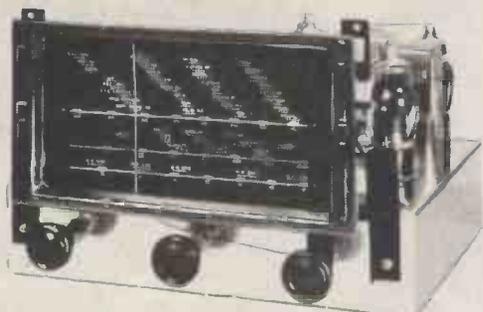
A seven-valve amplifier especially designed for the light-weight high-fidelity type pick-up. Independent bass and treble controls. Price complete, 17 gns., or in kit form, 13 gns. Blueprint available separately 2/6.

Our equipment can also be seen at Webb's Radio, Soho St., W.1. University Recording Co., 16 Burleigh Place, Cambridge.

Ernest Buchan, 28 Belmont Street, Aberdeen. Farmer & Co., 83 George St., Luton.

Signal Shop, 51 St. Mary Street, Bridgwater, LONDON W.8

**SOLVE YOUR
RADIO PROBLEMS WITH**



OUR HOME CONSTRUCTOR UNITS!

ANYONE can build our handsome SUPERHETS! The performance will equal that of commercially built units at double the cost, so you can be EXTRA PROUD of your achievement!

As our delighted friends already know the secret is our: **30 TUNING UNIT** comprising the famous 3 band 30 Coil pack, "MM" I.F.T.'s, new Dial and 2 gang—ALIGNED AND MATCHED AS A UNIT! Price 54/9 (inc.) or 76/6 with J.B. S.L.8. spin-wheel Tuner. * All parts and full construction Sheets available for Feeder Units, 4, 5 and 6v. sets. Quality Amplifiers, Test Gear, etc.

For details, all the circuits, data, etc., send 1/6 NOW for NEW ENLARGED EDITION (44 pp.) of "Home Constructor's Handbook" All items supplied by Mail DIRECT ONLY from:

RODING LABORATORIES
70, LORD AVENUE, ILFORD, ESSEX

DEPENDABILITY

Reception conditions range from excellent to very poor, signal strength from strong to very weak, and to cope successfully with all such conditions you need a pair of highly sensitive and dependable headphones.



For maximum reception results, insist that your local dealer supplies you with a pair of the rightly famous S. G. BROWN Type "F" headphones. Sea, land and air W/T operators, servicemen, experimenters and radio amateurs all vouch for their dependability.

TYPE "F"
(FEATHERWEIGHT)

PRICE 30/- PER PAIR
YOUR LOCAL DEALER CAN SUPPLY

Send for descriptive Brochure "W.W.," it gives details of full range. Prices from 30/- up to 105/- for Moving Coil Type K.

HEADPHONES WHICH UPHOLD BRITISH PRESTIGE

Telephone :
Watford 7241

S.G. Brown, Ltd.

SHAKESPEARE STREET, WATFORD, HERTS.



a step in the

right

direction

THE AMBASSADOR
"SIX-F.FTY" RADIOGRAM

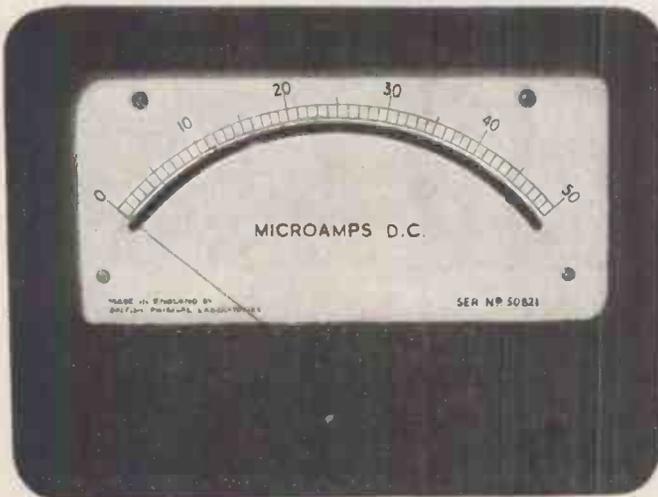
In this new Ambassador Radiogram we have put quality reproduction before anything else. Its six valve A.C. superhet circuit possesses unusual features which contribute to the receiver's most outstanding fidelity of reproduction. The response of the whole L.F. system to the L.S. terminals is flat within 1 D.B. limits from 50—12,000 c.p.s. Push-pull output via a high quality output transformer feeds a 12" high flux density loudspeaker

PRICE £72 · 0 · 0 TAX PAID

STYLED AND PRODUCED BY:—



RADIO WORKS, HUTCHINSON LANE, BRIGHOUSE, YORKS



SIZE	2½"	3½"	5"
RANGE	25μA to 50A	10μA to 50A	10μA to 50A
PRICE	50μA 55/- 200μA 45/- 1mA 35/-	61/- 51/- 41/-	93/- 83/- 73/-

All sizes available with
MIRROR SCALE

1st Grade Accuracy

SENSITIVE PANEL MOUNTING METERS

For particulars of these and our full range of measuring instruments write to:—

BRITISH PHYSICAL LABORATORIES

HOUSEBOAT WORKS · RADLETT · HERTS · Telephone: RADlett 5674-5-6

R & A

*Suppliers of Loud Speakers
to Britain's foremost
Radio Manufacturers.*

*Reproducers and Amplifiers Ltd.,
WOLVERHAMPTON,
ENGLAND.*

ACRU



*neon
indicator
lamps*

In handsome Black Bakelite holder complete with series resistance and leads, to show Pink, Red, Amber or Green, on 230v or 400v AC or DC. Specially designed for easy assembly in 1/4-inch mounting hole.

Send now for full details, prices and terms.

THE ACRU ELECTRIC TOOL MFG. CO. LTD.
123, Hyde Road, Manchester, 12.

Ardwick 4284.

- For SWITCHBOARDS,
- INDICATOR PANELS,
- MACHINE CONTROLS,
- HEATING APPLIANCES, ETC.

VALVES!! VALVES!!

RECEIVING, TRANSMITTING,
MAGNETRONS, KLYSTRONS,
CATHODE-RAY TUBES, PHOTOCELLS,
ETC.

LARGE QUANTITIES
& GREAT VARIETIES
IMMEDIATE DELIVERIES FROM
STOCK
WRITE OR 'PHONE:—

S. Szymanski

(pronounced SHE-MAN-SKEE)
ELECTRONIC
ENGINEER & STOCKIST

95 STRODES CRESCENT
STAINES - MIDDLESEX
STAINES 3971
PROBABLY THE LARGEST ACTUAL
STOCKIST IN ENGLAND
EXPORT ENQUIRIES WELCOMED

New Two Speed-motor....

At the turn of a switch you have two speeds, 33 $\frac{1}{3}$ or 78 r.p.m. The Turntable is a full 12" diameter; its main spindle precision ground and lapped, runs in phosphor bronze bearings. The synchronous motor is virtually vibrationless and is suitable for playing standard, transcription and microgroove recordings. Guaranteed mechanically perfect. New super lightweight pick-up available with the interchangeable heads for microgroove and standard recordings.



Retail price without pick-up £13-15-0

Purchase Tax £5-19-2

A Connoisseur PRODUCT

Manufactured by

A. R. SUGDEN & CO. (ENGINEERS) LTD. WELL GREEN LANE BRIGHOUSE YORKS.

The TRUE TEST of an instrument is **RELIABILITY**

The "SELECTEST" is built for the main job in radio servicing — that of measuring VOLTS, AMPERES and OHMS — and nothing else. That was the intention. The result is that it does this job accurately and reliably — and will continue to do it. *There is no better instrument for the job.* You can rely on a "SELECTEST" — it's a G.E.C. Measuring Instrument.

Cat. No. M4111.

Price £16.5.0

VOLTS	AMPS	OHMS
A.C. 7.5, 15, 75, 150, 300, 600, 750, 1,500.	A.C. 75, 150, 750mA.	1,000
D.C. 150mV, 300mV.	1.5, 7.5, 15 A.	10,000
1.5, 3, 15, 30, 75, 150, 300, 600, 750, 1,500 V.	D.C. 1.5, 3, 15, 30, 150, 300 mA.	100,000
	1.5, 3, 15, 30 A.	1 Megohm.

Please send for leaflet No.X334

F.S.D. 1 mA



A G.E.C. PRODUCT

SELECTEST

MULTI-RANGE MEASURING INSTRUMENT



HOMELAB SIGNAL GENERATOR

(100 kcs — 130 mcs)

PRICE **£9 - 9 - 0**

C.O.D. or Cash Orders and enquiries to:—

HOMELAB INSTRUMENTS, 116, Grove Road, London, E.17

Showrooms: 374, High Road, London, E.11

Unfortunately we have to increase the price. The rising cost of materials is partly to blame—the rest is due to our striving after perfection. Hundreds of *HOMELABS* have now been supplied, and in the course of production all improvements resulting from continued development have been incorporated. The result is an instrument of really outstanding performance which is being used in Universities, Industrial Organisations, Medical Research and other fields where the requirements are exacting and the price a secondary consideration. For those experimenting with television and radio receivers the *HOMELAB* with its wide frequency coverage is an ideal instrument, and many are being used very successfully for these purposes. Why not call and see it yourself, not just the finished article in its attractive cabinet, but the works as well—we have nothing to hide. If you cannot call send s.a.e., for full particulars enclosing P.O. for 2/6 if the circuit diagram is required.

IMPORTANT. Orders at present on our books will be executed at the old price.

DELIVERY. The *HOMELAB* is not yet available ex stock. The supply position of difficult items has improved and a steadily increasing rate of production is being achieved. All enquiries will receive our prompt and courteous attention.

Quality **HR** Television
Sets, Chassis and Components

NEW PM FOCUSSING UNIT

Rear operated shift controls.

Remote focussing control, worked through gears by key extending beyond cap of CR tube.

Alcomax III magnet.

Tube supporting plate for solid fixing concentric with neck of tube.

Type PM15A for tetrodes and PM20A for triodes. Price **36/-**

For further details ask for Technical
Publication No. 44.

SCANNING UNITS for aluminised CR tubes, for
circuit see Technical Publication No. 38A

10KV. RF. E.H.T. UNITS:

TELEVISION RECEIVERS and COMPLETE SETS
in SINGLE CHASSIS FORM, all with ALUMINISED
CR TUBES. Circuit booklet 1/6 post free.

HAYNES RADIO LTD. Queensway,
Enfield, Middx.

Stars for Sale!

MOTORS

B.S.R. shaded pole types for recorders, fans, display, models, etc. 8R1, 3in./oz. torque 32/-; 8R2 2in./oz. 25/-; FP10 4-pole type enclosed, 3in./oz. 38/-.

GRAM MOTORS RADIOGRAM UNITS

Centre drive, variable speed, 12" turntables (no P.U.) Collaro AC47 25/3/2. Garrard AC/6 26/3/2.
Modern rim-drive types, 10in. turntables, with magnetic pick-ups. Collaro AC504 25/3/2; Garrard "S" 25/10/6 Collaro AC/04 with crystal P.U. 25/17/6.

AUTO-CHANGE UNITS

Marconi A.C. 100 plays 10in. or 12in. un-mixed, lightweight P.U. with matching transformer 10 gns.; De Luxe model in cabinet ACP-100 215/1/0; Collaro RC500, plays 10in. or 12in. un-mixed, Hi-Fi lightweight P.U. 210/15/0; Garrard RC85A plays 10in. and 12in. mixed, De Luxe model with plug-in P.U. head, 215/11/4.

PICK-UPS

Marconi 142 23/11/8; matching transformer 25/- extra. Connoisseur 23/17/6; matching transformer 13/- extra. Goldring 130 "Bantam" lightweight for standard needles 30/-, Goldring miniature lightweight 121 22/10/0; or with permanent sapphire 23/0/8. The latest Acos GP20 23/11/5.

SPEAKERS

W.B. Concentric Duplex with O.P.T. 26/6/0. Wharfedale De Luxe cloth suspension types, Super 8/CS 24; Golden 10/CS 24/10/0; W10/CS 27/5/0; 3 ohms or 15 ohms; W12/CS 27/10/0; W1/CS 212/10/0; 15 ohms only. Goodman, new enclosed streamline type, Audion 60, 12in. 23/15/0; Axiom 150 twin cone 12in. 23/8/0. All the above speakers have die-cast chassis.

BOOKS

Limited supplies still available of the Mullard Valve and Service Reference Manual 5/-, plus 6d. postage. Ediswan 240 page valve manual 1/-, plus 4d. postage. Brimar Radio Valve and Teletube Manual 190 pages 4/-, plus 4d. postage. "Viewmaster" Home Constructor Television 5/-, plus 6d. postage. "Wireless World" Constructor Television, 5/-, plus 6d. postage. "Electronic Engineering" Constructor Television, 4/6, plus 4d. postage.

TV

Full range of parts in stock for all popular television designs, coils, formers, condensers, resistors, valves, C.R.T.s, transformers, chokes and controls.

All goods post free over £1. Satisfaction guaranteed or cash refunded instantly. Return of post service.

**Frith
RADIOCRAFT Ltd.**
69-71 CHURCH GATE, LEICESTER
PHONE 58971
GPO REGD. COMM. G2R1

MINIATURE VITREOUS ENAMELLED RESISTOR

TYPE M.V.1

RATING 3 watts for 250°C rise.

RESISTANCE RANGE 1-4700 ohms.

Full rated watts over the whole resistance range

DIMENSIONS - 15/32" × 13/64"

Agents in Belgium: Monsieur Paul Groeninckx, 43 Avenue Jean Stobbaerts Bruxelles.



Actual size of resistor

TYPE APPROVED



KINGSTHORPE, NORTHAMPTON.



It's so simple!

- Recording with a magnetic recorder is simplicity itself.
- The portable unit shown will record continuously for one hour and recordings may be played over on the machine as often as desired or erased and the wire used again and again for further recordings.



Portable Wire Recorder (Wirek)

IMPORTANT!
A new TAPE RECORDER will be available shortly

SIMON SOUND SERVICE

Recorder House, 48/50 George Street, Portman Square, London, W.1, England

Telephone: Welbeck 2371 (4 lines)

Telegrams: Simsale, Wesdo, London

Cables: Simsale, London

TELCON TELEVISION AERIAL DOWNLEADS



*For Improved Picture Quality
and Maximum Efficiency*

TELCON have recently introduced a new 80 ohm balanced screen twin feeder for fringe area operation. This coupled with our well-known K.12.SM. covers all possible requirements for screened twin television aerial feeders.

CABLE CHARACTERISTICS

Area	Local	Fringe
Code	K.12.SM.	BA.24.PSM.
Attenuation db/100 ft. at 45 Mc/s	5.9	2.5
Overall diameter	0.232"	0.297"

Further details of these and other R.F. Cables on application.

THE TELEGRAPH CONSTRUCTION & MAINTENANCE CO LTD

Head Office: 22, OLD BROAD STREET, LONDON, E.C.2. Telephone: LONDON Wall 7104
All enquiries to: TELCON WORKS, GREENWICH, S.E.10. Telephone: GREENWICH 3291

BAKERS 'Selhurst' RADIO

PIONEERS OF MOVING COIL SPEAKERS SINCE 1925

NEW "HIGH FLUX" 1950 MODELS

HIGH FIDELITY SPEAKERS

The World Famous
12" triple cone 12.B.

The standard 12"
P.A. model 12 C.

The Cinema Model
18" "Duplex" C.T.

Write for Illustrated list
and technical details of
SPEAKERS, TUNERS and
AMPLIFIERS.



BAKERS 'SELHURST' RADIO

Dingwall Road, Croydon

Telephone: CROYDON 2271/2

COIL PACKS

Improved performance at lower price with the new F. P. series. 3 and 5 waveband models with or without R. F. stage.

VALVE TESTER

Type 218 for the Laboratory and Service Engineer.

Manufactured by:—

H. C. ATKINS LABORATORIES LTD.

World Sole Concessionaires:—

HERMES PRODUCTS (Export) LTD.

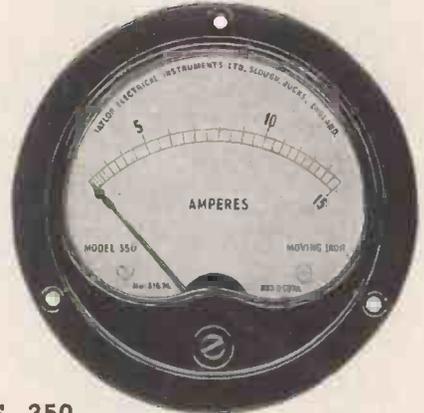
32 CUMBERLAND RD., KEW GARDENS.

Telephone—RICHMOND 2950.

New Moving Iron Meters

Taylor moving iron meters are repulsion type instruments of an improved and patented design, noteworthy is the almost linear scale shape from 20% to full scale. Available in round flush and semi-flush rectangular types, many ranges are "ex stock"

Illustrated catalogues of all Taylor products gladly sent upon request



SERIES 350

Other products include: MULTIRANGE A.C. D.C. TEST METERS
SIGNAL GENERATORS • VALVE TESTERS • A.C. BRIDGES
CIRCUIT ANALYSERS • CATHODE RAY OSCILLOGRAPHS
HIGH AND LOW RANGE OHMMETERS • OUTPUT METERS
INSULATION TESTERS • MOVING COIL INSTRUMENTS

TAYLOR ELECTRICAL INSTRUMENTS LTD
419-424 MONTROSE AVENUE, SLOUGH, BUCKS, ENGLAND
Telephone SLOUGH 21381 (4 lines) • Grams & Cables TAYLINS, SLOUGH

CONSTANT VOLTAGE. POWER SUPPLY UNITS

MODEL 101-C

Output: 250/400v. 0.250mA max.
Stability: Better than 0.1%.
Output Impedance: Less than 1 ohm.
Output Ripple: Less than 2mV. R.M.S.
Mains Supply: 200/250v. 45-60c/s.
Regulation down to zero load.



DETAILS ON REQUEST.

ALL-POWER TRANSFORMERS LTD.
CHERTSEY ROAD, BYFLEET, SURREY
Tel: Byfleet 3224/5.

The Revolutionary

GOLDRING

Headmaster
HYPERFIDELITY
PICK-UP

With an interchangeable Pick-Up Head for every type of record.

Supplied in attractive Display Carton complete with Goldring Tonaliser and Transformer

★

Goldring Products include:
PICK-UPS, PICK UP HEADS,
SAPPHIRE JEWEL POINT
NEEDLES, AND RADIOGRAM
ACCESSORIES.

Write for full Descriptive Lists and Technical Information.

ERWIN SCHARF
49-51a DE BEAUVIOR ROAD, LONDON, N.1
Telephone: CLISSOLD 3434

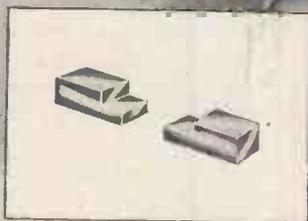
Sintered Permanent Magnets

The DECCA ffr pick-up uses Murex sintered permanent magnets. Where small complex shapes with high magnetic efficiency and stability are required, sintered permanent magnets are essential.

Illustrated by courtesy of the Decca Record Co. Ltd.



Actual size
of
MAGNETS



MUREX LIMITED, RAINHAM, ESSEX, ENGLAND

Telephone : Rainham, Essex 240



A NEW LOUDSPEAKER with greatly increased response

The latest addition to the well-known Wharfedale range of loudspeakers is the SUPER 8/CS/AL, a special model for H.F. reproduction. Embodying all the exclusive features of the popular Super 8/CS this new model has an aluminium voice coil which extends the effective response by almost one octave.

Wharfedale SUPER 8/CS/AL

PRICE
85/-
For general purposes the original Super 8/CS is still available at 80/-

WHARFEDALE WIRELESS WORKS BRADFORD ROAD, IDLE, BRADFORD, YORKS.

Telephone : IDLE 461.

Telegrams : Wharfedel, Idle, Bradford.



Leaders in their field



TMC.10 DUAL PROGRAMME UNIT

This equipment is specially designed for the dissemination of two simultaneous radio programmes in hospitals, nursing homes and infirmaries. Use can also be made of this versatile equipment in hotels.

Two separate superheterodyne radio units covering long, medium and short wave bands, and two 15 watt power amplifiers are built into one compact and attractive cabinet.

A built-in monitor speaker enables tuning adjustments to be made to each channel. Inputs for microphone and gramophone are included and it is possible to transmit speech over both channels simultaneously.



SR.20 RADIO AMPLIFIER

A 20 watt radio amplifier superbly engineered and attractively finished in brown crystalline.

Comprises a superheterodyne radio unit covering long, medium and short wave bands, coupled to a high fidelity 20 watt power amplifier.

Microphone and Gramophone inputs provide for amplification of speech and records if desired.

A monitor speaker is included which can be switched off at will, and can be used for pre-tuning radio.

Both low and high impedance outputs are fitted.

Particularly suitable for small factories, schools, restaurants, hospitals, canteens, hotels, theatres, clubs, etc.

BIRMINGHAM SOUND REPRODUCERS LTD.

Telephone
Cradley Heath 6212

CLAREMONT WORKS, OLD HILL, STAFFS.

'Grams' ELECTRONIC
Oldhill, Cradley Heath

Wireless World

RADIO AND ELECTRONICS

40th YEAR OF PUBLICATION

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

Editor: H. F. SMITH

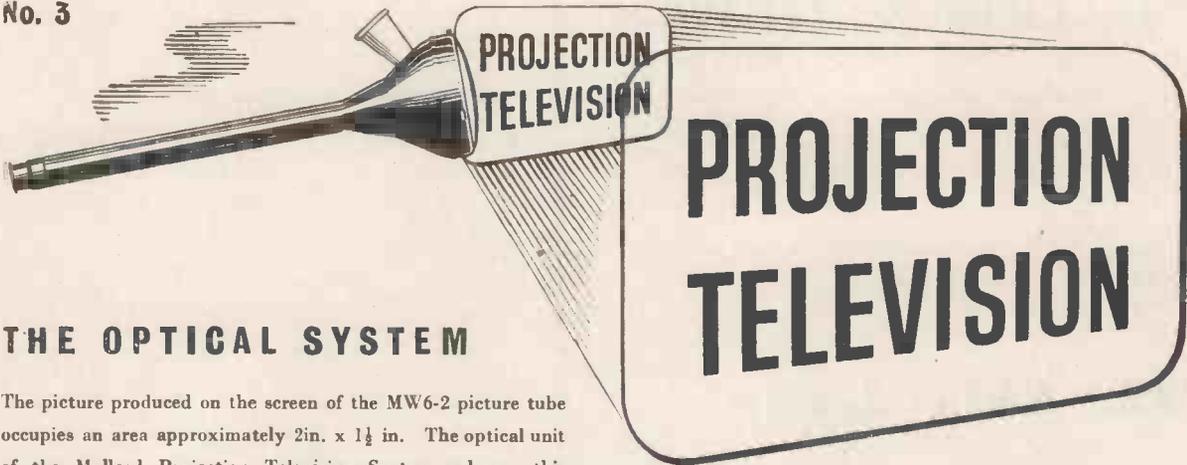
In This Issue

EDITORIAL COMMENT	201
NARROW-BAND PULSE COMMUNICATION.	
By <i>Thomas Roddam</i>	202
SHORT-WAVE CONDITIONS. By <i>T. W. Bennington</i> ..	205
TELEVISION MONITORS. By <i>J. E. B. Jacob</i>	206
SCREENING. By "Cathode Ray"	211
THAMES RADIO SERVICE	215
MODERN SOFT-SOLDERING TECHNIQUE.	
By <i>R. W. Hallows</i>	217
WORLD OF WIRELESS	220
ELECTRONIC CIRCUITRY. By <i>J. McG. Sowerby</i> ..	223
AMPLIFIERS FOR CARDIOGRAPHY. By <i>B. J. Shelley</i> ..	227
TRENDS IN COMPONENTS	229
UNBIASED. By "Free Grid"	236
RANDOM RADIATIONS. By "Diallist"	237
LETTERS TO THE EDITOR	238
MANUFACTURERS' PRODUCTS	240

JUNE 1950

PUBLISHED MONTHLY: Price 2/- (on last Thursday of preceding month) by ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1. Telephone: Waterloo 3333 (60 lines). Telegrams: "Ethaworld, Sedist, London." Annual Subscription: Home and Overseas, £1 6s. 0d.: U.S.A. and Canada \$4.50. BRANCH OFFICES: Birmingham: King Edward House, New Street, 2. Coventry: 8-10, Corporation Street. Glasgow: 26B, Renfield Street, C.2. Manchester: 260, Deansgate, 3.

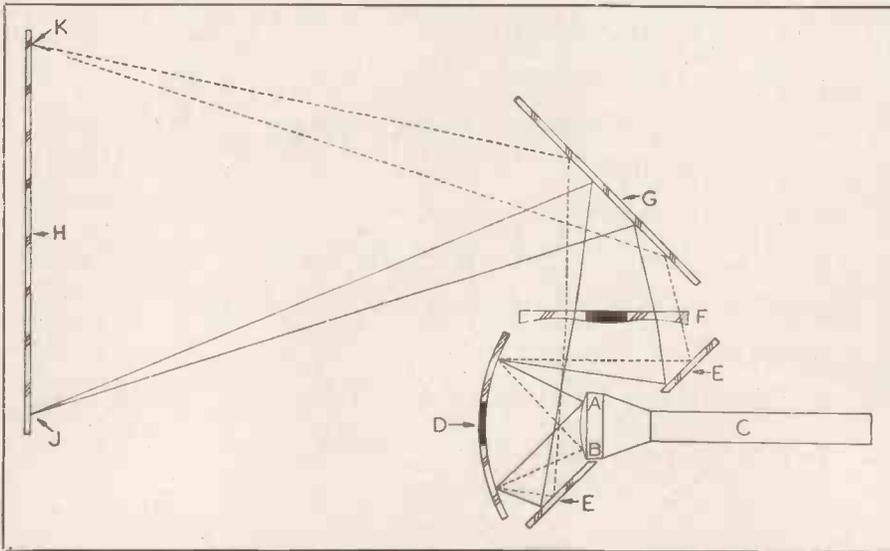
No. 3



THE OPTICAL SYSTEM

The picture produced on the screen of the MW6-2 picture tube occupies an area approximately 2 in. x 1½ in. The optical unit of the Mullard Projection Television System enlarges this picture so that an image of one of the standard sizes (ranging up to 16 in. x 12 in. for cabinet viewing or up to 48 in. x 36 in. for wall projection) is seen on the viewing screen.

Of the various methods of optical enlargement available, that in which a spherical mirror is used as the enlarging element has



been selected on account of its simplicity, its suitability for manufacture on a mass-production basis, and its high luminous efficiency.

The optical principle is indicated in the diagram where C is the MW6-2 picture tube, D a front-silvered concave spherical mirror, E a plane mirror mounted at an angle of 45° to the axis of the picture tube, F a lens of special contour to correct for spherical aberration, G a second plane mirror mounted at right angles to E, and H the viewing screen which for cabinet viewing is of the dispersive type and for wall projection of the reflective type.

A picture element A formed at the top of the raster emits light which is collected by the spherical mirror and is reflected as a convergent beam to mirror E and thence, via corrector lens F to mirror G from which it is again reflected, still as a convergent beam, to point J at the bottom of screen H, where

it is visible as a magnified image of picture element A.

Similarly a magnified image of a picture element B situated at the bottom of the raster is brought to focus at K at the top of screen H.

The length of the optical path, i.e. the combined distance from corrector lens F to mirror G and from mirror G to screen H must, of course, be such that the spot is correctly focussed on screen H. The correct distance is determined by the contour of lens F, and

the five standard models of the optical unit differ only in the design of the corrector lens, each model being suitable for a specified throw distance and corresponding picture size



Equipment manufacturers are invited to send their enquiries to:—
MULLARD ELECTRONIC PRODUCTS, LTD.,
SETMAKERS DEPARTMENT,
CENTURY HOUSE, SHAFTESBURY AVE., W.C.2

These Valves make News!

NEW TYPES FOR V.H.F. OPERATION



B9A (Noval) Base
Seated Ht. 2 1/2 in. max.
Diameter 1/2 in. max.
Retail price. 20/-

TYPE 5763 Miniature Beam Power Amplifier

Specially designed for use as frequency multiplier to 175 Mc/s., type 5763 will give considerable output for very small driving power. As a Class C power amplifier it will operate efficiently at frequencies exceeding 100 Mc/s.

RATINGS

Heater Voltage	6.0 v.	} Absolute maximum values
Heater Current	0.75 a.	
Heater Cathode Potential	100 v. max.	
Anode Voltage	300 v.	
Screen Voltage	250 v.	
Anode Dissipation	12 w.	
Screen Dissipation	2 w.	
Bulb Temperature	250° C.*	

* At the hottest part of bulb surface.

Operation as Class "C" amplifier or oscillator at 50 Mc/s.

Anode Voltage	300 v.
Screen Voltage	250 v.
Driving Power	0.35 w.
Output Power	8.0 w.

Operation as Frequency Multiplier to 175 Mc/s.

	Doubler	Tripler
Anode Voltage	300 v.	300 v.
Screen Supply Voltage ...	300 v.	300 v.
Driving Power	0.6 w.	0.6 w.
Output Power	3.6 w.	2.8 w.



Octal Base
Seated Ht. 3 1/2 in. max.
Diameter 1.5/16 in. max.
Retail price. 25/-

TYPE 2C26A Power Triode

This valve will function efficiently as oscillator or power amplifier at 150 Mc/s and is particularly suitable for pulse operation.

RATINGS

Heater Voltage	6.3 v.
Heater Current	1.1 a.
Anode Voltage	400 v.
Anode Dissipation	10 w.

PULSE RATINGS *

Peak Anode Voltage ...	3,500 v.	} Absolute maximum values
Peak Anode Current ...	6.0 a.	
Peak Grid Voltage	700 v.	

* For Pulse length 10μs, Duty Cycle 1 per cent.

BRIMAR

TECHNICAL ADVICE SERVICE

WRITE NOW TO DEPT. 4530
for data sheets on the above valves.

STANDARD TELEPHONES AND CABLES LIMITED, FOOTSCRAY, SIDCUP, KENT.



THE ACOS G.P.20 MICRO-CELL PICK-UP

Manufacturers: Cosmocord Ltd.,
Enfield, Middx.

Price: £2 10s. plus £1 1s. 5d.
purchase tax.

In the interesting realm of gramophone pickups, the crystal types have always been capable of producing excellent results when designed correctly and when operated with the correct circuit constants. The *Cosmocord* organisation have specialised in this type of pickup for many years, and the unit now under review must be the nearest approach to perfection yet reached for this crystal type.

Construction

The pickup head is a really diminutive size, being about one inch high, half inch wide and five-eighths of an inch deep. The sapphire needle employed is mounted on a flat stiff torsion arm that freely accommodates vertical movement, and conveys the modulated track to the crystal without any lost motion. To prevent damage to the armature and needle a more rigid spring finger takes up the shock if the pickup is accidentally dropped on the record. The head is mounted in a neat moulding with an attractive chromium motif. The head is detachable from the carrying arm and contact is made via two small spring contacts. The arm is a cream moulding with an offset head in order to reduce the tracking error, and at the rear end is a beautifully smooth bearing, incorporating a counterweight so that the pickup pressure on the record is between 12 to 14 grams. The base for mounting the pickup to the motorboard is adjustable between $1\frac{1}{16}$ to $2\frac{1}{8}$ inches, thus accommodating all types of motor heights above the motorboard. An extremely thin screened lead from the head to the base is housed in a slot in the moulding, and due to its lightness it reduces drag to an absolute minimum.

The following is an independent report by
J. C. G. Gilbert, F.R.S.A., Assoc. I.E.E., M.Brit. I.R.E.,
reprinted from the *Music Trades Review*, March, 1950

The unit is supplied with a baseboard template for correct mounting and a moulded support for the pickup when not in use.

Test Report

The pickup was mounted according to the instructions, and the adjustable height of the arm greatly facilitated the correct position of the pickup head relative to the record. A series of tests were done with various constant frequency records, with (a) an open circuit valve voltmeter, and (b) a wide range amplifier and Voigt domestic loudspeaker. The valve voltmeter test confirmed the published graph under this condition being flat from 30 cps. to 300 cps. followed by a gradual drop by 3db. to 1,000 cps. and remaining within 1 db. to above 10,000 cps. With an amplifier having a grid leak of 500,000 ohms input, the bass register fell below 100 cps. to 30 cps. by 8 db. By the inclusion of a simple resistance capacity filter in parallel with the pickup, the whole of the response above 300 cps. can be raised to that below and then the pickup response is sensibly constant throughout the recording range. On some of the full amplitude cut constant frequency records one always expects to hear much direct radiation from the pickup itself, but one of the most remarkable points of the *Acos* pickup is the almost complete absence of noise. On standard recordings of wide dynamic range, the direct noise is so small that it can be heard only when the amplifier is shut off.

Compared with other types of pickups that possess a similar wide band characteristic, the output is extremely high, for it exceeds a half volt on normal records, and can therefore be used with the majority of commercial radio receivers without the need for a pre-amplifier. Modern high fidelity magnetic moving coil and ribbon types usually have outputs in the order of millivolts or even less, and therefore it is essential to use a fair amount of pre-amplification before connecting the signal to the main amplifier. This point alone should en-

courage many potential customers to purchase this pickup. The vertical flexibility of the needle armature motor rumble, that is noticeable on more rigidly mounted armatures, virtually disappears. Due to the very low downward pressure of 12/14 grams coupled with the freedom of movement, the sapphire should last for many hundreds of playings before any noticeable wear is experienced. During the period of this test the needle was inspected before using it on an Adams and Hilger Shadowgraph that enlarged the needle by 50 times. After nearly two months' use, during which some 150 records were played, no measurable wear was found. The pickup was purposely dropped several times from two inches on to the record, and due to the efficiency of the spring protector no damage was suffered by the sapphire.

On musical records the results are truly outstanding. The delicacy of the violins, the sourness of the oboes, the snare of the timpani, and the pureness of the flute are all reproduced as near to the original as I have ever heard. Due to the lack of resonance within the recording range, the reduction of needle-scratch is most noticeable, giving a gentle "shush" in place of the normal "hiss." Transients are fully reproduced and the piano suffers none of the added damping that many pickups provide. Truly this is a remarkable pickup, and even more so when one considers the extremely low price of 50s. plus purchase tax. I am aware only of two other pickups that can compare in performance with the *Acos Microcell*, and both of those handsomely exceed £20. To the engineers who have developed such a remarkable crystal pickup with its low noise, high output and negligible record wear every praise is due, and although the U.S.A. was the home of the crystal pickup, and it still enjoys high popularity, they have nothing to compete with this unit.

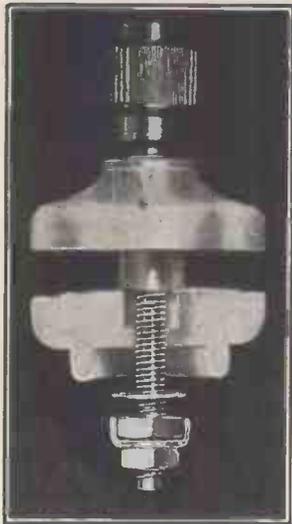
It is understood that supplies of this pickup are now becoming more plentiful, and from now on they should be available in small quantities.

COSMOCORD LIMITED • ENFIELD • MIDDLESEX

Telephone: ENFIELD 4022

THE "BELLING-LEE" PAGE

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



20 MILLION

Twenty million of anything is a lot, 20 million megohms is the resistance of the new "Belling-Lee" high leakage resistance terminal specially designed for instrumentation in nuclear physics, triode electrometers, high resistance bridges, etc. A smaller type is available with a resistance of 3.6 million megohms. Tests were taken at 850 Volts D.C. 55° F and 70 relative humidity.

3-ELEMENT ARRAYS

We are often asked why we do not make a folded dipole array. Obviously if we felt that there was any practicable advantage over the type we do make, we would have done so long ago, but we have asked our Research Department for their comments which are quoted here:

- (1) "The folded dipole enables the band width of a television aerial to be increased, but our most selective aerial, the "Multirod" 4-element array, is capable of resolving the test card 3 Mc/s bars on the better class receivers. Therefore, the use of the folded dipole would not provide any better definition, but would increase slightly the amount of input noise to the receiver and the susceptibility to interference from radio and radar stations, diathermy, and industrial R.F. heating apparatus operating on near-by frequencies.

- (2) The output from a folded dipole is no greater than that obtainable from a dipole when matched to the receiver.
- (3) The cost is obviously greater because of the additional material and assembly involved."

During the war, and in the services to-day, there are many applications for a folded dipole, largely on account of its greater bandwidth. For the purpose of television reception it seems to us that the development of the simple dipole with the impedance of 72 ohms is the most useful combination and the most economical to manufacture. We can hear the critics saying, "But 'Belling-Lee' aerials are expensive." Yes, the expense is not confined to the physical form the collector takes, there are many other considerations.

Repeating what we have often said before, raising a well designed quarter-wave spaced dipole and reflector by a few feet may give a greater improvement in signal than will be obtained by the substitution of a 3-element array at the original height. Readers will remember that we kept on stressing this point when we were asked for a 3-element array. We just do not see any useful improvement for the additional engineering involved. A 4-element array such as the "Multirod" is quite a different proposition.

LIGHTWEIGHT T.V. AERIALS

Why we prefer $\frac{1}{2}\lambda$ spacing

Whereas the $\frac{1}{2}\lambda$ dipole and reflector still tops the list as our standard television aerial, we have, for those not too far distant from a transmitter, or where an "H" is required only on account of its directional feature, recently introduced the lightweight range.

The elements of these new types have been reduced from $\frac{1}{2}$ inch to $\frac{3}{8}$ inch diameter, and the distance between dipole and reflector has been reduced. This raises the old controversy of picture flutter in wind $\frac{1}{2}\lambda$, versus $\frac{1}{2}\lambda$ spacing, etc. Picture flutter is bound up with the rate of change of gain with separation of dipole and reflector. From zero spacing to $\frac{1}{2}\lambda$ the gain rises rapidly and thereafter falls very slowly by about 1 db. at $\frac{1}{2}\lambda$.

The effect of flutter may be demonstrated by anybody with the aid of a string on the tips of the elements by which they are pulled while the picture is being watched. There are two schools of thought,

and we are ready to admit that we may have over-rated the appreciative faculties of the public, who are obviously prepared to tolerate a somewhat inferior picture in certain bad weather conditions. We have, however, not reduced the spacing of our new aerials to $\frac{1}{2}\lambda$ but to 0.15λ , i.e., approximately $\frac{1}{2}\lambda$; at this distance picture flutter is not likely to be troublesome as the curve depicting it is fairly flat between $\frac{1}{2}\lambda$ and $\frac{3}{4}\lambda$. This allows us to reduce pole diameters from 2 inch to $1\frac{1}{2}$ inch and to supply lashings and cross-arms of lighter materials.

This range must not be expected to stand up to heavy weather conditions in exposed locations, e.g., subject to south-west gales or in mountainous country.

MAKE A POINT OF PAINT

At this time of year, it is as well to remember that many aerial installations may have suffered in the autumn and spring gales, and have been rendered unsafe or in need of maintenance. With the house decorating season at its height and the availability of long ladders on the premises, it is wise to arrange an inspection. Certainly all steel aerials and brackets, etc., should be treated to a coat of good paint. The cable should be examined for signs of chafing and the whole installation examined in a general way.

SUPPRESSION OF MOTOR CAR IGNITION INTERFERENCE

In the April issue, we invited readers of this page to write to us for a supply of leaflets printed by the Television Society which readers could send or hand to neighbours whose cars were "unsuppressed." The response has been most gratifying and others do please take advantage of this offer. We are beginning to feel that the efforts of the various committees interested in this matter, and our own efforts are at last bearing fruit. It has been a slow uphill fight and all can help. Viewers who have no car should also write for pamphlets. Dealers and garage owners have written for quantities: and some garages fit the suppressors free of charge, presumably in the hope that the beneficiary will fill up with petrol at the same time—and perhaps come again.

* "Multirod" with 14 ft. mast
£13. 18. 0. L698 London, L699 Midland.

BELLING & LEE LTD
CAMBRIDGE ARTERIAL RD., ENFIELD, MIDDLESEX, ENGLAND



on Pleasure or Business

TRIX carries the Sound



Typical rack-mounted equipment

Wherever sound amplifying equipment is called for, there is a call for TRIX. From a portable outfit for a social gathering or a meeting to rack-mounted installations for large multiple-speaker broadcasting systems, the TRIX range covers every requirement—and every item backed by 25 years' experience and an unrivalled reputation for reliability.

Write for complete catalogue.



"TRIXETTE" portable automatic gramophone



12-watt High Fidelity Amplifier T101



Self-contained Portable Model B65 (open)

THE TRIX ELECTRICAL CO., LTD
 1-5 MAPLE PLACE · TOTTENHAM COURT ROAD · LONDON, W.1.
 TELEPHONE : MUSEUM 5817 GRAMS & CABLES: TRIXADIO, WESDO, LONDON.



HIGH QUALITY REPRODUCTION

"FIFTY and THIRTY WATT" CINEMA AMPLIFIERS as illustrated for single or double P.E.C. input with separate adjustable bias. Full range of tone controls to suit all needs with built-in Exciter Supply if required. PRICES range from **34½ gns.** to **42½ gns.**



TYPE C.P. 20A AMPLIFIER

For AC Mains and 12 volt working giving 15 watts output, has switch change-over from AC to DC and "Stand-by" positions. Consumes only 5½ amperes from 12 volt battery. Fitted with mu-metal shielded microphone transformer for 15 ohm microphone, provision for crystal or moving iron pick-up with tone control for bass and top. Outputs for 7.5 and 15 ohms. Complete in steel case with valves.

PRICE **£28 . 0 . 0.**

FOUR-WAY ELECTRONIC MIXER

This unit has 4 built-in balanced and screened microphone transformers, normally of 50-30 ohms impedance. It has 5 valves and selenium rectifier supplied by its own built-in screened power pack consumption 20 watts. Suitable for recording and dubbing, or large P.A. Installations since it will drive up to six of our 50 watts amplifiers

whose base dimensions it matches. The standard model has an output impedance of 20,000 ohms or less, and any impedance can be supplied to order. PRICE **£24 . 0 . 0.**



OTHER MODELS IN OUR RANGE OF AMPLIFIERS

"SUPER-FIFTY WATT" - - - - - PRICE **36½ gns.**

"THIRTY WATT" - - - - - " **30½ gns.**

"10-15 WATT RECORD REPRODUCER" " **25½ gns.**

These are fitted in well ventilated steel cases with recessed controls, as illustrated.

Full details upon request.
EXPORT ENQUIRIES INVITED.

VORTEXION LIMITED, 257.261 THE BROADWAY, WIMBLEDON, LONDON, S.W.19

Telephones: LIB 2814 and 6242-3

Telegrams: "Vortexion Wimble, London."

the user —

"I must congratulate you on your product which I think is one of the best I have heard. It compares favourably with much more expensive speakers."

the trade —

"I do agree with you when you state it to be the best speaker in domestic use. Quite candidly I will say it is the first time I have been satisfied with a speaker for quite a while . . . I can now say to my friends and customers 'There, that's the type of speaker you want.'"

the technical press —

"On a plane baffle the Concentric Duplex gives a clean and full-bodied bass response of surprisingly good quality for a 10 in. diaphragm. The diaphragm suspension is also of a type well suited for use in conjunction with a cabinet of the 'bass-reflex' type if this is preferred."

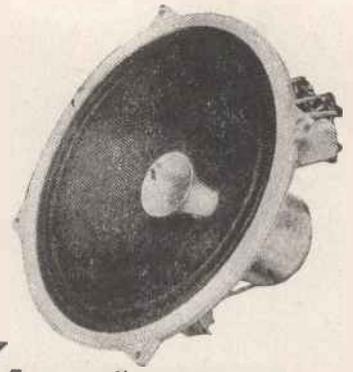
Wireless World February 1950

Table Cabinet Model - £11. 3. 0
 Corner Console, less transformer
 £12. 12. 0



A 12in. chassis is now available and details will be sent on request.

**a
 chorus
 of
 praise
 for**



**Stentorian
 Concentric Duplex**

HIGH FIDELITY REPRODUCER

SPECIFICATION: Series Gap magnet of Alcomax 3.
 Flux in LF gap 12,000 gauss on 1" pole
 " " HF " 13,000 gauss " " "
 Power handling capacity, 6 watts. Frequency range
 50-14,000 c.p.s. Fundamental bass resonance, 65 c.p.s.

Complete with matching transformer and filter condenser. **£6 - 6 - 0**

WHITELEY ELECTRICAL RADIO CO. LTD. · MANSFIELD · NOTTS · ENGLAND

"YANKS ROLL IN LIKE LOCALS"

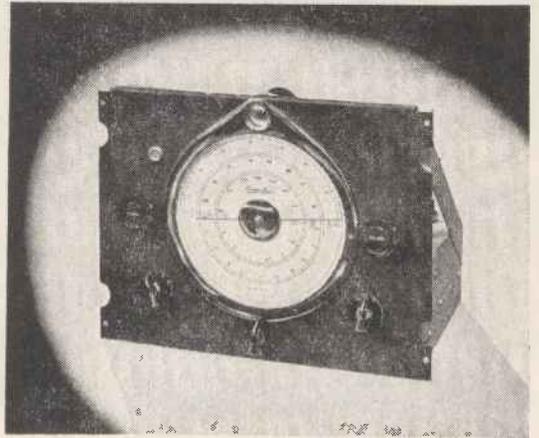
WHEN YOU HAVE A "D.X. PLUS TWO FEEDER UNIT" working in conjunction with the "TONEMASTER AMPLIFIER."

Every feature to ensure good listening is incorporated in this equipment, including Tone Controls, and Master Volume Controls brought out to a separate panel to facilitate mounting.

THE "D.X. PLUS TWO FEEDER UNIT" covers from 5 to 2,000 metres in five overlapping steps, plus infinitely variable selectivity, tuning indicator, etc.

THE "TONEMASTER" AMPLIFIER incorporates push-pull output, negative feedback and separate electronic tone control circuits.

OVERALL COST £44.10.0 plus purchase tax.



SOUND SALES' PRODUCTS are backed by 12 MONTHS GUARANTEE, plus 20 years' experience in the manufacture of electronic equipment.

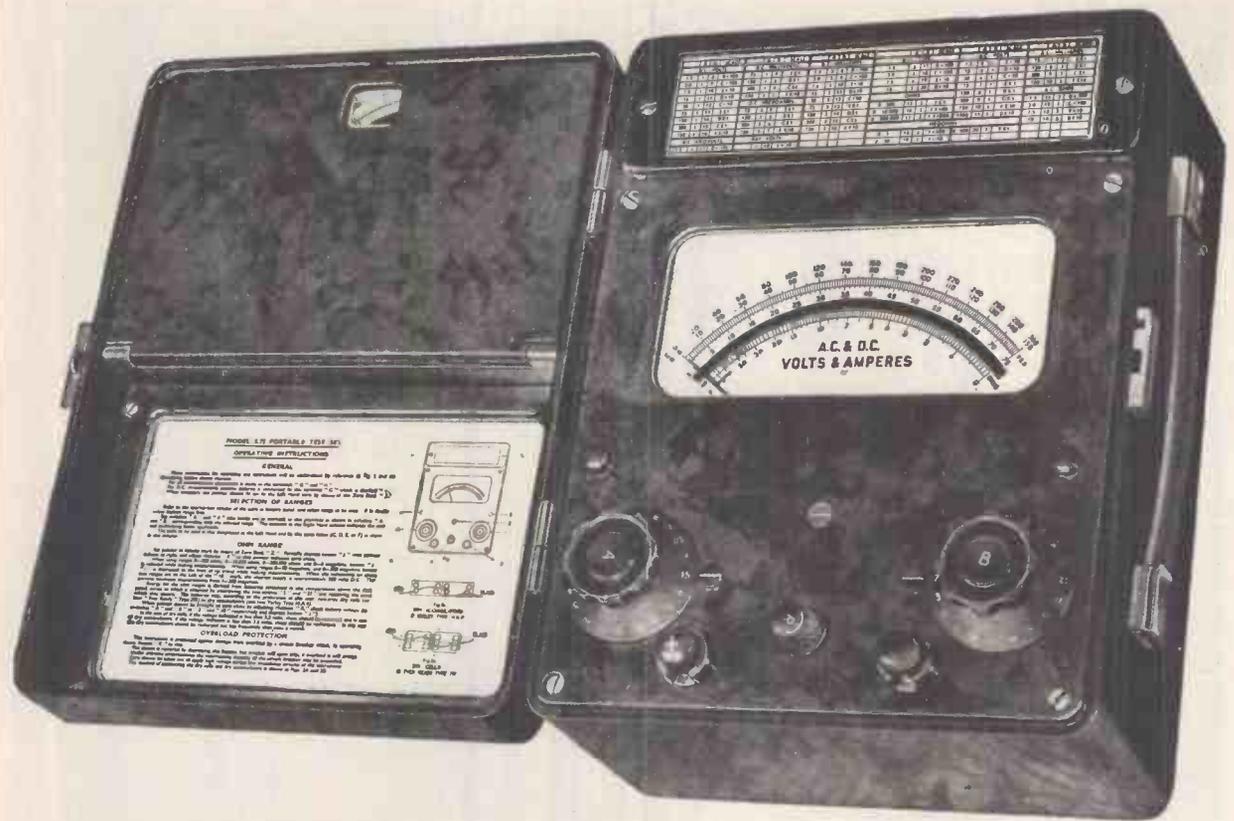
IMPORTANT: We wish to disclaim that this company has any connection whatsoever, with any other firm marketing any product of a similar nature.

Sound Sales Limited

MANUFACTURERS OF ELECTRONIC PRODUCTS

London Office, Demonstrations
Lloyds Bank Chambers, 125 Oxford St., London, W.1.
 (Gerrara 8782)

Head Office and Works
West Street, Farnham, Surrey
 (Farnham 6461/2/3)



**The
WESTON
S.75
Multi-Range
Test Set**

53 Ranges with Rotary Switch Selection

This uniquely comprehensive Test Set has 53 ranges for measuring AC and DC current and voltage, resistance and insulation. It is completely self-contained, with internal batteries to provide power for the ohms ranges and self-contained power pack for insulation measurement at 500 v. Selection is carried out by two 20-position switches. A fully protective safety device is fitted and is operative for forward or reverse overload. The 150 division 6" scale is uniformly divided and is fitted with an anti-parallax mirror. The set is enclosed in a handsome bakelite case and fully complies with B.S.S. No. 89 covering first grade instruments. Full details of this, and other Weston electrical measuring instruments will gladly be supplied on request.

SANGAMO WESTON LIMITED

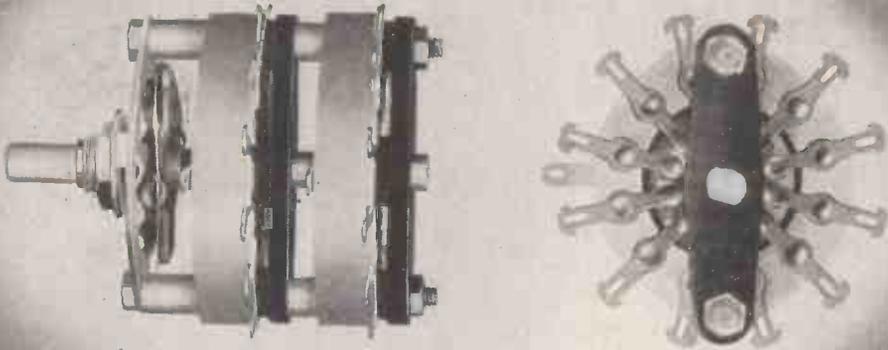
ENFIELD, MIDDLESEX

TELEPHONE: ENFIELD 3484 (6 LINES) AND 1242 (4 LINES)
TELEGRAMS: SANWEST, ENFIELD

AREA DEPOTS:

201 St. Vincent Street, Glasgow.
Millburn House, Newcastle-on-Tyne.
22 Booth Street, Manchester.
33 Princess Street, Wolverhampton.

Central 6208
Newcastle 26867
Central 7904
Wolverhampton 21912



CERAMIC SWITCHES

For applications where only the best is good enough. Stators and rotors of Frequentite "R" ceramic. All contact members of silver alloy.

Wright and Weaire Limited

138, SLOANE ST. · LONDON · S.W.1 TEL SLOANE 2214/5 FACTORY: SOUTH SHIELDS, CO. DURHAM



PLAN YOUR CAREER

RADIO · TELEVISION
and other INDUSTRIAL
ELECTRONIC subjects
ELEMENTARY &
ADVANCED COURSES

DAYTIME

- Principles and Practice of Radio—1 year.
- Telecommunication Engineering—2 years.
- Electronic Engineering—3 years (including one year's practical training in E.M.I. Factories)—leading to C & G full Technological Certificate.
- Marine and Air Radio Officers' Course (for P.M.G. Licence).

also HOME STUDY

- Radio
- Television
- Industrial Electronics
- Maths.
- Physics.

Write for FREE BOOKLET to Dept: 16

E.M.I. INSTITUTES

10 PEMBRIDGE SQUARE, NOTTING HILL GATE, LONDON, W.2
Telephone: BAYswater 5131/2.

Associated with
"H.M.V."
MARCONIPHONE
COLUMBIA
ETC.

E.166B

STOP

AND SEND FOR DETAILS

LOOK

INTO ALL THE FACTS

LISTEN

TO RECORDINGS



Gramplan Direct Disc Recorder, Type S.R.2, used in conjunction with Gramplan Transportable Recording Amplifier, Type R.A.2 See models above. List Price **£237** (combined)

DON'T CHOOSE UNTIL YOU HAVE ENQUIRED ABOUT

GRAMPIAN DISC RECORDERS

Gramplan recording equipment has been supplied to The Egyptian State Broadcasting Corporation, Swedish State Broadcasting Corporation, G.P.O. Research Station and other authorities, and to a large number of private Recording Studios.

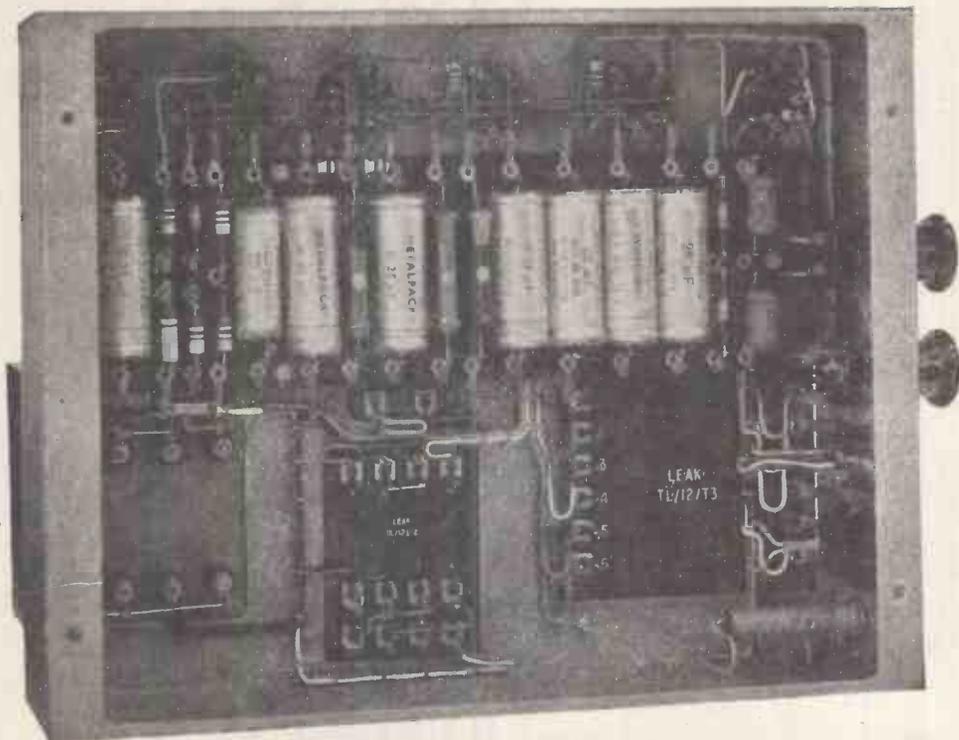
GRAMPIAN REPRODUCERS LTD.

Hanworth Trading Estate, Feltham, Middlesex
Phone: Feltham 2657 Grams: REAMP, FELTHAM

CRAFTSMANSHIP

"I can most certainly say at this stage that the workmanship and finish are of a quality which I have never before encountered in the radio industry, despite the fact that my association with the industry in one capacity or another extends back over 27 years. I think you are to be congratulated all the more on this achievement in view of the increasing tendency nowadays towards inferior workmanship and design."

Part of a letter from a purchaser who is a very well-known engineer and whose identity is known to the Editor of "Wireless World."



UNDER CHASSIS VIEW OF THE TL/12 POWER AMPLIFIER

LEAK equipment is built to laboratory standards in materials and workmanship by experienced men. TL/12 TRIPLE LOOP FEEDBACK AMPLIFIER Price £25.15.0 RC/PA REMOTE CONTROL PRE-AMPLIFIER Price £6.15.0

The high standard of workmanship of the TL/12 amplifier is apparent on inspection. Our claimed performance figures are substantiated by a NATIONAL PHYSICAL LABORATORY REPORT on tests they have made of the TL/12. We are the only amplifier manufacturers who publish such a report.

These amplifiers are the choice of many distinguished audio engineers for high quality reproduction in their own homes.

APPLY TO YOUR LOCAL DEALER FOR FREE 16-PAGE ILLUSTRATED BOOKLET W/TL/12 OR WRITE TO US.

H. J. LEAK & CO. LTD. (Est. 1934)

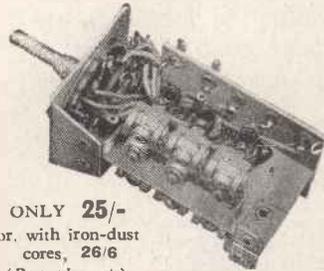
BRUNEL ROAD, WESTWAY FACTORY ESTATE, ACTON, W.3.

Phone: SHEpherds Bush 1173/4.

Telegrams: Sinusoidal, Ealux, London.

Foreign: Sinusoidal, London.

M.O.S.—THE HOUSE FOR VALUE & SERVICE



ONLY **25/-**
or. with iron-dust
cores, **26/6**
(Post, pkg., 1/-).

MINIATURE SUPERHET COIL PACK

Here is a REALLY SMALL COIL PACK which simplifies the design and construction of an ALL WAVE Superhet. It measures 3 1/2 in. long, 1 1/2 in. wide, and 2 in. deep. Within these dimensions are contained the trimmers and fixed padders. The unit is SINGLE HOLE FIXING and only four leads have to be connected to the Frequency Changer. Each unit is pre-aligned by the manufacturers and designed for an IF of 465 Kc.

The ranges are Short, Medium and Long—standard ranges—and the coils wound with litz wire. Tuning capacity 500 pfd.

BRAND-NEW SURPLUS
DC AVO MINORS, in cases
LIST PRICE: £5 5 0
Our Price: **£3 10 0**

MINE DETECTOR AMPLIFIERS

Here is the chance to buy a spare amplifier chassis for the mine detector which you purchased. Complete with all components, but less valves. **BRAND-NEW, 2/6**
(Post, pkg., 9d.)

TELESCOPIC AERIAL (ex Dinghy)

Extends from 15in. to 9ft. Ideal for use with field-strength meters or portable receivers. **BRAND-NEW EACH 7/6**
(Post, pkg., 1/3).

HAND MICROPHONES

Brand-new moulded bakelite hand microphones, with switch incorporated in handle. Complete with lead and jack. **TWO for 3/6**
(Post, pkg., 9d.)

TRANSMITTING CONDENSER

A ceramic insulated condenser, having wide-spaced vanes, suitable for P.A. operation. Satisfactory for use on voltages up to 750 v. Capacity 130 pf. **1/6**
(Post, pkg., 8d.)

HIRE-PURCHASE FACILITIES ON VIEWMASTER COMPONENTS

We can offer facilities on components for VIEWMASTER television receiver according to the following scale:

Ref.	Components	De-posit	12 Monthly Payments of
A.	W.B. Chassis, Tube Supports, Speaker, Valve Holders etc.	£2	8/2
B.	T.C.C. Condensers. LONDON	£2	9/1
C.	T.C.C. Condensers. MIDLAND	£2	9/6
D.	Westinghouse Rectifiers ...	£1	4/6
E.	Plessey Focus Ring etc., etc.	£2	7/-
F.	Morganite Resistors, Q.Pots, Colvern Pots, Wearite Coils, Belling Feeder, Belling Connector, GEC Neons, Bulgin Panels and LONDON switch. MIDLAND	£2 £2	5/11 6/5

MINIMUM DEPOSIT £5. (Instruction Book 5/- extra).

HAVE YOU SEEN THE NEW M.O.S. NEWSLETTER? Now in magazine style. Brings you the news and goods of the world. Send 6d. for specimen copy.

Terms: Cash with Order

M.O.S. MAIL ORDER SUPPLY CO.
The Radio Centre
33 Tottenham Court Road,
London, W.1. MUS. 6887-8-9

1/8 H.P. A.C. MOTORS

We now present to you a superb A.C. mains motor, approximately 1/8 H.P., to work on 220-250v. 50 cycles A.C. It has a speed of approx. 2,500 r.p.m. These motors are fitted with a grindstone and buff. Need NO ADAPTATION whatever. In addition they are fitted with a 3ft. 3-way mains lead. **Callers only 25/-**
BRAND-NEW

POWER UNIT 87

A rotary transformer for 24 volts input, having outputs of 250 v. and 6.3 volts D.C. Contained in neat black case with smoothing. **Each 5/11**
(Carr., pkg., 2/-).
Also available, Power Unit 104 as above but 12 v. input.

SOLDER GUN

The Burgoyne Solder gun needs no introduction. It is the finest soldering instrument for radio and television engineers. No wasted electricity. No element to burn out. Press the button, count seven and the job is done. **BRAND-NEW AND BOXED, OUR PRICE 52/6**
List price 79/6. **2-Year Guarantee. Post free.**

SUPPLY UNITS No. 1

Outputs 500 v. at 50 MA, 275 v. at 110 MA, fully smoothed and suppressed. Designed for use with Wireless Set 19. Input 12 v. D.C. This is the ideal Mobile Power Unit. **AS NEW 12/6**
(Carr., pkg. 5/-).

AUDIO MODULATOR TYPE 76

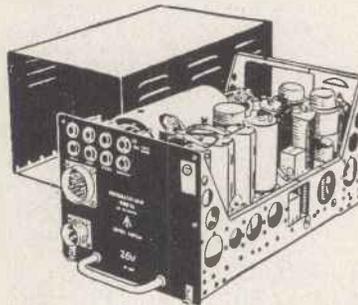
9-valve equipment comprising 2 stages I.F. amplification (560 kc/s) Detector A.V.C. separate B.F.O., 1-stage audio output (Phone). Also 4-valve push-pull modulation amplifier (1 valve used as A.F. oscillator on M.C.W.)

Complete with valves and power unit (24v. D.C. input with outputs of 250 v. D.C.).

Valve line-up: 2 KT33C; 2 EF36; 3 EF39; 1 EBC33 and 1 EF50.

Brand-new and complete in transit case **39/6**
as new
(Carr., pkg., 7/6).

A limited quantity to clear.



CONTROL KNOBS

A set of three knobs, engraved SW, MW, and LW. Two knobs fluted for easy turning. **A FIRST CLASS JOB—BROWN, WITH BRASS INSERTS—BRAND-NEW.**

The Set,
(Post and pkg., 3d.) **2/6**

R.1132A

Normally, this 10-valve receiver covers the range 100/124 mc/s. By simple alteration to the coils, the range may be extended to cover 144/146 mc/s. Additional sensitivity can be secured—if desired—by the use of a 6J6 or 9003 broad band R.F. stage.

The receiver has a large full vision dial with superb slow motion control. AVC control is effected on all the normal stages, and the local oscillator is voltage stabilised. An S meter is included.

A few left to clear. Condition **£2 19 6**
as new (store-soiled).
Carriage and packing (in transit cases), 5/- extra.



SPECIAL METER OFFER!

A brand-new 0-100 M/A instrument as illustrated. Made by E. Turner and fitted with push-button shorting switch. 2 1/2 in. dial.

ONLY **8/6**

(Postage, packing 9d.).

ALTITUDE LIMIT SWITCH

Consists of a two bank Yaxley Switch, each bank being single-pole eleven-way, and the two banks separated by two inches. Contains also eleven 2,700 ohm 1 watt resistors. Complete with dial and knob in aluminium case. Will make ideal multi-range meter selector switch. **BRAND-NEW. U.S.A. MADE**

EACH **2/-**

(Post, pkg., 6d.)

POWER UNIT TYPE 228

Outputs 4,000 v. and 350 v. D.C. (stabilised). Input 80 v. 1,500 c/s. Brand-new in transit cases size 9 in. x 8 1/2 in. x 19 in. Complete with 3 valves, 6V6G, 5U4G and SU2150A.

ONLY **12/6**

(Carriage, packing 7/6).

R.3515

21-valve radar units with six stage 14 MC I.F. Strip. There is sufficient space on the chassis to construct a complete TV receiver—excluding EHT. Valves: one EA50, ten SP61, five EF36, three EBC33, one EF39, one EB34. (See article May issue "Short Wave Listener.") **BRAND-NEW IN TRANSIT CASES**

£3 10 0

(Carr. Paid).

PREMIER RADIO COMPANY

MORRIS & CO. (RADIO) LTD.

Now being Delivered!

PREMIER TELEVISOR KITS

FOR LONDON AND BIRMINGHAM

USING 9" OR 12" MAGNETIC C.R. TUBES

£19·19·0 *including all parts, valves and loud-speaker, but excluding C.R. TUBE*

(Carriage and Packing 15/-)

CIRCUIT DETAILS

The Vision Receiver consists of 4 R.F. stages (EF54's) which are followed by a Diode Detector and Noise Limiter (6H6) which is directly coupled to the Video valve (EF54). Complete Kit with valves, £3/16/0. Carriage and packing 2/6.

The Sound Receiver comprises 3 R.F. stages (6SH7's) followed by a Double Diode Triode (6Q7), which acts as Detector and L.F. Amplifier. A Noise Limiter (EA50) is also incorporated. The output valve (6V6) drives a 10in. P.M. Moving Coil Speaker with closed field magnet, which is included in the Time Base Kit.

Complete Kit with valves, £3/1/0. Carriage and packing 2/6.

The Time Bases employ blocking oscillators on both Line (6SH7 and 807), and Frame (VR137 and 6V6). E.H.T. (Non-lethal) is taken from the Line Output Transformer through a voltage doubler employing two valves (VU111). The Sync separators are 6H6 and 6V6.

Permanent Magnet Focusing.
Complete Kit with valves, £8/5/6.
Carriage and packing 5/-.

The Power Supply is from a double wound mains transformer completely isolating the receiver from the mains. The H.T. Rectifier is a 5U4G.

Complete Kit with valves £4/16/6.
Carriage and packing 5/-.

EACH KIT OR INDIVIDUAL PART AVAILABLE SEPARATELY

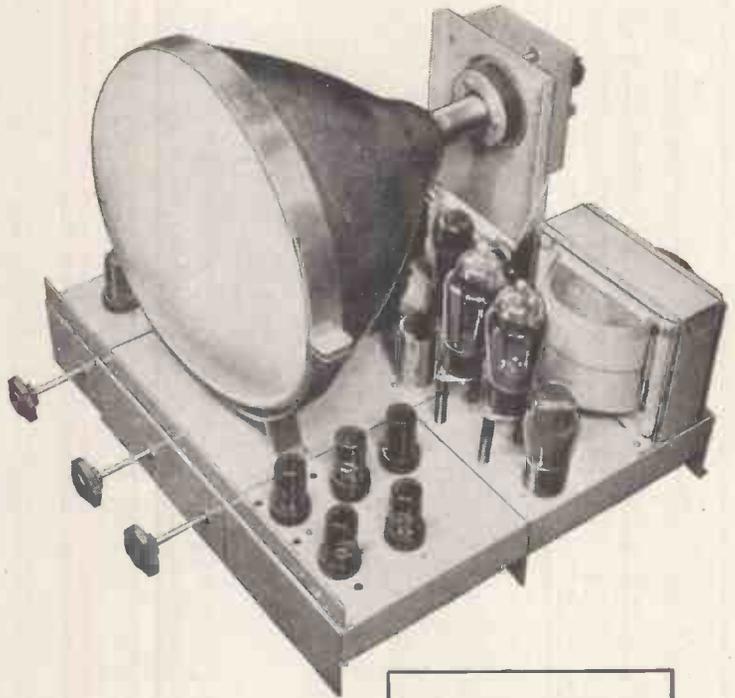
The following sensitivity figures prove that the Premier Televisor Kit is capable of reception at greater distances than any other standard commercial kit or receiver whether T.R.F. or Superhet.

VISION RECEIVER

Sensitivity : 25 μ V for 15V peak to peak measured at the Anode of the Video Valve.
Sound Rejection : Better than 40 db.
Adjacent Sound Rejection : Midland Model. Better than 50 db.

SOUND RECEIVER

Sensitivity : 20 μ V. Vision Rejection : Better than 50 db.



**"MAGNETIC"
CONSTRUCTION**

BOOK

3/-

167 LOWER CLAPTON ROAD, LONDON, E.5

Telephone : AMHerst 4723

THE PREMIER RADIO COMPANY

MORRIS & CO. (RADIO) LTD.



PREMIER MIDGET RADIO KIT. Due to greatly increased production we are now able to offer this Kit at a greatly reduced price. Including an attractive Brown or Ivory Bakelite case, 12in. long x 3in. wide x 6in. high. The valve line-up is 6K7, 6J7, 6V6 and a Selenium Rectifier in the A.C. model; and 6K7, 6J7, 25A6 and a Selenium Rectifier in the A.C./D.C. model. Both are for use on 200 to 250 volt mains. The dial is illuminated, and the receiver presents a very attractive appearance. Coverage is a very attractive appearance. Complete kits of parts with cabinet and diagrams, **24/19/6**, inc. Purchase Tax. State if A.C. or A.C./D.C. is required.

PREMIER MIDGET SUPERHET KIT. This powerful Midget Superhet Receiver is designed to cover the short wavebands between 16 and 50 metres and the medium wavebands between 200 and 557 metres. Two models are produced, one for 200-250 volt A.C. mains, and the other for 200-250 volts A.C. or D.C. mains. Both are supplied with the same plastic cabinet as the TRF Receiver. The A.C. valve line-up is 6K8, 6K7, 6Q7, 6V6 and a Selenium Rectifier. The A.C./D.C. line-up is the same, with the exception of the output valve, which is a 25A6. The dial is illuminated, making a very attractive receiver. Complete kit of parts with cabinet and diagrams, **26/19/6**, inc. Purchase Tax. State if A.C. or A.C./D.C. is required.

PLASTIC CABINETS, as illustrated above. In Brown or Ivory. 17/6.

COLLARO AUTOMATIC RECORD CHANGERS. Type RC500 Rim-drive. Plays nine 10in. or 12in. records. A.C. 100/250 v., with High Fidelity Magnetic or Crystal Pick-up, **£10/15/-**. With Sapphire Stylus, **£11/8/4**.

COLLARO GRAMOPHONE UNITS. High-grade Rim-drive Motors, complete with Pick-up and Automatic Stop-Start. A.C. 100/250. With Magnetic Pick-up, **£5/3/2**. With Crystal Pick-up, **£5/17/7**.

COLLARO GRAMOPHONE UNITS AT NEARLY HALF PRICE. Motor, Tone arm and Pick-up in one unit. Auto Stop-Start, variable speed, 12in. turntable. Induction Motor for 106/250 v., 50 cycles, with Magnetic Pick-up, **£6/6/-**. With Crystal Pick-up, **£7/4/8**.

CONRAD GRAMOPHONE MOTORS. A reliable Rim-drive Motor for A.C. 200-250 v. operation **£2/17/6**, with Turntable.

GOVERNMENT SURPLUS MAINS TRANSFORMERS. All are for use on 230 volt 50 cycle Mains.
Type
42 500-0-500 v. 170 mA., 4 v. 4a. 25/-
53 250-0-250 v. 60 mA., 5 v. 2 a., 6.3 v. 2-3 a. 15/-
54 275-0-275 v. 60 mA., 5 v. 2 a., 6.3 v. 2-3 a. 15/-
55 250-0-250 v. 100 mA., 5 v. 2 a., 6.3 v. 3-5 a. 17/6

WILLIAMSON AMPLIFIER KIT. We can supply the Kit of Parts for the latest version of this famous amplifier complete in every detail for **£10/10/-**, with Valves.

WILLIAMSON AMPLIFIER OUTPUT TRANSFORMERS to specification, 63/-.
Mains Transformers, 45/-.

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 rectifiers. 35/-.

TELEVISION AERIALS. The K.A. Loft Aerial for those close to the transmitter. London or Birmingham fixing, 20/-.

WALL FIXING DIPOLE. 32/6.

WALL FIXING DIPOLE. with reflector, 60/-.

See our new catalogue for complete range.

MULLARD MW22/3 9in. MAGNETIC TUBES. We can offer a limited quantity of these new and unused Tubes at **£8/15/-**. TO CALLERS ONLY.

V.C.R.97. C.R. Tubes. New and tested to give full-size picture, 35/- each.
The following C.R. Tubes at low prices. All perfect.
Type Diameter Persistence Price
NC18 (CV946) 6in. Long 5/-
ACR8 (CV1381) 6in. Short 15/-
VCR112 (CV1112) 6in. Short 15/-
VCR517E (CV1595) 6in. Long 20/-
VCR22 (CV1522) 12in. Short 15/-

All have 4 v. Heaters. Screen colour is green.
TRANSMITTING AND SPECIAL PURPOSE VALVES.
205A 10/- RL18 (CV1197) 5/-
881 60/- 803 10/-
832 10/- HY114B (CV3505) 15/-
V968 (OV1098) 6/6 MR300/E(CV3558) 15/-
EL266 (CV15) 40/- 1616 5/-
805 10/- 8012 10/-
E1191 (CV12) 60/- 843 5/-
EHTT (CV19) 60/- 1625 5/-
VT30 (CV1030) 7/6 U19 (CV187) 6/6
U17 (CV1113) 5/- 956 (CV649) 3/6
E1232 (CV92) 5/- N82 (CV1199) 5/-
PT25H (CV1046) 20/- OV67 (Klystron) 5/-
VU13A (OV54) 6/6 GU50 (CV1072) 7/6
ADI (CV1314) 6/6 BL63 (CV1102) 3/6
DQP (CV1141) 6/6 GUT (CV1262) 6/6
717A (CV3594) 6/6 V1906 (CV20) 6/6
K818 Magnetron 6/6
(CV128) 40/- E1389 (CV78) 40/-

ELECTRON MULTIPLIER PHOTO CELL TUBES.
Type 851A. Brand new. Guaranteed, 30/-.
Base, 2/6.

T.V. WHITE RUBBER MASKS. We can now supply a specially designed White Rubber Mask for 6in. C.R. Tubes at 7/6 each.
9in. White Masks, 9/6. 12in. White Masks, 16/11
SUPER QUALITY TELEVISION MAGNIFYING LENS. to suit 6in., 8in. or 7in. Tubes. Increase picture size considerably. 25/- each.

PERMANENT MAGNET FOCUS POTS. Available for all Tubes. 15/- . Please state Tube used.

THE PREMIER 1950 SUMMER CATALOGUE (Greatly enlarged)

contains all the newest TV Kits, Components, Aerials, Tubes, etc., in addition to thousands of Radio Bargains.

Now ready - 6d.

SUPER MOVING COIL MIKE AND STAND. We have purchased the entire stock of a famous Manufacturer of P.A. Equipment at a very low price, and are offering a 25/6 Super Moving Coil Mike, with a chromium plated folding stand to match. The list price of the stand was 23/8.

WE OFFER THE PAIR AT 79/6. LESS THAN HALF THE USUAL PRICE.

LOUDSPEAKERS by famous makers.
3 1/2in. 9/- 8in. 12/6
5in. 10/- 10in. 23/6
5in. 13/6 12in. 39/6

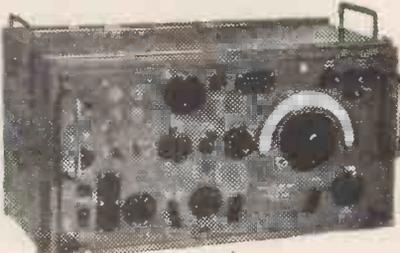
MOVING COIL EARPIECES. Comprise a 1 1/2in. Moving Coil Loudspeaker fitted with noise excluding rubber caps. Make excellent Mikes. Phones or Speakers, 2/- each.

SPECIAL HEADPHONE OFFER. High-grade Double Headphones, using balanced armature units, D.C. Res. 60 ohms, 3/6 per pair. Matching transformer if required, 2/6 each.

SPECIAL OFFER OF ELECTROLYTIC CONDENSERS
16 + 16mf 500 v. working 4/11
8 + 8mf 500 v. working 4/3
32 + 32mf 350 v. working, all cans 4/11
32mf 350 working 2/6
16mf 350 v. working, all cans 2/6
16mf 450v. working, cardboard 2/6
8mf 450 v. working, cardboard 2/6
4mf 500 v. working, cardboard 2/6
16 + 8 mf 450 v. working, all cans 4/11
All Capacities and Voltages available.

MOVING COIL METERS. 4 1/2in. outside diameter. 1 mA, 7/6; 5 mA, 5/-; 50 mA, 8/6; 150 mA, 6/-; 20 amp, 7/6; 40 emp., 7/6; 20 v. 5/9; 40 v., 5/9; 500 microamps, 7/6. All 3 1/2in. outside diameter. 1 mA, 15/11; 30 mA, 10/6; 200 mA, 2/6; 500 microamps, 19/6; Thermocouple meters, 2 1/2in., 2.5 amp., 5/-; 3 amp., 5/-; 3.5 amp., 5/-; 3 1/2in. 2 amp., 8/6; Electrostatic 3 1/2in., 2kV, 25/-.

A LARGE NEW PURCHASE ENABLES US TO OFFER AT A LOWER PRICE THAN EVER RI07. ONE OF THE ARMY'S FINEST COMMUNICATIONS RECEIVERS. (See "W.W." August, 1945.)



9 valves, R.F. amp. osc. Frequency Changer, 2 I.F.s. (465 kc.), 2nd Detector, A.V.C. Af. amp. B.F.O. A.C. mains, 100-250 v. or 12 v. accum. Frequency range 17.5 to 7 Mc/s, 7.35 Mc/s to 2.9 Mc/s, 2.9 to 1.2 Mc/s. Monitor L.S. built in. Complete. Write for full details. Price **£12/12/-**, plus 21/- carriage and packing.

BATTERY CHARGERS. Input 100/250 v. A.C. Output 15 volts at 16 amps. Continuously variable metered output. Usual price 22/. Our price, **£10/10/-** each, plus 10/- carriage.

A.C. ALL-WAVE SUPERHET CHASSIS. 7 valves (plus metal rectifiers) for 200-250 v., 40-60 cycle A.C. mains.

4 Wavebands, 13.8-52, 51-200, 200-550 and 900-2, 100 metres. Pick-up input. Uses 6K7, 6K8, 6K7, 6B8, 6J7 and 2-6V6 in push-pull, giving an output of 10 watts. Specially designed OP transformer to match 6V6's to 3 and 15 ohm speakers. Negative feedback is applied over 3 stages giving a high fidelity output. Tone controls incorporated. Completely wired and tested, **£15/17/6**. Also available for A.C./D.C. Mains. Specification as above except that valve line up is 6K7, 6K8, 6K7, 6Q7, 6J7, 2-25A6. In Kit form at **£13/8/10**.

ALUMINIUM CHASSIS. 16 S.W.G. Substantially made of bright aluminium with four sides.

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

MAINS NOISE ELIMINATOR KIT. Two specially designed chokes with three smoothing condensers with circuit diagram. Cuts out all mains noise. Can be assembled inside existing receiver. 6/- complete.

CO-AXIAL CABLE. Super quality cable, consisting of a centre copper core, a polyvinylresin type insulator, a flexible screen, a weather-proof P.V.C. outer cover. Just the thing for Television lead-in, super mike cable, etc., 80 ohms impedance, Cat. No. G755. 3d. per foot.

GRAMOPHONE AMPLIFIER KIT. Consists of Complete Kit of Parts for a 2 1/2 watt, Mains-operated 2-stage Amplifier for use with any type of pick-up. Volume and tone controls are incorporated. Output impedance is 3 ohms. Cat. No. AMP147. Price complete 59/6 For 200-250 v. mains with valves and diagrams.

SECTIONAL WHIP AERIAL. Three sections which plug into each other making an aerial 12' 6" long. Thinnest section 1/2in. diam., thickest section 1/2in. diam. Weather-proof enamel. 3/6 each complete.

INSULATED BASE for above, 2/6 each.

METER KIT. A FERRANTI 500 MICROAMP M/C METER, with separate High Stability, High Accuracy, Resistors to measure, 15, 30, 150 and 600 volts D.C. Scale length 1 1/2in., diameter 2 1/2in. 10/- the complete kit.

5 KV. ELECTROSTATIC VOLTMETER. Scale length 3 1/2in., flush mounting, 4 1/2in., diameter, **£2/10/-**.

207, EDGWARE ROAD, W.2 Phone: AMBassador 4033 **AND AT -**
All POST ORDERS to 167, LOWER CLAPTON ROAD, LONDON, E.5. 'Phone: AMHerst 4723
EDGWARE ROAD IS OPEN UNTIL 5 p.m. ON SATURDAYS

PREMIER RADIO COMPANY

MORRIS & CO. (RADIO) LTD.

LONG RANGE TELEVISOR KITS

FOR THE LONDON OR BIRMINGHAM FREQUENCIES

at the same price as the standard kit

— £17 - 17 - 0 —

As is usual in all Premier Kits every single item down to the last Bolt and Nut is supplied. All chassis are punched and layout diagrams and theoretical circuits are included.

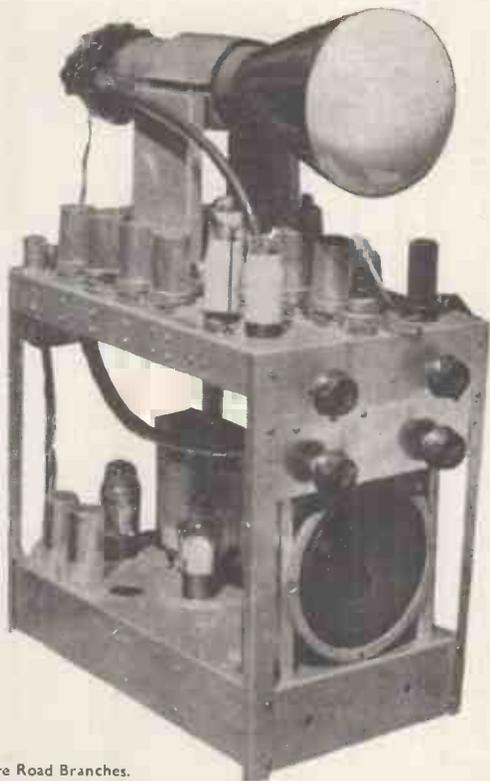
Five Easy to Assemble Kits are supplied :—

- VISION RECEIVER with valves, carriage 2/6..... £3 13 6
- SOUND RECEIVER with valves, carriage 2/6 £2 14 6
- TIME BASE with valves, carriage 2/6..... £2 7 6
- POWER SUPPLY UNIT with valves, carriage 5/-..... £6 3 0
- TUBE ASSEMBLY, carriage and packing 2/6..... £2 18 6

This unit includes the VCR97 Tube, Tube Fittings and Socket and a 6in. P.M. Moving Coil Speaker with closed field for Television. The Instruction Book costs 2/6, but is credited if a Kit for the complete Televisor is purchased.

Any of these Kits may be purchased separately ; in fact, any single part can be supplied. A complete priced list of all parts will be found in the Instruction Book.

20 Valves are used, the coils are all wound and every part is tested. All you need to build a complete Television Receiver is a screw-driver, a pair of pliers, a soldering iron and the ability to read a theoretical diagram.



The following sensitivity figures prove that the Premier Televisor Kit is capable of reception at greater distances than any other standard commercial kit or receiver whether T.R.F. or Superhet.

VISION RECEIVER.

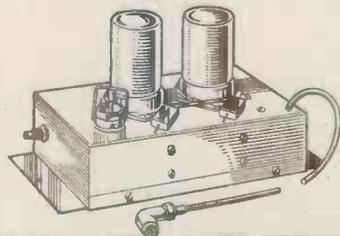
- Sensitivity 25 μ v for 15v peak to peak measured at the Anode of the Video Valve.
- Sound Rejection Better than 40 db.
- Adjacent Sound Rejection Midland Model. Better than 50 db.

SOUND RECEIVER.

- Sensitivity 20 μ v. Vision Rejection, better than 50 db.

A well-made walnut finish **PEDESTAL CABINET** is available from stock at £5/10/0 plus 7/6 carriage and packing.

Working Models can be seen during transmitting hours at our Fleet Street and Edgware Road Branches.



PRE-AMPLIFIER FOR FRINGE RECEPTION AREAS

We can supply the complete kit of parts to make this wide band width Pre-Amplifier, using 2 EF54 Pentodes. Powered by the TV Kit, it is completely screened. With all parts, valves, chassis, diagrams, etc., 27/6. All parts available separately.

When ordering Televisor kits

PLEASE STATE IF THE LONDON OR BIRMINGHAM MODEL IS REQUIRED

152-153, FLEET STREET, E.C.4

Phone : CENtral 2833

Terms of Business : Cash with order or C.O.D. over £1. Send 2d. stamp for list.

207, EDGWARE ROAD IS OPEN UNTIL 6 p.m. ON SATURDAYS

ONE MORE MONTH

OUR SALE PERIOD HAS NOW BEEN EXTENDED UNTIL 31st JUNE, AND WHERE STILL AVAILABLE PREVIOUSLY ADVERTISED GOODS MAY BE PURCHASED AT THE SPECIAL SALE PRICES UNTIL THIS DATE.

Amplifier 40 Watt

USES two 6L6's in push-pull with 6V6 feeder, complete with power pack giving up to 300 m.A. D.C. The whole mounted on chassis size 11 x 13 x 4 in. on which is also mounted push-pull output transformer. Equipment is store soiled but unused. Valves are brand new. Sale price is £14/10/0, plus partly returnable packing case deposit and carriage charge of 12/6.

Feeder Unit to Work With Above Amplifier

COMPRISES a 3-wave band superhet and special one valve input circuits for microphone and gramophone. Controls include: microphone volume, gramophone volume, radio volume, and tone control. The equipment is store soiled, unused. Valves are brand new. Sale price is £5/10/0, plus partly returnable packing case deposit and carriage charge of 10/-.

Metal Console Cabinet

TO take the above amplifier and radio feeder unit, size 3ft 6in. high x 17in. x 13in., fitted with 8in. monitor speaker and controls for external speakers. These cabinets are finished in black crackle, but in all cases they may need reackling because of careless handling and storage. Price is only £3/10/0 each, plus partly returnable packing case deposit and carriage charge of £1.

Special Offer

IF you buy the three items described above, you will have a very fine public address outfit suitable for medium size works or hall. The price if you take the three units together is £23, plus partly returnable packing case deposit and carriage charge of £1.

Push-Pull Driver Transformer

MADE by a very famous company, fully impregnated and tested 1,000v. between windings and frame, primary 70,000 ohms centre tapped, 2 separate secondaries, each 5 to 1, upright mounting size 3½ x 2½ x 4in. really superior quality will enhance any amplifier. Sale price 10/- each.

Push-Pull Output Transformer

SAME maker to match the above driver transformer. Primary impedance 4,000 ohms centre tapped, secondary 15 ohms tapped 7.5 ohms. Monitor winding upright mounting, size 5 x 4½ x 5in. Sale price 12/6 each.

Smoothing Choke

SAME maker and matches the above driver and output transformers, 10 Henry's at 170 m.A. D.C. D.C. resistance 100 ohms, upright mounting size 5 x 5 x 4½in. Sale price 10/-.

Special Offer No. 2

THE three items above for 27/6, which is probably less than half of the actual cost. All these items are new and unused in good condition, not Government Surplus.

Air Cored Choke

INDUCTANCE 6 m/H. at 50 cycles very high current, no measurable D.C. resistance. Upright mounting impregnated, size 5 x 5 x 4½in., finest quality. Sale price, 7/6 each.

Air Cored Choke

INDUCTANCE 8.5 m/H. at 50 cycles, no measurable D.C. resistance, size 5 x 5 x 4½in. impregnated, high quality finish. Sale price 7/6 each.

Very High Current Smoothing Choke

IRON cored, size 4½ x 5 x 5in., 7 Henry, no measurable D.C. resistance, high quality finish, will stand really large current without any appreciable volt drop. Sale price 7/6 each.

Mains Transformer

MATCHES the above transformers and chokes, by same manufacturer and really good quality. Primary 10-0-110-200-220-240v., H.T. secondary 425-0-425v. at 200 m/a., L.T. 5v. at 3 amp., L.T. 2.5 v. tapped to give 6.6v. and 8.4v. both at 4 amps. 2,000v. insulation tester between windings and frame. Sale price 29/6

Sensitive Relay

AMERICAN make, closes at 4 m.A., heavy duty change over contacts. Sale price 12/6 each.

Tuneable Inductances

HEAVILY silver plated, with silver wheel for making contact at any point as ceramic former of the inductance turns. Sale price 27/6 each.

Army Short Wave Receiver R109

THIS is a 6v. car battery operated receiver, range 1.8-8.5 m/cs. The vibrator unit is easily removable, thus leaving a receiver which can be operated off 2v. accumulators and a standard H.T. battery. It is an 8-valve superhet communications receiver. The case which is fitted with a metal front-guard is size 14 x 10 x 11in. Unused and in first-class condition complete with spare valves, spare vibrator and instruction book. Sale price £6/10/0, plus 10/- carriage and packing.

Control Unit "F"

THE purpose of this unit was to remote-control a receiver or transmitter, but with practically no modification it can become a field telephone, as it contains the following items: hand operated magneto generator, magneto bell, morse key, three key switches, seven brass terminals, two metal rectifiers, three mansbridge condensers, 1,000 ohm pot meter, speech transformer, three-way six-pole jack switch, 2,000 ohm relay, and miscellaneous items such as plugs, pointer knobs, resistors, condensers, etc. All contained in an excellent metal box, size 10 x 10 x 6½in. Sale price 9/6, plus 3/6 carriage and packing.

Test Set 72

THIS consists of two separate instruments, (a) an oscillator and (b) an absorption wave meter which tune over the range 200-240 m/cs. Contains many fine components, some of which are two-vernier slow-motion drives, calibrated 0-180, magic eye viewing assembly with magic eye valves, on/off toggle switch, pot meters, flexible insulated couplings, two-gang tuning condenser, air trimmers, Yaxley-type switch, miscellaneous condensers and resistors. Equipment is unused and complete with valves as follows: five H.F. pentodes, one magic eye, one V.H.F. triode and one V.H.F. diode, all 6.3 v. heaters. Sale price 32/6, carriage and packing 5/- extra.

Motor Alternator

GIVING 230v. 50 cycle A.C. from a 12v. car battery. Output approximately 100v. thus large enough to work the average type of domestic receiver and many appliances. Sale price £3/10/0, plus 4/6 carriage. Ditto but 24v. input £2/10/0, plus 4/6 carriage.

Indicating Watt Meter 6 in.

A SWITCHBOARD instrument for three-phase four-wire circuits, complete with current transformers and matched external resistance box, made by a very famous firm, and suitable for 200v. or 400v. Sale price £7/10/0.

Switchboard Ammeter 6 in.

SCALE reading 600 amps at 200v. or 300 amps at 400 volts, 50 cycle matches the above watt meter. Sale price £4/10/0.

Wheatstone Bridge

IN a fine teak case, really good grade instrument, with heavy stud switch and centre reading galvanometer, suitable for low resistance readings to a high degree of accuracy up to 220 ohms. Sale price £1/19/6.

American Radar Unit A/APN4

THIS is a fifteen valve airborne receiver for radar which houses in addition to its own components the power supplies for the cathode ray indicator unit. The chassis size is 18 x 9 x 8in. and the whole receiver slips into an oblong metal container. The whole contains a host of really useful parts, to mention a few: high voltage power transformer (high cycle) complete with high voltage smoothing equipment which includes three .25 mfd. 2,500v. paper condensers, high voltage valve sockets and porcelain top cap connectors, medium voltage power transformer (high cycle) with 8 mfd. volt smoothing condensers, 13 international octal valve sockets, four-bank four-position Yaxley-type switch, three toggle switches, fuse holders, pilot lamp holders valve retaining clips, coils, trimmers, I.F. transformers, iron-dust cores and hundreds of small condensers of best makes and many sizes and capacities, ditto for resistors. Sale price 17/6, plus 5/- carriage.

Service Sheet Manuals

CHAMPION, volume No. 4: gives details of American sets, R.C.A. Victor, General Electric and Admiral. The volume covers some 25 receivers giving circuit diagrams, component values and alignment data. **Champion**, volume No. 5: covers 49 Emerson receivers. Sale price 1/9 either manual, or 3/- for the two.

Service Engineers Collection

THIS is a folder containing 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 makers 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, Phillips, Pye, Ultra, and in addition the folder contains the two **Champion** volumes previously described. Undoubtedly a mine of information invaluable to all who earn their living from radio servicing. Sale price £1 for the complete folder.

I.F. Alignment Peaks

THIS book gives the I.F. frequencies of more than 4,700 receivers including British, American and continental types. Every popular British set is covered, and in addition hints on finding the frequencies of unknown British sets are also given. Sale price 3/9.

Miscellaneous Publications

THESE give circuit diagrams and details of Ex-Government receivers and equipment. In practically all cases the information has been extracted from official publications. Separate booklets for each piece of equipment. Booklets available covering the following: R1155, R208, R109, TR1196, TR18, BC348, BC312, R1116, Wireless Set 22, R107, R103, BC221, BC342, Pre-Amp from RF27, Pre-Amp from Unit 208A, T.V. Receiver from 1 1/2 metrie superhet for London or Birmingham, T.V. receiver from 3170, etc. T.V. receiver from 194 strip or 1355 strip. Dual band T.V. receiver. Sale price of any of these booklets is 1/9 each, 12 for 18/-. All post free.

Mains Transformers

DROP through 250-0-250 at 60 m.A., 6.3v. 3 amp., 5v. 2 amp. or 4v. 4 amp., 4v. 2 amp. Sale price 14/6 each.

Volume Controls

FULL length spindle, any value 2K-2 meg. not Government Surplus, with switch 3/9, less switch 2/6.

Contractors 25 Amp.

COIL voltage is 24v. D.C., but with a rewind or a small rectifier they will close off A.C. These have very heavy silver contacts which probably have a precious metal value greater than we ask for the contactor. Sale price 1/3 each, 12/- dozen.

Vacuum Delay Switches

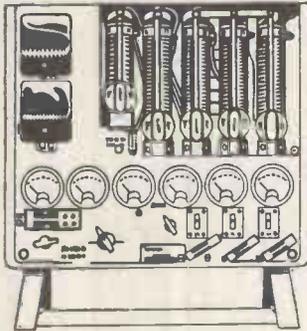
FOUR-PIN British base 6.3 v. one minute delay. Sale price 7/6 each.

Radio Control

HIGHLY sensitive light weight relay, closes on two milliamps, weight only 1 1/2 oz. Solid platinum changeover contacts, adjustable pressure. Sale price 13/6 each.

Last Time at This Price

THE 10in. speaker with 12in. quality, a real precision product made by a very famous firm whose name we are not allowed to mention, but you will recognise it immediately. This speaker has three special features, (1) a solid diecast frame, (2) special speech coil suspension to give wider frequency response, (3) dust proof cone assembly. Speech coil is normal 2-3 ohm impedance. Sale price 15/-, plus 2/6 post and insurance.



Charging Switch Board

THIS contains five high-wattage slider type variable resistors, four flush meters reading up to 15 amps each, and one reading up to 40 amps. In addition there is a voltmeter with a selector switch to permit voltage checking of all circuits, two cut-outs, switches, fuses and terminals. The whole being mounted on a panel and enclosed in a metal case with doors and feet. A source of D.C. fed in will be split up to permit battery charging at varying currents. If used with a generator the field of same and hence its voltage output can be controlled by the first slider. Excellent break-down value, as any one of the sliders would cost much more than we ask for the whole unit. Sale price 47/6, carriage 12/6.

Radio Control

SELECTOR switch 10B, sometimes known as impulse relay, remote selector, etc. This consists of a solenoid, the armature of which is connected to a ratchet wheel so that each time the solenoid is energised the ratchet wheel moves round one notch. Secondary switches are built-in which permit: continuous running, inching, following a four-position switch and undoubtedly a host of other operations. Articles have appeared in journals showing how these may be operated by radio impulses and thus control models. Sale price 3/9 each, six for 18/-. Order selector switch 10B.

Midget Thyatron

AMERICAN make type No. 2D21, 6.3v. .6 amp. heater, peak plate current 500 m.A., average plate current 100 m.A. B7G box ideal for radio control receivers. Sale price only 11/6 each. Many other special type valves available at low prices. Send 6d. for our Sale List.

Break-down Unit

AT present day prices the spares in this unit would cost at least £5. Here is a list of the main contents:—
 3 two-metre coils;
 3 tuning condensers split-stator type;
 4 two-watt carbon resistors useful values;
 1 tapped 20 watt resistor vitreous covered;
 6 paper condensers, .05 mf. 1,000v. working;
 3 paper condensers, .1 mf. 1,000v. working;
 2 H.F. chokes;
 4 paper condensers, .1 mf. 450 v. working;
 2 paper condensers, .15 mf.;
 5 bakelite moulded mica condensers .001;
 1 paper condenser, .01 mf. 3,000v. working;
 24 rubber grommets, assorted sizes;
 6 resistors 1 watt, all useful values;
 6 resistors 1/2 watt, all useful values;
 40 resistors 1/4 watt, all useful values;
 40 silver mica condensers assorted values, including: 10, 15, 20, 40, 50, 100, 150, 300, and 500 pf. types;
 4 English octal valve holders;
 2 English 5-pin valve holders;
 1 E.F.50 type valve holder;
 3 diode valve holders;
 1 louvered casing, size 12 x 7 x 4in.;
 1 heavy metal chassis size 12 x 7 x 2in.;
 8 condenser clips, assorted sizes.
 Also an assortment of nuts, bolts P.K., self-threading screws, tag boards, chassis mounting tag connectors, screened grid caps, plain grid caps, levers rollers, connecting rods, output Pye sockets, etc., etc. **ALL THIS COLLECTION OF PARTS FOR 4/6 only, plus 1/9 postage and packing.**

Tripods

WHEN fully extended the height is 3ft. They are very sturdy and would support heavy weight. Black japanned metal construction fitted with hook, and brass thread and cap. Useful for cameras and as supports for microphones, speakers, lamps, etc., etc. 3/6 each, plus 1/9 post and packing (storage soiled).

Sealed Glass-Type Thermo-static Switches

CONTAINED in a glass tube these switches operate automatically at 86 deg. F. Suitable for tropical fish aquariums, etc. Sale price 3/6.

Pay Us A Visit

ON these two pages we have mentioned only a few of the many bargains which will be available during our sale. We suggest that you "Pay us a Visit" because there will be many items for callers only. Failing this you must send for our Bumper Sale List. Do not forget to enclose 6d. in stamps, because we shall probably have to send it out in two editions.

Orders for and enquiries relating to the items on these two pages must be sent to the address below. Where your total order is £2 or more only include the specially mentioned carriage and other charges, otherwise under £2 add 1/6, under £1 add 1/-. Postable items can be sent C.O.D. additional charge approx. 1/-. Good stock of all items at time of going to press. Bargain list 6d. p.f.



PRECISION EQUIPMENT (2) ELECTRON HOUSE, Windmill Hill, RUISLIP MANOR, MIDD.

Henry's

RADIO COMPONENTS
ELECTRONIC
& TELEPHONE
EQUIPMENT

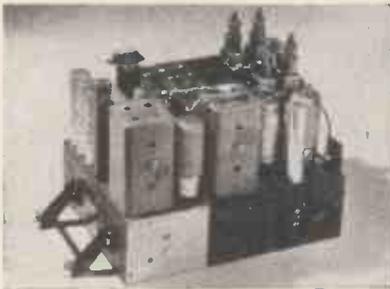
TRIPLETT. MODEL 1200C. VOLT-OHM-MILLIAMMETER. A special purchase enables us to offer these well-known instruments at the absurdly low price of £8/19/6 (plus 1/6 packing and carriage). Reads 0-1000 volts AC/DC, 0-250 mA. D.C., 0-250 microamps. 0-7.5 meg.

Sensitivity of the D.C. movement is 200 microamps, full scale and 5,000 ohms per volt. One 1.5v. cell and one 22.5 v. cell supply the energy for the ohmmeter circuits. The whole instrument is housed in an attractive brown-crackle metal case. Size 7 1/2 in. x 6 1/2 in. x 4 1/2 in., with leather carrying handle. The meter itself can be tilted on a pair of hinges to any convenient reading angle for the user. Supplied complete with test prods and instruction booklet, absolutely brand new in original sealed carton. Definitely not repeatable at this price.

MICROPHONE TYPE T45.

By the U.S. Electro-Voice Mfg. Co.
A small single-button carbon microphone, worn on the upper lip. It hangs in front of the mouth by face-straps and adjustable ear-loops. It cancels noise and can be used in place of a throat microphone. Absolutely brand new and boxed, supplied complete with fully illustrated descriptive leaflet. Only 3/6 (plus 6d. post).

R.3515 I.F. STRIP. A complete I.F. Unit, comprising 6 8P61 I.F. stages, tuned to 13.5 Mc/s., 1 EA50 diode detector, and 1 EF36 or EF39 output or video stage. A few modifications only are required to adapt this unit, which will give pictures of extremely good quality. Price complete with valves and foolproof modification instructions, is 45/-, plus 5/- packing and carriage. Limited quantity only.



RECEIVER TYPE 25. The receiver portion of the T/R 1196. Covers 4.3-6.7 Mc/s., and makes an ideal basis for an all-wave receiver, as per "Practical Wireless," August issue. Complete with valves types EF96(2), EF39(3), EK32 and EBC33. Supplied complete with necessary conversion data for home use. Only 22/6. Chassis only. 8/8. Illustration above.

RCA 931A PHOTO-ELECTRIC CELL AND MULTIPLIER. For facsimile transmission, flying spot telecine transmission and research involving low light-levels 9-stage multiplier. Brand new and guaranteed. Only 30/-, including special 11-pin holder, and data sheets on this cell.

TK VALVES. Westinghouse 813 at 50/-, 805 at 10/-, 832 at 20/-, 866A at 15/-, Klystron 723A/B at 82/6, 3E29 (829B) at 59/6. All brand new and boxed.

No. 18 SET. RECEIVER PORTION. A four-valve superhet receiver operating from 6-9 Mc/s. (33 m.-50 m.). Valve line-up: 3 ARP12 (VP33) and ARS (HL25DD). Requires only 120 v. H.T., 9 v. G.B. and 2 v. L.T. in perfect condition, only 17/6, plus 1/6 packing and carriage. An absolute bargain. Suitable brand new headphones can be supplied at 3/6 per pair. N.B.—Each receiver is tested working prior to dispatch.

RECEIVER TYPE 21. The receiver portion of the W/8 21 operating from 4.2-7.5 Mc/s. Double superhet from 18-30 Mc/s. Incorporating B.F.O. and crash limiter. Valve line-up: 7 ARP12 (VP33) and 2 ARS (HL25DD), plus spare valve of each type, making eleven valves in all. Only 35/- complete.

A.M. RECEIVER UNIT, TYPE 161. Comprising 2 EF50, EF54 and EC52. Coils, relay and many condensers and resistors. The whole in metal box, size 8 1/2 in. x 6 1/2 in. x 3 1/2 in. New, a bargain at only 22/6, carriage paid.

1628 V.H.F. RECEIVER. Ex-A.M. Comprising 10 EF50 valves, 2 EB34, 24 v. rotary generator, relays and hundreds of condensers and resistors. Complete in grey metal case. Absolutely brand new. 75/- only.

THE E.T.A. FOUR-STATION SUPERHET TUNER. Completely self-contained tuner, may be set to select any three medium—and one long—wave stations. No tuning condensers required. Four-position switch. Tuning by high permeability dust cores. Litz wound coils. Once set, requires no further adjustment. The station you want at a flick of a switch. Size 2 1/2 in. high by 3 in. by 3 in. Complete with full aligning instructions and suitable A.C. and A.C./D.C. circuit. Only 33/-, plus purchase tax 7/2.

C/B TUBE VOB97. Each tube brand new, suspended in manufacturers original packing case, guaranteed, complete with printed data sheet. Only 35/- (Carriage and packing free.)

TUBE ENLARGING LENS. For VOB97 or 50P1. Double your picture area without distortion. Easy fixing. Really amazing in performance. Only 25/-, plus 1/6 postage and packing.

WHITE 6in. MASKS for above. Not ex-Govt., but especially manufactured to give rectangular picture. 7/6 each.

Send stamp for current Component List—
Probably the most-comprehensive in the trade

5, HARROW ROAD, LONDON, W.2

PADddington 1008/9 and 0401

Exceptional Value in Receivers!

RECEIVER type B21

A superb communications receiver made by Marconi's
Wireless Telegraph Company.

Valve line-up: two R.F. stages, freq. changer, three I.F. stages, double diode triode, B.F.O. and output pentode. Freq. coverage 1-20 mc/s. (15-300 metres) in 4 unbroken bands via turret coil change. "S" meter and valve check meter incorporated. Sensitivity for 10 db signal to noise ratio—better than 1 microvolt! Filament transformer for 230v. A.C. operation is included but the H.T. supply is required. Necessary valves are: International Octal types, two of KTW61, two of X65, three of KTW63, one of DH63 and one KT63.



Supplied complete with circuit diagram. NEW AND IN UNUSED
CONDITION. Here's your chance to buy a £100 receiver for

ONLY £9-19-6 less valves

or **£13** complete with all valves.
Carriage and packing 10s. in each instance.

SMALL QUANTITIES OF THE FOLLOWING ARE STILL AVAILABLE

Receiver R1355. Slightly soiled condition. 49/6, plus 5s. carriage. Medium-wave Command Receiver. NEW condition. £4/19/6, plus 2/6 carriage.

18 Set Receiver. Complete with valves and 465 kc/s I.F.'s. Circuit diagram provided gratis. 17/6, plus 1/- post and packing.

Receiver R1155. Brand NEW and air tested. Full technical data and modification instructions supplied. £11/10/0, plus 9/6 carriage and packing in transit case.

A.C. Mains Power Pack and Output Stage for R1155. Just plug in! £3/10/0, post paid. SPECIAL OFFER. Receiver R1155, complete with power pack for £15, carriage paid.

Receiver R1224. Battery superhet 30-300 metres continuous. With circuit. £4/19/6, plus 7/6 carriage and packing.

Receiver R28/ARCS. Complete with 10 valves (four of 717A) and four crystals. 45/-, plus 2/6 carriage and packing.

Receiver type 25. Receiver portion of TR1196. Complete with six valves and circuit and modification data. Exceptionally good condition. 22/6, post paid.

Performance Meter No. 2. NEW, contains 230v. 50 cycle A.C. power pack, etc. £2/5/0, carriage paid.

Power Pack 567. NEW, contains 11 valves all octal based. 42/6, plus 5/- carriage.

18/165 Amplifier Unit. Super bargain at only 17/6, post paid. Mullard Resistance and Capacity Bridge. NEW. Instruction Book included. £8/19/6, carriage paid.

Indicator Units 116H. NEW, in transit boxes. £4/10/0, plus 7/6 carriage.

R.C.A. Speech Amplifiers. Brand NEW. Magnificent instrument. £13/10/0. Callers only please, as so few remain.

PLEASE REFER TO PREVIOUS ISSUES OF WIRELESS WORLD FOR FULL DETAILS OF THE ABOVE OFFERS.

10,000 different items of equipment in stock. A treasure house for the enthusiast. Enormous stocks of valves, components, etc. Our prices are exceptionally reasonable. A competent technical staff always in attendance and at your service.

Best Buy at Britain's



CHARLES BRITAIN (Radio) Ltd.

11, UPPER SAINT MARTIN'S LANE
LONDON, W.C.2

TELEPHONE 05 5

3 minutes from Leicester Square Station (up Cranbourn Street)

Shop Hours: 9-6 p.m. (9-1 p.m. Thursday). Open all day Saturday

D. COHEN

RADIO & TELEVISION COMPONENTS

MAINS TRANSFORMERS

350-350 v. 130 mA., 6 v. 5 amp., 5 v. 3 amp. Primary 200/250 v. 18/6, plus 1/- post and packing.
Semi-shrouded drop through type primary 200-240 v. secondary 350-0-350 v. 80 ma. 6 v. 3 amp. 5 v. 2 amp., 15/- plus 1/6 post and packing.

350-0-350 70 mA. 6 v. 2.5 amp. 5 v. 2 amp. Pri. 200/240, 13/6, plus P. & P. 1/-

Mains Transformer—primary 110-250 v. secondary 350-0-350 v. 250 ma. 6 v. 4 amp. 4 v. 3 amp. quarter inch gap between laminations and bobbin, extra heaters could be easily wound, 29/6, plus 2/- post and packing.

Auto Transformer 110-250 v. input, 70 v. 0.2 amps. and tapping for dial lamp. 3/-, plus 1/- post and packing. Small dimensions.

Heater transformer, 6 v. 1 1/2 amp. Primary 230/250 volts. 6/- plus 9d. post and packing.

Heater Transformer, 2-4 or 6 v. 2 amps. primary 230-250 v., 7/6 plus 1/- post and packing. Car Radio Vibrator Transformer. 6 or 12 v., 6/-, plus 1/- post and packing.

Standard output transformer, 5000 ohm imp. 3/3, plus 6d. P. & P.

Midget O.P. transformer, 5000 ohm imp. 2/9, plus 6d. P. & P.

Smoothing choke, 10 Henry 80 mA. 3/9, plus 6d. P. & P.

Smoothing choke. Midget. 40 mA. 1/11, plus 3d. P. & P.

20 v. Line matching transformer. Pri. imp. 500 ohms. Sec. 15 ohms. 10/-.

ELECTROLYTIC CONDENSERS

- 2 mfd. 250 work. 9d.
- 50 mfd. 50 work. 1/9.
- 16-24 mfd. 350 work. 2/11.
- 100 mfd. 12 v. work. 1/3.
- 16-16 mfd. 450 work. 3/6.
- 50 mfd. 12 v. work. 1/-.
- 25 mfd. 25 v. work. 1/6.
- 8 x 32 mfd. 450 work. 4/-.
- 16 x 8 mfd. 450 work. 3/9.
- 8 mfd. 450 v. work. 1/11.
- 500 mfd. 6 v. work. 1/3.
- 250 mfd. 12 v. work. 1/3.
- 16 x 32 mfd. 450 v. work. 4/6.
- 8 mfd. 500 v. 2/6.
- 16 mfd. 500 v. 3/6.
- 8 x 8 mfd. 450 work. 3/3.
- 30 x 30 mfd. 350 work. 3/9.

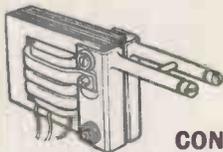
P.M. SPEAKERS

Size	with trans.	less trans.
5in.	12/6	
6 1/2in.	12/6	8/9
8in.	14/3	11/9
10in.	17/6	14/6

Post and packing on above items 1/- each extra.

THE HEART OF THE BURGOYNE SEVEN SECOND SOLDERING GUN.

As illustrated 200/250 v. input. 13/6 plus 1/6 post and packing. Copper bit, 6d.; automatic switch assembly, 1/-, plus 6d. post and packing.



CONSTRUCTOR'S PARCEL

as illustrated. Comprising 5-valve superhet chassis with transformer cut-out, size 13 1/2in. x 6in. x 2in., with L.M. & S. scale, size 7in. x 5in. Back-plate two supporting brackets, drive drum, pointer, two-speed spindle, twin gang condenser. Mains transformer 250-0-250 v. 60 mA., 6 v. 4 amp., Pri. 200/250, 6 1/2in. ROLA energised speaker and 6 x 5 Rect. 28/-

Plus 2/- post and packing.

5-VALVE SUPERHET CHASSIS

with transformer cut-out, size 13 1/2in. x 6in. x 2in. with L.M. & S. scale, size 7in. x 5in. Complete. 6/6 Plus 1/6 post and packing.

7in. x 5in. Two supporting brackets, drive drum, pointer and three pulley wheels.

6-STATION SWITCHED SUPERHET COIL UNIT, by famous manufacturer. Ideal for Car Radio or radio set. Range coverage Pos. 1, 200-300 m.; 2, 250-360 m.; 3, 250-360 m.; 4, 320-460 m.; 5, 400-550 m.; 6, 1100-1850 m.; no oscillator required for lining up, complete with Circuit, 15/6, post and packing, 1/-.

PRE-ALIGNED MIDGET 465 Kc. Q.120, made for the above Coil Unit, 8/6 per pair, post 6d.

CHASSIS TO FIT COIL UNITS AND IFs, size 11 1/2in. x 5 1/2in. x 1 1/2in., 2/6

MAINS TRANS. TO FIT ABOVE CHASSIS. Pri. 200/250 volt. Sec. 250-0-250 v. 60 mA. 6 v. 4 amp., 13/6, post and packing 1/-.

CONSTRUCTOR'S PARCEL, comprising chassis 10 1/2in. x 5 1/2in. x 2in., with speaker and valve holder cut-outs; ROLA 5in. P.M. with O.P. trans; twin gang with trimmers; pair of TRF coils; 4 International Octal valve holders; wave change switch and Erie 20k pot with switch, 17/6, plus 1/6 post and packing.

CONSTRUCTOR'S PARCEL, comprising Midget twin gang with slow-motion drive; Pair Midget 465 Kc. IFs.; frame aerial; medium wave osc. coil and layer type H.T. and L.T. Battery, 90v + 1 1/2v. 21/-, plus 2/- P. & P.

CONSTRUCTOR'S PARCEL, comprising 5-valve Superhet chassis with Transformer cut-outs. Size 13 1/2in. x 6in. x 2in. with L.M.S. dial size 7in. x 5in; back plate, two support brackets; drive drum; pointer and spindle; twin gang condenser and mains transformer 250-0-250 60 mA. 6 v 4 amp., Pri. 200/250; ROLA 8in. P.M. with transformer. 30/-, plus 2/- P. & P.

SUPERHET COIL KIT, comprising medium and short wave coils, twin gang, pair of 465 IFs, 6 pole 3 way switch, 6 trimmers, two trackers and 5-valve superhet chassis with IF and speaker cut-outs. 14/6, plus 1/- post and packing.

STANDARD 465 KC. I.F.'s. Air cored Q.110, 6/- per pair.

STANDARD 465 KC. I.F.'s. Iron cored Q.120, 7/- per pair.

MINIATURE 465 KC. I.F.'s. Type M400B, 12/6, plus 6d. post and packing.

CERAMIC 220 pf. tolerance 10%, £4 per thousand.

VALVE HOLDERS. Paxolin International octal. 4d. each. Moulded International octal, 6d. each. EF50 ceramic 7d. each. Moulded B7G slightly soiled 6d. each.

LINE CORD. 3-way 0.3 amp. 180 ohm per yard, 10d. per yard.

CERAMIC PFS. 3 each of the following: 330, 220, 180 & 82, 2/6.

ENERGISED SPEAKERS

8in. 2000 ohm field with O.P. trans. 5000 ohm imp. 15/6
5in. 1,000 ohms field with O.P. trans. 5,000 ohm imp. 12/6.
P. & P. 1/- each extra.

TUNING CONDENSERS

.0005 twin gang with feet, 4/-
.0005 twin gang, fitted feet, trimmers and drum. 4/7.
Midget .00037 twin gang, fitted trimmers and Perspex dust cover, 6/6.
.0005 tuning condenser, 2/3.
Post on the above items, 6d. extra.

POLISHED WALNUT RADIO CABINET

15in. high. 17in. long. 10in. deep. c/w. L.M. & S. dial. Size 9 1/2in. long x 4 1/2in. wide, and 5 valve superhet chassis. Valve holder and transformer cut-outs. 27/6 plus 2/- post and packing.

MAINS DROPPERS

.2 amp. 1000 ohms tapped 900 ohms. 1/9.
.2 amp. 717 ohms, tapped 100 ohms. 1/6.
.3 amp. 520 ohms tapped. 2/6 ea.

WAVE CHANGE SWITCHES

- 6 pole 3 way. 1/2.
- 3 pole 2 way. 1/2.
- 6 pole 2 way. 1/2.
- 5 pole 3 way. 1/2.

TELEVISION MASKS

In white rubber, 9in, 7/6, plus 1/- each extra for P. & P.

VARIABLE TRACKERS

300 x 300, 100 x 500, 100 x 220, 500 x 750, 2100, 150 x 150, 1000 x 1000, 250 x 250, Ceramic bases, 9d. each.

METAL BRAIDED WIRE

with PVC outer insulation. 6d. per yard.

POSTAGE STAMP TRIMMERS

50pf. 4d. each.

POST ORDERS ONLY

67 RALEIGH AVENUE, HAYES, MIDDLESEX

RADIO EXCHANGE CO.

BRAND NEW 13558. The now famous unit specified for "Inexpensive Television" with six I.F. stages (7.5 mc/s), det., output and rectifiers, these are supplied in ORIGINAL MAKER'S CRATES, complete with 11 valves. Price ONLY £3/15/-.

RECEIVER TYPE 18 covering 6-9 mc/s. these may easily be modified for other frequencies. Requiring 90-150 v. H.T. and 2v. L.T., they are complete with 4 battery valves. Complete with circuit, OUR PRICE 19/6.

HEADPHONES. Complete with jack plug, and matched for the above, 2/6.

MERCURY BATTERIES. The new wonder batteries, with an almost infinite shelf-life delivering 94 v. H.T. and 1.3 v. L.T. BRAND NEW, 6/6 or a sealed case of 4 22/-.

MIDGET L.T. ACCUMULATORS, 3AH accumulators measuring 1 1/2 x 1 1/2 x 4 1/2. Brand New 2/6 each, or £1 per dozen.

RECEIVER TYPE 18, complete with phones, and batteries, 31/6.



TWIN CELL CYCLE LAMP BATTERIES. Of recent manufacture, and tested before despatch, THREE for 1/6.

METAL CASED SPEAKERS, BRAND NEW speakers, in circular metal cases (9in. o/d.) 30/- each.

HEAVY DUTY OUTPUT TRANSFORMERS, with two high resistance windings (one centre tapped and one low resistance winding (4 taps), these can be matched to almost any valve/speaker combination. ONLY 4/6.

TRANSFORMERS. Heavy modulation transformers which may also be used as step down transformers, handling some 75 watts. Potted, 6/- each.

RECEPTION SET VRL

Made by Vancouver Radio Laboratories, this receiver, establishing a new high stand in communications, is offered to commercial and Ham users in sealed maker's cartons.

- ★ 1.5-20 mc/s (4 bands).
- ★ 13 valves.
- ★ Variable selectivity Xtal filter.
- ★ Noise limiter.
- ★ RF and IF gain controls.
- ★ Optional A.G.C.
- ★ Magic eye (with optional damping for C.W.).
- ★ Built-in speaker.
- ★ Full view dial.
- ★ Crystal calibrator (pipe every 10, 100 or 1000 kc/s)
- ★ Provision for phones with optional muting internal speaker.
- ★ Standard rack dimensions.
- ★ Self-contained for 115 v. 50 cps. (we supply a step-down transformer FREE).

Complete, with 19 spare valves £29/10/-.
Send Stamp for Leaflet VRL.

MIDGET MOTORS. Measuring 2 1/2 in. long x 1 1/2 in. dia. these are supplied complete with a removable fan they develop 1/135 H.P. with 27 v. input. ONLY 9/6 each.

RECEIVER TYPE 21. A superhet covering 4.2-7.5 mc/s and a double superhet covering 18-31 mc/s, supplied complete with its correct power pack. This small communications receiver requires only 6 v. input, and the two units will fit together to make a compact unit. With 9 two volt valves, B.F.O. crash limiter and circuit. OUR PRICE 48/6.

POWER UNIT 19. Still a few available, delivering 540 v. at 40 mA and 275 v. at 110 mA, from a rotary converter, and 275 v. from a vibrator pack: 12 or 24 v. input. TO CLEAR 12/6.

RADIO EXCHANGE CO., (W), 9 CAULDWELL STREET, BEDFORD. Phone 5568
PLEASE WRITE YOUR NAME AND ADDRESS IN BLOCK LETTERS

All goods sold as used unless otherwise stated.

QUALITY COMMUNICATION RECEIVERS

HRO TYPE MX. Brand new. 4 coils covering up to 30 Mc/s. Six-volt HRO Power Pack. A Beauty, £35. If desired we can supply an A.C. Power Unit to suit in lieu of 6 volt for an extra 30/-, carr. paid.

MARCONI CR100 (E28) RECEIVERS. Perfect order and fine condition. 12 valves. 60 Kc/s to 30 Mc/s. Six only, £15/15/- each. Carr. and packing case 15/-.

BC348. Perfect order and condition. Expertly modified for 230v. A.C. operation, £25, carr. paid.

AR88. Six Bands, 540 Kc/s to 32 Mc/s. Loud speaker to match. Condition equal to NEW. One only, £45.

AR88, ditto, fitted with Diversity Gain Control. Magnificent condition. One only (no loud speaker), £45.

EDDYSTONE 640. Brand new condition. First £22/10/-.

HALLCRAFTERS SKY CHAMPION. Excellent condition, 8 valves. 540 Kc/s to 43 Mc/s. Grey metal cabinet. Built-in loud speaker. A snip, £22/10/-.

RI132A. Size 19in. L, 10in. D, 11in. W. Air Ministry grey cabinet. (Metal) Meter 0-5mA. Slow motion Dial. Tone Frequency Control, Manual Gain Control, RF Gain Control, Frequency Range 100-126 Mc/s. 10 valves. Full Circuit diagram and component values in case. CONDITION BRAND NEW AND UNUSED IN ORIGINAL MANUFACTURER'S WOODEN CRATE. Price £4/19/6, plus 5/- part carriage. Articles have appeared in the Radio Press on the conversion of these sets to 2 metre operation.

Subject to being unsold. Prompt delivery.

RECEIVER TYPE 25. Covers 4.3-6.7 Mc/s and makes an ideal basis for an all-wave receiver as per "Practical Wireless," August issue. Complete with valves EF36 (2), EF39 (2), EK32 and EBC33. Brand new condition. Supplied complete with necessary conversion data for home use. Only 21/-, carr. 1/4.

RI355 RECEIVERS. Good condition, 39/6, carriage 5/- (few only).

RF UNITS TYPE 24. New condition. Complete with 3 valves. 20-30 Mc/s. Tunes to 5 spot frequencies, 14/-, carriage 1/4.

1155 A.C. POWER PACK AND OUTPUT STAGE. As per "Wireless World" specification. Brand new in neat Crackle Case, 12in. x 8in. x 5in. Handle and P.V.C. feet. Complete with L.S. Just

PROMPT DELIVERY AND SATISFACTION GUARANTEED AS ALWAYS.

plug into 1155 and set is all A.C. operated. Special Value, £5/19/6, carr. 3/6.

VCR97 CATHODE RAY TUBES. Brand new in boxes, 29/6 each. Bases, 2/-, carr. 1/4.

EF50 CERAMIC VALVE HOLDERS, 5/- dozen, post 6d.

813 VALVES, G.E.C. of U.S.A. Brand new, 27/6.

P.M. SPEAKERS. Best makes. No transformer. 5in., 10/-; 8in., 16/6. Post 9d.

TYPE 87 POWER UNIT. Input 12v., Output, 265v., 65mA., 6.5v. 2.5a. Incorporates beautiful Rotary Generator in neat case, 8 1/2 in. L. 6 1/2 in. H. 4 1/2 in. W., 5/- each, post 1/4.

PLUG-ON POWER UNIT for Command Receiver BC453/4/5 or ARC5 series. No alterations to set wiring. Simply plug on. Fitted 6X5 rectifier. (Not Surplus.) Beautifully made, 50/-, carr. paid.

MODULATOR UNITS. Type 64. 7 valves, VR91 (2), CV93, CV85, VU133 (2), VT604A. 3 Relays. 4, 2,000v. 5mfd. 1 3,500v. .05 mfd., etc., 18/6 each. Carr. 5/-.

CONDENSERS. Brand new Waxed Tubular, 50 for 10/- (25 1/2 mfd. 1000 v., 25.25 mfd. 500v.). A really outstanding offer.

PAMPHONIC P.A. SPEAKERS. 10in. Unit in handsome maroon metal cabinet (low impedance). In original maker's packing (NOT SURPLUS), 55/- each, less than cost.

TELEVISION PRE-AMPLIFIER. Just the thing you have been looking for. This Ex-Govt. one-valve pre-amplifier is of very high sensitivity and makes an amazing improvement in vision and sound reception in all fringe areas. Available for Birmingham Transmission only. Ready for instant use. Very small dimensions. Length 4in., width 3 1/2 in. Chassis Depth, 1 1/2 in. Overall Depth to top of valve, 4 1/2 in. Fitted with EF50 valve. Ideal for the "Inexpensive Television Receiver" or the "Electronic Engineering Television Set" and any set where 6v. L.T. and around 200v. H.T. can be obtained. Can be used on any Commercial set fitted by a competent T.V. Engineer. Co-Ax input and output sockets. 3 connections only to Power Supply. H.T. Common and L.T. Price less than that of a new EF50. Valve, 15/-, postage 1/-. All tested and guaranteed before despatch.

SCT522 TRANSMITTERS. Brand new, no valves. Modulation transformer, choke and crystal switch have been removed but we have been able to secure these which are supplied but not fitted. Get going on 2 metres with these. Our Price, 19/6 each, carr. 3/6.

2/6 stamped envelope must accompany all enquiries.

Lists Available

H. P. RADIO SERVICES LTD.

Britain's Leading Radio
Mail Order House

Estd. 1935

55 COUNTY ROAD, WALTON, LIVERPOOL, 4

Tel. Aintree 1445
Staff Call Signs, G3DGL, G3DLV

BARGAINS IN EX GOVT. AND SURPLUS RADAR RECEIVERS, TRANSMITTERS, TRANSMITTING AND SPECIAL VALVES, AND COMPONENTS.



EVERYTHING FOR THE AMATEUR, SERVICEMAN, EXPERIMENTER, RADIO AND TELEVISION CONSTRUCTOR.

World Renowned for Service & Reliability

EX. A.M. UNIT TYPE 567 C/W W BRAND NEW AND UNUSED. IN MAKER'S CARTON. Contains 11 valves, 3 6Z4G; 2 6AU6; 1 VU120; 1 6X6GT; 1 EF50; 1 EF55; 1 6V6G; 2 6V80 (voltage stabilisers). Dozens of various components, including high voltage condensers, chokes, pot/meters, resistances, condensers (8 mfd. 500 v.w.), etc. Totally enclosed in metal case, size: 12in. x 1 1/2in. x 8in. Wt. 40lb. **LASKY'S PRICE, 49/6.** carriage 5/- extra.

6-VOLT VIBRATOR PACKS, NEW AND UNUSED. Output 300 volts 80/100 mA. With minimum of conversion this unit will run any normal A.C. mains radio from a 6-volt source. Supplied complete with 6 volt vibrator and 6 x 5 rectifier. In black metal case, size: 6in. x 5in. x 4in. **BRITISH MANUFACTURE.** **LASKY'S PRICE, 25/-,** postage 1/6 extra.

EX A.M. TRANSMITTER/RECEIVER TYPE TR9. Battery operated. Supplied with all valves (8 transmitting, 6 receiving). Two meters—one 5 amps., and one 30 mA. Frequency coverage 6-9 Mc/s. Completely enclosed in metal case, size 18in. x 12in. x 8in. Packed in maker's original wood transit cases, these sets are in a solid condition. **LASKY'S PRICE, 25/-,** Carriage 5/- extra.

EX-AMERICAN AIR CORPS RECEIVER TYPE B0733D. Supplied complete with 10 valves: 1 12A6; 3 12BR7; 1 12AQ7; 2 12AG7; 3 717A; 1 12AH7. Also 6 plug in type crystals. This is a really compact unit and is built in a black metal case, crackle finished, with removable sides. Size: 13in. x 7in. x 6in. Weight 16lb. **LASKY'S PRICE, 39/6.** carriage 3/6 extra.

V.H.F. RECEIVER UNITS. These units are partly stripped but contain a wealth of components, resistances, condensers, coils, I.F. transformers, etc. Also 4 valves: 2 EF39; 1 EB033; 1 EF32. Overall dimensions, 30in. x 7 1/2in. x 6in. **LASKY'S PRICE, 10/-,** carriage 2/6 extra.

RECEIVER UNITS, Type 153 (46 Mc/s Pvc strip). Contains 4 R.F. stages, detector, Video amplifier and phase splitter. Uses 6 EF30 and 1 EA50. A complete vision receiver. **BRAND NEW AND UNUSED.**

Supplied with full circuit and connecting details.

CATHODE RAY TUBES, Type VOR97. Brand new ex-Government. Fully guaranteed. Supplied in sprung wood transit case. Characteristics: Heater 4 volts, 1 amp. H.T. 2.5 kv maximum. Tested before despatch. **LASKY'S PRICE 35/-,** carriage free.

CIRCUITS STILL AVAILABLE. Circuit of the 3984A. Price 1/-, post 3d. extra. Conversion of the Receiver type 3984A to television sound and vision. Data for London and/or Sutton C.F. H. X. Price 1/6, post 3d. extra. Full circuit diagram giving suggested sound and vision television receivers, time base and all associated circuits, power packs, etc., utilising available ex-Government equipment, (3084A VOR97, etc.). Price 2/-, post 3d. extra. Data for London or/and Sutton Coldfield now available.

SIX and 12-VOLT VIBRATOR TRANSFORMERS SUITABLE FOR CAR RADIOS Price 6/11 each.

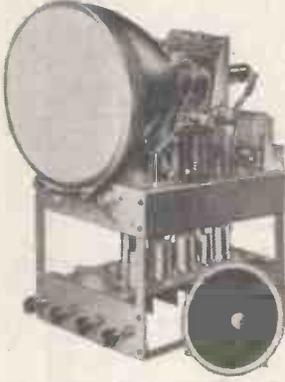
LOW VOLTAGE METAL RECTIFIERS HEAVY DUTY 12 volts 6 amps. Price 27/6 each. Post extra.

STRONG METAL CHASSIS DRILLED FOR 4-VALVE HOLDERS I.F. TRANSFORMERS, etc. Size 2 1/2in. high by 5in. by 1 1/2in. **LASKY'S PRICE 1/-** each. Post 4d.

MINIATURE I.F. TRANSFORMERS, TYPE M400B. Iron dustcores. Frequency 465 Kc/s. Size 1 1/2in. high by 1in. by 1in. **LASKY'S PRICE 12/6** per pair. Postage 6d. extra.

THE VIEWMASTER

The television set you can build at home from standard parts. London or Midlands Operation. Brilliant high definition black and white picture. Superb reproduction. Uses 9in. or 12in. Cathode Ray Tube. Table or Console Model. Incorporates all the latest developments. Television for the home constructor at its finest. Send to-day for the CONSTRUCTION ENVELOPE, a 32-page booklet crammed with top-rate information and all the necessary data, also 8 full-size working drawings and stage by stage wiring instructions. Model "A" for use in London and Home Counties. Model "B" for use in Sutton Coldfield Area. **PRICE 5/-** per copy, post free.



See the View-Master working Demonstrations every day during transmitting hours. 9in. and 12in. Cathode Ray Tubes in stock for immediate delivery. Manufactured by Mazda, Mullard, G.E.C., Brimar. **PRICES: 9in., £11/6/10.** including Tax. 12in., £15/2/5. including Tax. Brimar 12in. atomised, £16/1/4 including Tax. If you cannot call to collect Cathode Ray Tubes, please enquire for details of our special delivery service. Anywhere in the U.K. fully insured. Complete Price List of Viewmaster Components will be supplied free on request. Full details for building a pre-amplifier for fringe area reception now available, price 1/- per copy. We can supply a single item to a complete kit by return of post. All components in stock. **NO WAITING.**

VOR97 SCREEN ENLARGERS. Latest type plastic oil-filled lenses. Will give a bigger, better, clearer and sharper picture from your 6in. cathode ray tube. **LASKY'S PRICE: 1st grade, 29/6. 2nd grade, 25/-.** Postage 1/6 per lens extra.

RUBBER MASKS FOR CATHODE RAY TUBES.

SPECIAL PURCHASE OF 9in. WHITE MASKS, FINEST QUALITY. Manufacturer's surplus. **LASKY'S PRICE 7/6,** plus 1/- post. 6in. Round black. Price 3/6. 6in. Square white. Price 7/6. 12in. Square black. 8/6. Price 19/6. **SAFETY GLASS SUITABLE FOR 12in. CATHODE RAY TUBES.** Size 12 1/2in. x 10 1/2in. x 1/4in. thick. Price 4/11 per piece. **SAFETY GLASS SUITABLE FOR 9in. CATHODE RAY TUBES.** Price 3/6 per sheet.

RECEIVER UNITS TYPE 25. New and unused. The Receiver section of the TB.1106. Easily converted to an all-wave receiver. 6 valve superb. Supplied with 6 brand new valves: 2 EF36; 2 EF39; 1 EK32; 1 EB033. Full details and circuit supplied free with each unit. **LASKY'S PRICE, 25/-,** Carriage 2/6 ex. The Receiver type 25 Less valves. **LASKY'S PRICE, 8/6,** plus 2/6 carriage.

BRAND NEW IN ORIGINAL WOOD TRANSIT CASES. EX. A.M. RADAR INDICATOR UNIT. Contains 1 6in. cathode ray tube type VCR517 and mu metal screen. Also the following valves: 3 8P61; 1 J66; 3 EA50; 1 D1. Dozens of components including 7 pot./meters, resistances, condensers, etc. Enclosed in metal cabinet, size: 12in. x 9in. x 19in. Weight 40 lbs. **LASKY'S PRICE 49/6.** Carriage 7/6 ex.

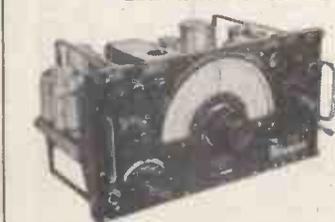
CO-AXIAL CABLE, SUITABLE FOR TELEVISION.

Screened, 1/4in. diam. Price 9d. per yard, post extra. Screened, 1/2in. diam. Price 9d. per yard, post extra. Twin balanced feeder. Price 5d. per yard, post extra. Any length cut to your requirements. Twin screened co-axial cable. Price, 1/- per yard.

SPECIAL AMERICAN VALVE BARGAIN.

Special high voltage rectifiers type 3B2; Filament 5 v. UT; H.T. 20 Kv at 60 mA. **LASKY'S PRICE, 12/6** each.

EX-A.M. COMMUNICATION RECEIVER TYPE E1155.



Complete kit of parts, including output valve and rectifier for building a power pack and output stage for the T1155 Receiver as described in the modification instructions. **PRICE 55/-.** Complete, carriage free. The above power pack and output stage fully assembled in black crackle case, ready for use. **PRICE, 79/6.** Carriage 5/- extra.

MAINS TRANSFORMERS. All 200-250 volts tapped primary.

SBT/1. 330-0-330 volts 80 mA.; 6.8 v. 3 a.; 5 v. 2 a. Price 15/- post 1/6. Semi-shrouded, black finish.

SBT/5. 300-0-300 volts 80 mA.; 6.3 v. 3 a.; 5 v. 2 a. Price, 16/11. post 1/6. Semi-shrouded, black crackle finish.

SBT/8. 350-0-350 volts 250 mA.; 6.3 v. 5 a.; 4 v. 3 a. Price 42/-, post 1/6. Heavy duty transformer. Tapped input 100/250 volts, 50 c.p.s.

SBT/7. 350-0-350 volts 250 mA.; 6.3 v. 5 a., 0.5 v. 3 a. Price 37/6. post 1/6. Chassis mounting.

SBT/10. 275-0-275 volts 250 mA.; 6.3 v. 5 a., 5 v. 3 a. Price 32/6, post 1/6. Upright chassis mounting.

MBA/2 MIDGET MAINS TRANSFORMER. 250-0-250 volts 80 mA.; 6.3 v. 3 a. Price 12/6, post 1/- extra. Fitted with voltage adjustment panel.

MBA/3. 350-0-350 volts 80 mA.; 6.3 v. 3 a.; 5 v. 2 a. Both filament windings are tapped at 4 volts. A robust job excellent for replacement purposes. **PRICE 18/-,** post 1/6.

PHOTO ELECTRIC CELLS, Type VA28. Requires 100 volts D.C. of Peak A.C. to function. Price 12/6 each, postage 1/6 extra.

MINIATURE 2-GANG TUNING CONDENSERS. .0005 mfd. Size: 2in. x 1 1/4in. x 1 1/4in. 1in. spindle. **LASKY'S PRICE 5/-** each, post 6d. extra.

MIDGET I.F. TRANSFORMERS, 465 Kc/s. Iron cored. Size: 2 1/2in. high, 1in. wide, 1 1/2in. deep. **LASKY'S PRICE 8/6** per pair, postage 6d. extra.

THROAT MICROPHONES. LOW LEVEL No. 2, Mk. II. **LASKY'S PRICE 2/11** per pair, postage 6d. extra.

CONDENSER BARGAINS. BRAND NEW STOCK, FULLY GUARANTEED. FAMOUS MANUFACTURER'S SURPLUS. 8 mfd. 600 v.w., 3/- each '8 for 20/-.

Other electrolytic condensers now in stock: 8 x 32 mfd. 450 v.w., at 4/11 each. 16 x 16 mfd. 450 v.w., at 4/11 each. 16 x 32 mfd. 500 v.w.; at 4/11 each. 16 x 8 mfd. 500 v.w., at 4/3 each. High voltage smoothing condensers .001 mfd. 4 Kv. working. Price 1/6. New high voltage T.C.C. Viscoid .001 mfd. 7 Kv. working. Price 4/6.

Send a 2fd. stamp with your name and address (In block letters please) for a copy of our current stock list giving full details of our Ex-Government Radio Radar and Surplus equipment, **THE LASKY'S RADIO BULLETIN.**

370 HARROW ROAD, PADDINGTON, LONDON, W.9 (Opposite Paddington Hospital)

TELEPHONE: CU Nainham 1979. Hours: Mon. to Sat. 9.30 a.m. to 6 p.m. Thurs. half day 1 p.m.

LAWRENCES

AMERICAN COMMUNICATION RECEIVERS TYPE AR.88LF. For operation on 230 v. A.C. This superlative set tunes 75-550 kc/s. and 1.5-30 mc/s and is designed for exceptional performance. A very limited stock, used but in excellent condition. Price £32.

NEW MULTI-PURPOSE TEST METERS MODEL 856. Made by Precision Instruments Inc. An advanced instrument with a 20,000 ohm per volt movement, provision is made for optional 1,000 ohm per volt sensitivity by means of panel switch. Numerous ranges within the following limits: 60 microamps-12 amps; 3 volts-6,000 volts; 0-60 megohms; also output range calibrated in decibels. Fitted in stout teak case with testprod compartment and carrying handle. Ideal for television service and other exacting work. £15. Fully guaranteed.

WIRELESS SET NO. 21. Reliable Army Transmitter receiver which operates on frequencies 4.2-7.5 mc/s. and 19-31 mc/s. Powered from 6 volt D.C. source complete with all accessories in excellent condition. £15.

BRAND NEW NATIONAL HRO SENIOR COMMUNICATION RECEIVERS. One of the most eminent of all radio Rx. with all advanced refinements. Complete with valves, Instruction Handbook, packed in sealed maker's cartons, less coils. Guaranteed perfect. £20.

AMERICAN FIELD STRENGTH METERS. TYPE 1-95 AM. Completely self-contained using small dry batteries. Meter indicates strength of received signal on freqs. 100-160 mc/s. Chromed telescopic antenna extends from top of compact portable case. New £4/10/-.

TEST SET TYPE SE2. 230 volts A.C. Incorporates receiver, tuning 160-240 mc/s. Built-in noise generator, panel mounted 500 microamp monitor. A precision instrument complete with connecting leads, etc. £7/10/-.

RECEIVERS TYPE B29. 230 volts A.C. Similar in construction to the famous B28 set. A very limited stock in used condition, price only £9 each.

NEW RCA QUALITY AMPLIFIERS TYPE M.17179B. A civilian pattern, constructed regardless of cost, providing truly exceptional performance. For A.C. mains 190-250 volts. Approx. 25 watts undistorted output is obtained from two valves type 6L6 operating in push/pull, with negative feedback. Output transformer is tapped for load impedances of 5; 7.5; 15; and 500-600 ohms. whilst specially input transformer allows selection of impedances to match various types of microphones, pick-ups, etc. Modern cabinet of handsome appearance with heavily chromed fittings. Dimensions: Height 7in., Width, 15½ in., Depth 10½ in. Weight 26 lbs. nett. Further details on request. Price fully guaranteed, £25.

NEW SA2 RADAR EQUIPMENT. Units in stock include receiver indicator, train indicator and control unit, antenna pedestal unit with power drive, Selsyn amplifiers, R.H. transmitter, etc. Made by Westinghouse etc. for operation on 115 volts A.C. Details on request.

NEW FREQUENCY METERS TYPE BC.221. Employs self-contained crystal calibrator and micrometer dial, and suitable for use as an exact frequency standard. Fully calibrated within the range 125 kc/s-20 mc/s. Complete with spare valves, manual, in maker's packing. Guaranteed new and perfect. £15.

NEW FERRIS MODEL 32A RADIO NOISE AND FIELD STRENGTH METER. Measures RF micro voltages between 1 microvolt and 10 volts. With directly calibrated Meter indication. Decibel reading also provided. Incorporates precision five band receiver tuning 150-350 kc/s. and .55 -22 mc/s. With internal calibrator. May also be employed as infinite impedance RF volt meter. Built-in stabilised Power supply consuming 3 amps at 6 volts. Complete with accessories. Guaranteed. £75.

NEW CAVITY MAGNETRONS TYPE RK725A. Freq. 9345-9405 mc/s. Heater 6.3 v. lamp. Anode 12 kv. Peak power output, 50 kW. Complete with 5,400 gauss Magnet Assembly, 50/-.

NEW RADAR GAS GAPS. Type 1B24. 15/-; Type 721A. (10 cm.) 15/-; Type 724B; complete with cavity holder, 15/-.

MAGNETRON TRANSMITTER WAVEGUIDE. Complete assembly with fittings and tunable TB cavity, etc. 25/-; Klystron Receiver Unit, with silver-plated waveguide 15/-; Also numerous other items of centimetric equipment in stock. Your enquiries will receive prompt attention.

MARCONI AMPLIFIERS TYPE 6. A really fine rack-mounting job, employing two PX25 valves in push-pull running at 500 v. Undistorted output of 25 w. Standard size panel is fitted with Anode Current Meter. Volume Control, etc. Power Unit, on similar panel, is also supplied. Very robust construction with delayed H.T. switching. For operation on 230 v. A.C. mains, 50 cycles. Ideal for Commercial Installations Hospitals, Auditoriums, Amateur Stations, etc., etc. Price complete with small mixer panel and circuit diagram £6. Standard 5ft. Rack by Cassor also available for use with the above. Supplied separately £2 each.

NEW METAL STORAGE CABINETS. Of improved design, fitted with 12 sliding drawers, overall dimensions: 10½ x 7½ x 6in. Extremely useful for segregation and neat storage of small parts 17/6.

NEW AMERICAN STAR IDENTIFICATION INSTRUMENTS. Complete with charts for all latitudes in Northern and Southern Hemispheres. Accurate in all parts of the world. In leather case 5/-.

SELSYN TRANSMITTERS. Repeaters and Magslips. Large stocks which also include a great variety of other useful instruments, at bargain prices. We invite your enquiries.

Experienced Export Shippers.

TERMS C.W.O. ALL PRICES INCLUDE U.K. CARR.
SATISFACTION GUARANTEED OR MONEY IMMEDIATELY REFUNDED.

LAWRENCES

61 BYROM ST., LIVERPOOL, 3

Telephone: CENTRAL 4430.

A NEW HIGH GRADE MOVING COIL TEST METER BY AMPLION



With Leather case, 12/6 extra

All these unique features at a sensationally low price:—

- Sensitivity 1800 ohms per volt on all DC and AC ranges
- Ranges: DC/AC 10v., 100v., 500v., 5000v. DC 50 m.a. & 500 m.a. Resistance up to 200,000 (3000 centre scale) with internal battery.
- Supplied with test prods
- Multicolour scale—easily readable
- 5000v. H.T. test prods 9/6 extra

PRICE
£3.17.6

Obtainable from Radio Dealers Everywhere

If in difficulty write to:—
AMPLION (1932) LTD.

230 Tottenham Court Road, London, W.1

Tel. MUSEUM 9823

MIDLAND INSTRUMENT CO.

FOR GOVT. SURPLUS STOCK ETC.

RESPONDER UNITS. Adm. Pattern, contains 10 valves, 8P61 (6), EA80 (2), EF54 and VE137, 14-metre superhet, ideal for television receiver conversion, oscillator R.F. and aerial unit dials, v-control, 4-pin power input socket, requires 6.3 and 250v. supply, smart grey finish case, size 12in. x 11in. x 7in., new unused condition, 60/- carriage 8/-. **RADIO RECEIVERS TYPE BC-624,** contains 11 valves, 9003 (3), 9002, 12SG7 (3), 12AH7 (2), 12CB and 12HB, 3 and 3-gang var. conds., and many other components, chassis mounted with side protection frame, 15½in. x 7½in. x 6in., new, unused condition, 25/-, carriage 2/6. **2nd class condition, 20/-, carriage 2/6.** **TYPE 21 RECEIVERS** (less valves), superhet with 465-L.F.s, and 2- and 3-gang var. conds., Westinghouse type M.3, full wave rectifier, various xaxley type and toggle switches, 11v. holders, etc., etc., 10/- post 1/4. **U.S.A. UNITS,** contains 10 valves, 68H7 (6), 6E6 (2), 7193 (2), also 2 relays, chokes, coils, over 80 resistors and condensers, chassis mounted with cover, size 12in. x 8in. x 6in., bargain, 12/6, post 1/4. **MAGSLIP MOTORS.** 3in. transmitter Mk. II, 2 of these motors can be wired in series for 100v. A.C. 50-cycle single phase, or in parallel for 50v., in this way when the shaft of one motor is turned, the other will follow 100%, clockwise or anti-clockwise, 2 motors supplied with wiring instructions, 15/-, post and packing 1/6. **OIL TEMPERATURE GAUGES** with 40-ft. tubing and mercurial capsule, 0 to 100° Cent., drum wound, new, unused, 7/6, post 9d. **GENERATORS** for electrical speed indicators Mk. II, new, boxed, 12/6, post 1/-.

P.V.C. FLEXIBLE twin flat figure 8, 7/36in 9 colours, 100-yd. drums, 12/6, post 9d. **REFLECT. OR GUNSIGHTS,** consists of lamp house to take a s.b.c. lamp, var. rheostat, high grade projector lens system by "Rosa," fitted reflector glass, supply flexible, brand new, boxed, 7/6, post 1/-. **MAINS TRANSFORMERS,** input 230-v. 50-cycle single phase, output 50 v. 11 amp. or with little alteration 100 v. at 51 amp., new, unused, 25/-, carriage 5/-. **PLASTIC SLEEVING,** 2.5 mm., 1 gross yds. drum wound unused perfect stock, in yellow or black, 7/6, post 1/-. **BATTERIES** new, unused, 1948 manufacture, fully guaranteed by us; 72 plus 11 v. 6in. x 6½in. x 1½in., 4/-, post 9d., 90 plus 11 v. 8in. x 4in. x 3½in., 4/6, post 1/-, R.M. type, 94 plus 1.3 v. 8½in. x 3½in. x 2½in., 5/-, post 1/-. **HOME VACUUM PUMPS,** also suitable as compressors, rotary vane type, 40/50 lb. sq. in., fitted 2in. long ½in. dia. spined shaft, new, unused, 15/-, post 1/3. **MICRO SWITCHES,** 4 different types, 5/-, post 9d. **HEADPHONES,** balanced armature high resistance, the finest and most sensitive phones available, brand new, boxed, 7/6, post 9d. **MOVING COIL HEADPHONES,** 5/-, post 9d., single m.c. phones, 2/6, post 6d. **HOOVER BLOWER MOTORS,** dual voltage 12 or 24 v. A.C./D.C., 15/-, post 1/-; ditto, 80 v. D.C. or 110 v. A.C., 12/6, post 1/-. **smaller type 24 v. A.C./D.C., 10/-, post 9d., all blowers unused condition.** **BATTERY CHARGERS,** output 12 v. 10 amp. D.C., input, 15 taps from 90 to 250 v. A.C. 50 cycle, single phase, coarse and fine controls, primary and secondary fuses, 2in. scale 0-15 amp. meter, selenium metal rectification, grey wall fixing cases, 17in. x 13in. x 10in., new, unused, bargain, 27/10/-, carriage and crate, 10/- extra. **TELEPHONE SETS,** consists of 2 combined microphones and telephones, 28ft. twin connecting flex., provides perfect 2-way communication, self-energised, no battery required, complete ready for use, brand new, boxed, 7/6, post 9d. **TELESCOPE DINGHY MASTS,** 14in. long, extends to 7ft. 6in., base ½in. dia. tapers to 7/16in., weight 6 oz., ideal for TV aerials, tents, microphone stands, fishing rods, etc., brand new, 7/6, post 6d. Send for a copy of our 1600lets with supplement; contains hundreds of interesting Radio, Electronic and mechanical items. S.A.N. please.

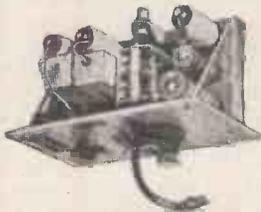
MOORPOOL CIRCLE, BIRMINGHAM 17.

Tel.: HARborne 1308 or 2664

CLYDESDALE

Bargains in Ex-Services Radio and Electronic Equipment

EX. ARMY WS-18 RECEIVER UNIT.



A 4 valve superhet chassis. Range 6-9 mcs. (50-33.3 m.). With ARPI2 (VP23) F.C. 2/A R P 12's L.F. and AR8 (HL23 - DD) Audio Loc. Osc., 2nd det. and A.V.C.

slug-tuned I.F. Trans. 465 kcs. etc. The complete receiver mounted on a chassis 8½ x 5 x lin. all control front panel 9½ x 5½ in. Unused, good condition. Power requirements approx. 3V.O.2A.L.T., 120 v. 15 ma. H.T., 1.5 v. bias. **CLYDESDALE'S PRICE ONLY 17/6** CARRIAGE PAID.

Circuits for WS-18 Rcvrs.: Mk. I, II and III, available at 2/3, post paid.
Circuits for WS-18 R/T: Mk. II and III available, at 4/6, post paid.

Brand New in maker's original carton. TRANSMITTER TUNING UNITS.

Each having vernier tuning dial, variable capacitors. Tank coil unit on ceramic former; ceramic switch; R.F. chokes, etc., in metal cabinet 47½ x 7½ x 8 in., finish black. TUSB. 1500-3000 kcs.

CLYDESDALE'S PRICE ONLY 22/6 each CARRIAGE PAID.
TU6B. 3000-4500 kcs. TU7B. 4500-6200 kcs. TU8B. 6200-7700 kcs.
CLYDESDALE'S PRICE ONLY 17/6 each CARRIAGE PAID.
TU26B. 200-500 kcs.
CLYDESDALE'S PRICE ONLY 10/6 each CARRIAGE PAID.

12 FOOT SECTIONAL AERIAL WITH BASE.

Comprising 3 lengths copper tubing, tapering from ½ in. to ¼ in. each section sleeved into the other with insulated base. **CLYDESDALE'S PRICE ONLY 10/6** CARRIAGE PAID.

PLUGS AND SOCKETS.

U.S.A. Amphenol Co-axial plug, 16 mm. dia. polystyrene ins., type 93 series, complete, 11 mm. cable entry, bright chrome finish. Price 2/6 each.
U.S.A. Phenolic Co-axial plug 11 mm. dia. type 80-81, 10 mm. cable entry, complete, dull finish. Price 2/6 each.
U.S.A. 4-way Cable skt. PL-108, less cable retainer. Price 1/9 each.
U.S.A. 18-way Cable skt. PL-153, complete for "Command" SCR-274-N and ARC-5 units. Price 3/9 each.
U.S.A. 12-way Cable skt. PL-154, complete for "Command" SCR-274-N and ARC-5 units. Price 3/9 each.
U.S.A. 8-way Cable skt. PL-152, complete for "Command" SCR-274-N and ARC-5 units. Price 2/6 each.
U.S.A. 8-way skt. PL-152-A for open wire, suits "Command" SCR-274-N or ARC-5 units. Price 2/- each.
U.S.A. 5-way Cable skt. PL-156, complete, suits "Command" SCR-274-N or ARC-5 units. Price 3/9 each.
Pye type Co-axial Cable skt. 10H/701 11 mm. cable entry. Price 1/- each.

EX. ROYAL NAVY.



Sound Powered Telephone. NO batteries required, gives long service without attention. Complete with warning

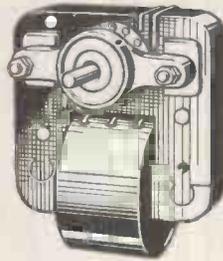
indicator lamp and generator, giving a high-pitched note, which can be heard through any noise; where a number of units are used the lamp would indicate which one is being called. Dim. 7½ x 9 x 7½ in., overall, for wall mounting. Designed for ships' use, but suitable for the Home, Office and Factory. **CLYDESDALE'S PRICE ONLY 27/6** each CARRIAGE PAID.

POWER UNIT 247.

For 230 volts, A.C. 50 cycles, output 600 volts at 200 ma. smoothed D.C., 6.3 volts, A.C. 3A. Complete power pack, with 5U40 rectifier etc., built on metal tray 10½ x 9 x 1½ in. with grey finish metal cover 11 x 9½ x 7½ in., 2 chromium handles, red indicator and inspection door, giving access to rect. and pilot bulb.

CLYDESDALE'S PRICE ONLY 59/6 CARRIAGE PAID.
With transit box.

Brand New. SHADED POLE MOTOR MODEL S.R.2.



A rugged and highly efficient motor, giving an amazing performance at an economical price. It will stand heavy overloads, and for intermittent ratings is capable of giving up to twice the rated power. 200-220/230-250 volts. 50 cycles. Under 30°C. Rise. Continuous rating.

Stack Thickness 0.675 in.
Watts (Light) 17
R.P.M. (Light) 2750
Starting Torque (In. ozs.) 1.7
Full Load Torque (in. ozs.) 2.0
Full Load R.P.M. 2000
Weight 1.7 lb.
Shaft dia.: 0.1875 in. Steel Centreless Ground. Bearings: Graphite Bronze Oilless type, Self Aligning. Rigid Diecast Bearing Brackets. Vacuum Impregnated Layer Wound Coil. Carefully tested for balance, and individually put through a Silent Room test, this motor is ideal for Gramophone Motors, Wire and Tape Recorders, Fans, Motion Displays, Switch Movements, Timing Mechanisms, and many other applications. **CLYDESDALE'S PRICE ONLY 25/-** POST PAID.

UNITS OF THE SCR-522 (TR5043). BC-624-A Receiver Unit Chassis, frequency 100-156 mcs.

Complete chassis (less crystals) with 11 valves, I.F.T.'s, relay etc. Power requirements (external) H.T. 300 v. D.C. 75 ma., L.T. 12 v. D.C. 3 A. Dimensions: 15½ x 7½ x 6 in. Circuit supplied. **PLUS, Free Gift. BC-625-A Transmitter Unit Chassis.** Partly stripped, but containing many useful parts, R.F. section in good order, no valves, modulation trans., or external switch. Dim. as Rcvr. **CLYDESDALE'S PRICE ONLY 37/6** CARRIAGE PAID.

EX. R.A.F. T.V. EXPERIMENTAL UNITS. New delivery — Just arrived.
R1355 IF/AF Units, at..... 67/6
Type 6H Indicator Units, at..... 89/6

READY JUNE! COMPLETE ILLUSTRATED LIST No. 7 OF EX-SERVICES BARGAINS.

Plus list of Radio and Television Components by foremost manufacturers, fully illustrated, also containing useful valve, coil and other data.

Send 6d. to cover distribution cost. Please print name and address.

INFRA-RED IMAGE CONVERTER CELL. Sniperscope.



Snooperscope. The famous wartime "Cats-eye" tube used in "Tabby" for night sniping and observation.

Provides a Silver Cesium Oxide Screen for the conversion of Infra-Red rays to visible rays, using an Infra-Red source. Data provided. Dimensions overall: dia., 2in. x 1½ in. Screen dia.: 1½ in.

CLYDESDALE'S PRICE ONLY 12/6 each POST PAID.

STILL AVAILABLE.

- Wireless Set No. 48 at £14 10 0
- BC-456 "Command" Modulator Unit 19 6
- TI154 Transmitter Unit 4 range .. £10 10 0
- TI154 Transmitter Unit 3 range .. £7 18 6
- RI155 Receiver Unit £12 12 0
- Bridge Megger 100 megas. at 1,000 v. £35 0 0
- Wee Megger 20 megas. at 250 v. 19 6
- A.C. Power Unit type 3 £3 19 6
- Crystal Multiplier type MI-19468 £1 19 6
- Battery Amplifier A.1368 11 6
- Reflector Aerial (MX-137/A) 5 6

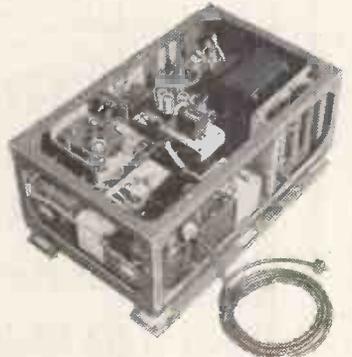
As previously advertised, prices include carriage.

VIEWMASTER TELEVISION.

Circuit and data, 5/-.
Component Kits available.
State whether London (A) or Sutton Coldfield (B).

Brand New in original wood case.

EX-CANADIAN ARMY SUPPLY UNIT RECTIFIER, FOR No. 43 TRANSMITTER



Inputs: 110 v. A.C. 50/60 c/s. 1.7 K.V.A.
Outputs: 2100 v. H.T. 375 ma. 500 v. H.T. 400 ma. 385 v. regulated; 450 v. H.T. line: 275 v. H.T. line; 415 v. neg. bias; 250 v. neg. bias; 150 v. neg. bias; 80 v. neg. bias.
The unit consists of 3 complete power supplies, one of which provides various stabilized L.V. supplies. All are fed via double choke, condenser input circuits.
8 valves: 4/866-866A's, 5Z3, 6SJ7, 2/6A3's, plus 1V time delay and VR150/30 strbilizer. Other components include: Power Trans. 2100-500-0-500-2100 v. Power Trans. 450-0-450v. 13 v. ct., 6.3 v. ct., 6.3 v.
Fil. Trans. 2.5 v. ct., twice, Fil. Trans. 6.3 v. (thermal starter) Chokes, 2/15H. 375 ma. 15H. 450ma. 2/15H. 110 ma. 20H. 162 ma. plus various H.V. condensers, resistors, etc.
The complete unit mounted in metal case with lid 2ft 6in. x 1ft. 6in. x 1ft. finish olive-drab crackle with shock absorbing feet. Wgt. 420 lbs.
CLYDESDALE'S PRICE ONLY £16 CARRIAGE PAID.

Order direct from:—

CLYDESDALE

SUPPLY 2 BRIDGE STREET CO. LTD. GLASGOW - C.5

Phone: South 2706/9

Visit our Branches in Scotland, England and Northern Ireland

INEXPENSIVE TELEVISION

is the title of the latest publication which shows how a variety of ex-Government Radar Units can be converted with the minimum of effort into efficient Television Receivers. A second edition of the booklet carrying the same title, it has been extended to cover units other than the R.1355, and is well worth buying. Send only 2/9 for your copy (post paid) and a complete price list of the specified equipment. Start accumulating the equipment now, at the low summer prices and be ready for the long winter evenings.

RECEIVERS R.1355. Still in great demand for T.V. Construction. Complete with all valves. ONLY 55/- (carriage, etc., 7/6).

R.F. UNITS TYPE 25. Specified with above for London Area Station. ONLY 17/6 (postage, etc., 1/6).

R.F. UNITS TYPE 26. Specified for Birmingham Station now all sold, but we can supply one of the other R.F. Units with full details of modification, which has been fully tested some 70 miles from Sutton Coldfield. BRAND NEW IN CARTONS, ONLY 25/- (postage 1/6).

THE 194 I.F. STRIP. One of the units specified in the above book. A first class strip containing six valves VR65, and one each VR53 and VR92. Easily converted for vision or sound for both stations and supplied with the necessary instructions. Size 18x5x5in. ONLY 45/- (postage, etc., 2/6).

RECEIVER 25/73. The receiver portion of the T.R.1196. Covers 4.3-6.7 m/cs and makes an ideal basis for an all-wave receiver. Complete with six valves: two each of EF36 and EF39, and one each EK32 and EBC33, and modification details. New condition. ONLY 25/- (postage, etc., 2/6).

U.E.I. CORPN.

10 VALVE 1½ METRE SUPERHET RECEIVER.

A ground control radar receiver, this will convert into a first class Television Receiver for the fringe areas. Full details for both stations being supplied. Contains six valves SP61, two of EA50, and one each RL7 and RL16, and six I.F.T.s of 12 m/cs with 4 m/c. bandwidth. BRAND NEW IN MAKER'S CARTONS, ONLY 59/6 (carriage, etc., 5/-).

INDICATOR UNITS TYPE 62. Contains 16 valves SP61, two of EB34, two of EA50, and VCR97 C.R. Tube. ONLY 75/- (carriage, etc., 12/6).

TRANSFORMERS for "Inexpensive Television" can be supplied as follows: Time Bases and Vision Transformer, 350-0-350v. 60 m/a., 5v. 3a., 6.3v. 6a., 6.3v. 3 a., ONLY 36/-. Sound Receiver Transformer, 250-0-250v. 100 m/a., 5v. 3a., 6.3v. 6a., ONLY 27/6. E.H.T. Transformer for VCR97 Tube, 2-0-2v. 1.1a., 2-0-2v. 2a., 2,500v. 5 m/a., ONLY 30/-. POSTAGE 1/6 per transformer, please.

COMMUNICATIONS RECEIVER R.1155. A special Summer offer of these famous 5-waveband R.A.F. Receivers the specification of which is too well known to repeat. When you own this set, you own the best. Complete with full details of how to adapt it for mains use, or we can supply a power pack and speaker ready to plug on and work immediately for only £6 extra, to the cost of ONLY £7/19/6 (carriage, etc., 12/6). Every set fully tested before despatch.

RECEIVER 18. The receiver portion of the No. 18 Walkie-Talkie. Operates on 6-9 m/cs. Complete with four valves: 3 of VP23 and one of HL23DD. Only requires normal battery supply to operate. New condition. ONLY 17/6 (postage, etc., 2/6).

Cash with order please and print name and address clearly.

The Radio Corner, 138 Grays Inn Rd., London, W.C.1
(Phone: TERminus 7937)

RUCO PRODUCTS

GLASS DIALS
for the
NEW WAVELENGTHS
are now available
for all our units

RUCO PRODUCTS
Crown Works,
197, Lr. Richmond Rd., Richmond,
Surrey

Phone: Prospect 7463

EX - GOVERNMENT STOCK DISPOSAL!

The finest

RADIO VALUES

ever offered

SATISFACTION GUARANTEED or MONEY REFUNDED

Ex-War Surplus

HUGE CLEARANCE SALE

Thousands of Radio Components
at Knock-out Prices

ILLUSTRATED CATALOGUE
NOW READY

Forward P.O. 1/- to

WESTON PRODUCTS

(LIVERPOOL) LTD. • TEL: ROyal 5754/5.

71-GT. GEORGE STREET LIVERPOOL 1

UNIVERSITY RADIO

Offer Guaranteed Used Equipment at Attractive Prices

Premier Radiogram (1948) Cabinet. In good condition. Callers only	£10 0 0
Garrard RG70A Record Changer. As new	£10 0 0
Goodmans 12in. P.M. Speaker, 15 ohms. As new	£4 0 0
Collaro New Centre-drive Gram Motors, with 12in. Turn-tables. 6 only. Each	£4 10 0
Latest model Avo Valve-Characteristic Meter. As new	£28 10 0
Pullin Series 100 Test Meter, as new	£7 10 0
1154 Transmitter, complete with valves	£9 0 0
Evershed's 500 volt Megger in aluminium case. Perfect working order	£9 10 0

Adaptagram, fitted with Garrard RC65 mixer-changer in walnut cabinet. As new	£20 0 0
Adaptagram, as above fitted with AC/DC unit	£22 0 0
Eddystone 5-10 Meter Converter. As new	£4 10 0
Pam Amplifier, AC 200-250 volts. Perfect	£17 10 0
Simon Sound Service Recording Amplifier, Model EA25. As new	£20 0 0
Portable Transmitting Receiving Equipment, Type 3 Mk. II. 5 to 15 megs. Battery or mains AC 250 volts. In good condition	£10 10 0
Taylor 90A, as new	£9 10 0
Hallcrafters' S27, rack model 100-230 A.C. Perfect	£21 0 0

Philip's Communication Receiver (PCR-1) A.C. 100-250 volts Complete and perfect	£14 0 0
Sound Sales DX Plus I Radio Unit, perfect as new	£11 0 0
Eddystone 640, as new	£21 0 0
AR88, Model D perfect. As new	£45 0 0
Hambander, as new	£13 0 0
H.R.O. Senior (3 only) with one coil—14.4 to 30 meg. Complete with valves. No Power-Pack. Perfect	£14 0 0
MCR-1, complete with all coils, phones, AC/DC Power-Pack. As new	£7 10 0
Hallcrafters' SX28, as new	£43 10 0
Rola G.12 Energised Speaker, 2,000 field, 15 ohm Sp. Coil. Perfect	£3 0 0

WE NEED GOOD USED EQUIPMENT URGENTLY. PLEASE SEND, BRING OR PHONE FOR OFFER

Evershed's Low Range Bridge Megger Testing Set, 100 volts. Perfect	£11 10 0
Taylor 1,000 o.p.v., Model 70A, As new	£7 10 0
Taylor AC/DC Minor, model 120A, as new	£5 10 0
Avo Minor AC/DC, as new	£5 10 0
Avo Minor, (D.C. only) as new	£2 12 6
Avo 40. As new	£11 10 0
Avo 47A. (Ex-W.D. as model 40). Perfect, as new	£10 0 0
Taylor Cap and Res. Bridge, as new	£7 10 0
Taylor 85A, 20,000 o.p.v. Test Meter. As new	£12 0 0
Avo Cap. and Res. Bridge. As new	£7 0 0
G.E.C. Miniscope, as new	£12 0 0
Garrard AC/DC Record Changers, mixer type, Model RC65-U-16C. Brand new. At each	£22 10 0
Evershed's Bridge Megger, 500 volts, with built-in Resistance Box. In perfect condition	£15 10 0
Taylor 65B Signal Generator. As new	£11 0 0
Avo 1948 Model Signal Generator. As new	£10 10 0
Avo Valve-Tester with Roller Panel as new, 1948 model	£11 10 0
Taylor 90A, as new	£9 10 0

Ambassador P.A. 145, 20 watt Amplifier, with built-in Radio Unit. A.C. 200-250 volts. In new condition	£17 10 0
Latest Model Columbia Record-Player Units, perfect	£8 0 0
Ardente 6 watt AC/DC Portable Amplifier, complete with Speaker, M/C. Mike and stand. Perfect	£12 10 0
S.T.C. Ball and Biscuit Mikes, (model 4021/C). In perfect condition	£9 0 0
G.E.C. 1/2 h.p. Motors, (D.C.) 1,440 revs. Perfect	£3 10 0
Hoover 1/2 h.p. Motors, A.C., 1 phase, 220-230 volts. 1,425 revs. As new	£6 0 0
Brookes 1/2 h.p. Motors, (D.C.) 230-250 volts. 1,400 revs. As new	£6 0 0
DC-AC Rotary Convertors (Debeg). 210-230 D.C. to 210-230 A.C., 180 watts. Complete with Filter. Perfect. 50 cys.	£7 10 0
Ward Rotary Converter, 24 volt D.C.-230 A.C., 50 cys., 250 watts. As new	£11 10 0
Nelco Rotary Converter, 24 volts D.C. to 230 A.C. 150 watts, 50 cys. Perfect	£7 10 0
Shaftesbury 15 watt AC/DC Portable Amplifier, complete with Mike, Stand, Speaker, etc. Perfect. Nearly new	£15 0 0
Wharfedale Speaker, (W-10-CS), as new	£5 0 0

Goodmans Axiom 12, as new	£5 10 0
Goodmans Axiom 22, as new	£7 10 0
Latest Model Hartley Turner, as new	£6 0 0
Vitavox Pressure Units, 20 watt. Type N. Perfect	£5 0 0
Taylor Model 30A, 'Scope. As new	£19 0 0
R-1155, with Magnavox 66 12in. Speaker and power pack. Perfect To callers only	£12 10 0
R-1155 converted. No power pack. With all valves. To callers only	£5 10 0
Collaro Microgram, 1948 model. Perfect	£10 0 0
Collaro Microgram, 1950 model. (Auto-Change) As new	£20 0 0
Cambridge Flux-Meter. Perfect	£13 10 0
BPL RS600 Signal Generator. Perfect. As new	£10 10 0
M.S.S. Tracking Gear. 1946. On base-plate, complete with cutting head. Perfect	£15 0 0
Recording Motor, with 12in. Turn-table. Perfect	£6 10 0
Will Day Spring Drive Recording Motor, with tracking-gear and cutting-head in oak box. Perfect	£12 10 0
Collaro RC500 'Changer, as new	£8 0 0
Wharfedale 10In. Golden Speaker As new	£2 7 6

WE HAVE OTHER EQUIPMENT ARRIVING DAILY!

ALL S.A.E. INQUIRIES WELCOMED.

CASH OR CHEQUE WITH ORDERS. ALL ITEMS LISTED ARE CARRIAGE PAID UP TO 50 MILES.

22 LISLE STREET, LEICESTER SQUARE, LONDON, W.C.2

'Phone GERrard 4447 and 8582.

Hours 9 to 6.

Thursdays 9 to 1.

NEW!

GOODSELL FEEDER UNIT

WITH WIDE RANGE TONE CONTROL

- FOUR STATIONS AT THE TURN OF A SWITCH.
- SOUNDLY BUILT FOR EXCEPTIONAL PERFORMANCE WITH HI-FIDELITY AMPLIFIERS.
- EXTREMELY COMPACT.
- ATTRACTIVE DESIGN WITH COLOURED 'PERSPEX' PANEL WITH ENGRAVED KNOBS.
- SEVEN B8A VALVES.

PRICE £13 - 13 - 0 plus tax

Leaflet on request

GOODSELL LTD.
40, GARDNER STREET, BRIGHTON, 1
Brighton 26735

HUGE DEMAND FOR THE MURPHY T.V. PATTERN GENERATOR ★

The demand for the Murphy T.V. Pattern Generator continues to grow, and although substantial deliveries are being made, our waiting list is still a very considerable one.

EARLY APPLICATION IS ADVISABLE AS WE ARE RECEIVING MANY REPEAT ORDERS.

For those who are still unaware of the outstanding excellence of the Murphy T.V. Pattern Generator we invite you to make application for a demonstration.

★ The Murphy T.P.G.11 provides in a small, portable equipment the complete synchronising waveform, as used by the B.B.C., in the test signal, essential for correct alignment of T.V. receivers. A pattern generator which does not give such a waveform is of very limited use, so pay the extra cost—and have a Murphy T.P.G.11.

For full specifications write to:—

F. LIVINGSTON HOGG

65, BARNSBURY STREET, LONDON, N.1.
or Telephone TUDor 5277 for a demonstration

F. LIVINGSTON HOGG, SPECIALIST IN
HIGH GRADE INSTRUMENTS FOR THE
COMMUNICATIONS INDUSTRY.

G2AK This Month's Bargains G2AK

SPECIAL OFFER. POWER TRANSFORMERS.

620/550/375/0/375/550/620 volts at 200 mA., also plus 250 mA. at the 375 v. taps. Two separate windings of 5 v. at 3 amps. each for rectifiers. Rated at 278 watts. (This is a very conservative rating and could be exceeded by at least 50 per cent. for amateur use.) Weight 24lb. This is the transformer buy of the year. Price only 50/-. Carriage paid.

MODULATION TRANSFORMERS.

360 watts. Prim. 5500, 5000, 4500, ct. Sec. 1. 3550 at 450 mA. Sec. 2. 6700 ohms, 12 watts. Ideal for Plate and Screen Modulation. Price only 27/6. Carriage paid.

Both of the above transformers are fully shrouded and are new and unused but some may be a very little store soiled.

HEAVY DUTY L.F. CHOKES. FULLY POTTED.

30 Hy. 100 mA. 150 ohms (Wt. 14lb.). Price 13/6.

20 Hy. 126 mA. 100 ohms (Wt. 14lb.). Price 15/6.

30 Hy. 150 mA. 150 ohms (Wt. 18lb.). Price 17/6.

(For Amateur use, above ratings could be doubled.)

All transformers and chokes are carriage paid except to Eire for which we must ask for 5/- extra.

SPECIAL METER OFFER.

100 microamps. Scaled 0-100 2 1/2 in. Only 22/6 each

500 Microamps. Scaled 0-500 2 in. dia. Each 7 6

500 Microamps. Scaled 0-15-600. Each 6 3

Ditto, but ex-equipment. Each 5 0

.5 amp. Thermo 2 in. dia., 2/6 each or 5 for 10/- 0-5 mA. 2 in. dia.,

5/- each. 0-100 mA. and 0-500 mA. 2 1/2 in. Flush mounting, 7/6 each.

0-20 volt 2 in. dia., 5/- each. 20-0-20 amps. 2 in. dia., 5/- each. 0-3500 v.

Moving Coil 3 1/2 in. dia., 25/- each. 0-9 amps. Hot Wire Ammeters

(by removing external shunt, full scale deflection is 4 amps.), 1/6

each. Radiator Thermometers 2 in. dia. Movements 2.5 mA.

Backwards reading. Ideal for "S" Meters, 1/6 each.

Postage on single meters, 6d. Three or more post free.

PLEASE PRINT YOUR NAME AND ADDRESS.

CHAS. H. YOUNG, G2AK

All Callers to 110 DALE END, BIRMINGHAM
Phone: CENTRAL 1635.

Mail Orders to 102 HOLLOWAY HEAD, BIRMINGHAM
Phone: MIDLAND 3254.

1 KW TRANSMITTERS. Two HF. 300's output CW operation 3.5 Mc to 16 Mc.

HALLCRAFTERS BC.610 (or HT.4B) operating over 2 Mc. to 18 Mc. and modified for 21 and 28 Mc. Crystal and V.F.O. on all bands, complete with speech amplifier, antenna tuning unit, exciter units and coils for all bands, set of 36 x-tals specially made for BC.610 and new valves.

R.C.A. TRANSMITTERS. Type ET.4332. B. 2 Mc to 20 Mc., 350 W.C./W., 250 W. R/T. Two 813's output. Crystal controlled and modified for V.F.O. With separate speech amplifier.

60 W. TRANSCIEVERS. Very compact, weight 13 lbs. 829 output. 2 Mc. to 8 Mc. or 4 Mc. to 16 Mc. Phone and key. High class superhet. receivers. Complete with power pack for 110/220 V. A.C. and two rotary converters for 12 V. battery supply, two sets of aerials (dipole and counterpoise aerial), microphone, spare key and set of spare valves.

AUTOMATIC HIGH SPEED TELEGRAPH EQUIPMENT

"Boehme" (U.S.A.). Up to 400 signs per minute on line or wireless.

AR.88.D's, L.F., S.X.28's, H.R.O.'s with 5 or 9' coils.

METAL RECTIFIERS, type 7B, Max. D.C. output at 36 V. 56 Amps Supply voltage 200/250 V. Brand new, in original cases.

All above items in excellent working condition. Working demonstration upon request.

Large stock of transmitting condensers, valves, crystal and other components. Alignment and repair of communication receivers and all other amateur equipment undertaken.

P.C.A. RADIO

Transmitter Division:—
The Arches, Cambridge Grove,
London, W.6. Tel. Riv. 3279

Receiver Division:—
170 Goldhawk Road,
London, W.12

ON PRODUCTION LINE

or laboratory bench, or anywhere a response curve in the audio spectrum is required, the Model 1900 Portable A.F. Response Curve Tracer will trace it in seconds on a log log or log linear scale.

The instrument may be set to repetition frequency sweep (variable rate),

or single sweep (variable speed),

or frequency may be set by hand to any part of the response curve for detailed investigation.

Built-in calibration checks are provided.

Frequency drift, harmonic distortion and hum is very low.

* THE CURVE MAY BE PHOTOGRAPHED



Model 1900 A.F. Response Curve Tracer—Write for specification.

NOW IN PRODUCTION

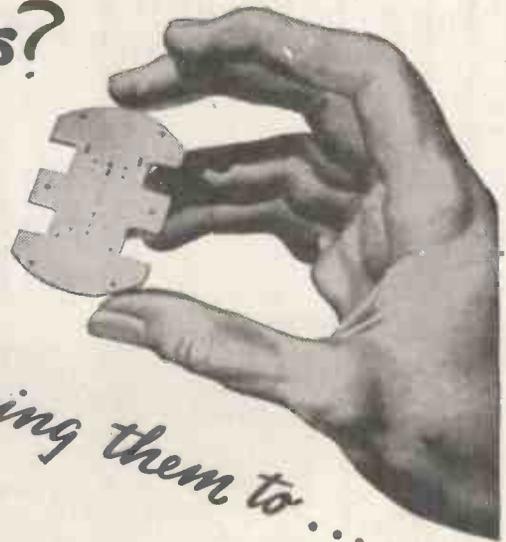
* Camera available

INDUSTRIAL ELECTRONICS

99, GRAYS INN ROAD, LONDON, W.C.1

Telephone : Holborn 9873/4

Difficult Problems?



Made in Three Principal Materials

FREQUELEX

An insulating material of Low Dielectric Loss, for Coil Formers, Aerial Insulators, Valve Holders, etc.

PERMALEX

A High Permittivity Material. For the construction of Condensers of the smallest possible dimensions.

TEMPLEX

A Condenser material of medium permittivity. For the construction of Condensers having a constant capacity at all temperatures.



Bullers

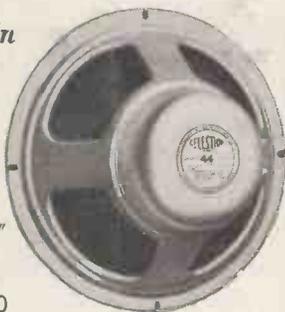
BULLERS LOW LOSS CERAMICS

BULLERS LTD., 6, LAURENCE POUNTNEY HILL, LONDON, E.C.4

Telephone : Mansion House 9971 (3 lines) Telegrams : "Bullers, Cannon, London"

CELESTION

The Foremost Name in Sound Reproduction



MODEL P44.

- Overall Diameter 12 $\frac{3}{16}$ "
- Voice Coil Impedance ohms 3.0
- Magnet Pole Diameter 1 $\frac{1}{2}$ "
- Flux Density (Gauss) 10,000
- Total Gap Flux (Maxwells) 60,000
- Peak Power Capacity 10W

The General Public should please order through their Local Dealers.

Manufacturers are invited to write for details of the full range of Celestion speakers.

CELESTION,

SUMMER ROAD
THAMES DITTON, SURREY

Telephone: EMBERBROOK 3402-5

"You're **CERTAIN** to get it at **ARTHURS**!"

★ **VALVES**: We have probably the largest stock of valves in the country. Send your enquiries.

AVO METERS IN STOCK

Avo Model 7	£19 10 0
Avo Model 7, high resistance	£19 10 0
Avo Model 40	£17 10 0
Valve Tester	£16 10 0
Test bridge	£11 0 0
Avo Minor, AC/DC model	£8 10 0
Electronic Test Meter	£35 0 0
Signal Generator	£25 0 0
Valve characteristic meter	£40 0 0

TAYLORS METERS. List on request.

DECCA PICK-UPS	£3 15 5
DECCA HEAD for Garrard	£2 19 2
Adaptors	3 8
COSSOR DOUBLE BEAM OSCILLOSCOPE	£85 10 0

"Viewmaster" Television Kits in stock for Birmingham and London area. Please state which required.

LONDON'S OLDEST LEADING RADIO DEALERS

LATEST VALVE MANUALS

- Mazda - 1/- ea.
- Brimar - 2/6 ea.
- Brimar Teletube & Radio - 4/-
- Post 4d. each extra

Arthur's

EST. 1919

PROPS: ARTHUR GRAY, LTD. Terms C.O.D. or cash with order

Our Only Address: Gray House, 150/152 Charing Cross Rd., London, W.C.2 TEMple Bar 5833/4 and 4755

ELECTRICAL, TELEVISION & RADIO ENGINEERS.

"Cyldon" VARIABLE Capacitors

MICA DIELECTRIC TRIMMERS



No. 10K1. Two Section. Range of max. capacities: Up to 1,000 pF. per section. Fitted with one insulated knob (10K2—two knobs) for incorporating in fly-back circuit of TV Receivers. 1.344" long, 1.344" wide, 1" high.



No. 23. Capacities: Max. 50pF.-80pF. Min. 3pF. 28A. Threaded section under base for one hole fixing. 0.875" long, 0.625" wide, 0.875" high.

MICA TRIMMERS to AIR DIELECTRIC HIGH-VOLTAGE Transmitting Capacitors

SYDNEY S. BIRD & SONS, LTD.
CAMBRIDGE ARTERIAL RD. ENFIELD, MIDDX.
Phone: Enfield 2071-2. Grams: Capacity, Enfield.

THE FIDELIA

Features include variable selectivity, infinite impedance detector, electronic bass and treble controls, push-pull triode output stage; 3 wavebands 16-50, 190-550 and 1,000-2,000 metres. Audio amplifier response 30-18,000 cycles; bass, treble and volume controls operate on gramophone, suitable for light weight p.a. Price £21/5/0 Also 'Precision' 5-valve chassis, £12/17/6 2 R.F. feeder, 8 gns.

9 VALVE LUXURY R/GRAM CHASSIS



Guaranteed 12 months
Data sheets on request



ELECTRO Acoustic DEVELOPMENTS
18 Broad Rd., Willingdon, Eastbourne, Sussex

SAVAGE OF DEVIZES LIMITED

INTRICATE TRANSFORMER CONSTRUCTION

SAVAGE TRANSFORMERS LIMITED
NURSTEED ROAD • DEVIZES • WILTS
TELEPHONE DEVIZES 516

CONSISTENTLY *Accurate*

PULLIN A.C. DYNAMOMETER MULTI RANGE TEST SET TYPE P.D.440 with the well known Pullin Iron-free dynamometer movement combines the functions of a Precision indicating Ammeter, Voltmeter and Wattmeter. Covers an extremely wide range to fine limits of accuracy :-

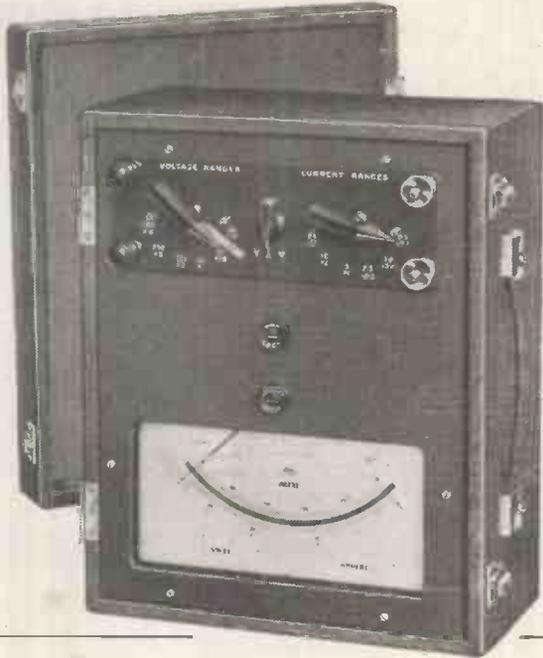
5 Voltage—Ranges from 25 to 500 Volts A.C. or D.C. Accuracy plus or minus 0.5%.

6 Ampere—Ranges from 0.5 to 25 (A.C. only). Accuracy plus or minus 0.5%.

30 Watt—Ranges from 12.5 to 12,500 (A.C. only). Accuracy plus or minus 1%.

Entirely self-contained in polished hardwood case with carrying handle and removable lid, as shown.

Weight 17 lbs. Size 10½ in x 13½ in x 7¼ in.



Get full details without delay from:

MEASURING INSTRUMENTS (PULLIN) LTD.

Electrin Works, Winchester St., Acton, London, W.3.

Telegrams : MIPULLCO EALUX LONDON.

Tel. : ACO 4651/3 & 4995

MORTLAKE TRADING CO.

Now in production

12 inch RECORDING DISCS - - - - 5/6 each or 62/6 doz.

SPECIAL TERMS TO WHOLESALERS AND RECORDING COMPANIES

We are manufacturers of TRANSFORMERS and COILS. Special Transformers to order.

MAINS TRANSFORMERS		
Tapped Primary 270-0-270 v. 70 ma. 6.3 v. 3 amps., 5 v. 2 amps. each	14/6	Small Mains Transformer suitable for midget receiver, 6 v. 1 amp. 5/-
Tapped Primary 350-0-350 v. 100 ma. 6.3 v. 3 amps., 5 v. 2 amps. each	19/6	Chokes, 60 ma. 300 ohms, 3/- ; 150 ma. 200 ohms ... 7/6
4 volt 8 amps. ... each	8/6	Output Transformer. Will carry 50 mA. State ratio required ... 3/6

GOVERNMENT and MANUFACTURERS' SURPLUS

LOUD SPEAKERS
 Loud Speakers, 5in. with trans., 10/6.
 Loud Speakers, 5in. less trans., 8/6.
 Loud Speakers, 6in. less trans., 11/-.
 Loud Speakers, 8in. less trans., 11/9.
 Special offer of set manufacturer's surplus of Goodman's Bin., 14/- ; 10in., 17/6.
 The famous ROLA REGAL extension speaker, limited number only, 27/6 new and in original cartons.
 Rola Bin. energized, with trans., 11/6.
 Rola Bin. P.M. with trans., 15/6.

CONDENSERS
 Electrolytic, 8 mfd. tubular 450 and 500 volt, 2/- ; 16 mfd. 450 and 500 volt, 3/- ; 8-8 450 volt, 3/3 ; 16-8 450 volt, 3/6 ; 16 mfd. plus 24 mfd. 350 volt working, 2/9.
 Mansbridge and oil filled types, 4 mfd. 400 volt working, 1/3 ; 4 mfd. 500 volt working, 1/9 ; 4 mfd. 600 volt working, 2/3.
 2 Gangs .0005, 3/9.

WHIP TYPE AERIALS, 4 sections, 2ft. each length, interlocking, complete with canvas carrying case, new, each 7/6.

The famous BURGONEY SOLDER GUN, complete and new, 49/6.

V.C.R. 97 TUBES, 35/-, carriage paid.

WHITE RUBBER MASKS for above, 7/6.

MAGNIFYING LENSES for same 25/-.

SEND FOR LIST

Terms of business Cash with order. All orders under 20/- postage and packing 1/8 extra.

The famous 1155 Receivers

10 valves, Aerial tested, in original transit cases, carriage paid, £9/19/6.

A few needing service but otherwise complete, £6/19/6.

1355 Receivers

Brand new and in original sealed cases, 11 valves, as specified for the inexpensive television receiver, carriage paid, 79/6.

Dinghy Transmitters

Valves 12SC7, 12A6, hand-wound generator, for L.T. & H.T. 300 v. 40 mA., 28 v. 175A, complete with aerial, etc., carriage paid, 29/6.

POST ORDERS To 197, LOWER RICHMOND ROAD, RICHMOND, SURREY. PROspect 4464

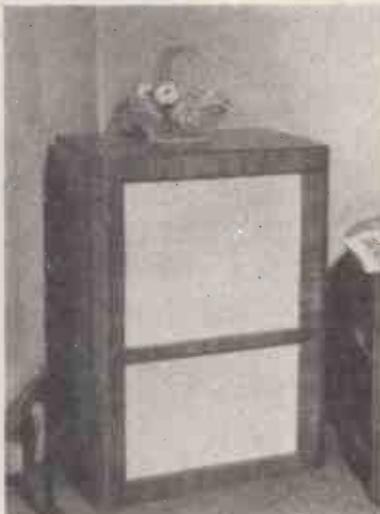
Callers to above address and THE ARCADE (opposite G.P.O.) GEORGE STREET, RICHMOND.

—OPEN UNTIL 6.0 p.m. SATURDAYS.—

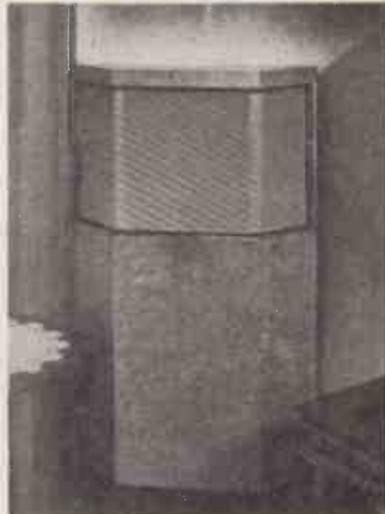
QUALITY LOUDSPEAKER CABINETS



JUNIOR CORNER CABINET



BASS REFLEX CABINET



SENIOR CORNER CABINET

An Illustrated leaflet describing these attractively designed and solidly constructed cabinets is now ready. Models are available to house the majority of the leading high fidelity loudspeakers. Send for the leaflet now, or better still call and hear a demonstration.

ROGERS DEVELOPMENTS CO.

106, Heath Street, HAMPSTEAD, London, N.W.3.

Hampstead 6901

T.V. in the FRINGE AREAS



★

A Superior PRE-AMPLIFIER

By 'RAINBOW'

For use with CO-AX or BALANCED FEEDER

Built-in Power Pack, with Metal Rectifier, E.F.91 valve, exclusive Rainbow Coils. Complete with all Plugs, Crackle Finish, Steel Case
8 $\frac{3}{8}$ " x 4 $\frac{3}{4}$ " x 2 $\frac{1}{8}$ ".

Price £5 17 6

Alexandra Palace or Sutton Coldfield Model

Is giving excellent results with Receivers by Bush, Pye, H.M.V., Marconi, Philips, etc.

It's to your advantage to write for fuller details.

RAINBOW RADIO MANUFACTURING CO. LTD.

Mincing Lane, Blackburn, Lancs., England



RELAYS AND KEY SWITCHES



LARGEST EX-GOVT. STOCK
IN GT. BRITAIN

Types 600-3000 Relays — Siemens High Speed
Also A.C. 250 volts 50 cycles

Uniselector Switches, Carbon Insets, Telephone Components, Plugs, Jacks, Handsets, Co-Axial Cables — Government Contractors

JACK DAVIS (Dept. W.)

30 PERCY STREET, LONDON, W.1

Phonés: MUSEum 7960, LANgham 4821

Varley
REGD. TRADE MARK

Products of
Quality & Reliability

MAINS TRANSFORMERS
A. F. TRANSFORMERS
THERMAL DELAY SWITCHES
SMOOTHING CHOKES
POWER RESISTANCES

Made by

OLIVER PELL CONTROL LTD

Telephons: WOOLWICH 1922-1926
CAMBRIDGE ROW · WOOLWICH · S.E.18

Wireless World Classified Advertisements

Rate 6/- for 2 lines or less and 3/- for every additional line or part thereof, average lines 6 words. Box Numbers, 2 words plus 1/-. (Address replies: P.O. 0000 c/o Wireless World, Dorset House, 1, Stamford St., London, S.E.1.) Trade discount details available on application. Free Day: July 1 50 issue, first 10 cent Monday, June 5th. No responsibility accepted for errors.

WARNING

Readers are warned that Government surplus components which may be offered for sale through our columns carry no manufacturers' guarantee. Many of these components will have been designed for special purposes making them unsuitable for civilian use, or may have deteriorated as a result of the conditions under which they have been stored. We cannot undertake to deal with any complaints regarding any such components purchased.

NEW RECEIVERS AND AMPLIFIERS

WRITE for details of:-
 THE SC/M receiver/amplifier, specifically designed for schools, hotels, clubs, etc., with inputs for gramophone and microphone.
AEROTRON RADIO COMPANY, Peel St., Chadderton, Br. Oldham. [5356]
UNIVERSAL ELECTRONIC PRODUCTS, 35, Marylebone High St., London, W.1. Welbeck 4058.
SPECIALISTS in the design and manufacture of high fidelity reproducing equipment from 5-100 watts for domestic or industrial purposes. Our new twin channel amplifier (type U.E.57) with independent bass and treble outputs, provides the most satisfying standard of reproduction we have yet experienced. It is now being demonstrated in our showrooms daily (we close Thursday 1 p.m., Saturday 4.30 p.m.) and we invite those who seek perfection from recorded music to hear this superb instrument. We also offer tuning units or complete chassis designed and constructed to individual requirements.

HALLICRAFTERS dual diversity receivers, complete with power units and loudspeakers; few only available.
McELROY ADAMS MFG. GROUP, Ltd. (Hallcrafters), 46, Greyhound Rd., London, W.6.
12-watt high quality amplifiers, bass and treble boost; £12/10; lists.—Broadcast & Acoustic Equipment Co., Ltd., Tombland, Norwich. [0067]

A.C./D.C. 6-valve amplifier for mic. and gram, separate gain and tone controls, suitable for 3, 7.5 and 15 ohm speakers, housed in black crackle cabinet; £10/15.
UNLIMITED, Elm Rd., Walthamstow, London, E.17. [0072]

TRUETONE amplifiers and tuners built to your requirements by high quality experts, from 5-50w; £5 upwards.—For demonstration, write or phone, **A. S. Colman**, St. Stephen's Circus, W.C.2, Bay, 3661 after 7 p.m. [5176]

BERNARDS, makers of television, radio, amplifier equipment, available for early delivery; television time-base chassis and E.H.T. supply combined, 5 valves, completely wired, tested, only new components used; £7/12/6.
BROADBENT, 12, Chertson Rd., Putney, London, S.W.15. Pup. 7538.

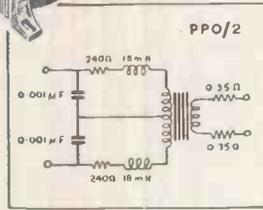
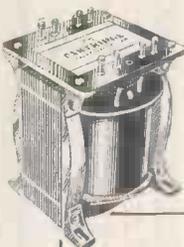
A SOUND investment—Our 5-valve all-wave superhet radiogram chassis is really value for money; large fully illuminated glass scale in attractive case, fine and adjustable tone control radiogram cabinet, aerial tested complete with speaker; price with 6in p.m. £12, with 10in p.m. £12/10. 2/6d. stamp for illustrated leaflets; trade enquiries invited.—**Bavly Bros.**, 46, Pavilion Drive, Leigh-on-Sea, Essex. [5305]
DEVELOPMENT, Ltd., Hubert St., Birmingham, 6 (Aston Cross 2440). The Midlands specialist manufacturers of high fidelity sound reproduction equipment, for the world-famous Williamson amplifier and associated accessories including tone control stages, loudspeaker crossover units, distortionless contrast expanders and radio feeders; send for details and prices. [5470]

TRULAD ELECTRONICS, 70, Church Rd., Upper Norwood, London, S.E.19, designers and manufacturers of Trulad quality amplifiers for commercial and domestic use; unique amplifiers, with exceptional quality; built to satisfy the discriminating ear; bass and treble independent controls, providing widest possible variety to suit all recordings and varying acoustic properties of one room with another; £18, complete; full details on request.—Write, call or phone **Livingstone** 4879. [0019]

CONNOISSEUR'S receiver, acclaimed by its users as the finest receiver for the enthusiast and the one with the following facilities: 9-1,500-metre, world-wide results on highly sensitive 10-valve receiver, comparable with any good communication set, or by change of switch, maximum fidelity reception of local stations on non-superhet receiver with high quality 2-PXs push-pull amplifier incorporating all refinements, bass and treble tone control (boost to cut), whistle filter and gram input, etc.; basis rebuilt R1155; write for details or call for demonstration FEEDER units as above for use with external high quality amplifiers; R1155 specialists, receivers repaired and re-aligned, also modified as above, or to your requirements; R1155 circuit and valves 2/- post free.—**R.T.S., Ltd.**, 5, Gladstone Rd., Wembley, S.W.19. Tel. Lib. 5303.



A new standard in
PUSH-PULL
 OUTPUT PERFORMANCE



THE new "PPO" output transformers permit the reproduction of a full A.F. range with minimum distortion. Rating is 12w. for 0.5% harmonic distortion at 50 cycles. Six standard models are available, for accurate matching anode to anode loads of 4,000 ohms to 12,000 ohms. The secondary in each case is brought out in two sections for series or parallel connection to match a 15 ohm or 3.7 ohm load. These standard models are available from stock, other specifications can be wound to special order.

Full details are given in *Technical Data Sheet No. 1*, a copy of which will gladly be sent on request.

PARTRIDGE TRANSFORMERS LTD
 ROEBUCK ROAD, KINGSTON BY-PASS
 TOLWORTH SURREY
 Telephone: ELMbridge 6737-8

NEW RECEIVERS AND AMPLIFIERS

"THE WIRELESS WORLD" Booklet of the famous Williamson amplifier describes the acknowledged finest reproducer in the world; as pioneer makers we can offer a really superior quality job (the admitted Rolls-Royce of amplifiers); original 7-valve model, £23/10 or 9-valve model with built-in pre-amplifier, £28/10 (ex covers); special pre-amps, etc., built to order; it will pay you to purchase a guaranteed hand-built tested product; all parts of finest quality built on extra heavy gauge chassis; our model of this amplifier is acknowledged the finest product of its kind in the country; send for details (3d stamp) to **R.T.M.C. (Ealing), Ltd.**, Laurel House, 141, Little Ealing Lane, W.5. Ealing 6962. [3674]

THE outstanding radio feeder. The R/E1 superhet unit with infinite impedance detector, tuning eye, slide rule dial, L.M.S. waves, I.F. curve control, bass and treble tone controls, switched gram input, complete with 6 valves; £10; the P/E series amplifiers for use with the R/E1 or any high quality radio unit, from £15/10, outstanding performers for all reproduction work. P.A. amplifiers, P.A./12T super fidelity portable amplifier, 12 watts P.P. output, bass and treble tone controls, £14/10; SS/6 8-watt single-ended portable amplifier for small P.A. work, high gain, bass and treble tone controls, multimatch output, 6L6 power stage, a.c. only, provisional price, in Imhof case, £9/19/6; AA/5 series 5-watt amplifiers for home use, AA/5 with volume and tone control £5/10, with volume, bass and treble controls £5/7/6; AA/10 10-watt P.P. model, twin inputs, tone control, £10; full details and quotation for special amplifiers gratis.—**Midland Radio Coil Products**, 19, Newcomen Rd., and 28, Winstanley Rd. (callers only), Wellingborough. [5466]

RECEIVERS, AMPLIFIERS—SURPLUS AND SECONDHAND

- A**.R.88, good condition; £30.—Box 3961. [5420]
- M.V.** 5-valve radiogram, walnut; £15.—Write Box 4133. [5489]
- C.R.1**, complete, carriage paid; £7.—Mospr, 41, Hayle Rd., Maidstone. [5396]
- HARTLEY-TURNER** 25-watt amplifier, power unit and pick-up; £20.—Box 3962. [5421]
- MARCONI** CR100 and speaker, perfect; £30.—420, Chipstead Valley Rd., Coulsdon, Surrey. [5395]
- FOR** sale, RCA-AR88 receiver, as new; £40.—Johnson, 31, Hall Lane, N.W.4 (Hendon 1315). [5410]
- FERRANTI** 6-watt amplifier, components available; stamp list.—84, Beaumont Rd. Nuneaton. [5354]
- S.S.** high quality 12/14 amplifier, push-pull, with an R.F. unit; £11/10.—314, St. Lambeth Rd., S.W.8. [5443]
- HAMMARLUND** Super Pro 17-valve communication receiver, with twin speakers, housed in desk-type cabinet; £75.—Box 3943. [5372]
- R.1155**, with noise limiter, push-pull 6V6s, power back and instruction book, professionally re-aligned; £12/10.—Box 3949. [5385]
- CANADIAN** staff car receiver, R.103, 6-volt supplies, 3 bands, 1-2.6, 2.6-7, 6-16 mcs., with aerial, valves, mountings, etc.; £25.—Box 3941. [5361]
- GT** standard rack amplifier with pre-amplifier stage, 220-250 V mains, 20 watt output; £28/10 each plus carriage.—R. G. Heaton & Co., 26-28, Abel St., Burnley, Tel. Burnley 4934, 5459.
- "E."** T.V. set, Birm. model, complete, newly built, working, cost £60, accept £40, near offer; also quantity radio, T.V. components, valves, etc.; E.M.I. changer unit, nearly new, £9, offers.—Box 4028. [5461]
- 4** 2-valve tone control, O.P. with power pack for 12v c.c. input; will sell with mains power pack if reqd., speaker optional; £15.—Oliver, Rockhill Site, Keynsham. [5474]
- H** new, £23; Hallcrafters Sky Champion, S20, as new, £18/10; AR88 L.F. modified for broadcast band, £37/10; 1155A with power pack and 10in speaker in wood cabinet; £13/10.—Box 4030.
- COMMUNICATIONS** receiver, galore, HRO Senior Rxs., in good condition, complete, from £12/10 plus carr.; also AR77, AR88, SX24, BC348, etc.—State requirements to R. T. & I. Service, 254, Grove Green Rd., London, E.C.35. Lev. 4986. [0035]
- HAYNES** radiogram, complete in cabinet, two H.R.F. tuner unit, 14-watt amplifier with PX.25 valves, Garrard auto-changer, crystal pick-up, Goodman's 12in speaker on separate baffle, spare valves.—Dean, 18, West Common Way, Harpenden. [5394]
- R.1155** adapted as feeder unit by R.T.S., Ltd., 9-1,500 metre, bass and treble controls, switch to local station fidelity circuit, noise limiter, etc., hardly used; £18 near; also Wilkins Wright coil pick-up and trans, and Lexington pick-up and trans.—60, Courtfield Gdns, S.W.5. Fro. 5060. [5419]
- WALKY** Talky all dry, range 15 miles or more, tested, guaranteed, weight 9lb, transmits/receivers 7-9mc/s built-in modulator; clearing last few at 65/- each; miniature 7w a.c./d.c. push-pull HRO amplifiers receiver galaxy cabinet with circuit unused 35/-; Pye, unused, 11 waveband table radio de luxe £21; Canadian 13 valve communication rec., built-in speaker, crystal calibrator var. selectivity, a.c. mains, 230v £14; television strips 6gns; a.c./d.c. amplifiers (transmitters, etc.—Collins Radio, 24, Lilyville Rd., S.W.6. Renown 4178. [5473]



NEW THOUGHTS ON HIGH-FIDELITY

The incidence of the Hartley-Turner 215 speaker on the American market has raised a small storm of controversy over what one really means by high-fidelity. We are highly gratified that our speaker has now become so well known over there that it should cause even a small commotion among the cognoscenti.

The cleavage of opinion arises from two schools of thought, one of which insists on the widest possible frequency range irrespective of the musical value, and the other which insists on the music coming first. The second school insists that the first school has let the "highs" catch up on it—in other words, that it has gone "top mad."

The 215 comes into the picture because it doesn't sound like any other speaker. The overwhelming proportion of those who have bought it consider that the performance is absolutely in a class by itself, but there are a few, particularly among engineers, who say it hasn't got enough top, and sounds as though it had very much less top than the American coaxial units. Ergo, it cannot be a high-fidelity speaker.

It isn't so easy as that, and the few critics get horribly tied up. For example, one man has said, almost in the same paragraph, "In the frequency range which it reproduces the 215 is delightfully clean—a large variety of isolated transients were handled better than I have ever heard from a speaker."

"The extreme high output is similar to that from a five-dollar speaker."

Now we all know that good transient reproduction demands not only superlatively good damping but a very wide frequency response, so that all the long series of overtones, which give a transient its peculiar quality, are properly reproduced. For the life of us we cannot see how the 215 could reproduce transients so well if it has no real top.

Yet the explanation of this apparent contradiction is perfectly simple. The extreme top response of the 215 doesn't hit you in the ear, but it is there all the same. The peculiar characteristic of the Hartley-Turner speaker is that it doesn't sound like a speaker—it sounds like the real thing. Here is one of the reasons why we have always been sticky about publishing static response curves of our speakers; we are not particularly anxious to design speakers to please the "top mad" school.

Our industrial mission in life is to design speakers for people who want music reproduced without distortion, and in that we are succeeding in America as we have succeeded in Britain and throughout the rest of the civilised world. Sooner or later, if you really understand what real music sounds like, you will buy the 215, which costs only £9. Why not send for details now?

H. A. HARTLEY CO. LTD.
152, HAMMERSMITH ROAD
LONDON, W.6. RIVerside 7387

RECEIVERS, AMPLIFIERS—SURPLUS AND SECONDHAND

1155 with balanced power pack and Marconi mains energised speaker. In first-class order. Bargain. £12.—White, The Hollies, 63, St. Stephens Rd., Hounslow, Middx.

W.W. Qual. Amp. Sound Sales Four band tuner, several spare valves, 12in Magnavox, field 1,250 ohms, secondary 15 ohms; best offer accepted.—W. Shaw, 68, Wakegreen Rd., Birmingham, 12. [5573]

HIGH fidelity 12-watt, 10-valve, 5-loop amplifier gram and 2 mic. preamplifiers. 81-position tone compensator, meter, in black metal case £24, little used; record player, 5-watt quality amplifier and speaker, £9; Lustraphone m/c mic. with stand, £4/10; Rothermel bullet mic. 12 yards cable, £2/10.—Vivian, 13, Brickwood Rd., East Croydon, Surrey. [5453]

NEW DYNAMOS, MOTORS, ETC.

BATTERY chargers, 4 models 2.6-12v, 1.2-4 amp D.C.; any mains voltage; also larger types special transformers, chokes, test gear, interior car heaters, etc.—The Banner Electric Co., Ltd., Hoddesdon, Herts. [5212]

JANETTE a.c. to a.c. rotary converters, 200/250 volts d.c. input, 200/250 volts, 50 cycles, 1-phase, a.c. output at 300 watts, new, £20; 500 watts, £23; complete with smoothing for television and radio.—Johnson, 319, Kennington Rd., London, S.E.11, Belano 1412-3

A types of rotating electrical machinery up to 20kva available, including rotary converters, rotary transformers, motors, petrol and diesel-engined generating plants, alternators, and d.c. generators. We are also in a position to quote for power transformers, as actual manufacturers we will be glad to quote for any quantity for home or export.

REVOLVING armature alternators, with separate exciter generators, 4-pole ball bearing, 1,500 rpm, output 250v, 50 cycles, 2.5kva, exc. output at 230v, 50 cycles, ditto, 2-pole, ball bearing, 3,000rpm with 4kva output, £29.

ROTARY transformers, input 20v d.c., outputs 6.5v d.c. and 300v d.c., permanent magnet field, 20v; ditto, input 28v d.c. and 1,200v, 70ma d.c. output, energised field, 35/-; ditto, input 12v d.c., output 500v, 90ma d.c., energised fields, 35/-.

PETROL electric generator plants, comprising a J.A.P. No. 2a single-cyl. engine coupled by vee rope drive to an alternator, giving an output of 230v, 50 cycles, 400 w.a., with screened ignition and filtering on generator, eminently suitable for operating television and radio on farms, etc., price £40; such plants can be supplied with various outputs, a.c. or d.c., for other applications.

CHAS. F. WARD, Lordscroft Works, Haverhill, Suffolk. Tel. 255. 10039

DYNAMOS, MOTORS, ETC.—SURPLUS AND SECONDHAND

I only, Onan petrol-driven alternator, 4-stroke, 1 side-valve, air-cooled, 1,500 r.p.m., output 250v/1.50, 25 kva; self-excited, new, unused, with box of spares, tools, instruction book, crated; £24/10, del.

PUSH-BUTTON start, Onan, new, unused, 30-36v, 1.25kw, d.c. lighting and charging plant, cylinder 4-stroke, side valve, air cooled, petrol tank, only 900 rpm, ammeter, cut out, etc. £26 delivered.

CHORE HORSE push-button start, 15v 300watt d.c. plant, 4-stroke, air cooled, exhaust box, ammeter, auto cut out, field reg., etc.; £12; used, good condition, less.

J.A.P. No. 2a engine 1.2hp complete, petrol tank, etc., instruction book, tools, new and unused, this engine is not ex-Govt. or surplus; £14, del.

14.4-32v generators 298watt (for above J.A.P. engine) with, or without, control box, ammeter, cut out etc.

WISCONSIN petrol engine 4-stroke air cooled by fan, side valve, 375cc complete, petrol tank, 15gall, and filter, exhaust box, handle start, mag. impulse coupled 18mm plug, detachable head, alu. piston, 1 1/2in shaft, big end inspection plate, fitted governor, 2,000 rpm, guaranteed new unused external paint silled; £12/10, and 10/- carr. Eng. and Wales; 12-18v, 550watts heavy duty lighting plants, complete with control box, petrol or T.V.O.; 6v 85amp (at 10hr. rate), h. duty batteries in crate, new, £5/10 del. new but slightly damaged, perfectly usable, £3 del.

18-36v, 1.250watts charging boards and field circuit res., 4 1/2a charging circuits, 5mc ammeters, 1mc meter, switches, 5v diode fuses, 5 var. res., 2 cut outs steel case, new, crated, £4/15 del.; h. duty rubber covered cable 50amp 10yds 19/6; 25v 240watt lamps, 2/6; 12v 350watt, 3/-; new Selenium rectifier units 200/250v input, 350-200v d.c. output 4amp, steel case, 30/-; and 2/6 carr. 2 with res. 20 1/2a 5v, 10v, 15v, 20v p. free; see displayed ad, page 91 for S.T.C. rectifiers.

PEARCE, 66 Gt. Percy St., London, W.C.1.

NEW LOUDSPEAKERS

BARKER 148A speakers in corner reflex cabinets from £20/14/6; Barker 150 ditto from £23/17/6; 4x10in, 22" dia. from £17/17/-; Dimant, 342, City Rd., London, E.C.1. No callers yet please. [5455]

IT'S new! The Triangle Corner horn extension speaker. Sits above, out of way, in corner of kitchen, supplied in bright colours, cream, green, blue, 2-3 ohm P.M.; price 27/6; carriage paid.—Malden Transformed Supplies, The Arcade, George St., Richmond, Surrey. [10085]

A NEW bargain from Phase-in Speakers—The Junior Twin, incorporating matched Wharfedale units with 1,000cycles cross-over, hand French polished solid inch thick cabinet; 16gms complete. Send stamp for details to Phase-in Speakers, 99, Abchurch Lane, Stoke-on-Trent. Deferred terms now available on all models. [5442]

PRESS BUTTON OHMMETER FOR THE SPEEDY

MEASUREMENT OF RESISTANCE

An instrument for high speed modern production, enabling continuity and resistance checks to be made on all types of electrical equipment.

Features

- Six ranges selected by press buttons

0-100	ohms.
0-1,000	ohms.
0-10,000	ohms.
0-100,000	ohms.
0-1	Megohm.
0-10	Megohms.
- Accuracy ± 1%
- Large eight inch diameter easily read meter
- Accuracy unaffected by variation of mains volts
- Mains operated 200-250v, 40-100~
- Low price—£25

For further particulars of this and other high-grade electronic instruments, write to:

HATFIELD INSTRUMENTS

175 Uxbridge Road, Hanwell, London, W.7
Telephone: EALing 0779

DUKE & CO.

AT YOUR REQUEST. Resistor parcels of popular sizes are now made up in: 25 for 3/-; 50 for 5/6; and 100 for 10/-. These are very popular bargains.

HEADPHONES. Still a few left of all types, low resistance, 2/6 pair. D.L.R. superensitive balanced armature, 3/6. Moving coils, complete with hand microphone, 8/6.

ELECTROLYTICS. Bargain parcel: three 25 mfd. 25v. and three 4 mfd. midgets, six for 3/-; 32+32, 3/6; 8+16, 2/6; 16+16, 3/6; 8+8, 3/6; 8 mfd., 2/6.

CONDENSERS. 25 500v., 6d.; 5,000v., .02, 1/6.

FURTHER SUPPLIES OF THESE BRAND-NEW CHOKES. Midget 40u/a. 10 H., lots of four, 5/-.

METERS. 0-40, 2 1/2in. square, 2/6 each. Morse Keys, 8d. each.

CHASSIS. New, endium plated steel, superhet, five valve, speaker aperture and slots, 12 x 6 1/2 x 2in., 2/3. T.R.F., five valve holes, speaker aperture, 3 1/2 x 4 1/2 x 1 1/2in., 1/9. Amplifier stepped chassis, five valve holes on lower step, two on upper, overall size 12 x 7 1/2 x 2 1/2in., 2/6.

EXTENSION SPEAKER CABINETS in walnut, metal grill, V.C. position on the side. To take a 10in. speaker. This cabinet usually sells at 25. Complete, only 25/- each.

AERIALS. Copper plated connecting, 12in. 3/6in. tubes, 12 for 2/-.

ALUMINIUM STRIPS. 10 1/2 x 1/2in. with seven screw holes, eight for 2/-.

RADIO DIALS. 3-band, 8 x 7 x 6 1/2in. glass, six for 2/-.

O.P. TRANSFORMERS. New standard pentode to 3 ohms matching, 2/6 each; 9 for £1.

PLYWOOD. Good quality, 3/16in. thick, 70 x 39in. 10/6; 3ft. x 2ft., 3/-; 3ft. x 17in., 2/-.

DUNLOPILLO cushions, 32 x 18in., 8/6; Dunlopillo seats, moquette covered with plywood back, 12/6.

When remitting C.W.O. please allow sufficient for post or carriage. Send stamps only for our summer price lists.

Trade enquiries invited. Order now in confidence of our money back guarantee.

219 ILFORD LANE, ILFORD, ESSEX Ilford 0295

NEW LOUDSPEAKERS

H-F1 reproducer cabinets and paying desks to match stamp leaflets.—Cabinetware, 1A, Hayes St., Blackburn. 10990

LOUDSPEAKERS—SURPLUS AND SECONDHAND

HARTLEY-TURNER 215, perfect condition; £6. or others.—84, Beaumont Rd., Nunceaton. 5355

TW unused Wharfedale bronze 10in speakers, 15 ohm coils; 35/- each, carriage paid.—Palmer, 25, Salt Ave., Stafford. 15407

SERIALIZED cases, large public address, with 3-unit alteration, suitable for bass reflex type for Goodman's speaker, etc., sound construction; bargain at £2 each. LOCKWOOD & CO., 67, Lowlands Rd., Harrow, Middx. 14903

BARKER 148A speaker in reflex cabinet, £16/10; Wharfedale W.12 ditto, £8; Magnavox 35 duode with rectifier but no cabinet, £4; all above as new.—21, Limes Avenue, Mill Hill, London, N.W.7. Tel. Mill Hill 4835. 15456

HARTLEY-TURNER 215, new and unused, latest model, in original carton, £6; Majestic Williamson output transformer, 4, 7.5 & 15 ohms. 70/-; Hiltzner, 12, Rochester Drive, Timperley, Ches. 15478

SUPERB loudspeaker, comprises Wharfedale W.15.C.S. for bass, and two Wharfedale W.10.C.S. in parallel for treble, using crossover network, in magnificent craftsman-built speaker cabinet, including throughout, size 32in X30inX14in; absolute bargain, £15. 15478

ALSO Connors 78 r.p.m. turntable and P.U. in mint condition (cost new £22/17/2), absolute bargain; £14.—J. N. Heaton, "Ingleside," Liverpool, Yorkshire. 15539

ON ORDER—In stock for immediate knock-out prices; PM 5 n. 10/-; 6 1/2 in with trans. 15/-; 8in. 16/6; 10in. 22/-; mains energised 1250 ohm Field Bin. 15/-; 10in with trans. 22/- (add 9d post).—Rodink Labs., 70, Lord Avenue, Ilford. 14753

TRANSMITTING EQUIPMENT

NO. 19 Mk. III TX/R, complete; £10.—Tigg, Rangidge, Monnowood, Alesford, Hants. 14753

TR9 transmitter-receivers; these were formerly sold at £6 each, the remaining few to be cleared at 25/- carriage paid. THE STAMFORD RADIO CO., 199, Stamford St., Ashton-under-Lyme, Lancs. 14795

HALLICRAFTER transmitters, Type HT4E (BC610), complete to makers' latest specification, covering all frequencies from 1mc to 30mc, complete with speech amplifier, connecting cables, etc.; limited quantities only now available. PANORAMIC adaptor, Type MCA44, British-made, suitable fitment to any good-class communication receiver, in addition to all Hallicrafter models. HALLICRAFTER official sole agents in U.K. including service and spares. MCELROY ADAMS MFG. GROUP, Ltd., 46, Greyhound Rd., London, W.6. Tel. Fulham 1802. Cables, Hallicrafter, London. 15212

NEW TEST EQUIPMENT

IS V.H.F. power measurement your problem? Consult the V.H.F. power comparator, Type B, 5-100, 45 ohms impedance, 60-200 megacycles. AECO, Sunleigh Works, Sunleigh Rd., Alperston, Tel. Wembley 2735. 15468

AVAILABLE for early delivery, two-beam type with 10 valves, self-contained power pack, variable switching frequency, provisional price, £10/14/6, enables two separate traces to be displayed on standard oscilloscope. BERNARDS, 12, Chelverton Rd., Putney, London, W.15. Tel. 7539. 10099

MODIFICATION—Taylor type 65 signal generators to cover frequencies 100 kc/s to 80 Mc/s; fundamentals, new scales, individual direct calibration, accuracy better than 1%; £3/16/6 inclusive.—Electronic Equipment Co., West Mall, Kent. Tel. 3311. 15455

APOLOGIES—Will all customers who have suffered delayed delivery of our products please accept our sincere apologies. Rearrangement, new premises, and additional staff has speeded production on all items.—Electronic Equipment Co., West Mall, Kent. Tel. 3311. 15455

OSCILLOSCOPE and Wavebulator complete, £20.0; T.B. c/s 10 to 350,000 c/s X and Y plate amplifiers, easy to handle, has outstanding performance, fully guaranteed, immediate delivery with set of leads and booklet, "Oscilloscope Technique"; further details from the manufacturers.—Erskine Laboratories, Ltd., Seably, Scarborough. 13456

H07-100 H.F. oscillator units, now ex-stock, wired, tested, ready for incorporation in signal generator, six ranges, 100 kc/s to 100 Mc/s, 59/6; directly calibrated matched scale, 9x5 inches, 9/6; diagram complete instrument free with order or 2/6 stamp for illustrative data please.—Electronic Equipment Co., West Mall, Kent. 15451

TEST EQUIPMENT—SURPLUS AND SECONDHAND

SURPLUS and a most unused test equipment; best offer accepted. MODEL 7.50 range universal Avo meter, with carry-over case. MODEL T.F.1952 beat frequency oscillator (Marconi). MODEL T.F.428B/1 valve voltmeter (Marconi). COSSOR double beam oscillograph. SET transportable wireless masts. P. & D. MOTOR DEVELOPMENT Co., Ltd., 139, Kensington High St., London, W.8. 15266

HUNTS condenser, resistance bridge, £11.—Hunts, 24, Ash St., Colliers Wood, 15482

100 S.W.K. Xials, unused, by R.C.A., Billey, G.E.C., 19/6 p.f., c.w.o.—Leigh, 9, Ashworth Lane Bolton, Lancs. 15459

GALPINS

ELECTRICAL STORES

408 HIGH STREET, LEWISHAM, LONDON, S.E.14

Telephone: Lee Green 0309. Near Lewisham Hospital.

TERMS: CASH WITH ORDER. NO C.O.D.

EARLY CLOSING THURSDAY

FROM 9a.m. UNTIL 4p.m. SATURDAYS

MAINS TRANSFORMERS, 230 VOLTS, INPUT, 525/0/525 volts 150 m/amps., 6.3 volts 5 amps., 5 volts 3 amps., 55 volts 50 m/amps. output, 30/- each; another 12 volts 12 amps. output, 27/6 each; another tapped 35 at 45 volts at 20 amps. output, 65/- each.

EX NAVAL CATHODE RAY INDICATOR UNITS, as new, containing loads of very useful components, condensers, resistances, transformers, chokes, etc., etc., weight 90 lb. last few to clear, 25/- each, carriage paid.

EX R.A.F. CRYSTAL MONITORS (less valves and crystals) sold for component value only, containing many useful parts, condensers, resistances, transformers, the whole a very good basis for a miniature 3-valver, complete in wooden carrying case (condition as new), 5/- each, post free.

D.C. MOTORS 110/230 VOLTS, rated at 1/12th h.p. with laminated fields suitable when fields are rewound for A.C. mains, 17/6 each; ditto half the above size, 10/- each; another 100 volts D.C. approx. 1/2 h.p. shunt wound solid field, 1,500 R.P.M., 10/- each.

MAINS BOOSTER TRANSFORMERS, 1,500 WATTS, tapped 0, 6, 10, 19, 275, 200, 225, 240, and 250 volts, good condition, electrically guaranteed, £4/10/- each, carriage 5/-; another double wound 4,000 watts, 130 to 250 volts or vice versa £7/10/- each, carriage 10/-.

EX GOVERNMENT CHARGING SWITCHBOARDS, 550 watts containing five moving coil 2in. scale volt and ampmeters, five variable resistances, three cut-outs, good condition, at 75/- each, carriage 5/-.

MAINS TRANSFORMERS 230 VOLTS, 50 cycles 1 phase input/output, 4 volts 5 amps. three times, 16/- each; another 6.65 volts 5 amps. twice 16/6; another input as above, output 15C/0/150 volts 150 m/amps. 6.3 volts 8 amps. 5 volts 2 amps., 16/6 each; all carriage paid.

EX GOVERNMENT AUTO WOUND TRANSFORMERS (as new) 1,000 watts output 115/230 volts or vice versa £4/10/- each, carriage 5/-; another 1,000 watts from 5 to 230 volts with 32 various tappings inclusive of 110, 150, 60, 90, etc., etc., all tapping at 1,000 watts £5/10/- each, carriage paid.

METERS ALL BY WELL-KNOWN MAKERS, as new, 2in. scale moving coil 0 to 20 volts, 5/- each, 0 to 40 volts 7/6 each, 0 to 10 amps, 12/6 each, post 6d. Thermo coupled 2 1/2in. scale 0 to 4 amps, 7/6 each, 2 1/2in. A.C. D.C. 0 to 20 volts, 10/- each.

EX G.P.O. GALVANOMETERS, vertical type, reading 30/0, 30 polarised, 8/6 each; rectifiers, output 50 volts 1 amp. D.C. from a 70/75 volt A.C. input, 8/6 each, post 1/6.

MAINS TRANSFORMERS, 200/250 volts input in steps of 10 volts, output 350/0/350 volts 300 m/amps. 4 volts 4 amp., 5 volts 4 amp., 6.3 volts 8 amp., 6.3 volts 8 amp., 62/6 each. Smoothing chokes 10 Henry 100 m/amps. 200 ohms D.C. resistance, 5/- each.

I.F.F. UNITS, EX R.A.F., containing 10 valves, all useful, also a 24 volt input 450 volt output rotary transformer and many useful condensers and resistances. The rotary transformer can easily be arranged to work off A.C. mains as a motor approx. 1/2 h.p. A few only, to clear, 20/- each, carriage paid.

EX R.A.F. ALTERNATORS, 230 volts 50 cycles input, 250 volts 625 cycles 1 phase output at 60 watts. These are separately energised by 24 volts at 0.4 amps., 65/- each, carriage 5/-.

CELL TESTING VOLT-METERS, moving coil, reading 3/0/3 volts by well-known makers, complete with test leads, 7/6 each.

MAINS TRANSFORMERS, 200/250 volts input in steps of 10 volts, output 350/0/350 volts 180 m/amps., 4 volts 4 amp., 5 volts 3 amp., 6.3 volts 4 amp., 37/6 each, ditto 500/0/500 volts 150 m/amps. 4 volts 4 amp., 5 volts 3 amp., 6.3 volts 4 amp., 42/6 each; ditto 425/0/425 volts 180 m/amps. 6.3 volts 3 amps. twice, 5 volts 3 amps. (Williamson Amplifier), 39/6 each; Ditto., 350/0/350 volt 180 m/amps. 6.3 volts 8 amps. 5 volts tapped 4 volts 3 amps., 39/6 each.

SWITCH-BOARD A.C./D.C. AMPMETERS, 0 to 14 amps. 4 1/2in. scale by well-known makers as new, 25/- each.

MAINS TRANSFORMERS, input 200/250 volts in steps of 10 volts, output 350/0/350 volt. 300 m/amps. 4 volt 8 amp., 4 volt 4 amp., 6.3 volts 6 amp., 3.6 volts 2 amp. tapped at 2 volts (electronic) at 57/6 each; another same input as above output 500/350/0/35C/500 volts 250 m/amps. 5 volts tapped at 4 volts 4 amps. twice, 6.3 volts tapped at 2 volts 2 amps., 67/6 each.

MAINS VARIABLE SLIDER RESISTANCES, protected type by well-known makers, 450 ohms, 9 amps., 22/6 each; ditto 1,500 ohms to carry .45 amps., 22/6 each, not protected, 0.4 ohms. to carry 25 amps., 10/- each; 14 ohms to carry 1 1/4 amps., 12/6 each; 5.7 ohms to carry 8 1/2 amps., 15/- each; 60 ohms to carry 1 1/2 amps., 15/- each.

MAINS TRANSFORMERS INPUT 200/250 VOLTS, 50/1 in steps of 10 volts, output tapped 0, 6, 12 at 24 volts at 10/12 amps., 47/- each; ditto as above but at 25/30 amps. output, 68/6 each.

ISENTHAL MAIN VARIABLE. Resistances (Dimmers) 700/750 watts from full/bright to b/our worm wheel control, as new, 27/6 each, carriage 2/- total resistance 60 ohms.

ELECTRIC LIGHT CHECK METERS, quarterly type, for sub-letting garages, apartments, etc., all fully guaranteed electrically for 200/250 volts A.C. mains 50 cys. 1 phase, 5 amp. load, 17/6 each; 10 amp. load, 20/-; 20 amp. load, 25/- each; 50 amp. load, 37/6 each; 100 amp. load, 45/- each; carriage 2/- extra on each; special discount of 10% on quantities of one dozen or more.

POWER TRANSFORMER AUTO WOUND voltage changer tapped 0, 110, 150, 180, and 230 volts at 1,600 watts, £5/5/- each, carriage 3/6; ditto, 2,000 watts, £6/5/- each, carriage 3/6; another tapped 0, 110, 200, 230 volts at 350 watts, at 47/6 each, carriage 2/-.

MAINS TRANSFORMERS, 200/250 volts 50/1 ph., in steps of 10 volts. Output 500/0/500 volts 300 m/amps., 6.3v. 8a., 6.3v. 8a., 6.3v. 4a., 5v. 4a., 4v. 4a., at 67/6 each; another same input, outputs, 450/0/450 volts 300 m/amps., 6.3v. 8a. 6.3v. 8a., 4v. 5a., 5v. 4a., at 62/6 each.

PRE-PAYMENT 1/2-SLOT ELECTRIC LIGHT CHECK METERS, all electrically guaranteed, 200/250 volts 50 cys. 1 ph., A.C. input, 2 1/2 amp. load, 27/6 each; 5 amp. load, 35/- each; 10 amp. load, 42/6 each; 20 amp. load, 50/- each, carriage 2/- extra; in quantities of one dozen or more a special discount of 10%.

MAINS TRANSFORMERS, 230 volts 50 cycles, 1 phase input, 700/0/700 volts 70 m/amps. 4 volts 2 amps., 12 volts 1 amp. output, 25/- each, post 1/6; another auto wound "booster" transformer tapped 0, 200, 215, 235, 250, and 265 volts at 1.25 amps., 10/6 each, carriage 1/-.

EX NAVAL ROTARY CONVERTORS, 220 volts D.C. input 50 volts, 3 phase, 50 cycles at 3 1/2 amps. output, 55/- each, carriage 5/-.

MAINS TRANSFORMERS, 230 volts A.C., 50 cys. input 17 1/2 volts 50 amps. output, 52/6 each, carriage 5/-; another auto wound, output 14 and 17 volts output at 30 amps., 35/- each, carriage 3/6; another with 2 x 4 volt 20 amp. windings, 25/- each, P/f.

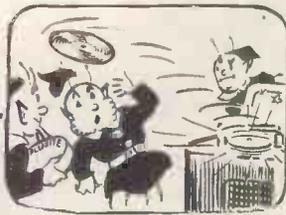
EX NAVAL SOUND POWER TELEPHONE HANDSETS, comprising earphone and microphone, no batteries required, complete with wall bracket, as new, 15/- per pair, 1/6 post.

EX R.A.F. MICROPHONE TESTERS. These contain a 2 1/2in. scale 0 to 450 Microamp meter shunted to 1 m/amp. calibrated 0 to 10 volts moving coil, complete with 1 m/amp. rectifier, "Mike transformer," etc., all contained in polished wood box, as new, 17/6 each.

EX R.A.F. D.C. TO D.C. MOTOR GENERATORS, 24/28 Volts input 1,200 volts 72 M/amps. output, as new, 7/6 each, post 1/6.

EXTENSION P.M. SPEAKERS, 3 1/2 inch by Johnson & Phillips, will handle 1 1/2 watts. New boxed, 7/6 each. Post 9d.

ALL GOODS SENT ON 7 DAYS' APPROVAL AGAINST CASH, all letters answered. We regret we have no lists available at present. We would be pleased to quote.



THE "FLUXITE GUINS" AT WORK

*"Your radio-gram's acting queer,
That record whizzed close past my ear
The changer's gone mad
But don't worry, lad
All it needs is some FLUXITE,
that's clear."*

See that **FLUXITE** is always by you—in the house—garage—workshop—wherever speedy soldering is needed. Used for over 40 years in Government works and by leading engineers and manufacturers. Of all iron-mongers—in tins, 10s., 1/6 and 3/-.

TO CYCLISTS! For stronger wheels that will remain round and true, here's a time tested tip. Tie the spokes where they cross with fine wire and **SOLDER**. It's simple—with **FLUXITE**—but **IMPORTANT**.

The **FLUXITE GUN** puts **FLUXITE** where you want it by a simple pressure. Price 2/6, or filled, 3/6

FLUXITE SIMPLIFIES ALL SOLDERING

Write for Book on the art of "SOFT" Soldering and for Leaflet on **CASE - HARDENING STEEL** and **TEMPERING TOOLS** with **FLUXITE**. Price 1d. each.

FLUXITE LTD. (Dept. WW), BERMONDSEY STREET, LONDON, S.E.1.



CHARGERS, CHARGER KITS, RECTIFIERS

New goods with full guarantee

SLIDER type chargers as illus., 2 v. to 12 v. 4 amp. max., heavy duty, weight 2 1/2 lb., with selenium rectification, impregnated transformer, only 28/5/-, plus crate and carriage, 12/6. Grate credited. Ditto, but no slider, for 6 v./12v. at 6 amps., 28/19/6.
"AUTOMAT," 6 v./12 v. 2 amp. motorists charger, 8 lb., as tested by Motoring Press, 18 months' guarantee, 65/-, carr. 2/6.

NEW SUPER CHARGER KIT, 2 v., 6 v., 12 v., output 3 to 4 amp. Transformer, ballast resistance, 15 v. 4 amp. rectifier, high-grade fusible bakelite ammeter, 59/-, Ditto, but 5 amp., 72/8, post 1/4. Case, 21/6. Junior kit for 2 v., 6 v., 12 v. at 2 amp., transformer, rectifier, ballast bulb, 35/6, case specially for this kit, 12/6 extra. Minor kit, transformer, rectifier, S.T.C. 13 v. 1 amp. ballast bulb for 2 v. to 12 v. 1 amp., 32/6, Case 11/-.

HEAVY DUTY KITS, S.T.C. giant fanned 16 v. 6 amp. rectifier, 8 lb. transformer, slide resistance, ammeter for 6 v./12 v. charger, 24/15/-, post 2/6, or ditto, but 4 amp. max., 23/10/-, Transformer, rectifier, ballast, ammeter for 20 cell 1 amp., 25/2/-, ditto, but 2 amp., 28/5/-, charges 1 to 20 cells.
S.T.C. L.T. SELENIUM RECTIFIERS, 6 v. 0.5 amp., 4/10, post 4d., 12/15 v. 1.5 amp., 10/6, 6 v. 4 amp., 16/6, 12 v. 4 amp., 19/6, 20 v. 3 amp., 39/6, also giant fanned type 15 v. 5 amp., 25/-, 6 amp., 28/6, 15 v. 10 amp., 42/-, 24 v. 6 amp., 23, 6 v. 10 amp., 21/3, post 1/-. Half wave 6 v. 2 amp. recta. not S.T.C., 8/6, post 6d.

H.T. RECTIFIERS, small space selenium H.T. recta., 250 v. 100 mA. bridge, 12/6, 250 v. 60 mA. h.w. for A.C./D.C. sets, 6/8, 110 v. 80 mA. for U.S.A. midgeets 8/-, 350-0-350 v. 80 mA., 12/-, post 6d.
ELIMINATOR KIT, 20 watt trans., h.t. rect., 2 v. 0.5 amp. trickle rect., 2 x 8 mfd. Drilites, special case for 120 v. 30 mA. eliminator with trickle charger, 42/-, post 1/-.
CRYSTAL DIODES, new, capuled, 3/6, post 3d.
M.B. 3 instrument rectifiers, 3/6. Fluxite type, bakelite 0-6 ammeters, 12/6. Sliders 8 ohms 5 amps., 17/6, post 1/3.

CHAMPION PRODUCTS
43 Uplands Way, London, N.21
Phone: LAB 4457

TEST EQUIPMENT—SURPLUS AND SECONDHAND

TAYLOR 30A osc'graph, little used, as new, cost £29/10; bargain, £20.—Box 4029.
A VO model 7 with leather case, £11; Avo test bridge, £8; both very good condition.—5409
Palmer, 25, Salt Ave., Stourton, Dorset.
A VO model 47a, excellent condition, with test leads and wooden transit case; £12.—21, Shakespeare Drive, Kenton, Harrow. [5498]

ADVANCE model E1, sig. gen., perfect, as new, unscratched, £14. Owner buying larger model.—Downes, 24, Guildford Ave., Hull.
OSCILLOSCOPES, Cossor double beam, model 3339, fully reconditioned, from £30; Cossor ganging oscilator £18, one only.—Cox Radio, West St., Bognor Regis. [5430]

EVERSHED bridge meggers, latest all metal type, leather cases, 0.01 ohms to 50 megohms, very good condition, 250v models; £8/10.—Palmer, 16, The Crest, Widley, Portsmouth.

A VO wide range signal generator, mains, latest model, 3 months, £20; Avo oscilator, old model, mains, £9; both surplus to requirements.—Cleveland Engineering Co., Ltd., The Triangle, Clevedon, Somerset. [5360]

SIGNAL generators: Marconi TF144G, £75; S TF390G, £40; TF517E, £40; TF517F, £40; scarpord 106, £40; Advance B2, £15; osciloscopes: Cossor 359 D.B., £30; Clough & Bingle, £12/10; Ireq. meters G.B. 720A, £20; BC221, £12; Collins, £10; V.V. Marconi TF428/A, £37/10; valve tester: Taylor 45, £12; etc.; list now available.—R.T. & I. Service, 254, Grove Green Rd., London, E.11; Ley. 4986. [0056]

NEW GRAMOPHONE AND SOUND EQUIPMENT

MAGNETIC tape, Empire type 65 on 1,200ft spool, 25/-; paper tape, 20/-; blank recording discs, 12in 4/sided, 4/6; all from stock; full trade terms available.

SOUND DISCS (SUPPLIES), Ltd., 178, Bishopsgate, Southport, Lancs. Tel. 285.
DEFINITE baffled corner reflectors, scientifically designed acoustic chambers for 8 to 15in speakers; lists.—Broadcast & Acoustic Equipment Co., Ltd., Tombland, Norwich. [0064]

TRANSFORMERS, tone control and loud speaker filter chokes for all "W.W." circuits; special designs promptly made.—R. Clarke, 30, Langland Crescent, S. Stammer, Middx, Wor. 5321. [5976]

NEW American Brush sound mirror tape recorder and playback, 230 volts, with microphone, provision for radio, and external speaker, £95; Armour portable wire recorded, 230 volts, with microphone and playback, £60.—Harris, 93, Wardour St., W.1. [5445]

KINE-VOX disc recording machines, type C7J; a precision-built unit in chassis form, fully assembled and ready for immediate 5in to 13in recordings from existing amplifier and microphone equipment or from conventional radio or radiogram apparatus; price 25gns ex works.

COMPLETE recording channels with amplifier and moving-coil microphone from 60gns. WRITE for details to Kine-Technic Services, Ltd., 60, Aylward Road, London, S.W.20. Tel. Liberty 24225. Callers by appointment only.

E.M.I. equipment of special interest to amateurs and experimenters at attractive prices; including amplifiers, microphones, loudspeakers; only limited quantities available.—Full details and prices from E.M.I. Sales & Service Ltd., Amateur Division, Head Office, Hayes, Middlesex. [5377]

TAPE recording panels; a precision panel comprising two motors, high fidelity sound and erase head, high speed scan and unique design giving tape speed of 7 1/2in and 15in per sec. suspended between ball races with heavy fly wheel to ensure freedom from wow; no unlatching of tape is necessary for rewind; panel finished in black crackle, size 14in x 12in. £29.

HIGH fidelity tape recording wire panels, record-playback £4/10; erase heads, £4/10; standard record/playback, £1/10; erase head, £1/10; osc. coil, 15/-; head to grid transformers, 7/6; circuits supplied with orders; trade inquiries invited.

MORECAMBE SOUND SERVICE, Sealand Works, Cross Cop, Morecambe. Tel. Heysham 570. [0078]

GRAMOPHONE AND SOUND EQUIPMENT—SURPLUS AND SECONDHAND

BRIERLEY microarmature pick-up, as new, £7/10; signal generator, 100kc/s-28mc/s, as new, £8.—Shear, 23, Lee Rd., Aylesbury. [5366]

M.S.S. studio pedestal type recorder, 78rpm 16in turntable, electric motor, Patmo recording amplifier, 30watt, 2,500, 5 and 15ohm output.—Offers to Box 3964. [5436]

12-VOLT disc recorder; two cutting heads, 60 ohms and 15 ohms impedance; ideal for mobile work; nearest offer over £40 secures.—Box 181, W.B.G., 39, Cheapside, E.C.2. [5367]

MAGNETIC sound recording wire, stainless steel, temporary wooden spools, approx. 1 1/4 hours' running time at 2ft per sec.; 14/- per spool.—A Smart, 40, Grange Rd., Halesowen.

RECORDING unit in case, tracking gear, time scale, play-record switch pick-up less cutter head (can supply suitable head if required); quality amplifier for above 2 channel input, £60 the lot; write, or call Saturday or Sunday morning, for demonstration; deliver by car 30 miles if desired.—R. W. Archer, 82, Beechwood Ave., St. Albans, Herts. [5343]

M.S.S. studio recorder, CB/45 (17 1/2in turntable), 78-33/4rpm, grey finish, standard 6ft 6in rack, electric motor, 1.5m microphone and power amplifiers, mixing for 4 microphones, G.E.C. radio receiver, etc., ST & C 4021 microphone and stand, 12in Baker, all in perfect condition; price £250 or reasonable offer; photo available.—Box 3965. [5437]



AMPLIFIER CHASSIS AND COVERS

SIZE A.
Chassis in 18 Gauge Steel 17 x 12 x 2 1/2in. fitted with base plate having rubber feet and cover in 20 Gauge Steel with radiused top corners giving 7in. clearance above chassis; louvered back and front, complete with two Chromium Plated Handles..... £3 5 0

SIZE B.
Chassis 17 x 10 x 2 1/2in. as above, with one Chromium Plated Handle..... £2 17 6

SIZE C.
Chassis 14 x 8 x 2 1/2in. as above, with one Chromium Plated Handle..... £2 12 6

STANDARD FINISHES: Black, Grey or Brown Wrinkle Enamel.
CARRIAGE: Paid on Orders Over £2.

ILLUSTRATED LISTS AND TRADE TERMS ON APPLICATION.

REOSOUND ENGINEERING & ELECTRICAL COMPANY, "Reosound Works," Coleshill Road, Sutton Coldfield.
Tel.: SUT. 4685, Grams: Reosound, Sutton Coldfield

GOVT. SURPLUS, UNUSED

CONDENSERS of all types...

We can offer, FOR IMMEDIATE DELIVERY from very generous stocks, a wide range of ultra-high quality fixed paper Condensers, from .001 μF to 8 μF. Also STOCKS of small, genuine MICA Condensers from .00001 (10 pf) to .01 μF (10,000 pf). Prices are exceedingly moderate.

Enquiries are invited for manufacturers' requirements, wholesale and export only for bulk quantities, and for scheduled deliveries over a period, as required. Most condensers are now available for immediate delivery.

Please request our 4 page bulletin CONSEVEN 01114

CLAUDE LYONS LTD.
180 Tottenham Court Rd., London, W.1
and 76, Oldhall St., Liverpool 3, Lancs.

EVERY GOOD AMPLIFIER IN EVERY LAND DESERVES A BARKER LOUDSPEAKER



If you own a really good amplifier, with a really good pickup and/or a good radio tuner, then there is one speaker above all others to do justice to such gear—the 150.

This is not merely a question of frequency range. The 150 gives a satisfactory output to over 15,000 cps and its bass output will go to below 40 cps in a box of 8 cu. ft. But there is far more than this to it; the 150 is absolutely unique in its freedom from sharp peaks and undamped resonances, because of its exclusive, triplet dual drive.

The grip and control exercised by the powerful magnetic field on the aluminium coil former produces the effect of very heavy critical self-adjusting feed-back, and gives that characteristic Barker clear, clean, detailed reproduction at all frequencies, with no whiskers added, no boom put in, no flop or puddling; in fact, the 150 and its brother 148a are, we believe, the nearest approach yet made to the neutral reproducer, which can assume the character of any sound faithfully without adding to, or modifying it to any appreciable degree.

BARKER NATURAL REPRODUCERS BCM/AADU LONDON, W.C.1.

NEW COMPONENTS

HANNEY OF BATH offers:

WIRELESS World T.V. superhet; complete set of 20 coils wound exactly to designer's specification. 45/4.

POLYSTYRENE formers, 1 1/2 in x 3/4 in tapped 0 B.A. for slug with fixing hole, 1/-; 2 1/4 x 3/8, 8d.

PAXOLIN formers, 1 1/2 in x 3/4 in, tapped 0 B.A. with fixing hole, 9d; 2 in or 1 1/2 in x 1/2 in, 8d; 1 3/4 x 3/8, 9d; Polystyrene varnish, large bottle, 1/4 0; 0 B.A. screwed rod, copper, 2/- ft, brass, 1/- ft 0; Eddystone 583 split stator, 7/6; B.T.H. C.G.I.-C. crystals, 11/3; H.4/200 rectifiers, 28/-; co-axial cable, 1/3 yd; Dubilier condensers, type 680, 5,000v test, 0.001, 6/6 doz; 0.002, 7/-; Reliance pots, 1k, 2k, 10k, type T.W., 4/6; 100k, 150k, 2 meg, type S.G., 5/-; Erie resistors, 1/2 watt, all values, 4d; also T.C.C. condensers, Dubilier diatrics, valves, tube masks, aerials, etc.; complete list, 2 1/2d stamp please.

THE Viewmaster everything in stock, T.C.C. condensers, L'don £6/15, B'ham £7; W.B. chassis speaker, transformers, £6/5; Plessey transformers and focus coils, £5/12/6; Morganite resistors, 26/9; Colvern pots, 19/3; Westinghouse rectifiers, 62/6; Wearite coils 22/-; Bulgin panels, switches, 12/6; detailed list on request; 2 1/2d stamp please; Mullard 9in tube MW22-14C, £11/6/9; Mullard 12in tube MW31-14C, £15/2/5. **WILLIAMSON** amplifier, Gardner output transformer, 105/-; Woden ditto, 82/6; mains transformer, 55/-; Reliance 1000 pots, 4/6; high stability resistors (all specified values), 1/4; 1/2; ±5%, 1/3; ±1%, 2/3; 1/4 watt ±5%, 1/-; ±1%, 2/-; other values to order; silver mica condensers; 25 to 500pfd, -5%, 9d.; ±1%, 1/3; 1,000 pfd. 1/-; 4,000pfd, 2/-; 5 bank 6 position switch, 7/6; matched resistors supplied; send for detailed list, 2 1/2d stamp please.

COMPONENTS in stock for the new G.E.C. Osram radio receiver for use with high fidelity amplifiers, described in their technical publication T.P.4; write for complete components list.

COILS, formers, condensers, resistors, etc., are also available for the P.W. television, E.E. television, and Bernards high definition television.

EDDYSTONE and Raymart S.W. list, 1d stamp; Wearite P coils, all ranges, 3/- ea; Denco type C T.R.F. coils, 6/6 pr.

MARCONI ac 100m auto-changer, with the new lightweight P.U., £10/0/8, matching trans., 10/-; **COLLARO** R.C.500 auto-changer, with either crystal or lightweight P.U., £10/15.

B.S.R. T.U.2 gram. motors, £3/4/3.

ACOS G.P.20 P.U., £3/11/5; Connoisseur lightweight P.U., £3/17; Marconi No. 14 P.U., lightweight high fidelity complete with matching trans., 96/8.

GOODMAN speakers, 12in, T1205/15, £6/15.

AXIOM 12in high fidelity, £8/8/8.

AMPLION universal test meter ac/dc, £3/17/6.

WE supply components for all Wireless World designs; order on us for all goods (inc. valves) advertised by leading makers or get our quotation by return, retail only.—L. F. Hanney, 77, Lower Bristol Rd., Bath. [5467]

WIRELESS World televisors.

FOR approved components all enquiries should be addressed to the makers, "Handyparts," 226-228, Merton Rd., Wimbledon, S.W.19. Lib. 7461. S.a.e. for replies. [f0033]

THE simplest s'het pack, type M1. M.L. waves, 25/-, thousands in use.

DOUGLAS COIL Co., Brinklow Nr. Rugby.

VIEWMASTER all parts in stock; valves, tubes, cabinets.—H.G. Radio, 1350, Stratford Rd., Birmingham, 28. [5072]

CHANNION CRD. POTS, 43, Uplands Way, N.21.—Still at your service; see our advertisement on page 78. [5314]

CRYSTAL microphone inserts (Cosmocord Mic-6), guaranteed brand new, 15/6 post free.—Radio-Aid, Ltd., 139, Market St., Wat-ford, Phone Watford 596. [f0036]

EHT Transformers, mains transformers, output transformers and chokes; open or potted types; transformers designed to individual specification; singles or in quantity.

WILLEDEN TRANSFORMER COMPANY, Ltd., 781, Harrow Rd., N.W.10 (adbroke 2846 10075)

PERSONAL portables; this new book by E. N. Bradley contains full constructional details of five different circuits; book 2/6, post free; we can supply all the necessary components from stock.

M. WATTS & Co., 8, Baker St., Weybridge, Surrey. [5471]

THE brain of any good radio is an Osamor Q coilpack, used with our matched components you can build a radio really worth boasting about, write to-day for free circuits and our latest lists, including the Bargain Bulletin.

OSMOR RADIO PRODUCTS, Ltd., Bridge View Works, Borough Hill, Croydon. (Cr. 1220.)

ELECTRONICS—Write to the firm which specialises in electronic equipment for your requirements in relays, valves, thyratrons, photocells, electron multipliers, special c.r.t., image converters, selsyns, velodynes, etc., as well as all components.

J. McMILLAN, 5, Oakfield Rd., Bristol, 8.

TRIMMERS: (1) 50 pf silver-plated, air-spaced vanes on ceramic, with lock nut, 8d each; (2) 25 pf, ultra midget, air-spaced vanes on ceramic, 8d each; (3) 2 x 30 pf, compression type, on metal plate with fixing holes, 6d each; post orders only; please add postage.

COLBOURNE & GREY, 18, Botwell Common Rd., Hayes, Middx. [5369]

WODEN 6.3v, 2amp, 1t. transformers. Tapped tag input, 200, 230, 250v, size 2 1/2 in x 2 1/4 in x 2 1/2 in, boxed 12/-; Woden potted 20watt push-pull 6L6 transformer, load 6.5k, speech windings 8 or 15 ohms, 23/6 boxed, write for latest bargain lists.—Jack Porter, Ltd. (Radio), 30/31, College St., Worcester. [5474]



A WINDOW WORTH LOOKING INTO

Chokes L.F. 200 m/a., 5H., 100 ohm, 3/6 each; 60 m/a., 7H., 500 ohm, 3/6 each; 40 m/a., 25 Henry, 1,000 ohm, 4/6 each; 1000 m/a., 1H., 12 ohm, 3/-.

Transformers. Ex-W.D. 700 volt 20 m/a., 4v, 1.25 amp., twice tested at 5,000 volt 230 input, 17/6 each; 250 x 250 up to 60 m/a., 5 v. 2 amp., 6.3 amp., 10 v. 1 amp., input 230 volt, 13/6 each; 4 v. 2 1/2 amp. 230 volt input, 9/- each.

I.F. Transformers. Popular make 465 Kc/s, 8/6 pair.

Television. Coils wound 45 mc/s 1/2 in. x 1 in. Polystyrene, single hole fixing, 7d. each; formers only, 5d. each, complete with dust cores.

Special Offer. Condensers, 6 mfd. Mansbridge 1,000 v., 2/6 each; .1 mfd. Mica condensers, 2/6 each.

Television. Condensers "Trouble Free" Oil filled type, .1 mfd. 4,000 volt, 3/- each; .1 mfd. 5,000 volt, 3/3 each; .001 9,000 volt Ceramic, 1/3 each; .001 Mica 5,000 volt, 1/3 each.

Starter Relays. 12 volt. Boxed, new, 3/6 each.

L.T. Condensers. 2,000 mfd. 12 volt, boxed, new, 3/6 each.

Television. Receivers, Brand New and Boxed, Ex-W.D. type 3585, containing complete 45 Mc/s I.F. strip, plus 20 odd other valves and condensers and resistors by the hundred, £47/6 each.

Receivers. RT/7/APNI, 10C/150 Mc/s complete with 2 12H6, 3 12SH7, 3 12SH7, 1 150/30, 2 954, 2 VT121, with 24 volt supply. Ideal for conversion to F.M., 52/6 each.

AR.88. Complete switch Assembly with all screening, brand new and boxed, 17/6 each, limited number only.

Television. R.1355 receivers, Brand New, complete with all valves, 59/6 each.

Precision Pots. 200,000 ohms wire wound 3 1/2 in. x 2 1/2 in. roller wiper 25 watts, 4/6 each. 10K wire wound 10 watts, 2/6 each.

Accumulators. Brand new 6 volt 72 amp. in Teak boxes, 62/6 each.

Television. Amplifier Units Ex-W.D. type 208a, complete with 2 E.F. 50s, can be adapted for sound or vision, circuit supplied, 15/6 each.

Oscillators. Units type No. 10, containing complete A.C. mains pack, output 350 x 350 at 125 m/a with 5U4G, 4 EF 50s, all brand new complete with metal case, 62/6 each.

Television. Power packs, output 2,000 volt 5 m/a, 350 x 350v, 200 m/a., 6.3 v. 15 amps., Ex-W.D. type 285 complete with all valves, £4/19/6 each.

Open all day Saturday.

G. W. SMITH & CO.
(RADIO) LTD.
3, LISLE STREET, LONDON, W.C.2
Phone: GERard 8204

The truth about
"HIGH FIDELITY"

Come and hear the following
for yourself.

CHARLES AMPLIFIER and DUAL
RADIO TUNER

SOUND SALES "TONE-
MASTER" AMPLIFIER and
"DX PLUS TWO" FEEDER

LEAK AMPLIFIERS and PICK UP
VORTEXION "STEREO-
PHONIC" AMPLIFIER AND
ACOS "GP 20" PICK UP

ARMSTRONG 83 and 103
CHASSIS

A.C. BARKER'S LOUDSPEAKERS
GOODMANS "AXIOM 12 and
22" SPEAKERS

WHARFEDALE and W.B.
LOUDSPEAKERS

GARRARD RECORD CHANG-
ERS and DECCA PICK UPS

AT

HOLLEY'S RADIO STORE

285 CAMBERWELL ROAD,

S.E.5

Phone RODNEY 4988

Open all day Saturday

NEW COMPONENTS
TEL RAD ELECTRONICS, 70, Church Rd.,
Upper Norwood, London, S.E.19, television
components for "View Master," Belling & Lee,
Bulgin, Colvern, Morganite, Plessey T.C.C.,
Wearite, Westinghouse, Whiteley; complete parts
as specified in stock; also E.E. chassis, mains
transformers, etc.—Write, call or phone your
order Livingston 4879. [0020]

BEL television; coil sets are manufactured for
all the current televisions; WW s/het, Mid-
land or London, 20 coils, 52/6; Home, Moss
coils short, EE TRF Lond, 19/6; Birmingham,
14 coils 1V1 choke, heater chokes, 18/6; EE
pre-amplifier, 3 coils, 3/6; EE FM enquiries in-
vited; PW s/het, Midland 16 pieces, 35/-; PW
TRF Lond, 18/6, Mid, 18/6; VM 10 coils and
choke Lond, 16/6, Mid, 19/6; various video,
boost and corrector chokes available.

CHASSIS Sets; WW superhet, two RF chassis
in 20 and 26 SWG copper, valveholders and
screening cans mounted, 52/6; ditto unassembled
and semi-drilled 42/-; complete chassiswork,
83/-; EE T/B and P/P chassis, plated steel, £1
the pair; Pract. W/less chassis set fully drilled
inc., screening division and tube support, 80/-.
OTHER parts; WW televisor, focus coils heavily
made, 37/6; set of 4 deflector coils, mounted as
specified, 35/-; block trans., 15/-; line trans.,
42/-; power trans., 95/-; EC35 valves, 8/6;
BB350 condensers 4/-; coil-formers Aladd, n
8mm bakelite or polystyrene, 10d. 6mm 7d; 1/4in.
slotted and tapped for mounting screw 1/6
polystyrene paxxon, 1/6; brass and silvered
slugs and other repeating turned parts; en-
quiries for special coils invited; trade enquiries
particularly welcomed.

BEL SOUND PRODUCTS Co., Mig. Radio Engrs.
Marlborough Yard, London Archway,
N.19, Tel. North 1025.

54 s unit, consisting of 3-waveband Model
30 superhet coil pack, pair I.F. trans-
formers, 2-gang condenser and attractive dial
(6in x 6in); each component individually selected
pre-aligned, send for the whole set to-
gether as a unit; the superhet you build with
this unit needs no further adjustment! Or
supplied instead with the superb J.B. horizontal
Spin wheel tuner and dial assembly at 75/6.
Full details of design and our other high quality
products (coils, IFTs, mains transformers, etc.)
together with many circuits and constructional
tips, contained in the "Home Constructor
Handbook," price 1/-. Mail order office.
SUPACOILS, 95, Greenway Ave., London, E.17.
COMPONENTS SURPLUS AND
SECONDHAND
BRAND new guaranteed goods.

MAINS transformers, fully interleaved and im-
pregnated, primaries 200-250-250v screened, drop
through types with top shrouds, 350-0-350v 60ma,
4v 4a, 4v 3a, 12/11; 260-0-260v 70ma, 6.3v 3a, 5v
2a, 12/11; Midget 250-0-250v 60ma, 6.3v 2a, 5v
2a, 14/11; fully shrouded upright mounting types,
250-0-250v 80ma, 6.3v 6a, 5v 3a, for 1355 con-
version, 23/9; 350-0-350v 150ma, 6.3v 2a, 6.3v
2a, 5v 3a, 27/9; Midget 250-0-250v
60ma, 6.3v 2a, 5v 2a, 15/6; full range of mains
trans. in stock; smoothing chokes, 60ma 15h 400
ohms, 4/3; 80ma 12h 350 ohms, 5 3; electrolytics,
tubular, 8mf 450v, 1/11; Can 8-8mf 450v, 2/9;
Can 8-8mf 450v Midget, 3/6; Can 8-8mf
350v, 2/6; Clix int. oct. valve holders, 2/9 doz.
24/- gross; c.w.o. or c.o.d. over £1; post free
over £2; full bargain list 3d; special list for
trade, callers welcome 9 a.m. to 5.30 p.m.
RADIO SUPPLY Co., 15, Queen Square, Leeds, 2.
SOUTHERN RADIO'S wireless bargains:—

T.R.1196 six valves superhet, complete with
valves, etc., and circuit, 22/6; receivers type
E1125, complete with 2 valves, 17/6; throat
microphones complete with lead and plug, 6/6;
radio publications: Radio Pocket Book, 1/6;
Handbook of Radio Circuits 2/-, and 2/6 per
book, Radio Valve Manual (characteristics and
alternatives) 3/6, Manual of Direct Disc Recording
2/-, Wireless Amplifier Manual, 2/-, Using
Ex-Service Radio Apparatus 2/6, The Oscop-
scope Design and Construction Manual 4/6,
Midget Radio Construction Manual 3/6, Televi-
sion Servicing Manual 4/6, World Radio Station
List 1/6; Valve Encyclopaedia, 17,000 different
types of valves and C.R. tubes, with all data in
many languages, 42/-; please add postage for
books; full publications list 24d; goods previously
advertised still available; please see display ad-
vertisement in this issue Wireless World.

SOUTHERN RADIO SUPPLY, Ltd., 46, Lisle St.,
London, W.C. Gerrard 6857. [0016]

LITTLEWOODS, North London's best selection
of radio and television components; pay us
a visit or post or phone your enquiries; no lists.
LITTLEWOOD & GRUNER, Ltd., 27, Ballard's
Lane, Finchley, N.3. Tel. 3060. [0055]

CONDENSERS, 0.1µF 1kv, 0.2µF 750v, 5µF
doz.; 1µF 350v 4/- doz.; 25µF 350v, 5µF
350v 4/6 doz.; .0005µF 1/2inx 1/4inx 4/9 doz.; all
post free.

HATFIELD RADIO, 78, Stroud Green Rd. N.4.

VACUUM relays, the range 6" x 35ma
(approx.) will switch 230v 10 amps length
5 1/4in. diam. lin. fitted with standard 4-pin
valve base; 6/6 ea.

VELODYNES, Magslip and Selsyns, many types
in stock, send for list. technical advisory service
available.

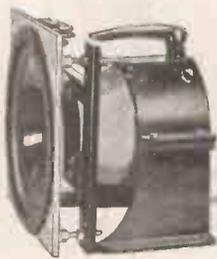
HOPTON RADIO, 1, Hopton Parade, Streatham
High Rd., London, S.W.16, Streatham 6165.

TELEVISION, all parts in stock for EE tele-
visor, Haynes scan and focus coils; line
trans. model on view—H.G. Radio, 1350, Strat-
ford Rd, Birmingham, 28. [4418]

BRASS morse keys, 1/6; 12v 1/4a; rectifiers,
selenium, 1/-, .0001 split stator condensers,
1/9, post extra; money-back guarantee; no
c.o.d.; s.a.e. lists.—Annakin, 25, Ashfield Place,
Oley, Yorks. [5397]

—towards perfection—
LOWTHER P.M.2 Unit

fitted with Voigt's Re-matched diaphragm,
is the most efficient drive-unit, for horn loading.



When used in conjunction with P.W.1
cabinet, it offers at £57 (in the white) a
complete loudspeaker system unequalled
except by P.M.2 in conjunction with the
Voigt Reflector Horn at £80.10.0 (in
the white complete) which, as yet, remains
unsurpassed.

Further details, please write:—

THE LOWTHER MANUFACTURING CO.

(The Laboratory Production Unit)

Lowther House, St. Mark's Road,
Bromley, Kent RAV. 5225

THE HAYES COMPANY
BIRMINGHAM

ARMSTRONG 83 chassis, 7 valve, 3 waveband
with 8-watt push-pull output, Mazda valves,
ample gain for p.u. operation, large 3-colour glass
dial, flywheel tuning, 10in. 1/1s, tone control,
ready for cabinet mounting, tax paid, £18/17/1

ARMSTRONG 103 chassis, 10 valves with 10
watts push-pull output. High gain R.F. stage,
variable selectivity, negative feed back, "magic
eye" tuner, two I.F. stages, high sensitivity on
short waves, coverage 16-50, 195-550 and 800-2,000
metres. Adequate gain for lightweight p.u.
operation. Output trans. tapped for 3 and 15 ohms
speech coil. Price £24/7/6, tax paid.

TELEVISION CHASSIS. We give below details
of the outstanding ARMSTRONG TV20 chassis,
which is giving excellent results up to 100 miles
from Sutton Coldfield, and which has brilliant
definition. In June we hope to have in stock other
TV chassis of various makes, and also a very limited
number of chassis with 15in. tubes. In addition
to the range of radio chassis we hope to have a
5 valve replacement chassis selling at about £12.
Readers who write to us will be kept informed as
these new chassis become available.

ARMSTRONG TELEVISION CHASSIS,
Superhet receiver with R.F. stage, ample gain for
"fringe area" operation. Two main controls,
noise limiters on sound and vision, blocking
oscillator time bases and a total of 21 valves. The
complete receiver is on one chassis, ready for
mounting in cabinet. Definition is outstanding,
picture quality compares with any TV set, irrespec-
tive of price. Complete with 10in. speaker, £66/3/4.
Write for details of these and other chassis. T.V.
demonstrations daily, and on Wednesday evenings.
All Armstrong chassis in stock. We despatch
same day by passenger train.

THE HAYES COMPANY

1 ALCESTER RD., MOSELEY, BIRMINGHAM, 13.

**OPPORTUNITIES
IN RADIO**



Get this FREE Book!

"ENGINEERING
OPPORTUNITIES"

reveals how you can
become technically-quali-
fied at home for a highly-
paid key-appointment in
the vast Radio and Tele-
vision Industry. In 176
pages of intensely inter-
esting matter, it includes
full details of our up-to-
the-minute home study
courses in all branches of
**TELEVISION and
RADIO, A.M. Brit.
I.R.E., City &
Guilds, Special Tele-
vision, Servicing, Sound
Film Projection, Short
Wave, High Frequency, and
General Wireless Courses.**

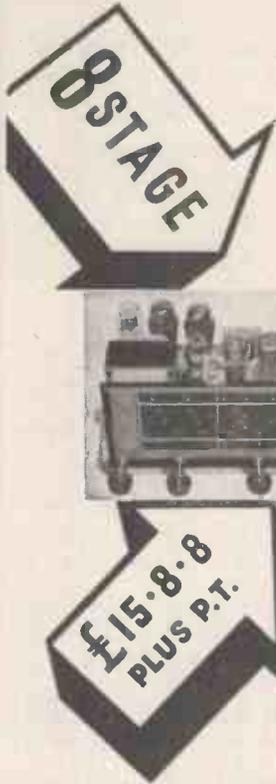
We definitely Guarantee

"NO PASS—NO FEE"

If you're earning less than £10 a week, this
enlightening book is for you. Write for your
copy today. It will be sent FREE and with-
out obligation.

**BRITISH INSTITUTE OF
ENGINEERING TECHNOLOGY**
389b SHAKESPEARE HOUSE
17/19 STRATFORD PLACE, LONDON, W.1

BIET



plus ARMSTRONG Superb Quality

What more could you ask of a modern radiogram chassis? And yet that's not all! Model EXP 83/2 also provides highly efficient negative feed-back; fly-wheel drive; special permanent pick-up switching; wave-bands covering 16-50, 200-550 and 1000-2000 m. and an audio output of 8 watts A.C. 200-250 volts.

OTHER ARMSTRONG CHASSIS Model RF 103/3. A 10-valve all-wave radio chassis with 3 wave bands. A.C. 200-250 volts. £19.19.0. Plus P.T.

Model 125/2. The "Armstrong" triumph—a 14-valve all-wave radiogram chassis with 3 S.W. bands down to 10.9 metres. The chassis for the man who wants the best. £33.12.0. Plus P.T.

ARMSTRONG TELEVISION —Model T.V. 20. A wide range 21-valve instrument incorporating a 12" C.R. Tube. £52.10.0. Plus P.T.

Write now for full information

Armstrong

THE CHASSIS PEOPLE

Armstrong Wireless & Television Co. Ltd.,
Warlers Road, Holloway, London, N.7.
Telephone: NORTN 3213
SOLE BIRMINGHAM AGENT: Hayes Company,
1, Alecote Road, Moseley, Birmingham. 13

COMPONENTS—SURPLUS AND SECONDHAND

RADIO CLEARANCE, Ltd. 27, Tottenham Court Rd., London, W.1.
20-WATT amplifier kits for constructing the McMurdo 8-valve A.C./D.C. amplifier; low impedance input (suitable for moving coil mikes, etc.), by triple shielded mu-metal trans to E.F. 57, R.C. coupled to triode, strapped stage (E.F. 57), with switched bass and top cut provided, trans coupled to output stage using 4 C133s in parallel push-pull; large Partridge O.P.T. to 150; rectifiers, 2 UR3Cs, parallel; alternative input, high impedance to second stage for Xtal pick-ups, tuner units, etc.; required inputs for full output, high imp. 0.5v R.M.S., low imp. 1 millivolt; V.C. operates on both inputs; chassis isolated from mains; complete kit of first-class components (including Partridge trans), all valves, black crackle chassis (ready drilled), black crackle and chromium case (15½x6¼x8in.), circuit diagram; everything required for the construction of a fine job. £13/15, carr. paid; Mansbridge condensers, 2mf, 1,000v wkg. (4¼x4x1¼in), 3/-; 6mf 2,000v test (5x4x1¼) 4/-; 5mf, 2,500v test (6¼x3¼x2¼), 2/6; 0.25mf, 8,000v test (7x5x2), 3/6; 2mf, 2,500v wkg. (6x5½x2¼) 4/-; 4mf, 2,000v wkg. (5x3¼x4¼), 4/6; 0.5mf, 4,000v wkg. (3x3x6in), 3/-; post extra.
PERSONAL receivers. 3-valve T.R.F. receivers, using I.T.4s, contained in handsome bakelite case, with lift-up lid, size 7x6½x5in, with lid handle, plastic carrying handle, trans. 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 high res. phones, controls S.M. tuning and reaction; opening lid switches on; supplied brand new, with valves, batteries, phones, an ideal set for many purposes, invalids, hosp. patients, etc.; these receivers are not Govt. surplus and are offered ready to play. £3/19/6, carr. paid; chassis (steel), 5x5¼x1¼in, drilled 4-button base holes 1/8; 5x5x1¼in, drilled 7-button base holes, 2/3; All., 17x9¼x2¼in, drilled 7 int, oct and square, open ends, 3/3; E.H.T. trans, 4kv, 1ma, 2v 2a, secs, Pri. 230v, 50c/s, gives approx. 5,500v with usual smoothing, 29/6; auto trans, 200-250v 50 c/s to 110v 60c/s enclosed, 18/-; smoothing chokes, 5H, 120ma, 1400/3/3, 5H 200ma 1000/4/11, 6H 200ma 1000/5/6; electrolytics, 8mf 150v 1/3, 8mf 170v 1/3, 8mf 450v 2/3, 8+32 450v Can 4/-, 16+8 350v Can 3/-, 32+32 350v Can 3/6, 16+24+8 450v Can 4/-, 15+15 450v+20m 25v Can 4/-, 32+32 550v Card 2/-, 32 450v Card 3/-, 60+100mf 350v Can 3/-, 16+8 double-ended Can 450v 3/-, 25/25v 1/3, 25/50v 1/3, 50/25v 1/6, 100mf 12v 1/4, 100/6v 6d, 50/12v 9d, 500mf 15v Can 2/-, 30+30 mf 450v+20mf 25v Can 4/6.
P.A. SPEAKERS. 250 ohm trans, 9/11; with trans 4,500/11/6; 64in, less trans, 10/11; 10in, with trans, P.P. 4,500/21/-; outputs trans, 2,000/20, 2,500/20, 2,750/20, 3,000/20, 6,000/20, 7,000/40, all at 3/-; heavy duty, 7,000/20 3/6, 3 ratios, 7,000-3,500, 7,500/21 4/6, 7,000/200, 7,500/40 4/-; switches, standard size, 2P 4W, 3B 2/6, 1P, 10W 2/6, 2P 4W 2B 2/6, 2P4W1B, plus additional water with shorting plate, 2/3; all have 3in spindles; resistors, 100 assorted, 47 valves, ranging 180Ω ¼w - 100k, 3w; all standard sizes; post makes 10/6, post 6/6; trimmers 3-50PF on bar 9d, 3 on bar 1/3, single 1-15PF 4d, single 3-30PF Phillips concentric airspaced 6d; U.I.C. 3/25PF single 3d, 15-45PF twin 4d; air-spaced variables, ceramic bases, ¼in spindles, 1in long, straight, 25PF 9d, 30PF 1/4, 30PF 1/2, 30PF 1/2, 30PF 5PF 6d, 30PF butterfly spindle nut ¼in dia, 1/-; car radio vibrator packs with 12v, 4-pin vib and OZ4 valve on chassis, 5½x3¼x1¼; output 250v 65ma, brought out on 8ft screened lead, 17/6; meters, metal cased, 2in circular, 0/500 microva 7/6, 0/15-600v, red, ext. res. 6/6; 0/200a 0/400a, with shunt, 5/-; bakelite cased, 2in square, 0/1ma 7/6, 0/5ma 6/-, 0/50ma 7/-; 0/300v series res. supplied, 7/-, 0/20v 5/-; bakelite cased, 2½in circular, 0/500 microva 18/6, 0/30ma 7/-, 0/50ma, 0/100a, 0/200ma, 8/6; desk type, 2½in, 0/1ma, 15/-; all meters flush mounting, visual indicators, type 1, crossover needle, 2-60 microva, with common magnet, 3/-; S.M. dials, as on R.F.26, less cursor, 3/11; rotary power units, 1 type 60va, 12v D.C. input, mounted on chassis with supp. 6/11; type 87, 24v input, output as 104, 5/11; 10-valve rec. R28/ARC5, covers 100-150 mc/s, with valves (inc. 4-717A), 42/6, carr. paid; Wilcox Gay V.F. 0 covers 2-10 mc/s, with 0-10ma meter, supplied brand new, in original cartons, with 807 accessories (plugs, leads, etc.), and instruction book, £5, carr. paid; 2-gang condensers, 0005, cer. ins., 1in spindle, 4/6; 2-gang, 0004, with electrolytic fitted, 3/6; superhet coils, 4x1¼in formers, M.W., H.F., A.E. or Osc., L.W., H.F., A.E. or Osc., 1/6 per coil; I.F. traps, 465 kc/s, iron-cored, 1/8; set of 6 coils and trap, 9/6; 10-pin plugs and sockets, with keyway, 1/6 pr.; 8-way plugs and sockets, with cover, 1/6 pr.; 1.5c. carbon with SW 2½in spindle, 25K, 50K, 100K, 250K, 2M, 4/-; 3-wire wire-wound twin 2.5K 2/6, twin 500Ω 2/6, twin 50K 3/-, twin carbon, 1M/1M, 2/6; telescopic aerials, all, 15in closed, 7ft 6in extended, 3/6; receivers, type 76, 150/505 kc/s, 3 valves, ARTH2, VR55, VR92, F. output 560 kc/s, brand new, in transit case, 22/6, carr. paid; bakelite cases, with lid, inside meas. 6x6¼x3¼in without lid, lid 1in deep with former for frame aerial, lid requires fixing, ideal for personal sets, meters, etc., 8/6, post paid; lightweight head-phones, high res., £100, 5/6 pr.; aircraft radio rec., type CRV 66151, 150w receiver, covers 195 kc/s-9,050 kc/s, in 4 bands, 195-560, 560-1,600 kc/s, 1.6-4.5 mc/s, 4.5-3.05 mc/s.

(Continued on next page)

MAINS TRANSFORMERS

(Postage Extra under £2)

As supplied by us to the Ministry of Supply, B.B.C. Education Authorities, Admiralty, etc. Interleaved and impregnated. Screened primaries tapped 200/250 v. (Also built to your specification—prompt deliveries—quotation per "Return of Post.")

DROP THROUGH TYPE. TOP SHROUD

(a) 250-0-250 v. 60 mA., 6.3 v. 3 a., 5 v. 2 a.	15/6
(b) 250-0-250 v. 60 mA., 4 v. 4 a., 4 v. 2 a.	15/6

Following types have Universal L.T. windings.
6.3-4-0 v. 4 a. C.T., 5-4-0 v. 2 a.

(c) 250-0-250 v. 80 mA.	17/6
(d) 300-0-300 v. 80 mA.	17/6
(e) 350-0-350 v. 100 mA.	17/6
(f) 350-0-350 v. 100 mA.	19/6
(g) 300-0-300 v. 100 mA.	19/6
(h) 350-0-350 v. 100 mA.	19/6

FULLY SHROUDED UPRIGHT TYPES.

(i) 250-0-250 v. 180 mA., 6.3 v. 4 v. 6 v. C.T., 5-4-0 v. 3 a.	39/-
(j) 425-0-425 v. 180 mA., 6.3 v. 4 a. C.T., 6.3 v. 4 a. C.T., 5 v. 3 a.	42/6
(k) 425-0-425 v. 180 mA., 4 v. 8 a. C.T., 4 v. 4 a. C.T., 4 v. 4 a. C.T.	44/6
(l) 425-0-425 v. 180 mA., 6.3 v. 4 a. C.T., 4 v. 3 a. C.T., 4 v. 3 a. C.T., 5 v. 3 a.	47/-

Note.—Model (j) above is suitable for Williamson Amplifier.

Williamson Pre-Amp Mains Transformer 325-0-325 v. 20 mA., 6.3 v. 4 a. C.T., 19/6
WILLIAMSON AMPLIFIER REPRINT 3/6

36-page booklet published by "Wireless World" £15.8.8
WILLIAMSON OUTPUT TRANSFORMER Built to Author's specification 1.72 secondary. Approved type £23 12 6

WILLIAMSON SMOOTHING CHOKES Choke No. 2, £1 2 6 Choke No. 1, 12/6
FEE-AMP. FEEDER UNITS. 50H. 90 mA., 5000Ω 15/6

High class audio feeder units with B.H. stage. Switched pick-up sockets. Glass cases. Completely aligned.
MODEL A. Covers 16/50, 190/0 and 900/2,000 metres. Price, including Purchase Tax £10 8 6
MODEL B. DE LUXE. Covers 4/145, 190/50, 900/2,000 metres and six ranges of band spread. Price, including Purchase Tax £18 7 6

MODEL E. As Model A, but with Variable Selectivity and Indefinite Impedance detector. Price, including Purchase Tax £12 15 0

"VIEW MASTER" TELEVISION RECEIVER. All individual parts stocked as well as complete kits CONSTRUCTOR'S ENVELOPE, containing full instructions, layouts, diagrams, etc., 5/-, post free.

POLISHED ALUMINIUM CHASSIS, 16 S.W.G., 4 SIDES, 3 IN. DEEP.

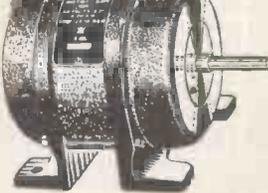
10in x 6in., 10in x 8in., 8/6; 19in x 9in., 10/6; 14in x 12in., 16in x 8in., 11/6; 30in x 8in., 12/6
EDDYSTONE SHORT-WAVE COMPONENTS Full range stocked. Eddystone illustrated catalogue 6d

SPECIAL OFFERS

0005 2-gang T. Condensers	6 6
Coll Paeks 3 W.B. Miniature	£1 9 6
485 K.E.I.F. Transformers, pair	12 6
T.M.'s 1 mid, 7 kv. Condensers, with clip	12 6

INSTRUMENT WIRE. Comprehensive range in enamelled cotton and silk covered copper wire from 18 S.W.G. to 40 S.W.G.
EX-GOV'T. SURPLUS

1/40 H.P. A.C. Reversible Induction Motors



A sturdily constructed motor, rated for continuous use. By means of the resistor and condenser included with the motor, it can be operated from the standard 200-250 v. A.C. mains supply. Full wiring instructions are given with details of securing rotation in either direction.
BRAND NEW. Reversing switch 2/-
500 V.A. Auto Transformers, 115/230..... £2 2 0
PACKARD BELL PUSH-PULL PRE-AMP'S. In sealed cartons with accessories and two valves, 85/6 and 28/6
TRANSMITTING VALVES 16 6
807, 6/-; 805, 23/6; M3, 27/6; 616, 9/6; 616, 9/6.
VCB7 C.R.T.s in maker's transit cases £1 12 6
Quantity discounts on Ex-Gov't. Valves.
SEND NOW 6d. P.O. for 64 PAGE CATALOGUE

Terms, C.W.O. or C.O.D.

COULPHONE RADIO

"The Return of Post Mail Order Service"
53 BURSCOUGH STREET ORMSKIRK, LANCS.

Phone 987

AMC

TELEVISION

Manufactured to "Electronic Engineering" Televisor Specification.

MIDLAND T.V. Sound and Vision Panels fitted with formers and dust cores now available.

LINE OUTPUT TRANSFORMERS

NEW Improved SET OF GANTRIES COMPLETE

FOCUS COILS

LINE AND FRAME SCANNING COIL ASSEMBLIES

All Steel CADMIUM PLATED POWER AND TIME BASE CHASSIS valve-holders, 3 point and single socket and all necessary cut-outs.

SOUND PANEL CHASSIS ASSEMBLY, fitted with screens, valve-holders, formers and dust cores.

VISION PANEL CHASSIS ASSEMBLY, fitted with screens, valve-holders, formers and dust cores.

9" C.R. TUBE SUPPORT for mounting on top of Gantry Assembly

9" CREAM MASKS.

5, SHAKESPEARE RD., FINCHLEY, N.3

Phone: FINchley 2188

COMPONENTS—SURPLUS AND SECONDHAND

(Continued from previous page)

switched, R.F., mixer, 3-1 F.s. det. output, using 4-12SF76, 1-12SA7, 1-12AB, 3.S.M. dial calibrated in kc/s, size 2 1/2" x 1 1/2" in. provision for aerial or loop, powered from 28v, self-contained dynamotor, supplied with valves and dynamotor, used, £5/19/6, carr. paid; mains trans. PRI 250/250v, 50 c/s, secs, 460v, 200ma. 210v, 15ma, 6.3v, 50, 14/1-

RADIO compass MN26C 12-valve unit containing 7-valve receiver covering the broadcast band 150/1,500 kc/s (2,000/200 metres) in 3 bands with 6F6 output. Valves 5-6K7m's, 2-6N7m's, 2-6J5m's, 1-6L7m, 1-6B8m, 1-6F6. Powered by self-contained 28v dynamotor. Good condition; £5/19/6 carriage paid.

EX-ADMIRALTY receiver B.21 covers 1-20 mc/s in four bands; 9 valves, 2-RF, 3IF, B.F.O., output, standard octal types; power supply required; supplied new less valves, £9/19/6, plus 10/- carriage.

RADIO CLEARANCE, Ltd., 27, Tottenham Court Rd., London, W.1. Tel. Museum 9188. [0015] **KLYSTRON** Unit 207a, contains 3 Neons, CV71 Klystron and 524, in metal case, brand new, £1

INDICATOR 198, uses VCR 138a tube, 6 valves and mass of parts; 35/-
MOVING coil hand mikes, brand new; 5/-
MOVING coil headphone and mike assemblies, brand new, 8/6

HEADPHONES, 4,000 ohms; 4/6
VIBRATOR packs, input 6v, output 180v, 80 mc/s, smoothed; 15/-

1196 TRANSMITTERS, less valves, contain pounds worth of parts, unused; 3/9

B36 MARCONI receivers, 1-20 mc/s in 4 overlapping bands, uses 2H stages, mixer, 2 F.S., B.F.O. double diode triode and pentode, output 1 microvolt sensitivity; the best communication receiver offered to-day, unused; £14/10; less valves, £12, carr. 10/-

12 mc/s IF STRIPS, wide band, suitable for vision receivers, employ 5 VR65, EA50 and EF36 as cathode follower; will work once, £2

6-VALVE battery receivers, the finest value to-day; complete with valves, they work right away; covers 20-80 meters approx., easily converted to broadcast bands; 15/6

MICROAMP meters, 0-500, rotund, flush type, 7/6; many other meters available.

ELECTRONIC eng. T.V. chassis, fitted with valve holders, coil formers, etc.; vision chassis 18/6, sound chassis 15/6, time base chassis 12/6, power chassis £1, gantry and front strap 6/6; all cadmium plated, complete set; post paid.

ALL E.E. and Viewmaster parts, Viewmaster constructor's envelope, 5/-; E.E. Midland Handbook, 4/6; London book, 3/6.

SPEAKERS in stock, from 3in at 8/6 to Goodmans Axiom 22.

ALSO all Williamson parts; lists available; 2 1/2d please.

BARTON, 41, Bedminster Down Rd., Bristol, 3.

[5390

ALLEN & GOULD, 5, Obelisk Parade, Lewis-

ham, S.E.13, offer the following goods,

new and unused, unless otherwise stated.

MIAT resistors, 100ohm, 250w 1/9; 350ohm,

250w, 1/6; SBC neoms, 200-220v, resistor in

cap. 2/-; FBC holders (cord-grp), 6d; Muir-

head slow-motion dials (as on R1224), 6/-;

mains transformers, PRI 0-200-220-240sec, 250-

0-250 at 80v, 10v, 20v, 5v etc., 2amp,

11/6; 01 MFD 5kv, wgr., 1/6; Jones P and S,

6w 1/6, 8w 1/9, 10w 2/-, 12w 2/6; B & L

T & S, 7-p 1/9, 10-p 2/-; Pye co-axial P & S,

strakht 1/3, angled 1/-; Pye co-axial connec-

tions, 6d; Pye T rotors, 1/6; rotary transform-

ers, 24v in, 300v 60ma and 150v 20ma out, 12/6;

rotary transformers, 14v in, 600v at 140ma

out, 17/6; switches (oak, taxley type, etc.),

SP 3w 6d, SP 10w 1/9, 6w paraneling 6d, 5-p

1w 1/-; toggle switches, laminated, 6d; 10v,

stripped from unused equipment, SP on-off 1/-,

BP on-off 1/3, DP DT 2/-; toggle switches,

black bakelite, new, SP DP 1/-, DP on-off

1/6; meters, 3 1/2in FSD 200ma, cal 0-15, 0-15

and 0-5v, ideal for valve voltmeter, etc., 35/-;

2in FSD 500ma cal 0-15, 0-600v, used, tested,

surplus 4/-, 2in 0-300v d.c. 5/6, 2in 0-50ma

d.c. 5/6, 2 1/2in 0-25a d.c. MT 5/-; selenium

rectifiers, heavy duty, can be used full wave

(with CT transformer), 320v 300ma or in bridge

160v 300ma, 9/-; low-resistance phones with

headband, lead and plug, 3/3 per pair; deaf

aid type phones with two spare insets, 7/6

per pair; magnetic throat mikes, 1/9 per pair;

dimmer switches for lamps or as extension

speaker volume controls, 3d; Plessey lightweight

PM speakers, 2 1/2in 10/-, 5in 10/-, 9in 13/6,

10in 17/6; banks of cement-coated w/w res-

istors, stripped from units, each bank con-

taining 3 of 11k 12w, 3 of 2.5k 12w, 1 of 4k

12w, 1/6 per bank; crystaloids CV 102, IN 22,

3.3; volume controls, w/w 50hm, 50hm, 500hm,

1k, 3k, 8k, 15k, 20k, 25k, 35k, 50k; carbon

500ohm, 3k 10k, 20k, 50k, 100k, 150k, 250k,

500k, 1m, 2m, 3m, at 1/9; double carbon 500k

+500k, 2/6; double w/w 215k+2.5k, 3/-; cera-

mic air spaced trimmers, 3/30 pF, 4d each,

3/6 per doz 24, per 100. [5469

TELEPHONE handsets, carbon mike, 4-way

lead and plug, latest streamline type, 10/6

plus 9d post, or two for £1 post free; brand new

and fully guaranteed.

A.C. GENERATORS, 230v 100w 50cps output, 24v

D.C. input, ideal for mobile P.A., etc., £3/15,

carr. pd.; unused R.A.F. surplus, tested and

guaranteed perfect, in stout case, 15X10X8in,

weight 40lb, sleeving, 1 1/2mm black Perlaibad,

reels of 1 gross yds., 7/6, 2 gross 10/-, 3 gross

12/6, post 6d per gross extra; discount for quan-

ties.

SINGLE P.V.C. hook-up wire, 72 yds. for 5/-,

plus 6d post.

FRITH RADIOCRAPT. Ltd., Leicester. [0026

"You can rely on us"

FOR CLEAN COMPONENTS AT COMPETITIVE

PRICES

IMMEDIATE DISPATCH

MIDGET COIL-PACKS

These are an ideal miniature Coil-Pack especially suited where space is limited. They consist of iron-core miniature coils for both Aerial and Oscillator stages, built-in Wavechange switch and midget trimmers. They are intended for an I.F. of 465 Kc/s and I.F. Transformers type RS/GB 465 (12/6d. per pair) are the ideal companions for a trouble-free superhet.

TYPE "R"

MW/LW/GRAM Ranges 200-550 metres, 800-2,000 metres.

SIZE: Length 2 1/2in. Width 1 1/2in. Depth 1 1/2in.

TYPE "S"

MVW/SW/GRAM Ranges 200-550 metres, 17-50 metres.

SIZE: As Type "R."

TYPE "C"

LW/MW/SW Ranges 800-2,000 metres, 200-550 metres, 17-50 metres.

SIZE: Length 3 1/2in. Width 1 1/2in. Depth 1 1/2in.

TYPE "R" and "S" each 25/-. TYPE "C" each 28/6. Post 6d.

All coils enclosed—All iron-dust cores adjustable. Completely wired, only five connections needed to external circuit.

Catalogue with Data, 3d.

RADIO SERVICING Co.

444, Wandsworth Road, London, S.W.8

Phone: M.A.Ceulay 4153.

77, 77A, Bus; 28, Tram, Wandsworth Rd. S.R. Station
Open till 6.30 p.m.

RADIONICS LABS. LTD.

Radio Engineers to the Trade

— ESTIMATES GIVEN —

Components and valves fitted at our large trade discount.

We carry a large stock of B.V.A. Valves.

198 HARDGATE, ABERDEEN

Phone: 27878

Phone: 27878

BOROUGH POLYTECHNIC

Borough Road, S.E.1.

Full-Time Courses in Electrical or
Radio Engineering

Full-time "sandwich" courses covering a total period of four years, equal periods being spent at the Polytechnic and in industry, will begin in September next. The courses lead to the examinations for the Higher National Diploma in Electrical or Radio Engineering, giving exemption from the associate membership examinations conducted by the Institution of Electrical Engineers.

Students seeking admission should either have passed the School Certificate Examination, with credit marks in Mathematics and Physics, or have taken the first and second years of the Ordinary National Certificate Course in Electrical Engineering.

Further particulars and forms on which to apply for admission may be obtained from the Secretary.

THE MODERN BOOK CO.

A Home Built FM Receiver. By K. R. Sturley. 4s. 6d. Postage 3d.

The Williamson Amplifier. Articles reprinted from "Wireless World." 3s. 6d. Postage 2d.

Television Servicing Manual. By E. N. Bradley. 4s. 6d. Postage 3d.

The Radio Amateur's Handbook 1950 Edition. By A.R.R.L. 20s. Postage 9d.

Data & Circuits of Modern Receiver & Amplifier Valves. Book 3. 12s. 6d. Postage 9d.

Short-Wave Radio and the Ionosphere. By T. W. Bennington. 10s. 6d. Postage 9d.

Radio Amateur Call Book Magazine. Winter number. 18s. Postage 9d.

Radio Instruments & their Construction. By D. Allenden. 2s. 6d. Postage 2d.

A Home Built Televisor for Sutton Coldfield Reception. 4s. 6d. Postage 3d.

Radio Valve Data. Compiled by "Wireless World." 3s. 6d. Postage 3d.

The Principles of Television Reception. By A. W. Keen. 30s. Postage 9d.

Principles & Practice of Radar. By H. E. Penrose. 42s. Postage 9d.

Handbook of Wireless Telegraphy. Vol. 1, 5s. Vol. 2, 6s. Postage 1s. the set.

Practical Wireless Circuits. By F. J. Camm. 6s. Postage 4d.

Electronics: Experimental Techniques. By Elmore & Sands. 32s. Postage 9d.

Television. By M. G. Scroggie. 6s. Postage 3d.

We have the finest selection of British and American radio books in the Country. Complete lists on application.

19-23 PRAED STREET

(Dept. W.6)

LONDON W.2

PADDington 4185

GEE RADIO LTD

FOR

QUALITY COMPONENTS & SATISFACTION

JONES PLUGS AND SOCKETS. 12, 10, 8, 6 and 4 way. Complete. Still available as previous advert. **PHOTO-ELECTRIC CELLS TYPE C.M.G.22.** Brand new, 18/6.

V.C.R.138 G.R.T. with Mu Metal screen and base, 25/- **B76 CERAMIC V/HOLDER** and screening can with spring, complete, 1/6.

12 v. 1 amp. and 6 v. 1 amp. SELENIUM RECTIFIER 7/8 each.

O.R.T. 5 C.P.I. with Mu Metal Screen and Holder, 35/- **12-WAY (W) PLUGS AND BASES, 10/H 416, 3/- Set.**

6-, 4- AND 2-WAY (W) PLUGS AND BASES, 2/6 Set. **HEAVY DUTY 2-WAY (W) PLUGS AND BASES, 10/H, 419 2/6 Set.**

4-WAY POST OFFICE PLUG 10/H 10991 and Socket 10/H 2206, 3/- pair.

EX-U.S. ARMY MINIATURE HEADPHONES. Complete with Plug. Ref. No. H3/30/V. New and Boxed, 9/6.

EX-U.S. ARMY THROAT MICROPHONES, Type T/30/V. New and Boxed, 2/6.

ROLA SPEAKERS. 3 ohm Speech Coil P.M. 5in., 9/11. 6in., 12/11. 8in., 13/6. 10in., 19 11.

0-100 MICRO AMP METERS scaled as 0-1500 yd. New and Boxed, 19/6.

METER DISTRIBUTION BOARD with 0-300 v 2 1/2 in. A.C. meter with D/F. 15 amp fuses, 3 1/2 amp 2 pin plugs and A.C. input socket. Total size, 12 x 6, 18/-.

2 1/2 in. 5-0-5 CENTRE ZERO MOVING COIL MILLIAMMETER. New and Box, 8/6.

G.P.20. Acos Microclic Pickup, 71/5.

F.72 IGRANIC JACK SOCKET, 15/- dozen.

P.O. JACK SOCKET. Ref. No. 10/H 1739, 7/6 dozen.

MINIATURE 2 MEG V/CONTROL with switch, 6/-.

STANDARD TWO-WAY TELEPHONE JACK PLUG, 10/- doz.

MINIATURE OUTPUT TRANSFORMER for personal Receivers, size 1 1/2 in. x 1 in. x 1 in., 3/6.

OSMOR COIL PACKS, miniature type, L.M.S., 33/-, M.S.S., 35/-.

COMPLETE RANGE OF OSMOR COIL PACKS AND COMPONENTS in stock.

MINIATURE L.F.T.s, 46f K/s, 16/6 pair. Size 1 1/2 in. x 1 in. x 1 in.

FULL RANGE OF WEARITE COILS in stock, 3/- each.

ELECTRIC LIGHT CHECK METERS, 5, 10 and 20 amps, 200-240 v. 50 ~ In good condition, 15/- each.

1.7kV T.M.C. CONDENSER with C/tp. Size 4 1/2 in. x 2 in., 10/6.

0.300 MILLIAMP D.C. MOVING COIL METERS. 2in. flush mounting, 7/6.

0-40 or 120 MILLIAMP METERS. Moving Coil D.C. 2in. square flush mounting, 7/6.

HEAVY DUTY 2 amp. LARGE VARIABLE RESISTORS 150 ohms, wheelco (strolled adjustment), 20/- each.

LEADING MANUFACTURERS' 5 watt. W/WOUND POTS, sizes 100 ohms, 250 ohms, 1,000 ohms, 2,000 ohms, 5K, 6K, 10K, 20K, 50K, 3/- each.

R1185 RECEIVERS. In very good condition, £10/10/- **ALSO LARGE STOCKS OF BELLING-LEE (PLUGS AND SOCKETS, 5, 7 and 10 Way.** Wholesale and Export Enquiries Invited.

We invite your enquiries for all types of Ex-Govt. Transmitting valves. Large stocks of all types held. No enquiry too large or too small.

We hold large stocks of new Ex-Govt. materials and will be pleased to quote special terms to manufacturers and exporters.

C.W.O. or C.O.D. Orders under 20/-, 1/- postage. Over 20/-, post free British Isles except where stated

GEE BROS. RADIO LTD.

15, Little Newport St.

LONDON, W.C.2

GER 6794

COMPONENTS SURPLUS AND SECONDHAND

TRF coils L and MW, with reaction boxed, with circuit, 4/9 pair; 1000 silver mica, 3d.; .01 mica wire ends, 3d.; 20 of ceramicons, 2d.; list from: T. G. Howell & Co., 29, McWilliam Rd., Brighton, 7. [5348]

THERMISTORS D-164699, 10/-; Xtal diodes IN25, 10/-; R.F.27 television units with valves, 45/-; Sonarscopes, infra-red image converter, complete with tube and lens assembly, f 2.1in. 60/-; send 2 1/4 stamp list. **PASSINGHAM, North St., Keighley.** [0002]

YOU'LL probably get it at Smith's, Edgware Rd. [0002] **RD.1.** Everything for the constructor, from a 1/10 watt resistor to a radiogram cabinet, lowest prices, biggest variety.—Near Metropolitan Music Hall. Pad. 5891. [8005]

SPECIAL offer, bargain parcel, contains heater transformer 200-250v to 6.3v 2a smoothing choke, and output transformer, two gang, four octal holders, 5 pole 2-way switch, four trimmers, 14 condensers, 12 resistors, only 32/6; every item brand new and perfectly usable.

WATTS & Co., 8, Baker St., Weybridge, Surrey. [5472]

MANUFACTURERS.—Enamel, copper wires, M all gauges, laminations, all types, huge stocks radio components, s/m, m/m, p/t and block condensers, close tolerance and high stability resistors, 1% and 10% goods guaranteed.

E. Simmonds, Ltd., 8a, Byron Rd. Harrow, Middx. Telephones, Harrow 2524 and 0315.

FERRANTI electrostatic voltmeters, 0-3,500, 2 1/2 in. plug-in type, 25/- each; condensers, price each: 0.01mfd 30 (0.001), 15/-; 0.1mfd paper foil 1,000v, 7d; 3mfd oil filled 200v, 7/6; electrolytics, 50mfd 12v, 6d; 4mfd 12v, 5d; 0.01mfd 5,000v, 4/-; 0.02mfd 8,000v, 5/-; I.F. twin filter units, 465 kc/s, 10/-; 7, Upper Kent St., Leicester. [5460]

COIL pack kits, L.M.S. 9/5; P coils, 2/3, 4d; P ceramic trim, 2d; 75 PF tun. cond., 4d; 50 assorted sil. mica, 10/-; 50 assorted res., 1/6; 8x450v elect., 2/-; 16/16x350v elect., 2/6; 1.7/1.1, 2d; Knobs, 2 1/4, mains trans, 17/-; mic. tran., 6d; send for latest "cheapest list in England".—Susssex Electronics, Ltd. (G.), Riley Rd., Brighton, 7. [5346]

FULL wave rectifiers, 12v 1a 5/6, 12v 7a 17/6, 36v 4a 35/-, all sizes available; mains units, 12v 16a d.c., 12v 50a a.c., £9/10; meters, 2-6in. at low prices; many types w/v, wirewound resistors; 250m watt 1/2, 2,500 ohm 50watt from 3/- per doz.; tone vol. controls, 15,000 and 1meg. 11d.; crystal oven thermostats, 44 0 to 47 C. 3/-; everything available, s.a.e. exact requirements.

C. J. EMMS, Ltd., 26a, Coleherne Mews, S.W.10, Frenantle 8941. [4889]

CONDENSERS, guaranteed fresh stock, 0.01, 1,000 6d; 0.1 350v. 6d; 8mfd 450v, 2/6; 8x8 450v, 2/6; 16mfd 500v, 3/6; 8x16 450v, 3/6; 16x16 450v, 4/6; 16x16 350v, 3/6; 32mfd 450v, 4/6; 25mfd 25v, 1/3; 50mfd 50v, 1/6; valve holders, int. oct., amp., 6d; 250 6d; 375 3d; V/cans, 1/3; coils, aer., osc., H.F. 2/6 each car vib. power pack, not ex-Govt., with vib. and 6x5 valve, 23/6; metal case with six 6J5GT valves, p.t.d. in sorbo, 25/6; metal rectifiers, 80 m/a, 4/9; 1436 twin twisted trans. flex, 3d yd; bumper list of hundreds interesting bargains, 1d stamp.

RADIO UNLIMITED, Elm Rd., Walthamstow, E.17. Tel. Key 4813. [0062]

SUPREME RADIO, 746b, Romford Rd., Manor Park, London, E.2. Tel. H. 1260. Est. 16 yrs.—2mfd 350V TUB.—cardboard cond. 6d ea. also 4mfd 450v cond. 6d ea.; 4mfd screw base metal cond. 350v 6d ea.; 4mfd 550v metal screw base 1/- ea.; 8mfd cardboard tub: 450v 1/6 ea.; 8+8mfd 450v metal tubular cond. 2/- ea.; 8+16mfd 450v metal can cond. 2/3 ea.; 1+16mfd 450v cardboard con. 2/9 ea.; 16mfd drylytic cond. 350v, small can type, 1/9 ea.; metal or cardboard 50mfd 50v or 25mfd 25v cond. 1/- ea.; also 50mfd 12v or 10mfd 25v metal 1/- ea.; or 11/- doz., or ass. doz.; 12mfd 50v screw base metal cond. 6d.

50v vol. controls, carbon 7 1/2 ea., 1mer carbon vol. controls 1/- ea.; 35k vol. cont. 1/6 ea. W.W.: 5kΩ W.W. vol. cont. pre-set type 1/- ea.; 100kΩ vol. cont. with s/p switch carbon 2/6 ea.; 0.25mΩ vol. cont., less switch, 2/- ea.; both long spindle; noise suppressor units consisting of 2, 0.1mfd cond. and iron core choke 6d ea., 5/- doz.; fly-back type line trans., with provision for EY51 valve, 22/6 ea.; fully shrouded.

MAINS Trans.: 350-0-350v 80 m/a, 4v 4amp and 4v 2amp tap; primary 14/11 ea.; E.H.T. 350-0-350v, 250 m/a with all L.T. windings and screen, £3/10. 5 hy 250 m/a choke 14/9 ea.; 10 hy 80 m/a choke 6/6 ea.; E.F. 50 valve holders, ceramic, 6d ea.; 5/6 doz.; retaining rings for same 8d ea.

1/4w resistors: 100, 220, 270, 470, 820, 1200, 1500, 2500, 3300, 3900, 8200, 1kΩ, 3.9kΩ, 11kΩ, 470kΩ, and 10mΩ, 1/9 doz or ass.; 18/6 gross or ass.; 1/4w resistors, 2.2kΩ, 6.8kΩ, 16kΩ, 18kΩ, 3.3kΩ, 100kΩ, 150kΩ, 220kΩ, 2/- doz. or ass.; 21/- gross only or ass. gross. 1 watt resistors, 2700, 4700, 1kΩ, 3.3kΩ, 8.2kΩ, 12kΩ, 33kΩ, 56kΩ, 68kΩ, 1meg and 2meg, 4/- doz or ass. doz; mica cond., ppf type, 40pf, 50pf, 60pf, 65pf, 305pf, 307pf, 500pf, 530pf, 570pf, 590pf, 700pf, 1.800pf and 4,550pf, all at 2/- doz or ass. doz; 0.01mfd 2.2kv and 0.005mfd mica tag end cond. 2/6 doz or ass. 100000 mica cond. 0.0005mfd, 0.0003mfd and 0.001mfd 6d ea. or 5/6 doz. or ass.; metal-mite cond. 0.01mfd 350v and 0.002mfd 500v 9d ea.; 7/6 doz or ass.; tubular wire-end cond. 0.01mfd 1k/vw, 0.02mfd 750v, 0.05mfd 350v and 0.1mfd 350v or 500v, 6d ea., 5/6 doz.; component parts for constructor television and radio circuits our speciality. **TERMS: c.w.o. no c.o.d.; send 6d extra for postage orders under £5. 24d s.a.e. all enquiries and list. [0021]**

RADIO BULLS
6 HIGH VACUUM TUBES
BRITISH
BATTERY, A.C. and UNIVERSAL TYPES.
Telephone ELGar 4444
All fully guaranteed

If yours is a Valve Problem BULLS are the people who will most likely solve it.

Mullard, Brimar, Gossow, Mazda, Marconi, Oram-Tunggram, Hivac—any type, at B.O.T. prices from 5/10.

OBsolete DK1, DAC1, DF1, DL2 can now be replaced with equivalent valves and ready to plug in adaptors.

Price of valves in above order: 12.10. 9/2, 11/-, 11/-, plus 3/9 each adaptor.

HOW TO REPLACE DIFFICULT VALVE TYPES 6B5, 6F6, 6N6, 6P8, 6U5/6G6, 12A7, 12F5, 12Z3, 15B1, 20A7, 32L7, 36, 39/44, 41, 45, 47, 50L6, 70L7, 84/62A, etc. We can help you here, too.

HIVAC, XSG, XW, XH, XD, XL, XLO, XP, XY and holders. Please enquire for any valve. We are fully stocked and well assorted. Lists sent.

"DEMOBBED VALVES." Service Valves and their commercial equivalents, 2/8 post free.

BOOKS on every aspect of Radio in stock. We shall be pleased to send special list. **Valve Equivalent charts** with quick reference Index, 2/8 post free.

SERVICE SHEETS—The one you require FREE in a dozen at 10/6.

WINDSOR and TAYLOR
Best for
TEST EQUIPMENT

BULLS Best for getting above even on EASY TERMS—up to 10 months—and very near cash price. **FREE** catalogue, Payment Plan and Order form.

AMPLION all-purpose test meter, 10 ranges A.C./D.C., moving coil. New bargain, £3/7/6. Avo-minor Universal, £8/8/0.

AN OPEN LETTER TO ALL OUR FRIENDS OVERSEAS
Many thanks for your kind letters, numerous orders—an appreciation of our efforts. We shall continue to keep up the standard of service we give, both at home and abroad, to our friends everywhere.
J. Bull & Sons

A PERSONAL RADIO FOR YOUR HOLIDAYS

EX-W.D. CHASSIS with valves in brand new condition: TR5, IT4, IS4, 154, complete with Circuit Diagram, showing how this can be converted to a very excellent set for Beach, Lawn, Picnics, etc. Bargain price only 27/6, post 1/-.

EX-R.A.F. 2-VALVE MORSE OSCILLATOR, battery operated, reduced from 27/- to 15/-, carriage 1/9.

MORSE BUZZER, training set, silver point fitted tapper, twin-coil buzzer, adjustable for high and low pitch, with diagram on back, 5/-.

5'- VIEW MASTER T.V.

The Television set anyone can build at home from standard parts. All parts available—list free. Complete book 5/4.

Order C.O.D. or remit with order. When writing please mark envelope (WW).

STOP PRESS.
FABRIF for all cabinets, any size cut, 3/6 per square foot (minimum).
OLD CABINETS—LIKE NEW with Scratch Remover Kit, also suitable for furniture. Complete 5/6 post 9d.
MINIATURE CABINETS, wood grain sprayed, fabric grill, for 2in. speakers, 6/-.

Make your own E.H.T. UNIT

2,000-12,000 volts

We can now offer a range of RF E.H.T. Coils and other components to cover this range, together with full instructions for building. Complete units also available.

Prices :

- 5.5 KV. COIL 22/6
- 5.5 KV. UNIT 75/-
- 8 KV. COIL 30/-
- 8 KV. UNIT 95/-

If 12 KV. UNIT is desired, the 8 KV. Coil with Voltage doubler can be used.

Please write for full details to :

HAZLEHURST DESIGNS LTD.
34, POTTERY LANE,
HOLLAND PARK, W.11.

Tel. : Park 6955.

COMPONENTS—SURPLUS AND SECONDHAND

LOUDSPEAKERS, 8in. new, 15/- by well-known makers; Elstone SR/250 and SR/350 transformers, 21/- each; radio chassis drilled 5-valve and standard components, 3/- each; 2-gang .0005mfd tuning condensers, 3/6 each; single-gang .0005 tuning condenser, 2/6 each; .1mfd and .01mfd 550 volt paper condensers, 4/- doz.; all items carriage paid. Cox Radio, West St., Bognor Regis. [5431]

SYNCHRONOUS clock units, self-starting, 200-250v a.c., 50 cycle, fitted Sangamo motors, consumption 2½ watts, size 2½in dia, 2in deep, geared 1 rev 60 min. electric reset; ideal movements for making electric clocks, time switches, etc., nickel plated finish, complete with 12 to 1 dial train and 5in hands, price 22/6, post paid. Sangamo as above; final speed, one rev. per min. less dial train, ideal for dark-room process time, etc., price 20/- each, post paid.

THERMOSTATS—made by Unity; voltages up to 250-15/20 amps, temperature variable from 35-70 degrees fahrenheit; price 26/- each; trade supplied.

G.E.C. 20hfd condensers; for power factor correction, with internal safety leak, rating, 275 volts, 50 cycles; price 8/- each; special quotation for quantities.

INDICATOR units, type 184a; fitted 3in and 6in cathode ray tubes type ACR.10 and V.C.R. 517B and 17 valves, viz., 6 V.R.92; 5 V.R.91; 3 V.R.54; 3 V.R.65; metal rectifiers, chokes, transformers, potentiometers, resistances; condensers, etc.; £5/10 each, carriage 10/-.

CRATER rotary switches, 250v 10 amps dc single pole 3-way series, parallel, ideal for photo floods, etc.; price 4/- each or 40/- per doz., post paid.

15-AMP Mercury switches; fitted with saddle and clip, 4/- each, postage paid.

A LARGE quantity of electronic items which we do not list, which are available to callers; a so assortment of various ex-W.D. radar and radio equipment, relays power packs, oscillograph units, gears, photographic apparatus; s.a.e. for lists.

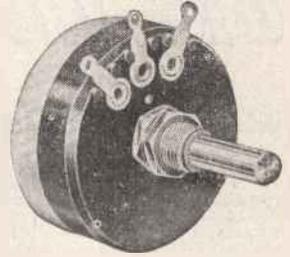
H. FRANKS, 58, New Oxford St., London, W.C.1. One minute from Tottenham Court Rd. Station. Tel. Museum 9594. [0057]

LONDON CENTRAL RADIO STORES.—Set of 4 heavy contacts for relays, etc., new, 2/-; ex-G.P.O. plug and jack, 2/-; throat mikes with plug and cord, 3/- pair; low resistance headphones, new, 4/6 pair; projector lamps, 12v 100watt, new, 9/6; camera motors, 24v, R.A.F., new, 1/6; centrifugal fans, 50v new, 4/6; new carbon mike inserts, 2/6; moving coil inserts, 30ohms for miniature speakers, mikes, etc., 2/6; hand generators, 4/3; 4-bade selector switches, 3/6; high voltage relay, 1,000-ohm, 2/6; ex-Govt. copper aerials, 100ft., with ebonite insulators, 4/3; table stand mike (carbon), 6/-; 2in Magslip receivers, Mark II, 9/6; 5,000ohm variable resistance on round porcelain base, 5/6; rotary transformers, new, made by Hoover, 11.5v input, 450v 65ma output, 8/6; small sliding resistance, ex-army, 100 for voltage control, 2/-; reg. regulator, 500hm 0.5amp, dimensions 6in x 4in, 5/6 each; see our displayed advert, P. 33.—London Central Radio Stores, 23, Lisle St., London, W.2. [5213]

H.R.O. receivers, complete with 7 coils and power pack, £28; Uyah wire recorder, £65; Hallicrafters, S27, SX24, AR77, AR88LF and Hammerlund Super Pro receivers from stock at reduced prices; ex-army 107 receivers, complete and in good order, £10; rotary converters, all voltages and wattage; 20-watt rack mounting amplifiers, complete with heavy duty a.c. power pack, 200-250v, FX25 p.p. output, less valves new, 30/- each; i.t. transformers, 6v-50v, all current ratings special types to order at competitive prices, we invite your enquiries; S meters for AR88, H.R.O. Hammerlund etc., available; mag slips in prs boxed, 3in new, £3 7/6 pair; Bendix 522 transmitter chassis including 2 832 ball coils, etc., 5/6 each; special offer of new meters 5 m.a. 6/6 100 m.a. 7/6; 5 thermo amp meters 5/6, all 2in scale; ex Government S.T.C. ball microphones, perfect, £4/17/6; 12in and 15in energised and p.m. speakers, Roa G12, Magnavox 66, etc.; 2w resistance phones, 3/6 pr; high resistance, 7/6 pr; U.S.A. m/coil, 7/6 pr; special offer of first grade m/coil meters, 500 m.a., 2½in scale, flush mounting, 7/6 each; 500 micro amps, with 2in scale, 3/6 each; 20 micro amps, 2½in scale, flush mounting, 65/- each; 50 micro amps, 2in projecting type, 30/- each; 1 m.a. meter rectifiers, 5/- each; telescope aerial masts, approx. 18ft., 25/- each; new hand bearing compass, with battery compartment in handle, new 85/- each; transmitting valves, 307 8/6, 113 4/6, 723 A/B 50/-, 35T 27/6, 832 22/6, 805 25/-, 829B 30/-, 721A, 931A 72/4A; also available, h.t. rectifiers, type H 176, 8/- each; Bendix receiver, type 2G/ARC5 3-6 mc/s complete with 6 valves and 2w dynamotor new, in sealed cartons, 45/- each; 20-way rotary stud switch, 5½in x 5½in 5/6 each; a.c. d.c. 1-20hp motors, 200-250v, suitable for sewing machines, 40.-; auto transformers from 100w up to 7kw in stock; large and comprehensive stock of relays, types 600-3000 and Siemens high speed uniselectors telephone handsets plugs, jacks, switches etc. 70-axial cable: special offer of mains transformers, 200-250v a.c., tapped 250-0-250, 100 m.a., 6v 4amp, 5v 3amp, £1 each; special offer of new s.v.l. induction electric motors (reversible) suitable for record, v.m. mechanism, etc., 200/250v A.C., 1/80hp, 1,500 r.p.m., 55/- each. New powerful Garrard double-sprung c.c.ockwork motors, complete with 10in turntable, 35/- each. New 3½in diam. A.C. 200/250v induction motors, 1/100hp, suitable for s.v.l., e.s., etc., 30/- each; postage extra on all goods.

SERVICE RADIO SPARES, 4, Lisle St., London W.C.2. Tel. Ger. 1734. [5452]

POTENTIOMETERS



by
RELIANCE

Wire wound and Composition types, Single, Ganged, Tandem Units.

Characteristics: linear, log, semi-log, non-inductive, etc.

Full details from

RELIANCE

Manufacturing Co. (Southwark) Ltd
Sutherland Rd., Higham Hill, Walthamstow E.17
Telephone: LARKSWOOD 3245

Cutofeed SOLDERING IRON

Simple self-feed speeds up soldering. Better work. Saves solder. Write for leaflet 30.J.

RUNBAKEN-MANCHESTER 1

LYONS RADIO

RECEIVERS TYPE R1155A. Frequency coverage n 5 switched bands; 18-7.5 Mc/s, 7.5-3 Mc/s, 1,500-600 Kcs, 50-200 Kcs, 200-75 Kcs. Once again a limited quantity of these well-known receivers are available. Condition as new, supplied in makers' transit case as PRICE £11.10 carr. 7/6. For callers only, some in varying condition from 28.

TRANSMITTING VALVES. Condition as new and unused. TYPE 805, 25/-, TYPE 805, 17/6, post free. 100 Kc. CRYSTALS. Brand new American made. Size 2½ x 1½ x 1.3 18in. with standard U.S.A. 3-pin base. PRICE 15/-, post free.

MAINS TRANSFORMERS. Primary 200-250 v, 50 cps. Secondaries, 350-0-350 v, at 60 mA., 0-4-6.3 v, at 4 A. and 0-4-5 v, at 2A. Can be mounted upright, sideways or as drop through chassis type. Brand new fully guaranteed. PRICE 18/6, post 1/6.

INDICATOR UNITS TYPE 6. Complete with C.R. Tube VCR 97, 4-VR91's and 1-VR54's etc., as specified in several Television designs. Brand new condition in maker's transit case. PRICE 95/-. Carriage 7/6. 30ft. AERIAL MASTS. Made of stout Ashwood sections (Max. dia. 1½in.). All guy ropes, clamps, etc., and illustrated assembly instructions; supplied. Pack into box 3ft. 5in. x 8in. x 5in. Total weight packed approx. 20lb., making it ideal for Field Days as well as a permanent installation. PRICE 45/-. (Carriage 4/6 or free 2 or more.)

3, GOLDHAWK ROAD (Dept. M. W.)
SHEPHERD'S BUSH, LONDON, W.12
Telephone: Shepherds Bush 1729

RADIO G800 OFFERS

ZEPP SPREADERS. 6in. glazed porcelain, 4/6 doz., 40 for 12/6

ALARM BELLS, 100-250 v. A.C. mains. Weather-proof double gong, 9/6.

140ft. coil, 14 a.w.g. enamelled copper wire, 10/-

TRANSFORMER OIL 8/- a gallon.

Trade and Overseas enquiries invited.

ARTHUR HOILE 55, Union Street, Maidstone
Tel. Kent. Phons Maidstone 3155

B. & H. RADIO EAST STREET, DARLINGTON

BASS & TREBLE SEPARATOR
Enables the use of separate speakers for bass and treble. Permits adjustment of amount of treble relative to bass and also allows speakers of different impedance to be used. Kit of parts... £1 9 6

SCRATCH FILTERS.
Gives marked reduction of scratch level without serious effect on treble response 15 0

VARIABLE SELECTIVITY I.F. TRANSFORMERS. 465 kc/s. Give 3 degrees of selectivity. Per pair £1 0 0

WHISTLE FILTER.
Steep trough, adjustable from 4 kc/s upwards. Eliminates 9 kc/s whistle etc. 15 0

All items complete with diagrams and full instructions. Also available tone control units, amplifiers, standard or to specification etc.

SOUTHERN RADIO'S WIRELESS BARGAINS

R.A.F. BOMBIGHT COMPUTERS. Complete with motors, gyro, blowers, gears, etc., etc. Ideal for mod makers and experimenters. The best component value ever offered. 55/7, plus 6/ carriage.

SERVO UNIT ASSEMBLY for bombight computer, including 27 volts motor, gearing, blowers, etc. 17/6.

CONTACTOR TIME SWITCHES. 10-hour movement with thermostatic control. Two impulses per second. Complete in sound-proof case. 10/-, plus 1/4.

TR1196 SIX-VALVES SUPER-HET RECEIVERS. Complete with valves, etc. 22/6.

PERISCOPEs. Ex-U.S.A. Type M.8, complete with removable telescope. 17/6.

COMMAND RECEIVERS. B.C.454 (49/100 metres), B.C.455 (43/49 metres). Complete with six valves. Ideal for easy conversion to mains receivers or car radio. 35/-, plus 1/4. Conversion circuit to mains etc., 1/6.

CAMERA CONTROL UNITS. Type 35 No. 26. Complete in wooden box. 20/-.

LUBERA HOLE CUTTERS. Adjustable from 1/4 to 3/16 in. For use on wood, metal, plastic, etc., 5/6.

RADIO COMPASS INDICATORS. With Selayn motor. 3in. dial 360 degrees. 13/6.

ROTOTHERM. Temperature gauges, from 200 to 500 degrees Fahrenheit. Chromalium finish, 8/-.

SECTIONAL AERIALS. 8ft. Interlocking, 3/6. Base for same, 2/6.

WESTCOTTERS. Wx6 and W112 types, 7/6 per doz. **THREAT MICROPHONES.** Complete with lead and plug. 3/6.

CRYSTAL DETECTORS. Semi-permanent type, 2/6.

RESISTORS. 100 Assorted values, from 1-ward to 3-watts. All useful values, 9/- per 100.

CONDENSERS. 100 Assorted values. All useful sizes. Mica and tubular, 15/- per 100.

INDICATOR UNITS. Type B.292A: seven valves. BX2 (1), BX3 (3), 6H6 (2), 6H8 (1), 6SN7 (2), three B.P.I. Tube, switching motor, etc., etc. Ideal for oscillator conversion, 44/-, plus 5/- carriage.

DRIVE CABLES for B.C.453/4/5. 14ft. long with adaptors at either end, 9/6. post 1/- extra.

RECEIVERS TYPE R1125. Brand new complete with 2 valves. 17/6.

RADIO RECEIVERS TYPE R-28/ARC-5. Complete with 10 Valves, 717 (4), 12SH7 (3), 12SL7 (2), 12A6 (1), etc., etc. 100-156 mc./ca. designed for Crystal Control. 55/-, plus 6/-. Full List of Radio Publications, 2/6.

THOUSANDS OF BARGAIN LINES FOR CALLERS.

SOUTHERN RADIO SUPPLY LTD.
46, Lisle Street, London, W.C. - GER. 6653

COMPONENTS - SURPLUS AND SECONDHAND

EX-GOVERNMENT heavy duty mains transformers: primary 100/250v 50 cycles; secondaries 500-0-500v at 250 MA, 300v at 100 MA, 12v 1 amp, 6.5v 3.5 amp, with common centre tap, and 4v 3.5 amp, massive job, weighing 25 lb., size 7 1/2 in. wide x 6 1/2 in. high, brand new, in original containers; 45 carriage paid, England and Wales.—Weatherheads, Bletchley, Bucks. [5088]

VIBRATOR packs, 6v input. 120v 30mA output. 9/6; co-axial plugs and sockets 4/6 doz.; blowers motors, 12/24 volt 10/-, two boxed 15/-; midjet 3 amp accumulators 2/6; WS19 variometers 2/-; hand generators, 28 volts, 175mA and 300v 40mA, 7/6; variable condensers. 0.0025 with high voltage. 0.002 mica fixed condenser, 1/3, 12/9 doz.; 0-5A thermocouple meters 3/6; 0-2.5 and 0-3A thermocouple meters 3/6; moving coil headphones, with mikes attached, 6/6; carbon mikes 5/9.—Haynsons, 14, St. Mary's Bedford. [0012]

WALTON'S, of Wolverhampton offer more amazing bargains. U.92 paid: Partly stripped 1154 TX, 4/11; 1196, 3/6; No. 18 TX, 6/-; R.3084, brand new in case but less valves, 17/6; co-axial cable 6d per yard, any length supplied; brand new 8in speakers, 12/6; TR.9 receivers, less valves, 7/8; 24v camera motors, 12/6 (were 25/-); 0-500 micro-amp meters, 5/-; polythene low loss dielectric insulators, 5/-; RF units, type 24 or 25, 17/6; EF.50 valve holders, 6d each; 22ft steel masts 20/-, 11ft 10/-; wood masts, approx. 15ft long, 20/- for 4; and hundreds of other bargains, send s.a.c. to-day for lists.

WALTON'S WIRELESS STORES, 203, Staveley Rd., Wolverhampton. [0061]

NOTICES

BRITISH SOUND RECORDING ASSOCIATION—Membership essential to all interested in or actively engaged in sound recording, and in high quality reproduction. Publications available to non-members: The current issue of the Journal, 2/9 p.f. Manual of Equipment and Accessories, 1/2 p.f. Full information, with brochure and membership application form, may be obtained from the Membership Secretary, Harrie J. King, 48, Mount View Rd., North Chingford, London, E.4. [2119]

WANTED. EXCHANGE ETC.
3955

WANTED, burnt out variacs, type 100L.—Box 5399

WANTED, any type magnetophone machine, or parts.—Box 4131. [5481]

WANTED, Magnetophon Tons B, with spares (amplifier not required).—Box 2665. [5074]

VALVES, type 815, must be genuine R.C.A. manufacture and new, any number.—Box 4134. [5493]

PAINTON type D volume controls, less knobs, good cond. tons.—Flat 3, 155, Fortuneswell, Portlath, Exeter. [5409]

RECTIFIERS, J50 and other types required; prices and samples to Ival, 37, Furnival Ave., Slough. [5337]

MARCONI-EKCO standard signal generator TRF144 required.—Newman, Kings 11 House, Tongham, Surrey. [5463]

SERVICE sheets wanted, any quantity, high price paid immediately.—J. Bull, 246, High St., Harlesden, N.W.10. [5425]

WANTED, U.S.A. dynamotors, type DM.32, 12-14 volt, in brand new condition, quantity and price.—Box 3950. [5387]

WANTED, AR.8Ds and SX.28s; cash or part exchange.—PCA Radio, Cambridge Grove, London, W.6. Tel. Riv. 3279. [0080]

WANTED, surplus relays and push-button units, and cond. relays, large or small quantities; highest prices paid.—Box 8485. [5352]

WE pay top prices for used test equipment, all types.—University Radio, Ltd., 22, Lisle St., London, W.C.2. Tel. Ger. 4447 and Ger. 8582. [5992]

WANTED, all kinds of laboratory test equipment, standard signal generators, bridges, oscilloscopes, "Q" meters, etc.; send price and details to:

HATFIELD INSTRUMENTS, 175, Uxbridge Rd., Harwell, W.7. Tel. Exline 0779.

PUCKLE'S time basis, clean copy urgently required; also wish to borrow or buy BC 221 Manual, good price paid.—Ascoli, Prospect House, Letham, Angus. [5357]

WANTED, all types of radio equipment test instruments, radio receivers, personal sets, television, components, etc.; call, write, send or phone.

MILLER'S RADIO, 38a, Newport Court, Charing Cross Rd., London. [5221]

WANTED, speech amplifiers for BC-610 Harrier Crafters transmitters (type BC-614-A or B.C.D.E.).—PCA Radio, Cambridge Grove, London, W.6. Tel. Riv. 3279. [0081]

OFFICIAL American and R.A.F. Air Publications urgently wanted, AP.1086, AP.1086C, AP.1186, all sections, individual air publications on all types of equipment, radio, radar, photography, engineering, etc.—Full details, quantity, prices to Box 3945. [5379]

WE buy for cash, new, used radio, electrical equipment, all types: specially wanted, radios, radiorams, test equipment, motors, chargers, recording gear, etc.—If you want to sell at the maximum price call, write or phone to University Radio, Ltd., 22, Lisle St., Leicester Sq., W.C.2. Ger. 4447.

WANTED, urgently, brand new, the following items: Indicating units type 6E, R.A.F. Ref. 10QB/141, type 62 or 62A, 10Q/13000 or 10Q/37, type 233, 10QB/6294; control units, type 222A, 10LB/6010; transmitter receivers, TR.317C, 10DB/8452, TR.1464; microphones T.17, T.31A; transmitters type T.1131A; transmitters type BC.640A/B; field telephones, type F; advice condition, quantity, prices, etc. to Box 3944. [6378]

You're SURE to get it at

TERMO

ESTABLISHED 25 YEARS

Denco T.R.F. Matched pair Medium and Long Wave, 6/6 pair. Weymouth F.I.F. Matched pair M. and L. Waves, 9/6 pair. Superhet Matched pair M. and L. Waves, 8/9 or 11/6 pair. All types Wearite "P" Coils, 3/- each, in stock. Weymouth Midjet 1 1/2 in. x 1 in. dia., Iron Core, Aerial H.F. or Osc., 3/6 each.

Aluminum Chassis. Substantially made of gauge 16 S.W.G. with four sides, 7 in. x 4 in. x 2 in., 3/11; 9 in. x 6 in. x 2 1/2 in., 4/-; 10 in. x 6 in. x 2 1/2 in., 4/11; 10 in. x 8 in. x 2 1/2 in., 5/6; 12 in. x 6 in. x 2 1/2 in., 7/8; 14 in. x 9 in. x 2 1/2 in., 6/11; 10 in. x 8 in. x 2 1/2 in., 7/8; 16 in. x 8 in. x 3 in., 8/6.

Meter Rectifiers. Westinghouse 250 micro-amp, 11/6; 1 mA., 10/6; 5 mA., 4/9.

Selenium Rectifiers, H.T.L. Wave, 250 v., 50 mA., 5/6; 200 v., 100 mA., 5/9; 250 v., 100 mA., 7/6. Bridge Rectifier, 6 v., 1 1/2 amp., 7/6; 12 v., 1 1/2 amp., 11/6; 12 v., 3 amp., 18/6; 12 v., 5 amp., 25/-; 24 v., 3 amp., 23/6.

Charger Transformers. Each has input of 230 volts. Output (a) 24 volts tapped 15 v., 9 v. and 4 v. at 3 amps., 21/6; (b) 30 volt/tapped 15 v. and 9 v. at 3 amps., 22/-; (c) 15 volt/tapped 9 v. at 3 amps., 14/3; (d) 12 volt, 1 1/2 amp., 11/3; (e) 16 volts tapped 9 v. at 6 amps., 19/9; 15 v. (tapped 9 v.) 11 amp., 11/9.

Filament Transformer. Input 230 volts, output 6.3 v. 11 amp., 7/6; 4 v., 1 1/2 amp., 7/6; Input 200/250 v., output 4 v. (0.2 A.) 1 1/2 amp., 4 v., 2 amp., 6.3 v., 3 amp., 19/6. Input 230 v. output 6.3 v., 4 amp., 16/3; or 4 volt 5 amp., 16/9.

A Midjet T.R.F. Battery Portable "Personal" Kit. A complete Kit of Parts to build a Midjet 4-valve All-Dry Battery Personal Set. Consists of Regenerative T.R.F. Circuit employing Flat Tuned Frame Aerial, with Denco Iron Dust Coiled Coil, thereby ensuring maximum gain for Single-Tuned Stage covering medium Waveband.

Valve Line-up: IT4 (R.F. Amp.), IT4 (Detector), IB5 (1st A.F.) and 354 (output). Includes instead Bolt 3in. Moving Coil Speaker, and a Chassis already drilled and shaped. A consumption of only 7 mA ensures long battery life. The Kit is designed for a cabinet, minimum size 6 1/2 in. x 4 1/2 in. x 3 in. Detailed Building Instructions with Practical Layout and Circuit included with Kit make assembly easy.

Complete Kit for £12.99 (plus 13/7 P.T.). Suitable unpainted Cabinet 6 1/2 x 4 1/2 x 3 in. 12/9. Ever Ready B114 Battery, 9/7. Building Instructions Circuit, etc., supplied separately, 1/-.

"Wireless World" Midjet A.C. Mains 2-Valve Receiver. We can supply all the components, including valves and MC/Col Speaker to build this set as specified in the March issue at a total cost of £3. Reprint of detailed assembly instructions and circuit supplied separately for 9d., incl. postage. A small complete outfit is now available to convert the 2-valve Receiver to the 3-valve Receiver, covering Medium and Long waves, at a total cost of 25 (4in. P.M. Speaker, 10/- extra), including drilled chassis and complete assembly instructions. (Supplied separately for 9d., incl. postage.)

"Wireless World" Midjet A.C. Mains 3-Valve Receiver covering Long and Medium Wavebands. We can supply all the components, including drilled chassis, valves, moving coil speaker, etc., to build this set as specified in the February issue at a total cost of £4/5/-, including a reprint of the Assembly Instructions showing component layout and circuit (reprint supplied separately for 9d., incl. postage).

We can supply all the Components, including Valves, MC/Col Speaker, etc., to build a Midjet A.C./D.C. Mains T.R.F. 3-valve (plus Metal Rectifier) Receiver as designed and specified by a popular Technica Magazine, at a total cost of £4/17/6. A reprint of the assembly instructions and layout available for 9d., incl. postage. An Entirely Complete 3-Valve Amplifier Kit of Parts. Operating on A.C. or D.C. Mains, 200-250 volts. Has an output of max. 3 watts, incorporating a 6in. MC/Col Speaker, Volume and Tone Controls. Price, including Wiring Diagram, 75/-; or without speaker, 65/-.

"ELECTRONIC" VALVE VOLTMETER. We can supply the COMPLETE KIT OF PARTS, including the Valves, Diode and Meter, etc., to build this instrument, as published in the January issue of "Electronic Engineering", complete with a reprint of the wiring diagram and assembly instructions (supplied separately for 9d.) at a total cost of £3/5/-.

TELEVISION !! The "Viewmaster" Telesistor assembly instructions showing Wiring Diagram and Practical Component layout, now available for 5/-. We have the specified Components, including the T.C.O.—Bulgin—Morganite—W.B.—Westinghouse—Plessey—Colvern, etc., outfit in stock. Specified components can be supplied separately, and we can also supply the various Stages 1 to 7 as published for London or Midlands.

"Electronic" Telesistor. Complete range of specified Components in Stock, instructions and explanatory booklet available for 2/6, London area, and at 4/6 for Midlands area.

Send 3d. stamp for our New Comprehensive Stock List. This now shows the various Kits we have available. Please cover postage and packing when ordering.

STERN RADIO LTD.
109 & 115, FLEET STREET, E.C.4
Telephone: CENTRAL 5814 and 2280



Established 1887.

REWINDS

Full comprehensive service, often by return of post.

TRANSFORMERS, CHOKES, FIELDS AS BEFORE, OR TO YOUR SPECIFICATION

See our space in classified column under REPAIRS and SERVICE

AISH & CO. LTD.

Radio Engineers
POOLE · DORSET
Telephone: POOLE 600

A COMPLETE RANGE OF TELEVISION COMPONENTS

- Line and Frame Scanning Assemblies.
- Focus Coils and P.M. Focus Units.
- Line and Frame Output Transformers.
- Line and Frame Oscillator Transformers.
- Combined Line Output transformers and E.H.T. Generators.
- Width controls.
- Video correction chokes.
- Filament transformers, E.H.T. transformers and Smoothing chokes.

Allen Components are specified for the Electronic Engineering Home Televisor and the range includes components suitable for use in all of the popular Home Constructor Sets.

ALLEN COMPONENTS LTD.
1, Shrewsbury Road, Stonebridge,
N.W.10

Telephone: Willesden 3675 and 4901.

The C.D.P. 1950 Model Disc Recorder

Ideal for use in conjunction with your tape recorder.

Write for particulars from:

BOURNE INSTRUMENTS
BOURNE, LINCS. Tel.: 224

HILL & CHURCHILL LTD.

BOOKSELLERS
SWANAGE DORSET

Available from stock:

- Silver—"Microwave Antenna Theory and Design" 68/-
- Smullin—"Microwave Duplexers" 55/6
- Pound—"Microwave Mixers" 47/-
- Pierce and others—"Long Range Navigation" 51/-
- Chance and others—"Electronic Time Measurements" 59/6
- Roberts—"Radar Beacons" 51/-
- Whitmer—"Crystal Rectifiers" 51/-
- Svoboda—"Computing Mechanisms and Linkages" 38/6

(Postage extra)

CATALOGUE ON APPLICATION

REPAIRS AND SERVICE

MAINS transformers rewound, new transformers to any specification.
MOTOR rewinds and complete overhauls; first-class workmanship, fully guaranteed.
F.N. ELECTRIC, Ltd., Potters Bldgs., Warser Gate, Nottingham, Est. 1917. Tel. 3855.
LOUDSPEAKERS rewound and cones fitted, any make, prompt service.—Dodds Radio Service, 34a, Bullington Rd., Oxford. [5509]
REWINDS. Our winding dept. having 1324 R extended and re-equipped with the latest machines, now offers an unrivalled service. ALL types of transformers, field coils, chokes and solenoids, other than wave wound, promptly rewound as an exact replica or to your specification, incorporating the following special features:—
LAYERS paper interleaved; wound with Lew-mex insulated wire; vacuum impregnated; full comprehensive testing during all stages of re-wind and final high voltage interwinding insulation test of at least 2kv; connections made to tag panels or left to required length, colour coded; smart external appearance.
SEND, quoting name and model of receiver or giving particulars of requirements with number and type of valves used.
T.O. Ash & Co., Ltd., Vanguard Works, Poole, Dorset. Tel. Poole 600. [5280]
MAIN and output transformers rewound to pattern or specification, return post service.—H. Pughe, Radio Rewind Service, Brithdir, Nr. Dolgelly, N. Wales. [3198]
MAINS transformers rewound or constructed to any specification; prompt delivery.—Bede Transformer Co., Ltd., Bedesway, Bede Trading Estate, Jarrow. [3198]
TELEVISION sets converted from London to Midlands station; radio repair and assistance to home builders.—E. W. Shackle, High St., Harlington, Hayes, Middx. [5165]
MAINS transformers rewound or constructed to any specification, prompt deliveries.—Avon Transformer Co., 20, Heath Terrace, Leamington Spa, Warwick. [4498]
REPAIRS to moving coil speakers, cones, R coils fitted, field rewind or altered; speaker transformers, clock coils rewound; guaranteed satisfaction, prompt service.
L.S. REPAIR SERVICE, 49, Trinity Rd., Upper Tooting, London, S.W.17, Balham 2559.
TELEVISION, radio and amplifier repairs or modifications; home built receivers aligned and tested; quotations by return; any type transformer or coil supplied.
BERNARDS 12 Chelverton Rd., Putney, London, S.W.15. Pat. 50099
L types of ammeters, voltmeters, Avons, etc. repaired; quick, efficient service, estimates free.—Donvin Instrument Co., 91, Princedale Rd., London, W.11. Tel. Park 4469. [5059]
ELECTRICAL measuring instruments of every make repaired and standardised.—The Electrical Instrument Repair Service, 329, Kilburn Lane, London, W.9. Tel. Lad. 4168. [3715]
REWIND service which duplicates or modifies as required; transformers, loudspeakers, etc.; prompt returns.—Raidel Services, 49, Lr. Addcombe Rd., Croydon, Cto. 6537.
REPAIRS—E.H.T., mains and O.P. transformers, field coils and chokes; also armatures and motors; new transformers designed to any specification; all work fully guaranteed.
WILLESDEN TRANSFORMER CO., Ltd., 781, Harrow Rd., N.W.10. Tel. Ladbroke 2846.
"SERVICE with a smile.—Repairs of all types of British and American receivers; coil rewinds; American valves, spares, line cord.—F.R.I., Ltd., 22, Howland St., W.1. Museum 5675. [1575]
RADIO MAINTENANCE SERVICE for suburban teed rewinds and repairs; armatures, P.H.P. motors, vac. units, portable tools, etc.; good deliveries.—139, Goldhurst Terrace, N.W.6. Mal. 6153. [5925]
LOUDSPEAKER repairs of every description executed at reasonable cost, with promptness and efficiency.—Messrs. Garr, Lee Warner & Shepherd, 256, Burnt Ash Hill, Grove Park, S.E.12. [5494]
"STURDY" rewinds, mains transformers, chokes and fields, first-class work, prompt deliveries and satisfaction guaranteed.—Sturdy Electric Co., Ltd., Dipton, Newcastle-on-Tyne. [2430]
A SECOND-to-none rewind service, reliable, next return of post service; your television requirements promptly executed, EHT, LHT and heater transformers; stamp for quotations.—R. E. F. 137a, Ashton Rd., Oldham [3519]
ALIGNMENT and repair of communication receivers and all other short wave equipment, receivers and amplifiers built to specification, experimental and design work executed.—PCA Radio, Cambridge Grove, London, W.6. Tel. Riv. 3279. [0093]
METROPOLITAN RADIO SERVICE for re-winds, mains and E.H.T. transformers, chokes and field coils; delivery 3-5 days; new transformers designed and manufactured singly or in quantities.—Metropolitan Radio Service Company, 1021, Finchley Rd., London, N.W.11. Tel. Speedwell 3000.
REWINDS.—Send your "burn outs" to be rewound; no technical data wanted; post transformer, etc. labelled with your name, address, and marked "for rewind"; our windings are double wound, interleaved and impregnated.—Southern Trade Services, Ltd., 297-299, High St., Croydon, Tel. 4870. [3110]
NATIONAL AUDIO SERVICE & TELEVISION Co., the complete service for high fidelity construction and maintenance; high fidelity receivers and amplifiers built to specification, converted and modernised; also transformer and armature rewinds and speaker repair service.—92, High St., St. John's Wood, N.W.8. Primrose 6725. [5305]

CABOT RADIO

A New Television Pre-amplifier

Model B. Has an effective gain of 10 times, and an extremely high signal/noise ratio. Capable of operating at an input of 5 microV. without showing deterioration of picture quality due to its own generated noise. Uses Mazda 6F1 valve in an up-to-date circuit. Bandwidth 5 mcs. Entirely self-contained, and operates from 200-250 v. A.C. 50 c.p.s. only. Size: App. 4in. cubed. Available for London or Birmingham frequencies from your own dealer.

Price £5.15.0

Including 6F1 valve.

If in difficulty write direct to:

Cabot Radio Co. Ltd.,
28, Bedminster Parade,
Bristol 3
Tel: 64314

LOCKWOOD

makers of

Fine Cabinets

and woodwork of every description for the Radio and allied trades

LOCKWOOD & COMPANY
Lowlands Road, Harrow, Middlesex. Byron 3704

SAMSONS SURPLUS STORES

Ex Govt.

A.M. POWER UNIT TYPE 45 for 1154Tx. Input 200/250 v. 50 c.p.s. Output 1300 v. 300 mA. 25/10/-, plus 10/- carr.
A.M. POWER UNIT TYPE 46. Input 200/250 v. 50 c.p.s. Output 230 v. 110 mA. 6.3 v. 15 amps. 28/10/-, plus 10/- carr.
R.A.F. TYPE 50. 36ft. Steel Aerial Masts. Complete kit consists of 9 tubular sections 2in. dia. set of pickets. Box plate, guy and all fittings. Brand new in canvas carrying bag. 23/15/-, plus 7/6 carr.
HEAVY DUTY AUTO TRANSFORMERS, tapped 110, 150, 190, 230 v. 1.6 kVH. 24/10/-, plus 5/- carr.
HEAVY DUTY TRANSFORMERS. Prim. 180-230 v. 50 c.p.s. Sec. 14 v. 20 v. 30 amps. 37/6, plus 2/- carr.
L.T. TRANSFORMERS. Prim. 200-250 v. 50 c.p.s. Sec. 6.3 v. 15 amps. 15/-, plus 1/6 carr.
L.T. TRANSFORMERS. Prim. 230 v. 50 c.p.s. Sec. tapped 8v., 12 v., 3.3 amps. and 6 v. 5 amps. 17/6, plus 1/- carr.
COAXIAL AERIAL FEEDERS, 30ft. coils with Pye Socket on each end, 3/6, plus 1/- carr.
HEAVY DUTY L.T. TRANSFORMERS. Prim. 180-230 v. 50 c.p.s. Sec. 4.2 v. + 4.2 v. 10 amp., 17/6, plus 2/- carr.
L.T. TRANSFORMERS. Prim. 230 v. 50 c.p.s. Sec. tapped 9 v. 15 v. 1 amp., 12/6, plus 1/- carr.
Hundreds of bargains for callers. Edgware Road branch open all day Saturday.

169/171 Edgware Road, London, W.2. Tel.: Padd. 7851.
125 Tottenham Court Road, W.1. Tel.: Bus. 4992.
All orders and enquiries to our Edgware Road branch please



5 SOLON MODELS

SOLON electric soldering irons have proved their capacity for continuous service under the most exacting conditions. 5 models; 240 watt oval tapered bit; 125 watt oval tapered and round pencil bits and 65 watt oval tapered and round pencil bits. Each model complete with 6 feet of Henley 3-core flexible. Now available from stock. Write to folder Y.10.



W. T. HENLEY'S TELEGRAPH WORKS CO. LTD.
61-63 Hatton Garden, London, E.C.1

SPECIAL BARGAINS
Govt. Surplus, Manufacturers' Surplus & Bankrupt Stocks.

We can offer for immediate delivery

- Bakelite Accumulators. Ex-Govt. S.W.
- Metal Rectifiers.
- Condensers. All Types.
- Meters.
- Switches. Toggle and Yaxley.
- Headphones, L/R and H/R.
- Vibrators, 6 and 12 v.
- Speakers. All types.
- Volume Controls.
- Output Transformers.
- Chokes.

Receivers. R1155 and 1355, brand new in original cases.

Your enquiries are invited.

Wholesale and Export only

Please enquire for our 12 Page Bulletin.

RADIO MERCHANDISE Co. Ltd.

65, Farringdon Road, London, E.C.1.
Telephone: Holborn 6377

REPAIRS AND SERVICE
24-HOUR service, 6 months' guarantee, any transformer rewind, mains outputs and i.f.s., etc.; all types of new trans., etc. supplied to specification; business heading or service card for trade prices.—Majestic Winding Co., 180, Windham Rd., Bournemouth.

WORK WANTED
F. W. ELECTRONICS can undertake design and production of electronic equipment; limited capacity available.

F. W. ELECTRONICS, 16, The Avenue, New Southgate, N.11. Tel. Enterprise 4079. [5359]
QUALIFIED radio television engineers with own stock, van, workshop-front, accepting work, servicing, sales, installations, etc. assembly.—Box 3960. [5418]

LONDON MANUFACTURING CO. can undertake production of light metal pressing small mechanical parts, turning or drilling.—Apply Hatfield Products, 1, Hatfields, S.E.1.

SPECIAL receivers, test gear, electronic apparatus, experimental and design work.—If you have a problem which needs expert handling, write in first instance to J. Mort, B.Sc., A.M.I.E.E., E.C.M./H.F.I.D.L., London, W.C.1.

DRAWING tracing and phototyping services; estimates free; contractors to the Ministry of Supply and the Admiralty for drawing and tracing work to their requirements and specifications, sub-contracting work of this nature undertaken.

DRAWING & TRACING LTD., 456a, Ewell Rd., Feltham, Surrey. Tel. Elmbridge 7406. 14183

WE offer the facilities of our modern factory to the radio trade: our surplus capacity includes light electrical and mechanical assembly equipment. Flowline conveyors readily adaptable to radio trade requirements; modern tool design office and tool room for press tool and jig production; machine shop including automatics, capstans, power and hand presses, rotary swaging, prototype work undertaken; A.I.D. and A.R.B. approved; competitive prices and continuity assured.

SUTER ELECTRICAL ENGINEERING LTD., Eugene Building, Welsh Harp, London, N.W.9.

MISCELLANEOUS

ALUMINIUM chassis, plain or fully drilled at negligible extra cost.

12IN x 6IN x 2 1/4IN, with rear fixing flange. 3/9. post paid.
FOR other sizes see last month's issue.

1 1/4IN dia or 1 1/2IN dia valve holes, etc., 1 1/2IN x 1/2IN A and E slots, etc., 1in sq i.f., all at 3d. each.

TRANSFORMER cut-outs (any size), 6d.; control spindle holes, etc., 2d. All prices include marking out to your rough sketch; cash with order or s.a.e. please with enquiry.

TAYLOR & TOY, Dog & Duck Ferry, Worcester.

ACCOUNTANT prepares accounts and income tax returns; write—Box 3908. [5405]

NEW Console television cabinets, Electronic Viewmaster, 9in or 12in, £10.—Box 3955.

48 "Wireless Worlds," 1945 onwards, 26/-; Adams, 18, South Parade, Whitby [5361]

SUPERB quality walnut radiogram cabinets; 8 stamp, leaflets.—Cabinetware, 1A, Heyes St., Blackburn. [0091]

RADIO and television cabinets made to individual requirements.—Sketch and details to Burman's, 64, Reighton Rd., London, E.5. [5020]

WALNUT radiogram and television cabinets, manufacturers' samples, few only; stamp details.—Walters, 501, Hale End Rd., E.4.

TELEVISION mast sections, 8ft 9in x 3in dia., 9in tight fitting sockets; steel tubular; reach any height, 15/6 ea 6 or more 13/9 ea., all car. paid.—Foundation Oil Co., Ltd., 9, Orford Hill, Norwich. [4971]

STROGRAPHS, U.S. type, in strong cases; telephone sets, balanced armature, cheapest intercom, no batteries, 25ft flex; instrument wire; insulation materials; many other radio and electrical bargains; send s.a.e. for list.

C. NORTHALL, 16, Holly Rd., Quinton, B'ham, 32. Retail at 416, High St., Smethwick. Tel. Woo. 3166. [5444]

ENGRAVING, amateurs and trade could take the opportunity of engraving problems in the future by getting in touch with A.G. Engraving, 19a, Windmill Rd., London S.W.18. Brass, bronze, erinoid, perspex dials; one knob or repetition equally entertained. [0034]

FLUORESCENT lighting, 80-watt choke ball-glow starter, 3 holders, tube clips, 55/9 pair, paid, buy your 5ft tube locally; other snips; brand new pair PX25s with matching P/P transformer, 5 ohm, 36/-; meter, M/c scaled 0-1.5v, 0-3v, 0-60mA, 0-5,000 ohm, 3in, 12/6; SU4G, 5/-.

MALDEN TRANSFORMER SUPPLIES, The Arcade, George St., Richmond, Surrey. [0038]

COPPER wires enamelled, tinned, Litz, cotton, silk covered, all gauges; BA screws, nuts, washers, soldering tags, eylets; ebonite and laminated bakelite panels, tubes, coil formers; Tufal roofing, sponges, flexes, etc.; latest radio publications, full range available; list, s.a.e.; trade supplied.—Post Radio Supplies, 33 Bourne Gardens, London, E.4. [1454]

A REAL bargain at £350.—A complete public address caravan, built with hardwood steam-bent framing, covered with heavy gauge Tufal roofing, sponges, flexes, etc.; wheels; two 30-watt built-in amplifiers (Woden transformers and chokes throughout) and T.C.C. 750-volt block condensers 7.5, 15, 250 and 300 lines output; five-valve three waveband radio, can be used as tuning unit for amplifiers or as separate radio and motor speaker; twin gram turntables with connoisseur pick-ups, also two rotary converters.

N. L. TAIT, "Cartref," Middle Lane, Lubenham, Market Harborough, Leics. [5345]

SUPACOILS

OFFER

QUALITY COMPONENTS

- **COILS.** A complete series of High Q variable iron dust cored coils in wave-lengths 10-30, 16-50, 30-75, 75-200, 190-550 and 800-2000 metres; Aerial, H.F. or Oscillator at the remarkable price of 2/3 each
- **MODEL 30** famous 3 waveband superhet Coil Packs, aligned 27/9 inc. Full connection details and instructions given with every pack.
- **MODEL 40** Coil Packs—similar, with R.F. stage, aligned 54/6 inc.
- **I.F. TRANSFORMERS**, iron-cored, high stability, aligned to 465 kc/s., 12/- pair.
- **MODEL 30 TUNING UNIT** consisting of 30 Coil Pack, pair of "M.M." I.F. Transformers, matched 2-gang and attractive Dial. Components aligned together as a unit and sealed 54/9 inc.
- **MODEL 40 TUNING UNIT**, similar, with R.F. stage 86/3 inc.
- **SL8**, Either of the above tuning units with the latest J. B. Horizontal Spinwheel tuning assembly and dial (SL8) 21/9 extra
- **COMPONENTS**—Complete range of radio, television and gram components in stock at lowest prices.

AND OF COURSE

THE LATEST EDITIONS OF THE HOME CONSTRUCTOR'S HANDBOOK

The Booklet no keen radio enthusiast should be without. It is invaluable to beginner, amateur or professional radio engineer and contains, among other things:

- Circuits of feeder units, superhet receivers, amplifiers and power packs, etc.
- Pages of servicing and constructional information which will assist you in YOUR radio problem.
- Complete resistance colour code.
- A considerable amount of invaluable general Radio information.
- A comprehensive catalogue.
- Above all it is profusely illustrated with half tone blocks and costs 1/- only or a copy will be given FREE with every order for £1 or more.
- Stop Press! Enlarged edition just published, price 1/6.

SUPACOILS MAIL ORDER OFFICE
98 Greenway Ave., London, E.17

AMPLIFIERS KIT for HOME CONSTRUCTORS Quality

A complete set of components to construct a 10 watt amplifier including Woden potted mains transformer. 5 valves, 10in. speaker with transformer. Components of the highest quality. No Govt. surplus. Three switched inputs, negative feed back, push-pull output. Price Complete to the last screw Suitable home or small hall. **£8 0 0** CASH WITH ORDER (Subject)

BEETHOVEN LTD ELECTRIC EQUIPMENT
Chapel Lane, Sands, High Wycombe Tel: 1152/3

POST RADIO SUPPLIES

OFFER EX STOCK

COPPER INSTRUMENT WIRE.
ENAMELLED, TINNED, LITZ.
COTTON AND SILK COVERED.

Most gauges available.

B.A. SCREWS, NUTS, WASHERS,
soldering tags, eyelets and rivets.

EBONITE AND BAKELITE PANELS,
TUFNOL ROD, PAXOLIN TYPE COIL
FORMERS AND TUBES, ALL DIAMETERS.

Latest Radio Publications.

THE CRYSTAL VALVE

as used in radar receivers.

These Crystal Valves or Diodes are not Government Surplus but brand new goods manufactured by one of the largest and most famous Radar Equipment Manufacturers in the country.

3/6 each, postage 2½d.

Protective Tube and Fixing Brackets, 3d. extra.
Send stamped addressed envelope for comprehensive lists. Trade supplied.

POST RADIO SUPPLIES

33, Bourne Gardens, London, E.4.
Phone: CL 5502 4688

MISCELLANEOUS
ALLSCREWS Ltd., for B.A. screws, nuts, washers, studs, grub-screws, bolts, soldering tags, woodscrews, etc., plain or nickel or cadmium plated, one-gross packets or large quantities; stamp for lists.—270a, King St., Hammersmith, W.6. Riv. 7762. [5426]

SITUATIONS VACANT

ENGINEERING OFFICER.
SUDAN GOVERNMENT POSTS AND TELEGRAPHS require one Engineering Officer (Aeradio) for service in the Sudan; duties involve installation and maintenance of all classes of radio transmitters, aerial arrays, direction-finding equipment, and modern radio aids to navigation (radar, etc.); only men with wide practical experience in this field need apply; knowledge of diesel-alternator plants and A.C. distribution systems an advantage; City and Guilds Radio-communication certificates (or equivalent) desirable, but not essential; age preferably 28 to 36; appointment will be on Short-Term Contract for 5 years at a starting salary between £E540 and £E675 per annum, according to age, experience and qualifications (£E1—£E1,076); a post-service bonus is payable; a cost of living allowance of £E180 for bachelors rising to £E390 per annum, according to number of dependants, is at present payable, and subject to certain limitations an outfit allowance of £E40 is payable on appointment; there is at present, no income tax in the Sudan; free passage of appointment; full particulars and application form obtainable from Sudan Agent in London, Wellington House, Buckingham Gate, London, S.W.1; please mark envelope "Engineering Officer". [5491]

GOVERNMENT OF INDIA.

THE Government of India require the services of two qualified electrical engineers (Electronics) in a Service establishment for training personnel in the maintenance and repair of equipment, one for high-powered wireless sets as used in the Services and the other for modern Radar equipment.

CANDIDATES must be competent engineers and should be Corporate Members of the Institute of Electrical Engineers, or hold equivalent qualifications exempting them from Part A and B of the examinations. An Honours degree would be an advantage. They must have had a thorough specialised training in their respective fields with subsequent practical experience in repair and maintenance of equipment used in the Services. Those with experience in methods of training would be preferred.

THE appointments in the first instance would be for three years. The initial salary would be between £1,400-£1,600 per annum, according to experience and qualifications, but a higher pay may be offered to an exceptionally well-qualified candidate. Income Tax would be on Indian rates, which is approximately 1/10th of the income. The normal rules regarding passage, free medical attention, accommodation and leave, will apply.

APPLICATION forms available on request by postcard, quoting No. 4/44H, from the Secretary, General Department, Office of the High Commission of India, Aldwych, London, W.C.2. Applicants should state their qualifications, the post applied for and the pay required. The latest date for the receipt of completed applications at above address is 19th June, 1950. As certain points in connection with these posts may have to be referred to the Government of India, it is likely that there will be an interval between the date of receipt of the application and the date for interview of selected candidates. [5479]

CROWN AGENTS FOR THE COLONIES.

RAILWAY wireless and telegraph superintendent required by the Nigeria Government for one year or 24 months with prospect of permanent and pensionable employment. Commencing salary according to qualifications and experience in scale £860 rising to £970 a year; outfit allowance of up to £60; free passage; liberal leave on full pay; candidates under 40, should have a sound knowledge of wireless operating and international procedure and have had experience in the control of wireless telegraph and telephone networks spread over a wide area; preference given to candidates possessing a Postmaster General's Certificate in wireless telegraphy; some technical knowledge of modern low power radio transmitters and radio receivers an advantage; employees of the General Post Office should apply through departmental channels. Apply at once by letter stating age, whether married or single, and full particulars of qualifications and experience and mentioning this paper, to the Crown Agents for the Colonies, 4 Millbank, London, S.W.1, quoting M/N/25419(3B) on both letter and envelope. The Crown Agents cannot undertake to acknowledge all applications and will communicate only with applicants selected for further consideration. [5370]

TECHNICAL ASSISTANTS, 20-30 years, for development of marine electronic and electrical apparatus.

WORK involves: (a) Initial experiments, (b) prototype construction and testing at sea, (c) elimination of production troubles.

QUALIFICATIONS: 3 years' workshop experience Higher National Certificate or City and Guilds Radio Communications Grade 3.

WORKS situated N.E. London.

WRITE, stating age, experience and salary required, to Box 3947. [5382]

DEVELOPMENT engineer, experienced in radio test equipment good pay and prospects.—Write Taylor Electrical Instruments, Ltd., Slough, Bucks. [5436]

Birmingham or London on a London Type Television Receiver, with a Spencer-West CONVERTOR UNIT Type AC/4.

This unit permits a London type Television receiver to be employed for the reception of the Sutton Coldfield transmitter, without alteration or re-tuning of any kind. The output socket is simply connected to the aerial socket of the London type Television receiver, and a Birmingham aerial is connected to the Converter unit's input socket. The unit is suitable for use both in the Birmingham service area and in localities where a choice of either station, depending upon the day-to-day reception conditions, is necessary.

SPECIFICATION

- 5 valves.
- Completely self-contained, including power supply unit to suit A.C. mains 200-250 v. 50 cycles.
- Both sound and vision channels are automatically converted to the correct frequencies.
- Pre-Amplifier stage to ensure high quality reception and freedom from noise.
- Incorporating only material and components of the highest quality.
- Manufactured to the usual Spencer-West standard.
- Fully guaranteed.
- Price complete with valves, etc., £15/15/0 (packing crate returnable, charged 5/-).
- Delivery ex stock.

SPENCER-WEST

Mfrs. of Scientific Equipment & Electronic Instruments.
Quay Works, Gt. Yarmouth, England.

YOUR METER DAMAGED ?



Leading
Electrical
Instrument
Repairers
to the
Industry.

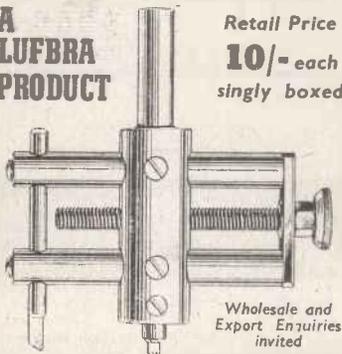
Repairs by skilled craftsmen to all makes and types of Voltmeters, Ammeters, Microammeters, Multirange Test meters, Electrical Thermometers, Recording Instruments, Synchronous Clocks, etc. Quick deliveries—for speedy estimate send defective instrument by registered post to—



L. GLASER

Electrical Instrument Repairers
341 CITY ROAD, E.C.1.
Tel. Terminus 2489

A LUFBRA PRODUCT



Retail Price
10/- each
singly boxed

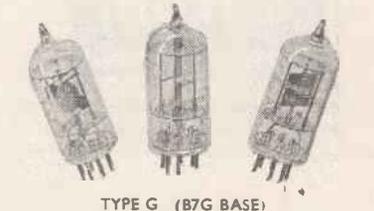
Wholesale and
Export Enquiries
invited

Adjustable FLYCUTTER A PRECISION TOOL

for the Craftsman and Handyman; also available with square shank for brace for cutting holes from 1" to 4 1/4"; also HCLE CUTTER for use with Hand Drill 5/-, also HCLE CUTTER for use with Carpenter's Brace 5/- each.

LUDFROY, LTD.

189 WARDOUR STREET, LONDON, W.1
Tel.: GERard 7685



TYPE G (B7G BASE)

ENQUIRIES FOR ALL TYPES INVITED

BROOKES CRYSTALS LTD.

10 STOCKWELL STREET,
GREENWICH, LONDON, S.E.10.
PHONE GRE. 1828. CABLE. XTALS LONDON

WILCO ELECTRONICS

CONDENSERS. 8 mfd. 750v. D.C. block type. Ideal for Williamson Amplifier, 10/6 each.

C.R. TUBES. V.C.R. 139A, 2½in. Electrostatic 15/- each. Holders for same, 2/- each.

V.C.R.97, 6in. 35/- each. V.C.R.516, 9in. Magnetic £5 each. V.C.R.140, 12in. Magnetic £6 each. For callers only.

RACKS, STANDARD P.O. 19in. with heavy angle iron base 5ft. 60/-; 6ft. 70/-; 5ft. 6in. lighter type 50/-.

OPERATORS DESKS. Standard 19in. Rack Mounting 12in. deep 15/- each.

SPEAKERS P.M. 5in. Rola in case 17/6 each.

AMPLIFIERS. 15 watt. complete with Power Pack, less valves, rack mounting, Input M.H.L.4 driving two PX25's—Push-Pull £6 each, carrying extra.

CO-AXIAL CABLE for T.V. down lead, 75 ohm, 10½d. per yard.

MICROAMMETERS. F.S.D. 25 microamps, scaled 0-500, 2½in., 57/6 each.

VOLTMETERS. 0-300 A.C. M.I., 2½in. flush, 17/6 each; 3½in. 22/6 each.

WAVEMETERS. 8-14½ centimeters, complete with magic eye, valves, power pack, 230v. 50 cycles, A.C., £3/10/0 each.

204 LOWER ADDISCOMBE ROAD,
CROYDON ADD. 2027

ANSWERS AT YOUR



FINGER-TIP

Answers
FLIK-O-DISK
Quick!

ELECTRICAL AND RADIO ENGINEERS OHM'S LAW CALCULATOR

Whether you are constructing or servicing a radio set, problems involving voltage, current and resistance can delay progress.

Flik-o-Disk will give the answer in a jiffy. For example, what resistance should you use to obtain a voltage drop of 100 v. when current equals 25 m.a.? A flick of the disk and there is your correct answer—4,000 ohms. The scales read from 1 millivolt to 1,000 volts. From 1 ohm to 1,000,000 ohms. From 1 milliamp to 10 amperes. From 1/10th of a milliwatt to 10,000 watts.

Please send a postal order for 6/6 to:—

PRICE

6/6

IONIC LABORATORIES LTD.
Swinley Buildings, Bath Road,
CIPPENHAM SLOUGH,
BUCKS.

SUCCESSFUL SALES! SATISFIED CUSTOMERS!

Pennine RADIO

THE ALL SEASON SENSATION. ACCLAIMED THE COUNTRY OVER. THE INTIMATE RECEIVER WHICH COMBINES APPEARANCE AND PERFORMANCE. HOUSED IN A BEAUTIFUL WALNUT CABINET. EACH SET FULLY GUARANTEED.

HEIGHT 10", WIDTH 12", DEPTH 5 1/2"
4 Valve SUPERHET

THE SET THAT SELLS ITSELF!

UNBEATABLE VALUE
£11 9 7
INC. TAX



"THE ROVER"

SUPPLIED ONLY THROUGH SELECTED WHOLESALERS. ILLUSTRATED LEAFLETS AND ATTRACTIVE DISPLAY CARDS.

PENNINE AMPLIFIERS
ELLAND YORKS ENGLAND
TEL. ELLAND 2107

SITUATIONS VACANT LONDON COUNTY COUNCIL.

NORWOOD Technical College. Applications are invited for a proposed new post of head of the telecommunications engineering and physics department, to take up duties on September 1st, 1950.

APPLICANTS should possess an Honours degree in electrical engineering (telecommunications) or physics, and suitable teaching and industrial experience.

The salary is expected to be in accordance with the Burnham Scale for Head of Department Grade III—800 by £25 to £250 with graduate and training additions and London Allowance. FORMS of application and further particulars can be obtained on receipt of a stamped addressed foolscap envelope, from the Principal at the College, Knicht's Hill, S.E.27, to whom completed forms must be returned not later than 14 days from the date of the appearance of this advertisement. (517) [5440

CLAREMONT Street Hospital.

ASSISTANT electroencephalograph technician. APPLICATIONS are invited for the post of assistant technician (recording) in the electroencephalographic department; the work involves the operation and minor maintenance repairs of highly specialised electronic equipment which records electrical activity of the brain; full opportunities for training in this new and highly important field of development will be afforded.

The salary attaching to the post is at the rate of £225 per annum, and will be subject to review in the light of future developments. **APPLICATIONS** (in writing), stating age, qualifications and experience, should be sent to the Secretary, Claremont Street Hospital, Claremont St., Belfast. (5375)

CROWN AGENTS FOR THE COLONIES.

WIRELESS station superintendent required by Nigeria Government posts and telegraphs department, (for aeronautical wireless stations) for 18-24 months with prospect of permanency; salary according to age and experience in scale £660-£850 a year (including expatriation pay); outfit allowance £60; free passages; liberal leave; candidates must hold first-class radio-telegraph operator's certificate, have recent experience in wireless operating and direction finding apparatus, have thorough knowledge of transmitters and receivers and be capable of maintaining (under an engineer's instructions) diesel engine sets driving small generators. Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience, and mentioning this paper to the Crown Agents for the Colonies, 4, Millbank, London, S.W.1, quoting M/N/2404(32) on both letter and envelope. The Crown Agents cannot undertake to acknowledge all applications and will communicate only with applicants selected for further consideration. (5360)

CROWN AGENTS FOR THE COLONIES.

WIRELESS operator/mechanic required for the Nyassaland Government Aviation Department for 2 to 3 years with prospect of permanency. Commencing salary according to age, qualifications and experience in the scale £490 to £865 a year. Outfit allowance £50. Free passages. Candidates, aged 25 and preferably single, must have had at least 4 years' secondary education and be able to transmit and receive Morse at 25 words per minute in plain language, and code groups at 20 groups per minute. They must have a knowledge of the operation of radio transmitters and of diesel electric plants up to 15 kVA, the installation and maintenance of V.H.F./D.F. equipment, the theory and design of aerial systems, and of radio theory and workshop experience. Apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience and mentioning this paper to the Crown Agents for the Colonies, 4, Millbank, London, S.W.1, quoting M/N/2945(33) on both letter and envelope. The Crown Agents cannot undertake to acknowledge all applications and will communicate only with applicants selected for further consideration. (5447)

CROWN AGENTS FOR THE COLONIES.

RADIO Officer required by East Africa High Commission for Posts and Telegraphs Department for one tour of 48 months in the first instance; commencing salary according to age in scale, £550 rising to £715 a year; gratuity of 15% per cent of total salary payable on satisfactory termination of contract; outfit allowance £300; free passages; candidates, aged between 25 and 38, must possess Postmaster General's First-class Certificate of Competency in Radio Telegraphy, the equivalent certificate of the Air Ministry, or the Ministry of Civil Aviation, or other equivalent service qualifications, and have had considerable experience in the operation of medium and high-frequency radio stations; experience in the operation of modern radio and/or radar navigational aids and the day-to-day maintenance of modern radio equipment an advantage; preference given to candidates with flying experience and/or experience as Station Signals Officer; apply at once by letter, stating age, whether married or single, and full particulars of qualifications and experience, and mentioning this paper to the Crown Agents for the Colonies, 4, Millbank, London, S.W.1, quoting M/N/25107 (33) on both letter and envelope; the Crown Agents cannot undertake to acknowledge all applications, and will communicate only with applicants selected for further consideration. [5404

NUSOUND PRODUCTS

136 WARDOUR ST., LONDON, W.1

Tel. GERard 8845

HOME BUILT TELEVISION AND AMPLIFIER SPECIALISTS

Full Mail Order Facilities (Add Postage)

Mon./Fri. 9-3.30 p.m. Sat., 9-1 p.m.
A QUALITY AMPLIFIER AND RADIO FEEDER. The 4-valve Amplifier Chassis has an output of approx. 4 1/2 watts. Includes 3 stage neg. feedback circuit and incorporates independent bass and treble boost controls and pre-amplifier stage. Circuit consists of EF36 Pre-Amp, EF36 Boost into 6V6 and special quality output transformer. Full constructional booklet for A.C. and A.C./D.C. models price 1/6. The A.C. model can be built for a little less £7, using surplus valves and A.C./D.C. for £8 with new valves. Built up complete and tested, both models cost 10 gu., complete with new valves. The radio feeder is a wide band T.R.F. using air spaced trimmers and pre-set to three stations with switched control. It is plugged straight into the Amplifier and together you have a high fidelity combination which nothing but the most expensive radiogram can compete with. Full constructional booklet price 1/6. Cost to build, £3/10/-.

VIEWMASTER TELEVISION (working model on view) Full constructional envelope for London or Birmingham, 5/-. All components in stock. For above and Electronic television. Viewmaster cabinet £6/17/6, post 3/6.

80 ohms 1/4 in. coax., 9d. yard. 80 ohms Flat Twin Feeder, 6d. yard. Audence Four Way Indoor Aerial, 25/-. We stock all makes of tubes, 9in., £11/6/10; 12in., £15/2/5.

GRAMOPHONE EQUIPMENT. Connoisseur pickups: Standard, £3/10/0; Trans., 13/-; L/c, eight, one head £5/14/8; Trans., 15/-; 6 tube pickup, £4/3/0; special Trans., 25/-; Acos. GP20 7/1/3; Goldring lightweight, 6/1/4; Miniature or standard sapphire, 6/8; ruby, 8/8; Connoisseur Steel 20 for 2/10; Trailer Sapphire, 6/6. We stock a full range of Wharfedale speakers, W. B. Duplex speaker, £6/6/0; Goodmans Arlon 150 Twin Cone, £8/8/0; Goodmans Arlon 60, £8/15/0; Goodmans Audion 22 20 watt twin cone, £12/13/0.

METAL RECTIFIERS. Voltages equal D.C. output volts.
N.T.C. H4/200 2.4 kv. 3.5 m.a., 29/6. S.T.O. H25/80 420 v. 150 m.a., 21/9. S.T.O. H18/30 280 v. 60 m.a., 15/-. S.T.C. H1/Miwa 1 m.a., 2/6. Westinghouse, 36EH/100, 3.5 kv., pulse input 5.5 kv., 26/3. 16HT56 1.76 kv. 3 m.a., 21/-. 36ERT25 875 v. pulse input 1.3 kv. 14A86 340 v. R.M.S. 180 m.a. MAX. 1, 21/2.

NUSOUND TRANSFORMERS. (Tapped pri. unless otherwise stated.)

A few selections from our wide range, and we can wind to your own spec. delivery 3 days. Estimates free. 350-0-350 v. 150 m.a., 6.3 v. 3 a., 5 v. 3 a., £2. 350-0-350 v. 100 m.a., 6.3 v. 3 a., 5 v. 2 a., or 4 v. version, £1/6/3. 350-0-350 v. 75 m.a., 6.3 v. 3 a., 5 v. 2 a., or 4 v. version, £1/1/9. 300-0-300 v. 60 m.a., 6.3 v. 3 a., 5 v. 2 a., or 4 v. version, £1/0/3. 250-0-250 v. 60 m.a., 6.3 v. 3 a., 5 v. 2 a., or 4 v. version, 18/9.

700 v. 10 m.a., 6.3 v. 1.5 a., 4 v. 1 a., 19/6. 250-0-500 10 m.a., 6.3 v. 9 a., 4 v. 1 a., 18/6. 6.3 v. 1 1/2 a. Heatertrans. 230 pri. only, 6/9. 4 v. 2 a. Heatertrans. 230 pri. only, 6/9.

6 v. 6 a. C.T. Heatertrans. 230 pri. only, 15/6. 6.3 v. 3 a. C.T. Heatertrans. 230 pri. only, 12/6. 12 v. 1 a. C.T. Heatertrans. 230 pri. only, 8/6.

NUSOUND CHOKES.

CH1, 10 H., 150 ohms, 75 m.a., 4/6. CH5, 10 H., 300 ohms, 60 m.a., 4/6. CH10, 15 H., 250 ohms, 80 m.a., shrouded, 10/9. CH8, 10 H., 300 ohms, 100 m.a., shrouded, 9/6. CH9, 10 H., 200 ohms, 150 m.a., shrouded, 12/6. CH2, 5 H., 80 ohms, 250 m.a., shrouded, 19/6.

Television aerials can be sent to any part of the country (send for list). Let us quote you by return of post for components of all types. Our comprehensive list on TV—Radio and Gramophone equipment, etc., is now available. Price 4d. post free.

RELAYS

for A.C. and D.C.
2VA Coil consumption from 2 to 600 volts and tested to 2000 volts. Aerial Changeover Relays, Mercury Relays, Measuring Relays and Time Delay Relays.

Midget Relay M/LC Ask for leaflets RE/WW

LONDEX LTD

Manufacturers of Relays
207 ANERLEY ROAD, LONDON, S.E.20.
SYDenham 6258

QUARTZ CRYSTAL UNITS



For— **AIRCRAFT, MARINE AND COMMERCIAL USE** are available in the complete range from 35 kilocycles to 15 megacycles.

Alternative mountings in standard two-pin A.M. pattern 10X, International octal, and miniature type FT243, can be supplied for most frequencies.

Prices are fully competitive, and we specialise in prompt deliveries for urgent requirements.

WE WELCOME YOUR ENQUIRIES. THE QUARTZ CRYSTAL Co., Ltd.

63-71 Kingston Road, NEW MALDEN, SURREY
Telephone : MALden 0334

MAINS TRANSFORMERS.

275-276, 6 v., 5 v., 4 v., 80 mA., 14/9. 350-350, 6 v., 5 v., 1 v., 80 mA., 18/6. 350-350 6v., 5 v., 100mA., 22/6.

LOUDSPEAKERS (Guaranteed new and boxed). 3pin. P.M., 14/6. 6in., 10/6. 6in., 11/6. 8in., 12/6. 10in., 18/6. 12in., 37/6. All leading makes.

"AMPLION" AC/DC TEST METER. Delivery from stock. Price 77/6. Descriptive leaflet available.

CHROMIUM PLATED FOLDING MICROPHONE STAND. 32/6.

TX VALVES. NEW/BOXED, VU11,807, 6/3 each. **R3615 RECEIVER CHASSIS** (less valves). Brand new condition. Packed with useful gear. Outstanding value at 9/6, carr. paid.

New catalogue now available.

RADIO UNLIMITED

Elm Road, Walthamstow, London, E.17 Tel: KEY 4813

RADIO TECHNICIANS SERVICE ENGINEERS "SEE FOR YOURSELF" BY JOINING THE E.T.U.

THE ELECTRICAL TRADES UNION CATERERS FOR YOU

IT IS IN YOUR INTEREST TO JOIN YOUR LOCAL BRANCH

A LETTER TO THE SECRETARY

E.T.U. HAYES COURT, WEST COMMON RD., BROMLEY, KENT.

WE WILL BRING YOU BY RETURN OF POST DETAILS AS TO HOW TO JOIN.



SITUATIONS VACANT MECHANICS (research and experimental).

APPLICATIONS are invited for vacancies existing at a Ministry of Supply Works, Windscale, Sellafield, Cumberland.

ENQUIRIES would be welcomed from men with experience in the assembly, repair and/or testing of instruments for the measurement or recording or control of temperature, pressure, flow, depth, specific gravity, using electrical pneumatic or other methods.

ON the electronic side enquiries would be welcomed from wireless enthusiasts provided their knowledge of theory is sound and their standard of education is equivalent to School Certificate. IDEAL qualifications would be apprenticeship served to instrument engineering or equivalent experience or apprenticeship served to radio, radar or electrical engineering or equivalent experience and courses taken in the Forces.

ENQUIRIES should be addressed to The Superintendent, Windscale Works, Sellafield, Cumberland. [5432]

WOOLWICH Polytechnic, Woolwich, S.E.18.

The Governing Body invite applications for the post of Senior Assistant for Telecommunications. The senior assistant will be responsible for teaching telecommunications and electronics to the level of the B.Sc. (Eng.) degree of the University of London, and he will be expected to carry out and supervise research work in these subjects.

SALARY in accordance with the scales of salary of teachers in technical colleges and the senior assistant scale is £700-£25-£850 per annum plus the following allowances where applicable: (a) London allowance £36, £48 if over 37 years; (b) graduate—£30 above minimum and maximum; first-class honours degree—£15 above minimum and £30 above maximum; (c) training—£15 for each year, up to three, for full-time training beyond two years above minimum and maximum. **FULL** particulars of the post and application forms may be obtained from the Clerk to the Governors, to whom they should be returned within three weeks from the date of this advertisement. [5368]

BOROUGH POLYTECHNIC, Borough Rd., S.E.1.

FULL-TIME Lecturer in the Department of Electrical Engineering and Physics.

THE Governors invite applications for appointment to the above post. Candidates should be graduates in electrical engineering and be able to teach electrical or radio technology principally to full-time and part-time students. Some industrial experience will be an additional qualification. The salary payable will be in accordance with the Burnham Technical Scale. **FORMS** of application and further particulars may be obtained by sending a stamped addressed foolscap envelope to the undersigned.

Douglas H. Ingeall, Principal.

MINISTRY OF SUPPLY has vacancies for both mechanical and electrical draughtsmen in London and the Home Counties.

CANDIDATES are normally required to have served an engineering apprenticeship, or have had equivalent workshop experience, and to possess the Higher National Certificate (O.N.C. if under 25) or equivalent technical qualification. **SALARY** £300 to £525 if in the London area (slightly less outside London) according to apt qualifications and experience, with opportunities of promotion to higher grades.

APPLICATION forms obtainable from Ministry of Supply, Est. 3(C)1, Room B28, Adelphi, London, W.C.2, quoting V.R.471. [5362]

CAPACITOR engineer required with experience in manufacture of electrolytic capacitors.

Apply A. H. Hunt, Ltd., Bendon Valley, S.W.13. **FIRST-CLASS** radio and television engineer required, energetic and capable man with wide commercial experience only need apply: Bedford district; top rate of pay.—Box 3959.

TWO first-class Radio Engineers required, knowledge of television an advantage.—Write, giving full particulars, experience, etc., to Wilson Peck, Ltd., Fargate, Sheffield, 1. [5342]

SENIOR research engineer required by manufacturers South-East London area for development work on domestic radio; excellent position offered to keen man with several years' experience.

ALSO senior engineer required for the development of television components; previous experience essential. [5381]

WRITE in confidence, giving full particulars of experience, qualifications and age, to Box 3946. [5381]

R wanted must have creative ability and past experience.—Write, giving full details and salary required, Box No. G.A. 148, 4-7, Salisbury Court, Fleet Street, E.C.4. [5413]

RADIO RENTALS, Ltd., require expert wire-wireless and television engineers immediately; ownership of saloon car essential; excellent prospects.—Apply by letter only in first instance to 33-41, Westbourne Grove, W.2. [5403]

SMART energetic shop manager required for television and radio in Leicester.—Only qualified men with experience need apply to Box No. 220, S. T. Garland Advertising Service, Ltd., 52, Mount St., London, W.1. [5424]

EXPERIENCED radio technician, conversant with factory layout and good knowledge of component manufacture, especially loudspeakers, wanted for overseas position.—Reply Box 3940, giving particulars of previous experience. [5352]

DEVELOPMENT engineer, H.N.C. standard manufacturer in S.W. London, laboratory experience essential, preferably in similar field.—Details, including salary required, to Box 3957.

MUMETAL and RADIOMETAL TRANSFORMERS and CHOKES

As Specialists with many years of experience we can design and supply practically any type of transformer or choke with a nickel iron core for use on a band within the frequency range.

1 c/s to 150 kc/s

Available for rapid delivery—Microphone Transformers, Input Transformers, Line Transformers, Pickup Transformers, Output Transformers, Rectifier Transformers, Vibrator Transformers, High Fidelity Transformers, Recorder Transformers, Midget Transformers, High Q Chokes, High Inductance Chokes, etc., with or without Mumetal Shields.

MAINS COMPONENTS ARE ALSO STOCKED.

SOWTER TRANSFORMERS

E. A. SOWTER, 1-B HEAD STREET, COLCHESTER.

Phone: COLCHESTER 5459.

Instrument wire, leatheroid, fibre, varnish, etc. **ASTROGRAPHS**, U.S. Pattern, in smart cases, 18/6, carriage 2/6. Case easily worth double.

Parneko Transformers, input 230 v. 50 cycles. Many other Radio, Electrical and Mechanical bargains, Motors, all types.

L. C. NORTALL
416, HIGH ST., SMETHWICK,
Telephone WOO 3166.

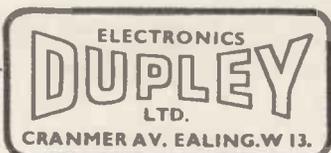
THE SMALLEST COILPACK IN THE WORLD BRIDISCO

(REGD.)

Three wave bands— $1\frac{1}{2} \times 2\frac{1}{2} \times 2\frac{1}{2}$ ins. Specially designed to eliminate second channel interference. All metal chassis with a 1" spindle. High Q permeability tuned coils, on low loss formers. Complete with full circuit diagram for 5 valve superhet. Aligned and tested at works.

30/6 incl. P.T.

From your local retailer, usual factor or — **BRITISH DISTRIBUTING CO.**
66, HIGH ST. LONDON N.8.



Transformer and Coil Manufacturers to the Trade
Telephones: EALING 5688

YOU SHOULD HAVE A NEW TAYLOR

* * * * *

We can supply the latest Taylor Test-Equipment, and take your used Equipment in part exchange. Balance by cash or hire purchase.

Write, phone or send your gear along for inspection and offer.

* * * * *

UNIVERSITY RADIO LTD.

22 LISLE ST. Tel. GERRARD 4447 & 8882

NEW STC SELENIUM RECTIFIERS.

Largest L.T. range in Great Britain. Current products. NOT surplus. E.H.T. H4/200. W.W. Telesistor, 29/6, H4/100 VR97, 19/6, post free.

HALF-WAVE RECTIFIERS.

16v., 2a., 7/-; 1a., 8/6; 2a., 9/10; 3a., 17/-; all post 6d. 2a., 16/4; 6a., 22/6, post 10d. 30v. 1a., 12/6; 2a., 14/8; 4a., 26/-; 6a., 38/6; -8v. 1a., 16/6; 2a., 21/-; 4a., 37/6; 6a., 54/-; 100v. 2a., 36/6; 4a., 69/-; 6a., 100/-, all p. 1/-.

HALF-WAVE HEAVY DUTY, 7 1/2 in. SQUARE COOLING FINES.

16v. 5a., 22/6; 10a., 24/6; 30v. 5a., 37/-; 8a., 40/6; -8v. 2.5a., 27/6; 5a., 50/6; 8a., 57/-, all post 1/-.

BRIDGE CONNECTED FULL WAVE.

Special price, 230v. 1a., D.C., 90/-; 17v. 1.25a., 12/9; 2a., 16/4; 2.5a., 21/3; 3a., 23/-; 4a., 26/-; 5a., 27/6; all post free. 33v. 2a., 19/6; 1a., 22/6; 1.5a., 29/6; 2a., 32/6; 3a., 37/6; 4a., 45/6; 5a., 46/6; all post 10d. 54v. 1.5a., 41/-; 2a., 50/-; 3a., 57/-; 5a., 70/-; 72v. 1.5a., 53/-; 2a., 64/-; 100v. 1.5a., 76/-; all p. 1/-.

BRIDGE CONNECTED HEAVY DUTY 7 1/2 in. SQUARE COOLING FINES.

17v. 6a., 36/2; 10a., 44/-; 12a., 76/-; 20a., 84/-; 33v. 6a., 68/-; 10a., 75/-; 12a., 132/-; 20a., 148/-; 54v. 6a., 95/-; 10a., 106/-; 72v. 6a., 122/-; 10a., 138/-; 100v. 10a., 200/-, all p. 1/4.

BRIDGE INDUSTRIAL FUNNEL COOL.

17v. 12a., 80/-; 20a., 92/-; 30a., 130/-; 50a., 198/-; 33v. 6a., 73/-; 10a., 84/-; 12a., 132/-; 20a., 152/-; 54v. 6a., 97/-; 10a., 114/-; 72v. 6a., 120/-; 10a., 144/-; 100v. 6a., 168/-; 10a., 202/-, all post 1/6.

VALVE CHARGER REPLACEMENTS.

No wiring alterations. Philips & Tungar. 2-12v. 4a. Chargers, 200/250 A.C., £5/10/-, del. free.

Wholesale & Retail

T. W. PEARCE (Est. 18 yrs.)

66 GREAT PERCY STREET, LONDON, W.C.1

Off Pentonville Rd. Between King's Cross and Angel

WE DON'T

supply anything Ex-Government ALL BRAND NEW GOODS

—fully guaranteed—

AUTOCHANGERS IN STOCK

GARRARD. RC65A. A.C./D.C. Mixed Records. Standard lightweight Magnetic Head, £20/15/-.

GARRARD. RC65A. A.C. Mixed Records. Standard lightweight Head, £15/13/6.

GARRARD. RC70A. A.C. Non Mixed. Rim Drive. Standard Lightweight Head, £10/9/1.

E.M.I./MARCONI, A.C. Auto Changer, non mixed, Hi-Fi Head, complete with Transformer, £10/10/8.

COLLARO. RC500. A.C. Auto Changer, non mix. Crystal or Hi-Fi Head, £10/15/0.

CABINETS. Unpolished for all above changers. Motor Boards ready cut to fit plate, £3/10/-.

MOTOR AND TURNTABLE, with magnetic Pick-up and Auto Stop, **COLLARO A.C.**, £9/13/6; **GARRARD, A.C./D.C.**, £12/9/2.

MOTOR AND TURNTABLE ONLY—COLLARO, Induction type, A.C., £5/18/4. A.C./D.C., £9/5/6.

TAYLOR TEST GEAR

The entire range by this famous maker is now available on HIRE PURCHASE. S.A.E. for Catalogue and Terms.

ALL AVO TEST GEAR NOW IN STOCK

AVO 7, Leather cases, £2/2/6. We are the largest actual stockists of Avo Meters in England. S.A.E. for Catalogue and Price List.

All items can be supplied C.O.D. up to 15lb. in weight. Otherwise Cash with order, please.

Special attention to Overseas Orders, which are free of Purchase Tax.

MODERN ELECTRICS LTD.

164, Charing Cross Road, London, W.C.2. Telephone: Temple Bar 7587.

SITUATIONS VACANT

MINISTRY OF SUPPLY requires radio engineers for unestablished appointments as Technical Authors in the Air Technical Publications Branch in Surrey and Worcestershire. DUTIES to collect information from research, design, manufacturing and other sources and prepare publications for the instruction of technical personnel in the Services on the theoretical and practical aspects of airborne and ground centimetric radar equipment.

CANDIDATES must be British with British parentage and should possess good instructional ability in scientific or technical subjects or experience in writing or editing publications on such subjects; they must possess a degree in engineering or in physics, or be corporate members of the Institution of Electrical Engineers or have passed recognised A. and B. exempting examinations for associate membership; good standard in physics and mathematics is essential; several years' experience of centimetric radar apparatus and techniques in the research and development department of a leading manufacturer or in a Government research establishment, or extensive experience in a position of technical responsibility in the Services on the operation and maintenance of such equipments also essential.

SALARY up to £720 per annum, depending on age, qualifications and experience; vacancies in higher grades are filled by promotion; opportunities to compete for establishment occur periodically.

WRITE for application form obtainable from the Ministry of Labour and National Service Technical and Scientific Register, (K) York House, Kingsway, London, W.C.2, quoting reference (D.135/50-A). Closing date, June 12, 1950. [5490]

PILOT RADIO, Ltd., requires immediately, fault finders, testers and mechanical inspectors for radio and television alignment; experienced in factory production; five-day week with overtime. Apply, stating experience, age and salary required.—**APPLY** or write to:—Bark Royal Rd., London, N.W.10. [5294]

EXPERIENCED radio and television service engineers required; permanent position with good salary and prospects offered to suitable applicants. North London district.—Write Box B5754, A.K. Advr. 212a, Shaftesbury Avenue, W.C.2. [5433]

MAN wanted for small transformer and coil winding shop, Ealing district; must be able to set up and maintain Douglas coil winders, make jigs and train winders; write, stating experience, age and salary required.—Box 4129. [5477]

ASSISTANT service manager required for central depot in Bedford; good practical engineer with knowledge of most leading makes of radio and television receivers; good disciplinarian capable of controlling staff; salary £400 p.a.—Box 3958. [5416]

DESIGNER/DRAUGHTSMAN required for the engineering laboratory of a large light engineering firm in the West London area for development work; should have a knowledge and experience of tool design.—Apply, giving details of age and experience, to Box 3951. [5391]

DRAUGHTSMAN required for interesting work on advanced television and electronic apparatus; experience in this field desirable; A.E.S.D. London rates applicable.—Write, stating age and experience, to Cinema-Television, Ltd., Worsley Bridge Rd., Lower Sydenham, S.E.26. [5406]

IN any grade or capacity there is usually a job for the right man at Sound Sales, Ltd.; applicants, who should be of British origin, should state age, details of experience, salary or wage required by letter; testimonials should not be forwarded with inquiry; previous factory experience essential.

THE Managing Director, Sound Sales, Ltd., West Street, Farnham, Surrey. [10054]

MECHANIC required for the construction and servicing of industrial electronic apparatus, maintenance of mechanical transducers, etc.; West London area.—Forward details of education, experience and salary required to Box A 895, Central News, Ltd., 17, Moorgate London, E.C.2. [5376]

GOVERNMENT Department situated in N. Bucks, requires men for winding small coils; applicants preferred with some experience of wave winding; five-day week, single accommodation available; payment up to 3/6 per hour according to qualifications and experience.—Write: Winding, Box 3939. [5551]

ENGINEERS required for electrical design of radar apparatus, must have sound basic training, preferably degree in physics and experience in pulse technique; applicants should state age, experience and salary required.—Apply Personnel Department, Murphy Radio, Ltd., Welwyn Garden City. [5428]

UNIVERSITY students taking finals in physics may be interested in vacancies at the Research Laboratories of The General Electric Co., Ltd., North Wembley, Middx.—Details will be sent to applicants who send particulars of their record and age to the Personnel Officer. [5423]

NUMBER of senior and junior vacancies for a radio, radar, electronic, television, etc., development, service engineers, draughtsmen, wiremen, testers, inspectors, etc., urgently required 30 television service engineers.—Write in confidence: Technical Employment Agency, 179, Clapham Rd., S.W.9 (Brixton 3487). [5191]

DRAUGHTSMAN required for design and development of radio and television receivers, preparation of service diagrams, etc.; knowledge of radio an advantage, but not essential; good all round man able to work with minimum supervision. A.E.S.D. rates paid.—Apply Regentone Products, Ltd., Eastern Avenue, Romford, Essex.

UHF AMPLIFIER CV971

Admiralty Pattern W.4825

An interesting small Unit designed for high-gain low-noise amplification at particularly high frequencies. Incorporates a CV53 (3A/1461) Grounded Grid Triode Valve. Cathode and Anode tuning coils, for 210-235 Mc/s, are easily accessible for modification or replacement. Adjustable link coupling coil to output, also varies the bandwidth. Air dielectric tuning; cathode circuit by adjustable pre-set condenser, anode by plunger-type condenser with knob and scale. An amplifier of this type is capable, at 350 Mc/s, of a stage gain of 16 db over a bandwidth of 1.5 Mc/s, or 13 db over 4 Mc/s. At lower frequencies it could be even better. Input and output connections via Pye coaxial plugs. (If suitable cable connectors required, please add 1/-.) Should modify easily for 144 Mc/s experiments, or make a really fine Television pre-amplifier. Requires 4 v. 0.65a. L.T. and up to 250 v. H.T. Apparently unused, in wooden transit boxes. Subject unsold; offered at only 27/6 each with Valve, inland postage paid.

WIRELESS SUPPLIES UNLIMITED

264-266 Old Christchurch Road, Bournemouth, Hants

GARLAND RADIO

Mains Transformers (1) : P. 0-200-220-240v. Sec. 250-0-250v. 80mA., 6.3v. 3a., 5v. 2a. Upright. Special offer 11/6.

Mains Transformers (2) : P. 0-200-220-240v.; Sec. 350-0-350v. 80mA., 6.3v. 3a., 5v. 2a. Upright or drop-through. Special offer 13/6.

Mains Transformers (3) : Auto-wound. 0-110-150-200-220-250v. at 650 watts. 65/- S.B.C. Neons : 200/220v. Resistor in cap. 2/-. Holders, 6d.

Selenium Rectifiers : Full-wave (with C.T. transformer). 320v. 300mA.; or bridge 160v. 300mA. 9/-.
Mat Resistors : 100 ohm, 250 watt 1/9; 300 ohm, 250 watt 1/6.

Low Resistance Headphones : With headband, lead and plug, 3/3 per pair.

Condensers : .01 mfd. 5 kv. tubular 1/6; .1 mfd. 1.5 kv. tubular 9d.

Plessey Lightweight P.M. Speakers : All 3 ohms. 2 1/2 in. 10/-; 5 in. 10/-; 8 in. 13/6; 10 in. 17/6.

2 in. M.C. Meters : 500µA., cal. 0-15v. 0-600v. Used tested surplus 4/-.
Ceramic Air-spaced Trimmers : 3/30 pF. 4d. each, 3/6 dozen, 24/- per 100.

Crystal Diodes : IN22, CV102, 3/3.
Amplifier Kits : As advertised this journal May issue. Kit No. AC1, 2-valve plus rectifier, 3 watt, with instructions, £2/15/0. Kit No. AC111, 6 valves plus rectifier, 10 watts p-p. output, high and low gain inputs, separate bass and treble controls, negative feedback over three stages, Partridge Output transformer; kit and instructions £7.

GARLAND BROS.
Chesham House, Deptford
Broadway, London, S.E.8

Phones: TIDeway 4412/3.

SPECIAL OFFER

NO. 2 PARCEL

of new components, contains 100 resistors 50 condensers, 50 yds. sleeving, 20 valve holders, volume controls, knobs, tuning condenser, wire, nuts, screws, washers, tag strips, grid clips, and many other useful components. Only 250 parcels, offered at the low price of

30/- post paid (overseas 35/-).

Exceptional value, less than half cost price. Satisfaction guaranteed or money refunded.

COVENTRY RADIO

Component Specialists since 1925

189, DUNSTABLE ROAD, LUTON, BEDS.



THE SERVICE ENGINEER'S FIRST CHOICE

BULLANCO. 66 QUEEN'S R. S.E. 15

ALUMINIUM

ANY SIZES CUT OR FOLDED

TEL. NEW CROSS 1092
SHEET EXPANDED TUBES, ANGLES, BARS, RODS, MOLDINGS, RIVETS

TRANSFORMERS & COILS TO SPECIFICATION.

MANUFACTURED OR REWOUND
Filter Coils ± 1% a Speciality.

JOHN FACTOR LTD.

9-11 EAST STREET, TORQUAY, DEVON.
Phone: Torquay 2162

ENGINEERS!

Whatever your age or experience, you must read "ENGINEERING OPPORTUNITIES". Full details of the easiest way to pass A.M.I.Mech.E., A.M.I.C.E., CITY & GUILDS, MATRIC, etc., on "NO PASS—NO FEE" terms and details of Courses in all branches of Engineering—Mechanical, Electrical, Civil, Auto., Aero., Radio, etc., Building, etc. if you're earning less than £10 a week, tell us what interests you and write for your copy of "ENGINEERING OPPORTUNITIES" today—FREE!

176 PAGES Free!



B.I.E.T.

397, Shakespeare Hse., 17-19, Stratford Place, London, W.1.

BRITISH INSTITUTE OF ENGINEERING TECHNOLOGY

SITUATIONS VACANT

EXPERIENCED draughtsmen required by leading electronic manufacturers situated in pleasant provincial town, five-day week, staff canteen, profit-sharing scheme.—Apply, stating age, experience and salary required, to Box 4130.
EXCELLENT opportunities are now available at the Research Laboratories of The General Electric Co., Ltd., for first-class engineers and physicists for research and development work in the mechanical and electronic engineering fields as follows:—

- (a) **MECHANICAL** Engineer to take charge of a Research Group in the field of special mechanisms. Experience in the theory and design of servo-devices and high efficiency gearing is essential. Ability to contribute to the build-up of a mechanical laboratory is required.
 - (b) **ELECTRONIC** Engineers and Physicists to act as Section Leaders for work on the following: (i) design of microwave aerial systems, (ii) intermediate frequency amplifier design, (iii) microwave circuit design and measurements, including wave-guides and concentric lines.
- FOUR figure starting salaries will be considered except for two or three positions on the approximate scale £700-£950. No age limits have been fixed, but some preference will be given to men between 30 and 40.

APPLICATIONS containing full details of qualifications, experience and age should be sent to Personnel Officer, G.E.C. Research Laboratories, North Wembley, Middlesex. [5483]

A LEADING firm of mobile radio equipment producers requires sales engineers for technical sales liaison, primarily with the automobile industry, applicants between 25 and 35 and possessing sound radio engineering training should apply in writing, giving age, qualifications, details of experience and salary required to Box 3370.

SENIOR electronic development engineer, fully experienced in light electro mechanical engineering, required for development work on microwave transmission systems including the design of waveguide rotating joints, paraboloid reflectors with dipole feed and equipment for the measurement of antenna system polar diagrams.—Box 3936. [5340]

QUALIFIED silk screen operator able to cut screens and operate photographic silk screens wanted for factory in Auckland, N.Z.; salary £425 to £550, according to qualification, applicants should be between 20 and 35 and single to be eligible under N.Z. emigration scheme.—Apply with photograph and references to Box 3637. [5571]

JUNIOR engineers for development work, excluding television and radio; applicants should have a good grasp of basic principles of electronic circuitry and some experience of similar work; write stating age, experience and salary required, to: Cinema Television, Ltd., Walsley, Bridge Rd., Lower Sydenham, S.E.26. [5487]

ELECTRONIC engineer with good academic qualifications and apprenticeship required for development work on control systems; experience of d.c. amplifiers and computing devices an advantage. Write full details of qualifications, age, and salary required, to Personnel Manager, Sperry Gyroscope Co., Ltd., Great West Rd., Brentford, Middlesex. [5465]

RADAR—Vacancies exist with a company in the West London area for first-class electrical and mechanical leading-hand assemblers on the production assembly of radar and other electronic units; previous experience essential; initial application will be treated in the strictest confidence.—Apply, giving age, full details of experience and salary required, to Box 3937.

BELLING & LEE, Ltd., Cambridge Arterial Rd., Enfield, Middlesex, require the services of a keen and inventive research assistant of British nationality for work in connection with television aerials and radiometric components; applicants should be 25 to 35 years of age and possess qualifications at least to Grad I.E.E., together with previous research experience; five-day week. [5273]

SENIOR electronic engineer, fully experienced in light electro mechanical engineering, required for development work in industrial electro mechanical equipment; a thorough knowledge of general electrical engineering and electronic techniques is required; applicants should be capable of carrying through a project to the production prototype entirely on their own initiative.—Box 3937. [5341]

SENIOR development engineer required for work on pulse and frequency modulated telemetering projects; must be thoroughly familiar with pulse circuit practice and measurement and capable of working on own initiative.—Apply by letter, giving full details of training, experience and salary required, to J. Langham Thompson & Co., Springfield Laboratories, Stanmore Hill, Middlesex. [5345]

MOTOR designer required for the F.P.E. motor laboratory of a large light electrical engineering company in the West London area; applicants should have a sound technical and practical training, with initiative to accept full responsibility of a project from the initial design stage to factory production; excellent prospects if qualifications and experience are suitable.—Apply, giving details of age, education and job history, to Box 3952. [5392]

THE GENERAL ELECTRIC Co., Ltd., Telephone Works, Coventry require in their production engineering department a young engineer to undertake production investigation work associated with the manufacture of windings used on carrier frequency telephone equipment; technical background with practical high-class winding experience essential; applications, giving qualifications, experience and salary required, should be addressed to the Personnel Manager. [5388]

MORSE CODE TRAINING



There are Candler Morse Code Courses for **BEGINNERS AND OPERATORS**

Send for this Free "BOOK OF FACTS" It gives full details concerning all Courses.

THE CANDLER SYSTEM CO.
(Room 55W), 121 Kingsway, London, W.C.2
Candler System Co., Denver, Colorado, U.S.A.

INSIST ON



There is a model designed especially for your receiver

Name of your local Agent from:

METRO PEX LTD.

38, Gt. Portland Street, London, W.1
King's Heath STN., Birmingham, 14

***"Globe-King" MARVEL IN MINIATURE (REGD) SHORT-WAVE RADIO KIT**

Probably the smallest one valve Short-Wave Radio receiver in the world using standard parts with Bandspread tuning device. "Magnificent performance"...vide testimonials British Isles and Abroad. Built and designed to precision standards, complete kit costs only 49/6d—write today for descriptive catalogue.

JOHNSONS (RADIO) MACLESLIEFIELD (SPECIALISTS) CHESLIFE (ENG)

BRASS, COPPER, DURAL, ALUMINIUM, BRONZE

ROD, BAR, SHEET, TUBE, STRIP, WIRE.
3,000 STANDARD STOCK SIZES

No Quantity too Small List on application
London: **H.R.C LLET & Co., Ltd.** Liverpool: 6, Chesham Place, S.W.1. Kirkby Estate, SLOane 3463 SIMONSWOOD 3271/3

You can master

MATHEMATICS

If you wish to understand radio really thoroughly you must know Mathematics. Our new Home-Study Courses make them really interesting and easy to learn.

T. & C. RADIO COLLEGE

Specialists in Home-Study Tuition in Mathematics, Radio & Television.
Write for free booklet "W" to:—
R. Heath Bradley, T. C. R. C., 50, Harland Road, SOUTHBOURNE, BOURNEMOUTH.



PEERLESS

RADIOGRAM CHASSIS TYPE 1150

This receiver forms the basis for a Radiogram of unsurpassed performance, and at great saving in cost.

Principal features include:

- | | |
|-----------------|------------------------|
| 11 Osram Valves | 10 watts output |
| 4 Wave Bands | Push-pull Amplifier |
| 2 I.F. Stages | Magic Eye Tuning |
| R.F. Amplifier | Wave-band Indicator |
| 4 Stages A.V.C. | Bandspread Dial |
| Treble Control | Negative Feed-Back |
| Base Control | Tropical Specification |

10 to 2,000 Metres, 12 months' guarantee.

Write for full particulars:-

PEERLESS RADIO LIMITED
 374 KENSINGTON HIGH STREET, LONDON, W.14
 Telephone: WE3tern 1221

SITUATIONS VACANT

A VACANCY exists for a technical representative in sales department, handling magnetic tape recording; applicants should have a working knowledge of audio equipment and preferably should be conversant with modern recording practice.—Apply, giving age, details of education and experience, together with salary required, to Personnel Dept., E.M.I. Factories, Ltd., Blyth Rd., Hayes, Middx. [5364]

ELECTRONIC engineers required for progressive posts as design and development engineers; qualifications, degree or equivalent in electrical engineering with some industrial experience of design work; experience of test gear design an advantage.—Apply, stating age, full details of education and experience, to Personnel Department ED/14, E.M.I. Engineering Development, Ltd., Blyth Rd., Hayes, Middx. [5485]

DRAUGHTSMEN, electrical or mechanical, are required by the Nelson Research Laboratories, English Electric Co., Ltd., Stafford; applicants should possess E.N.C. original design ability and a sound knowledge of engineering principles for work of a prototype nature.—Write, giving full details of previous experience, mentioning reference 414, to Central Personnel Services, English Electric Co., Ltd., 24-30, Gillingham St., London, S.W.1. [5388]

SANZAMO WESTON, Ltd. have a vacancy in their instrument sales correspondence section; applicants should have a good general technical training, with some specialisation in electrical measuring apparatus; they should be capable of expressing themselves clearly and concisely both in conversation and correspondence.—Applications should be sent, in strict confidence, to the Employment Manager, Sanzamo Weston, Ltd., Cambridge Rd., Enfield, Middlesex. [5400]

A NEW design D.O. will commence work at Acton, in London, in May; this office will undertake design work for, and be under the control of, the Nelson Research Laboratories of the English Electric Co., Ltd.; vacancies exist for men with considerable experience in the design of mechanical and electrical engineering and electronic equipment.—Write, giving full details, quoting reference 136, to Central Personnel Services, English Electric Co., Ltd., 24-30, Gillingham St., London, S.W.1. [5393]

ENGINEER required immediately in the north-west area for development of electro-hydraulic servo mechanisms; qualifications should include honours degree in electrical or mechanical engineering or physics; knowledge of the theory and practice of servo mechanisms desirable; a vacancy also exists for an engineer to specialise in hydraulic mechanisms; salary according to age, experience and qualifications.—Apply in writing, giving full particulars and marking envelopes "Engineer," to Box 3948. [5383]

MARCONI'S WIRELESS TELEGRAPH Co., Ltd., Chelmsford invite applications for the position of chief of studio equipment section. Applicants should be qualified electrical engineers, age 30 to 40 and fully experienced in all branches of video and audio equipment, including installation, operation and maintenance or design; salary £610-£830 p.a. according to qualifications and experience.—Write, giving full details, quoting reference 421, to Central Personnel Services, English Electric Co., Ltd., 24-30, Gillingham St., London S.W.1. [5279]

MANAGEMENT trainee; important firm associated with radio industry invites applications from young men (25-32) for growing Sales Management Executive; good health, high intelligence, commonsense, some technical training, ability to work without regard for hours; all are minimum qualifications; a living wage will be paid during the first year's trial period, thereafter salary will be in accordance with ability; if you think you are suitable send a complete dossier of your attainments to date and a short 250-word précis on why you think you should be selected.—Box 3954. [5398]

ASSISTANT radio engineer required by major oil company for duty in Middle East; applicants must be fully qualified and experienced air radio officers with good all-round theoretical knowledge and practical maintenance experience; successful candidate will be required to supervise the running and maintenance of an aerodrome radio station and to instruct local operators, with occasional duties as air radio operator; age not over 35; attractive salary plus generous allowance in local currency; free passage out and home, free medical attention, kit allowance, good leave arrangements, Pension Scheme.—Write, giving personal particulars and full details of qualifications and experience, quoting Department F.190, to Box 2564 at 191, Gresham House, E.C.2. [5355]

MINISTRY OF SUPPLY require unestablished Senior Examiners for electronic and radio inspection duties in various parts of the country; duties: supervision of the inspection during production of electronic and/or radio equipment at contractors' works or laboratory testing at a test house; must be British born of British parents and have had sound practical training and experience in production and testing of electronic and/or radio equipment; technical education up to National Certificate standard in electrical engineering; knowledge of factory inspection techniques an advantage; salary range: £500 (at age 30), £625 per annum, London rating (lower rates for Outer London and Provinces slightly less below age 30); applications should be made within 10 days of the appearance of this advertisement by letter only, stating age, name and address of present employer, and full particulars of experience in chronological order, to: Ministry of Labour and National Service, Appointments Department, 1-6, Tavistock Sq., London, W.C.1, quoting reference (KI.141).

More British Bargains

A.C. MOTOR PUMPS. 230 volt for garden fountain, etc.; compact unit, new Stuart Turner, £5/15/-. Foot valve and Strainer, 16/-. Electradix 12 volt D.C. Model for Caravan or Motor Boat; lift 2ft. head 10ft., capacity 100 g.p.h., £5/10/-.

Precision Temperature Control Ovens for Quartz Crystals, etc. 230 volts 50 cy. will give a stability with suitable crystals of better than 2 parts in a million. Fitted precision thermostat and thermometer. Temp. adjustable 40 to 60 deg., size 6 1/2 in. x 6 1/2 in. x 10 in. £4/17/6.

VARIACS. ZENITH variac Transformer, several sizes in stock, write for list. "V.V." OHMMETERS. Bench type for high-speed production. Six ranges 0-100 to 0-10 megohms fitted large 8 in. meter for quick and accurate reading. Ranges selected by push button, 200/250 ohms 40/100 cycles. £25. Write for descriptive leaflet on Ohmmeters.

CATHODE RAY TUBES. V.C.R. 97 new and crated, 35/-.

TRANSFORMERS FOR TELEVISION SETS. 3 kv E.H.T. primary 200/250 tapped H.T. Secondary 3,000 volts, other tapings 250 v. 80 v. C.T. 5 v. 2 a., 2 v. 1 a., 4.2 a., 6.3 v. 3 a., 4 v. 1 a. 30/-, carriage 2/6.

TRANSMITTING VALVES. We have just purchased a large stock of American and English Tx. valves and can offer at low prices. All valves new and guaranteed. Send for list. Here are two examples, 6j6 9j6, 807, 7j6. Postage 1/- each VARIABLE wire wound resistances; laminated brush gear, by leading makers. 4.6 ohms 16 amps twin slider with gear wheel, 35/-; 2.0 ohms 2.5 amps. single slider, 15/-; 1,000 ohms 0.6 to 0.16 amps, totally enclosed, 27/-; 300 ohms 1/2 amp., single slider, 15/-; 60 ohms 2.8 amps., 25/-.

WE WELCOME YOUR ENQUIRIES for Lighting Plants, Dynamos, Transformers, Telephone parts, Motors, Alternators, Fans, Radio Accessories, etc.

Please include postage for mail orders.

ELECTRADIX RADIOS

214 QUEENSTOWN RD., LONDON, S.W. 8
 Telephone: MACaulay 2159

NEW! NEW! NEW!

"SYMPHONY NO. 2" Sensational new Audio Amplifier by N.R.S. A complete breakaway from contemporary design. 10 w. push-pull output. 3 separate channels, complete and independent control of bass, middle and top registers, neg. feedback over 3 stages. Wooden transformers throughout. Inputs for all pickups and tuners. Output for 3, 7.5 and 15 ohms. Chassis finished black crackle. Large scale production enables us to offer this magnificent instrument at only 13 guineas. Carriage paid.

"SYMPHONY NO. 1" AMPLIFIER. A somewhat smaller edition of the above and with single valve output but incorporating the same patent principles 5 w. output, £28/19/6.

NO. 1 4-WATT AMPLIFIER for A.C. Mains 25/19/6. Complete Kit 25/10/-.

NO. 2 P.A. AMPLIFIER. 15 w. push-pull output, gram and mike inputs, 10 guineas. Complete Kit 29/10/-.

All above Amplifiers have full provision for Radio Feeder input.

NO. 1 HIGH QUALITY TUNER. Specially recommended for above amplifiers and Leak, J, Williamson and Charles Amplifiers. L & M wave T.R.F. infinite impedance detector. Incorporates whistle filter. Absolutely complete, built and tested 25/10/-. Ditto kit 24/10/-.

NO. 2 L.M. & S-WAVE SUPERHET TUNER, special quality bandwidth, beautiful large full vision dial assembly. 29/10/-. Ditto kit 27/10/-.

SPECIAL BARGAINS! A few only very slightly used Collaro AC49 mixed 8-record Changers for A.C. Mains 190-250 v. 50 cycles £12/19/6. Marconi AC100 non-mixed 10-record Changers with hi-f pickup and transformer 29 each. All guaranteed perfect.

NEW, UNUSED BARGAINS! Marconi AC100 Changers 1r beautifully made polished wood table cabinet 24/10/-. COLLARO MICROGRAMS in brown rexine case 16 1/2 x 13 x 7 1/2, 21 w. output, centre drive motor and magnetic pickup, £13/10/-.

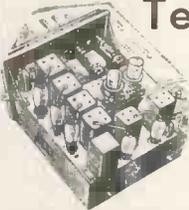
MICROGRAM CABINETS only 47/6. Full range of COLLARO SINGLE RECORD PLAYERS, centre drive and rim drive.

Full range of WHARFEDALE SPEAKERS and CROSSOVER UNITS.

BARGAIN CATALOGUE 21d. TERMS: C.W.O. or C.O.D. any amount.

NORTHERN RADIO SERVICES,
 16, Kings College Road, Swiss Cottage,
 London, N.W.3. Phone: PRImrose 8314

Thinking of building a Television Set?



10 VALVE
 1 1/2 METRE
 SUPER-HET

55/- Ideal for conversion into Television Receivers. I.F.

12 Megs. Band width 4 meg. Co-axial input and output sockets. 10 Mazda Mains type VR65 (SP61) valves, 6-3 volt filaments.

This chassis can be quickly modified for reception of sound and vision. The pre-H.F. oscillator and mixer inductances may be shunted with 30 p.f. trimmers to cover T/V frequency. Three of the I.F. circuits can be used for video and two isolated for audio.

Dept. W.W., WIRELESS INSTRUMENTS (LEEDS) LTD.

54-56 The Headrow, Leeds. Tel. 22262.

SITUATIONS VACANT

ELECTRONICS; large aircraft company has vacancies for specialists in electronics; applicants should not be under 27 years of age, nor have less than five years' experience since qualifying; responsible positions are offered in connection with important research and development work; applications, stating date of birth, qualifications, experience, present job and salary, should be sent to: Box 42, ...

MINISTRY OF SUPPLY require experienced radio engineers for unestablished appointments as Technical Authors in the Air Technical Publications Branch in Surrey, Hampshire or Worcestershire, to prepare official technical publications on theoretical and practical aspects of airborne and ground radio communications or radar equipment for the instruction of technical personnel in the Services.

APPLICANTS must be British with British parentage and have served a recognised engineering apprenticeship; Higher National Certificate in radio or electrical engineering, or relevant City and Guilds Certificates, e.g., Radio Communications III, desirable; good grounding in physics and mathematics and sound experience in position of technical responsibility on radio in industry or the Services are essential.

APPOINTMENTS Initially Engineering Technical Class, Grade III, within the range £380 (unsked) to £470 (£595 per annum) may be expected after training and experience; opportunities for establishment may occur later.

WRITE for application form obtainable from the Ministry of Labour and National Service Technical and Scientific Registrar (K), York House, Kingsway, London, W.C.2, quoting (D.136/50A); closing date, June 12, 1950.

ENGINEER required immediately for design of test equipment for radio valves, cathode ray tubes and phototubes, etc.; Higher National Certificate standard or equivalent; some practical experience essential.—Apply, giving full particulars of experience, age, etc., to Personnel Suplt., The Edison Swan Electric Co. Ltd., Cosmos Works, Edgworth, Bolton, Lancs.

APPLICATIONS are invited from electrical design draughtsmen for development of heavy switchgear; applicants should have at least H.N.C. in electrical engineering or equivalent and manufacturing and D.O. experience of switchgear of not less than ten years; permanent staff position, accommodation.—Apply, quoting reference 129, to Central Personnel Services, English Electric Co., 24, Gillingham St., S.W.1.

ELECTRONIC engineer aged 25-30 required for work in inspection department; qualifications: Higher National Certificate standard with production experience in field of radio engineering, knowledge of A.I.D. work in this branch would be an advantage.—Apply, stating age, fullest details of qualifications and experience, to Personnel Department, British Electrical Engineering Development, Ltd., Blyth Rd., Hayes, Middx. [5429]

RADAR Supervisors.—Vacancies exist for former Radar Supervisors who were officers in the Royal Air Force and the Women's Royal Air Force who wish to return to the Services. They will be responsible for the efficiency of radar operating and the work of radar operators and will be given a short service commission of 5 years with the opportunity of a permanent commission subject to passing a selection and medical board.

THE work is interesting and vitally important, and involves the use of the most modern equipment. There are facilities for sport, the opportunity to travel abroad and normally to leave a year. Pay for R.A.F. officers starts at £237 p.a. and rises to £420 after about 5 years. In addition, furnished accommodation and rations are provided, or an allowance in lieu. A marriage allowance of £38 p.a. is also payable to entitled married officers. Uniform allowance on entry. Gratuity is £100 for each year of service for short service officers; pension £375 p.a. upwards for long service.

W.R.A.F. officers' pay starts at £178 p.a. and rises to £315 after about 5 years. Accommodation and rations are free and there is an initial uniform allowance. Gratuity is £65 for each year of service for short service officers and pensions of £250 p.a. and more are provided for long service.

FULL details from The Under-Secretary of State for Air, A.R.7, Adastral House, Kingsway, London, W.C.1. [5448]

SITUATIONS WANTED

RADIO and T.V. service engineer, experience in leading makes, able to drive, seeks post, Ipswich area.—Box 5965 [5427]

RADIO and television man seeks opportunity in factory or service department in Midlands; at present with renowned manufacturers.—Box 4027. [5454]

SERVICE Engineer, at present self-employed, in South West Midlands trade and factory, television and radiomobile course, requires progressive situation.—Box 3953. [5396]

TECHNICAL Manager of leading North-West firm, desires change, preferably as tech. sales representative, where there is scope for initiative, confidence, organising, organising, full knowledge of radar, television, radio and wide experience of photographic equipment; accustomed to dealing with top retailers and high executives, aged 25; willing to take up post in any area, overseas or U.K.; min. salary £250.—Box 3950.—[5349]

AGENTS WANTED

AGENTS wanted for industrial electronic and electro-medical equipment in south-east, midland and northern areas; car considered essential; generous commission; state age, technical knowledge and present agencies.—Box 3956.

AGENCIES

RADIO engineer, located in Montreal, will represent British manufacturers of complete equipment and components; manufacturers will be assured of excellent representation of their products in the Canadian market; only those manufacturers who can keep to promised delivery dates can be considered; advertiser is A.M.I.E.E. and M.Amer.I.E.E.—Box 3964. [5439]

ADVERTISER seeks working partnership in radio, electrical business; willing to invest considerable capital; 20 years' experience electrical engineer, radio serviceman.—Box 2671. [5438]

BUSINESS FOR SALE AND WANTED CHELSEA, S.W.3.—Good class main road radio and electrical business for sale, rent £184 p.a. incl., lease and goodwill £500; s.a.v.; excellent opportunity.—Apply Andrews & Hitch, 69a, Kings Rd., S.W.3. [5402]

PATENTS

THE proprietor of British Patent No. 567462, entitled "Electronic Tube," offers name for licence or otherwise to ensure practical working in Great Britain.—Inquiries to Singer, Stern & Carlberg, 28, E. Jackson Boulevard, Chicago 4, Illinois, U.S.A. [5336]

TECHNICAL TRAINING

CITY & Guilds (Electrical, etc.), on "No Pass—No Fee" terms. Over 95% successes. For full details of modern courses in all branches of Electrical Technology send for our 176-page handbook, free and post free.—B.I.E.T. (Dept. 388A), 17, Stratford Place, London, W.1. [5401]

TRADE MARKS

THE Trade Mark Corvette registered under No. 652213 in respect of battery eliminator units was assigned on 4th April, 1950, by London and Provincial Factors, Ltd., of 230, Tottenham Court Rd., London, W.1 to Ampton (1932) Ltd., of the same address without the goodwill of the business in which it was then in use.

TUITION

RADIO training.—P.M.G. exams and I.E.E. Diploma; prospectus free.—Technical College, Hull. [5011]

WIRELESS officer's attendance and "Radio-certs" postal course.—Apply Manager, The Wireless School, Manor Gdns., London, N.7. [5400]

WIRELESS, land, sea and air; students, both sexes, age 14 upwards, trained for interesting appointments in all branches of radio; low fees, boarders accepted, 2d stamp for pros.—Wireless College, Colwyn Bay. [5018]

WANTED

TWO "LEESONA" MULTIPLE COIL WINDERS PREMIER RADIO COMPANY 167, Lower Clanton Road, London, E.5 Tel: AMHerst 4723

NOW AVAILABLE—THE NEW I' SQUARE "Q-MAX" CHASSIS PUNCH PRICE 19/6 (KEY 1/-)

BERRY'S (SHORT WAVE LTD.) 25, HIGH HOLBORN, W.C.1

TRANSFORMERS & COILWINDERS NEW AND REWINDS

All transformers interleaved & impregnated Tested for (1) Shorted turns. (2) Insulation at 2 K.V. minimum. E.H.T. A SPECIALITY "E.E." MIDLAND SOUND & VISION COLLS 19/6 SET. C.W.O.

J. E. THORNER & SONS 3 DEAN AVE. MANCHESTER 16

CH0 3849 EST. 1925

MALVYN ENGINEERING WORKS

Precision Engineers.

Manufacturers of—High-class Chromium Plated Panel Handles.

Chassis, Panels, Racks and Mechanical Assemblies to specification.

All enquiries receive prompt attention.

100, Park Road, Ware, Herts.

TO DEALERS

We can offer a limited number of Dealers a reliable and quick RADIO & TELEVISION REPAIR SERVICE

REGO-FRASER TELE-RADIO ENGINEERS

62, Hare Street, Woolwich, S.E.18 Tel. WOO. 1804

TUITION

TELEVISION.

The Gothic Television School specialises solely in training in television. All tutors possess university degrees and/or corporate membership of professional institutions and are appointed individually to postal course students to ensure complete and thorough training. Principals: G. G. and E. C. M. Brit. I.R.E., Education committee members, etc. Courses assume no previous television knowledge and provide guaranteed training for Brit.I.R.E. and R.T.E.B. examinations. Numerous well-known companies have adopted the School's Basic Television Course as standard television training for their staffs. Moderate fees.—Details from Gothic Television School, 13, North Avenue, London, W.13. [5051]

NOTHING succeeds like success! What we have done a thousand times we can do again, for you.—See the B.N.R.S. Advt. on page 8. [5611]

WELL-PAID jobs await those trained in radio and television and other applications of electronics; our free booklet describes the wide range of postal and daytime courses, and the thousands awaiting those who have qualified themselves.

WRITE to E.M.I. Institutes, Dept. W.W., 10, Pembridge Sq., Notting Hill Gate, London, W.2. Bayswater 5131-2. [5001]

A.M.I.Mech.E., A.M. Brit. I.R.E., City and Esoc. Eng., etc., on "no pass—no fee" terms over 95% successes. For details of exams, and courses in all branches of engineering, building, etc., write for 176-page handbook—free.—B.I.E.T. (Dept. 387B), 17, Stratford Place, London, W.1. [5400]

TELEVISION postal course for radio trades Examination Board's diploma, also postal courses for P.M.G. 2nd and 1st class Certificates and Amateur Radio Transmitting licence.—Apply British School of Telegraphy, Ltd., 176, Gresham Rd., London, S.W.9. (40 years experience in the retail trade; enrolments limited, fee moderate.—The Syllabus of Instructional Text may be obtained post free from the Secretary, I.P.R.E., Fairfield House, 20, Fairfield Rd., Crouch End, London, N.8. [5088]

TELEVISION Institute of Practical Radio Engineers have available home study courses in every phase of radio and television engineering, specialising in the practical training of apprentices in the retail trade; enrolments limited, fee moderate.—The Syllabus of Instructional Text may be obtained post free from the Secretary, I.P.R.E., Fairfield House, 20, Fairfield Rd., Crouch End, London, N.8. [5088]

TELEVISION INSTRUCTIONS, ETC. BERNARD'S Radio Publication. Send 1d. stamp for list now. [5094]

THE B.B.C. Training Department "is the title of an article in the new number of THE B.B.C. Quarterly (Spring 1950). ALSO in this issue are the following articles: THE "Pillar" System of Dutch Radio by P. Belshuizen. [5400]

OVERALL Frequency Characteristic in Magnetic Recording by F. E. AXON. LISTENERS' Sound Level Preferences (Part-II) by T. Somerville and S. F. Brownless. AMERICAN Television and Education by Bernard B. Smith. [5400]

TELEVISION: A Cautionary Approach by R. W. Moon. THE Documentary in Television by Duncan Ross. TWENTY Years of a Symphony Orchestra by Sir Stuart Wilson. [5400]

BROADCASTING and the Universities by Peter Laible. THE B.B.C. Quarterly is intended for those who are especially interested in broadcasting at home and abroad. It discusses and criticizes broadcasting as an art and a science. Its contributors write with expert knowledge about radio production, engineering and administration and the effect of these processes both upon the individual and the community. [5400]

B.B.C. Quarterly (Spring issue) has just been published. You can get a copy for 2/6. Annual subscription 10/-, including postage to any address. B.B.C. Quarterly is obtainable through all newsagents and booksellers. In case of difficulty, write to B.B.C. Publications, 35, Marylebone High St., London, W.1. [5400]

B.B.C. Quarterly, 2/6, Spring 1950. [5484] WEBB'S 1948 radio map of world, new multi-colour printing, with up-to-date call signs and fresh information on heavy art paper, 4/6, post 6d; on linen, on rollers, 11/6, post 8d. Write Radio, 11, Soho St., W.1. Gerrard 2089. [5400]

RCA invite enquiries for their technical publications and tube handbooks, information is also available on their range of electronic products.—Apply to RCA Photophone, Ltd., 36, Woodstock Grove, London, W.12. Tel. Shepherds Bush 230. [5110]

SUPACOILS stock the complete range of Bernards technical books. These publications treat radio and television from every aspect, and cost from as little as 1/- each; full list on application.—Mail Order Office, Supacoils, 99, Greenway Ave., London, E.17. [3779]

I.R.E. Technical Publications, 5,000 aligned ment peaks for superheterodynes, 4/9 post free; The Practical Radio Engineer, quarterly publication of the Institute, sample copy 2/- post free; membership and examination data, 1/- post free.—Secretary, I.P.R.E., 20, Fairfield Rd., London, N.8. [5089]

HOLIDAYS are on the way! And what better company than a Personal Portable, especially one made by yourself, to suit the area you are visiting? Personal Portables tells you how, with full data on both T.R.F. and superhet loudspeaker tube midget sets—Order 2/8, post free, from Bradbooks, Sennen, Penzance, Cornwall. Watch for details of our amazing new Portable T Book, next month. [5118]

BASS REFLEX CABINETS

Our RU12 is the best for the Axiom 12 & 22, the Barker, & Wharfedale Golden Units

From £10

Stamp for leaflets from

CABINETWARE

SUMMIT WKS., HEYES ST., BLACKBURN

TAMSA

High Quality Tape

Recording Components

RECORD HEADS | OSCILLATORS
PLAYBACK HEADS | AMPLIFIERS
ERASE HEADS | PRE-AMPLIFIERS
COMBINED RECORD-PLAYBACK HEADS
TAPE, Plastic Base, 600ft., 1,200ft., 3,250ft.
Comprehensive Booklet "Magnetic Tape Recording." Price 5/4 Post Free (G.B.).
Constructor Envelope: Complete Amplifier Equipment. Price 3/6, postage 3d.
Write for latest Price List

AUDIGRAPH LTD.

Dept. MR3, 74, Great Hampton Street, HOCKLEY, BIRMINGHAM, 18

THIS — Does these



ACCURATELY and QUICKLY Chassis, Brackets, Shrouds Condensers and Transformer Clips, in Steel or Aluminium. (Five sizes—12" to 36")
Trepanner available "SNAP" Cutter, Notcher and Shearer.

Details with pleasure.

Please Quote File No. or Serial No. of your tool if possible.

Our 6 page illustrated 1950 FOLDER will be ready shortly and copies reserved for our many "W.W." friends. Please ask for yours, quoting Ref. No. or date of your original enquiry.

A. A. TOOLS (W), 197a Whiteacre Road, ASHTON-U-LYNE

RADIOMENDERS LIMITED

FOR SPECIAL TRANSFORMERS AND REWINDS

We specialise in

AMATEURS' WINDINGS, TRANSFORMERS ALL TYPES, CHOKES, PICK-UP COILS, INSTRUMENT COILS, Etc.

Highest workmanship

Good Delivery



RADIOMENDERS, LTD.

Television & Radio Apparatus, Transformer & Coilwinders.

123-5-7 Parchmore Road,

THORNTON HEATH, SURREY

LIV 2261. Trade enquiries invited. Established 16 years.

"ADCOLA" SOLDERING INSTRUMENTS

Reg. Trade Mark



Designed for Wireless Assembly and Maintenance, SUPPLIED FOR ALL VOLT RANGES FROM 6/7v. TO 230/50v. The three Adcola Models covering the requirements of the Television, Telecommunication and Radar Engineers assure thorough jointing.

3/4 in. dia. Bit. Standard Model — 22/6

1/2 in. dia. Bit. Standard Model — 25/-

3/8 in. dia. Detachable Bit — 30/-

REPLACEMENT UNIT BIT ELEMENTS AVAILABLE.

Patented in England and Abroad.

Sole Manufacturers:

ADCOLA PRODUCTS LIMITED

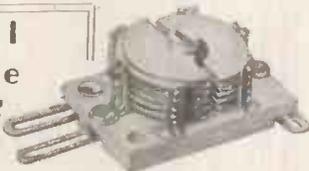
ALLIANCE HOUSE CAXTON STREET, WESTMINSTER, LONDON, S.W.1. Tele. MACaulay 4272

Technical Excellence

combines with beauty and soundness of DESIGN in the

OXLEY

DIFFERENTIAL AIR DIELECTRIC TRIMMER



★ Width: 16.5 mm Length: 25 mm/in Height:

1.5 to 8pF—8 mm

1.8 to 20pF—10.5 mm

2 to 26pF—11.5 mm

2 to 32pF—12.5 mm

Law: Straight line capacity
Power Factor: Less than .001
Insulation: Over 2,000 megohms
Voltage: 500 D.C.

OXLEY DEVELOPMENTS CO., LTD.,

ULVERSTON, N. LANCs. TEL. ULVERSTON 3306

WALTON'S OF WOLVERHAMPTON

The leading Midland Store for all your Radio and Television accessories and units, including stocks of many lines unobtainable elsewhere:

It will pay you to make a special visit to 48, Stafford Street or 65, Trysull Road. If unable to call send S.A.E. to-day to 203, Staveley Road: all of Wolverhampton, Staffs.

A few Special Clearance lines for callers only. Partly stripped 1154's, 1/6; 1196 TX, 2/-; No. 38 TX, 5/-; No. 18 TX, 5/-; 3515, 12/6; 1355, 37/6. and many hundreds of other items.

Designed and developed essentially to give best performance at lowest cost, the following apparatus is fast establishing itself wherever good telecommunication equipment is called for

1 kW TELEGRAPH TRANSMITTER 3.5-16 MC/s

60 W RADIOCOMMUNICATION TRANSCIEVER

2-8 MC/s RT/CW

20 W RADIOCOMMUNICATION TRANSCIEVER 2-16 MC/s

Ask for quotations!

MANUFACTURERS:

ATA SCIENTIFIC PROGRESS LTD.

63, Kensal Rd., London, W.10.

Tel. LAD. 1598

TRANSFORMERS, 230 v. A.C. Mains, shrouded. 150-0-150 v. at 100 Mills, size 3 1/2" x 3 3/8" x 4 1/2". Fitted with ceramic terminals, 4/- plus 1/- post.

TRANSFORMERS, 230 v. A.C. Mains, similar 150-0-150 v., 0, 10, 20, 30 and 40 v. all at 70 Mills, size 2 1/4" x 3 3/8" x 3 3/8", 4/- ea., plus 1/- post. No heaters.

PRE-AMPLIFIERS, 10 Metres, London or Sutton Television, with EF54, dust core wide band tuning, co-ax input and output sockets, size 3 1/2" x 4" x 4 1/2" (any number can be linked together), 15/- ea., plus 1/- post. Please state frequency.

FIELDS

435-437 STRATFORD ROAD, SPARKHILL, BIRMINGHAM, 11

INDEX TO ADVERTISERS

	PAGE		PAGE		PAGE
A.A. Tools	95	Factor, J. Ltd.	32	Post Radio Supplies	85
Acoustical Mfg. Co. Ltd.	36	Ferranti, Ltd.	31	Premier Radio Co.	57, 58, 59, 94
Aeru Electric Tool Mfg. Co. Ltd.	36	Fielden (Electronics), Ltd.	4	Quartz Crystal Co., Ltd.	90
Acqola Products, Ltd.	95	Field's	95	Radiant Heating Ltd.	26
Advance Components, Ltd.	29	Fluxite, Ltd.	78	Radio Exchange Co.	85
Aerialite, Ltd.	28	Frith Radiocraft, Ltd.	36	Radiomenders, Ltd.	95
Air Ministry	19	Galpins	77	Radiomics Laboratories, Ltd.	82
Aish & Co., Ltd.	85	Garland Bros.	51	Radio Merchandise Co., Ltd.	87
Albert Mfg. Co.	82	Gee Bros. Radio, Ltd.	83	Radio Servicing Co.	82
Allan, Richard, Radio, Ltd.	16	General Electric Co., Ltd.	18, 31, 37	Radiospares, Ltd.	92
Allen Components, Ltd.	96	Glaser, L.	68	Radio Unlimited	52
All-Power Transformers, Ltd.	34	Goodmans Industries, Ltd.	2	Rainbow Radio Mfg. Co., Ltd.	74
Amassador Radio	35	Goodsell, Ltd.	70	Rego-Fraser	94
Amplion (1932) Ltd.	66	Gramplan Reproducers, Ltd.	18, 54	Reliance Mfg. Co. (Southwark), Ltd.	84
Antiference, Ltd.	24	Gray, Arthur, Ltd.	72	Reosound Engineering & Electrical Co.	78
Armstrong Wireless & Television Co., Ltd.	81	Hallam, Sleigh & Cheston, Ltd.	28	Reproducers & Amplifiers, Ltd.	36
Ashworth, H.	16	Hardley, H. A., Co., Ltd.	76	Roding Laboratories	34
Astor Boisselier & Lawrence, Ltd.	40	Harfield Instruments	76	Rogers Developments Co.	74
Atkins, H. C., Laboratories, Ltd.	90	Hayes Co., The	90	Rollet, H., & Co., Ltd.	92
ATA Scientific Progress, Ltd.	45	Haynes Radio, Ltd.	38	Ruco Products	68
Audiograph, Ltd.	95	Hazlehurst Designs, Ltd.	87	Runoaken Electrical Products	84
Automatic Coil Winder & Electrical Equipmt. Co., Ltd., The	1	Henley's, W. T., Telegraph Works Co., Ltd.	84	Salford Electrical Instruments, Ltd.	32
B. & H. Radio	84	Henry's	82	Samsons Surplus Stores	86
Bakers "Selhurst" Radio	40	Hill & Churchill, Ltd.	86	Sangamo Weston, Ltd.	55
Barker, A. C.	79	Hogg, F. Livingston	70	Savage Transformers, Ltd.	72
Beethoven, Ltd.	87	Hoile, Arthur	80	Scharf, Erwin	42
Belling & Lee, Ltd.	49	Holley's Radio Stores	80	Simmonds Aeroaccessories, Ltd.	7
Berrys (Short Wave) Ltd.	92	Homelab Instruments	26	Simon Sound Service	39
Bird, S. S., & Sons, Ltd.	72	McMundo Instrument Co., Ltd.	64	Smith, G. W. (Radio), Ltd.	79
Birmingham Sound Reproducers, Ltd.	44	H.P. Radio Services, Ltd.	64	Sobel Industries, Ltd.	12
Booth, Jas., & Co., Ltd.	30	Industrial Electronics	71	Solotron Laboratory Instruments, Ltd.	10
Borough Polytechnic	82	International Correspondence School, Ltd.	89	Sound Sales, Ltd.	52
Bourne Instruments	86	Ionic Laboratories, Ltd.	89	Southern Radio Supply, Ltd.	85
Brierley, J. H. (Gramophones & Records)	14	Johnsons (Radio)	52	S-ster Transformers	90
Bristol Cine Service	14	Laskey's Radio	65	Sphere Radio, Ltd.	18
Britain, Chas. (Radio), Ltd.	62	Lawrence, G. & Co.	68	Stability Radio Components, Ltd.	28
British Communications Corp., Ltd.	26	Leak, H. J., & Co., Ltd.	55	Standard Telephones & Cables, Ltd.	47
British Distributing Co.	90	Lockwood & Co.	86	Steatite & Porcelain Products, Ltd.	25
British Institute of Engineering Technology	80, 92	Londex, Ltd.	89	Stern Radio, Ltd.	85
British Insulated Cables' Cables, Ltd.	Cover 11	London Central Radio Stores	33	Sugden, A. R., & Co. (Engineers), Ltd.	37
British National Radio School	8	Lowther Mfg. Co.	80	Supacolls	87
British N.S.F. Co., Ltd.	9	Ludry, Ltd.	88	Szymanski, S.	36
British Physical Laboratories	22, 35	Lyons, Claude, Ltd.	78	T. & C. Radio College	92
Brookes Crystals, Ltd.	88	Lyons Radio	94	Taylor Electrical Instruments, Ltd.	42
Brown, S. C., Ltd.	34	Mail Order Supply Co.	56	Telecraft	8
Bulglin, A. F., & Co., Ltd.	Edit. 259, 96	Malvyn Engineering Works	94	Telegraph Condenser Co., Ltd.	Cover 11
Bull, J., & Sons	85	Marconi Instruments, Ltd.	30	Telegraph Construction & Maintenance Co., Ltd., The	40
Bullenco	92	McMundo Instrument Co., Ltd.	10	Tele-Radio (1943) Ltd.	32
Bullers, Ltd.	71	Measuring Instruments (Pullin), Ltd.	73	Thorner J. E., & Sons	94
Cabot Radio Co., Ltd.	86	Metro Pex, Ltd.	92	Trix Electrical Co., Ltd.	50
Cabinetware	95	Metropolitan-Vickers Electrical Co., Ltd.	5	Ultra Electric, Ltd.	22
Candler System Co.	52	Miers, N., & Co., Ltd.	66	Universal Electrical Instruments Corpn.	68
Celestion Products	72	Modern Book Co.	30	University Radio, Ltd.	69, 90
Champion Products	78	Modern Electrics Ltd.	91	Valradio, Ltd.	20
Chapman, C. T. (Reproducers), Ltd.	96	Mortlake Trading Co.	73	Volgt Patents, Ltd.	32
Charles Amplifiers, Ltd.	34	M.R. Supplies, Ltd.	16	Vortexion, Ltd.	51
Cinema-Television, Ltd.	15	M.S.S. Recording Co., Ltd.	17	Walton's Wireless Stores	95
Clydesdale Supply Co., Ltd.	67	Mullard Electronic Products, Ltd.	11, 46	Wayde Kerr Laboratories, Ltd., The	30
Cohen, D.	65	Murex, Ltd.	Cover 43	Webb's Radio	4
Cole, E. K., Ltd.	23	Northall, L. C.	90	West, Spencer	88
CosmoCORD, Ltd.	48	Northern Radio Services	93	Weston Products (L'pool), Ltd.	68
Cossor, A. C., Ltd.	27	Nusound Products	89	Westinghouse Brake & Signal Co., Ltd.	20
Couplphone Radio	81	Oliver Pell Control, Ltd.	74	Wharfedale Wireless Works	45
Covestry Radio	92	Osmor Radio Products, Ltd.	14	Whiteley Electrical Radio Co., Ltd.	52
Davis, Alec. Supplies, Ltd.	6	Oxley Developments Co., Ltd.	95	Wilcox Electronics	88
Davis, Jack	74	Painton & Co., Ltd.	39	Wilcox Electric Co.	3
Duke & Co.	76	Park Radio, Ltd.	2	Wimbleton Eng. Co., Ltd.	6
Dupley Electronics, Ltd.	90	Partridge Transformers, Ltd.	75	Wireless Instruments (Leeds), Ltd.	93
Edison Swan Electric Co., Ltd.	23	P.C.A. Radio	70	Wireless Supplies Unlimited	91
Electradix Radios	95	Pearce, T. W.	91	Woden Transformer Co., Ltd.	41
Electro Trades Union	90	Peerless Radio Ltd.	93	Wright & Wearle, Ltd.	54
Electro Acoustic Developments	72	Pennine Amplifiers	89	Young, C. H.	70
Electronic Instruments, Ltd.	24				
Electronic Precision Equipment	60, 61				
E.M.I. Institutes	54				
Enthoven, H. J., & Sons, Ltd.	24				

HIGH FIDELITY AT ANY LEVEL**

A VENTEX CABINET fitted with first quality 12 in. L.S will reproduce the full frequency range at all levels. Scientifically designed. Heavily constructed. French Polished in any veneer. from 12 gns.

OUR COMPENSATOR, by correcting scale distortion, automatically gives true BASS response from a whisper to full volume. This ensures full enjoyment from your equipment at domestic levels. Suitable for use with all amplifiers. Replaces or can be used with existing volume control. 38/6 post paid C.W.O.

G. T. CHAPMAN (Reproducers) Ltd. FLAyman 3217
RILEY WORKS, RILEY STREET, CHELSEA, S.W.10

Daily demonstrations at WEBB'S RADIO

TELEVISION INTERFERENCE

Suppressors

No adverse effect. In stocks. P444 (plug-in). P445 (screw-in).

Fit in a second!

A.F. BULGIN & CO. LTD
BYE PASS ROAD, BARKING, ESSEX
Rippleway 3474-9





Specialists in **CONDENSERS** *since 1906*

It is axiomatic that experience breeds leadership—in condenser technique as in other fields of industry. That is why T.C.C. Condensers are always in the van of progress in design and efficiency.

Whatever the needs of the Electronics Industry or other users, the extensive T.C.C. range includes a suitable type, developed as a result of long and continuous research and development.

T.C.C. Condensers are exclusively specified in the View Master—the Television Set you build at home from standard parts. Constructor Envelopes (Model A, London, or Model B, Sutton Coldfield) 5/- each from all Wireless Shops.

THE TELEGRAPH CONDENSER CO. LTD.

RADIO DIVISION

NORTH ACTON · LONDON · W · 3

Telephone. ACORN 0061

IMPORTANT TO RADIO MANUFACTURERS AND TECHNICIANS

This profusely illustrated 24-page book **FREE**



"MODERN SOLDERS" is the title of this useful new book on Soldering which is offered free to buyers and technical staffs by the makers of Ersin Multicore Solder. Fully illustrated chapters on the Constitution of Alloys, Use of Solder, Melting Points, Standard Gauges, Flux Facts, etc., supported by useful graphs and tables, make this a concise reference work which is indispensable to buyers and assembly engineers. A letter (on your firm's letter heading, please) will bring a copy post free by return.

Manufacturers of radio and television equipment throughout the world find that the use of Ersin Multicore Solder effects great savings in material and labour costs. Ersin Multicore is the only solder in the world which contains three cores of extra-active non-corrosive Ersin Flux. The Multicore construction ensures flux continuity, eliminating H.R. or 'dry' joints, and giving high speed precision soldering without waste. Ersin Multicore is supplied to manufacturers in 6 standard alloys, 9 gauges and 2 flux percentages. Service Engineers and Workshops are supplied with the handy Size 1 cartons in the specifications shown.

PRICES SIZE 1 CARTONS

Catalogue Ref. No.	Alloy Tin/Lead	S.W.G.	Approx. length per carton	List Price per carton (subject)
C 16014	60/40	14	26 feet	5 0
C 16018	60/40	18	60 feet	5 0
C 14013	40/60	13	22 feet	5 0
C 14016	40/60	16	42 feet	5 0



For service engineers and radio enthusiasts two special publications are available free of charge on receipt of a stamped addressed envelope. Just include a slip of paper asking for "Hints on Soldering" and "Technical Data Card", the latter incorporates many useful radio tables including resistor colour code.

7lb. reel for factory use (Bulk prices on request) and Size 1 carton for service engineers.



MULTICORE SOLDERS LTD.

MELLIER HOUSE, ALBEMARLE STREET, LONDON, W.1 • REGent 1411