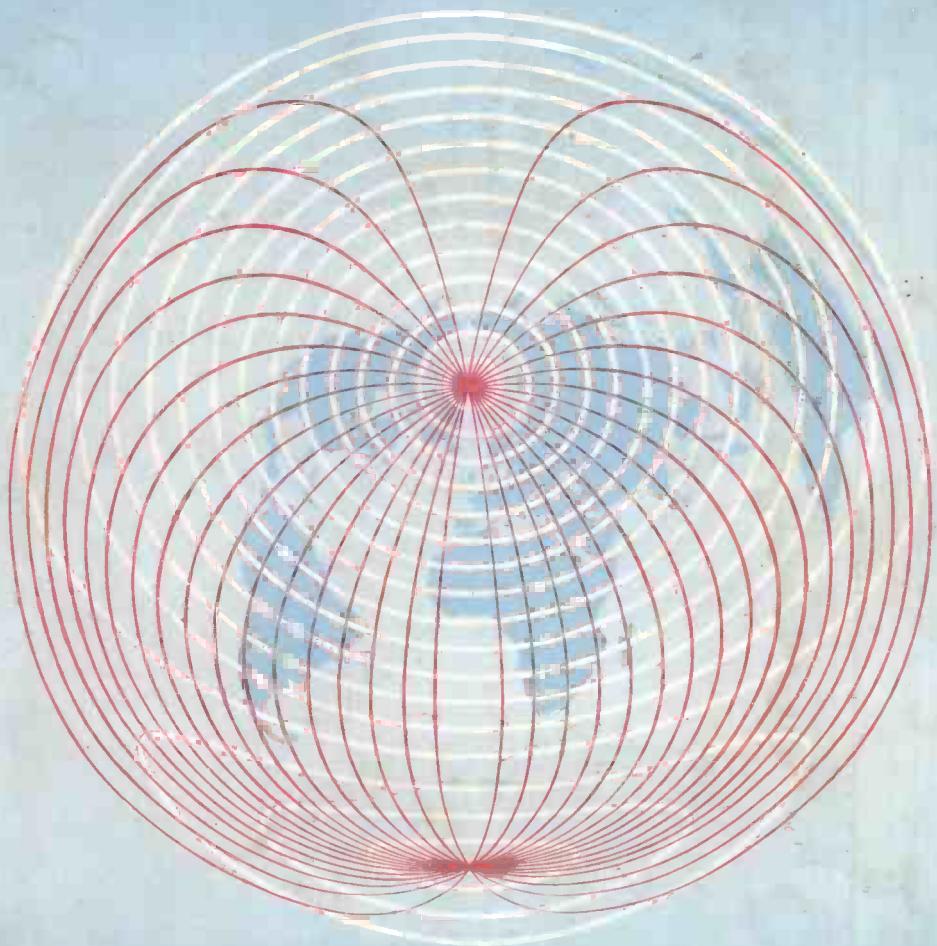


Wireless World

FEBRUARY 1954

TWO SHILLINGS



RADIO, TELEVISION AND ELECTRONICS

minus 75°c
to plus 250°c

For Radio Frequency
at Extreme Temperatures

BICC are now producing radio frequency cables insulated with P.T.F.E. (Polytetrafluoroethylene) capable of withstanding temperatures from minus 75°C up to 250°C. Inner and outer conductors are of silver-plated copper wire, while overall protection is provided by an impregnated glass braid.

Due to limited supplies we regret that this cable is only available against approved contracts.



P. T. F. E. R. F. CABLES

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

Wireless World

RADIO, TELEVISION
AND ELECTRONICS

43rd YEAR OF PUBLICATION

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

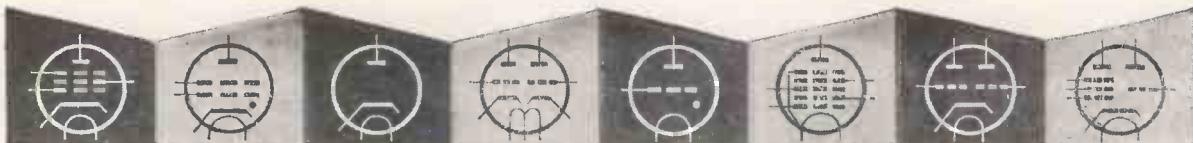
Editor: H. F. SMITH

FEBRUARY 1954

In This Issue

EDITORIAL COMMENT	51
"CHAMELEON" OSCILLATOR. By <i>Thomas Roddam</i> .. .	52
THE TRANSISTOR IN HEARING AIDS. By <i>S. Kelly</i> .. .	56
MEASURING NON-LINEARITY. By <i>D. C. Pressey</i> .. .	60
THE D.C. COMPONENT IN TELEVISION. By <i>W. T. Cocking</i>	63
IONOSPHERE REVIEW: 1953 By <i>T. W. Bennington</i> .. .	66
LETTERS TO THE EDITOR	69
RUSSIAN TELEVISION	71
TELEVISION SOCIETY'S EXHIBITION	72
RADAR ON AIRLINERS	74
WORLD OF WIRELESS	75
ELECTRON OPTICS. By "Cathode Ray"	79
MAGNETIC TAPE RECORDING	84
MEGAWATT TRANSMITTER	85
WIDE-BAND I.F. AMPLIFIERS. By <i>H. S. Jewitt</i> .. .	86
ELIMINATING C.W. INTERFERENCE. By <i>B. L. Morley</i> ..	91
"PLUG AND SOCKETRY." By <i>C. Lister</i>	92
SHORT-WAVE CONDITIONS	94
RESISTANCES IN PARALLEL. By <i>Francis Oakes</i> .. .	95
MANUFACTURERS' PRODUCTS	96
RANDOM RADIATIONS. By "Diallist"	98
UNBIASED. By "Free Grid"	100

PUBLISHED MONTHLY (last Monday of preceding month) by ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1. Telephone: Waterloo 3833 (60 lines). Telegrams: "Ethaworld, Sedist, London." Annual Subscription: Home and Overseas, £1 7s. 0d. U.S.A. \$4.50. Canada \$4.00. BRANCH OFFICES: Birmingham: King Edward House, New Street, 2. Coventry: 8-10 Corporation Street. Glasgow: 268 Renfield Street, C.2. Manchester: 260, Deansgate, 3.



VALVES, TUBES & CIRCUITS

14. FULL-WAVE RECTIFIER TYPE EZ80

The new Mullard full-wave rectifier, type EZ80, having a maximum output current of 90 mA, is suitable for the power supplies of most small and medium power amplifiers designed for operation from a.c. mains. It is a miniature all-glass valve having a single-ended construction and a B9A (naval) base. With a heater rating of 6.3V, 0.6A, the maximum peak heater-to-cathode voltage of 500 volts is sufficient to permit the heater of the EZ80 to be supplied from the same 6.3-volt winding on the transformer as the other valves in the amplifier.

CHOICE OF RESERVOIR AND SMOOTHING CAPACITORS. When designing an amplifier it is desirable to know the amount of a.c. ripple which may be superimposed on the direct voltage supplied to the valves. For a particular input voltage and output current the values of ripple and direct voltages depend upon the reservoir capacitance and upon the type of smoothing network. Generally the power supply includes a reservoir capacitor (C1), either an inductance (L) having a resistance (R) or a resistance (R) alone, and a smoothing capacitor (C2). The following table shows typical values of ripple and direct voltages across C1 and across C2 for several standard values of components. The input voltage is 2×250 V.r.m.s. and total output currents of 90 and 60 mA are considered.

In general, the value of the ripple voltage across C2 is inversely proportional to the values of both C2 and C1 whereas the ripple across C1 is only inversely proportional to the value of C1 and not dependant upon L, R or C2. To ensure a low ripple voltage at C2 it is necessary to make both C1 and C2 as large as possible. If further smoothing is desired, as with the supplies to a pre-amplifier stage, it is usual to incorporate this in a form of decoupling in order to isolate this stage. If large values of capacitance are used it is possible to economise in the design of the amplifier by replacing the smoothing choke by a resistor with little change in ripple voltage. The output voltage from C2 will then be reduced by an amount depending upon the load current and the value of the resistor. In this case the voltages required for the anodes of the output valves may be taken from C1. With a single valve output stage, the ripple across C1 must then be as low as possible. In push-pull stages, if the two output valves are reasonably similar, quite large amounts of ripple can be tolerated as they will be balanced out.

From the table it is seen that the conventional network of C1 = 8 μF, L = 10H, C2 = 16 μF may be replaced by C1 = 50 μF, R = 500 Ω, C2 = 50 μF with only a slight increase in ripple across C2 from 210 mV to 225 mV and a reduction in the ripple across C1 from 21V to 3.5V. The output voltage across C2 is reduced from 251V to 220V but the anodes of the output stage may be connected to C1, across which is a voltage of 265V.

VALVE DATA

HEATER

V _h	....	....	6.3	V
I _h	....	....	0.6	A

LIMITING VALUES

V _a (r.m.s.) max.	....	2 × 350	V
I _{out} max.	....	90	mA
C max.	....	50	μF
V _{h-k(pk)} max.	....	500	V

BASE

B9A

DIMENSIONS

Max. seated height	61	mm.
Max. overall length	67	mm.
Max. bulb diameter	22.2	mm.

$$V_a (\text{r.m.s.}) = 2 \times 250 \text{V}, I_{\text{out}} = 90 \text{mA}$$

C1 (μF)	C2 (μF)	L (H)	R (Ω)	Ripple Voltage		Direct Voltage across C1 (V)	Direct Voltage across C2 (V)
				across C1 (V _{r.m.s.})	across C2 (mV _{r.m.s.})		
8	8	10	100	21	450	260	251
8	16	10	100	21	210	260	251
16	16	10	100	10.5	110	263	254
50	50	0	500	3.5	225	265	220
50	50	0	1000	3.5	110	265	175

$$V_a (\text{r.m.s.}) = 2 \times 250 \text{V}, I_{\text{out}} = 60 \text{mA}$$

C1 (μF)	C2 (μF)	L (H)	R (Ω)	Ripple Voltage		Direct Voltage across C1 (V)	Direct Voltage across C2 (V)
				across C1 (V _{r.m.s.})	across C2 (mV _{r.m.s.})		
8	8	10	100	15	315	283	277
8	16	10	100	15	145	283	277
16	16	10	100	7.5	75	285	279
50	50	0	500	2.5	160	287	257
50	50	0	1000	2.5	80	287	227

TYPICAL OPERATING CONDITIONS						
V _a (r.m.s.)	....	2 × 250	2 × 275	2 × 300	2 × 350	V
C	....	50	50	50	50	μF
*R _{lim} min.	....	125	175	215	300	Ω
I _{out}	....	90	90	90	90	mA
V _{out}	....	265	285	310	360	V

*Per anode.

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



MULLARD LTD., Technical Publications Department, Century House, Shaftesbury Avenue, W.C.2.

MVM 260

Wireless World

FEBRUARY 1954

VOL. 60 No. 2

V.H.F. Very Much at Sea

THE world as a whole seems to have got itself into an almost inextricable tangle over international marine radio-telephone communication on v.h.f. The trouble started with the Atlantic City conference in 1947, where, we can now see clearly, insufficient thought was given to the framing of regulations for this branch of communications. As a result, frequency modulation is used in the Americas while almost everywhere else amplitude modulation has been adopted.

So far as purely local marine services are concerned, the lack of universally accepted standards is not necessarily a serious handicap. But it is a different matter when we come to ocean-going ships, which, to derive the fullest benefit from v.h.f. equipment, should be able to communicate freely with coastal stations, as well as with tugs and possibly other ships, in all parts of the world. For these vessels, universally agreed standards are clearly desirable.

America, as the principal champion of frequency modulation, has suggested that Great Britain should change over to that system, and it has been implied in reply to questions in Parliament that this change has been considered. The Post Office, however, in a memorandum issued as long ago as 1949, showed itself very much in favour of amplitude modulation. Whatever may be the advantages of f.m. for broadcasting and for some other services, it certainly has not been proved that these hold good for marine communication. A strong argument advanced against f.m. for marine applications is that it would prevent intercommunication between ships and a.m.-equipped aircraft in case of accidents.

All these matters are discussed at length in a statement, summarized on another page, recently issued by Rees Mace Marine. For an ultimate solution of the various problems, the company, appreciating the necessity for a completely new international agreement, pleads for the setting up of a truly representative marine international body. For such a highly specialized branch of communications, a body of this kind would appear to be essential, but, inevitably, the framing of new international regulations and their universal acceptance would take years. As a matter of short-term policy, Rees Mace face the inevitable,

and suggest that ships sailing to those countries which have adopted f.m. should be fitted with equipment for dual modulation as soon as the other factors involved can be agreed internationally. This proposal does at least provide a realistic solution of an awkward problem.

Safety in the Air

IF we wireless people had our way, ships and aircraft would become merely floating or flying platforms for the carrying of radio equipment. So runs an oft-repeated gibe and, in our more dispassionate moments, we must admit there is a grain of truth in it. We must always bear clearly in mind the fact that the primary function of craft navigating sea or air is to carry passengers and freight as economically as possible. There is, particularly in the air, a distinct upper limit to the amount of space and weight that can be allocated to wireless gear. Then there are the associated problems of operation and maintenance; both of these are mainly economic.

These thoughts are provoked by recent correspondence originating in *The Times*, where it was suggested that passenger aircraft could be made a good deal safer if more extensive use were made of airborne radar for preventing collisions with mountain peaks, other aircraft and dangerous clouds.

All this raises problems that cannot be summarily disposed of, one way or the other. Elsewhere in this issue a contributor who cannot be accused of undue partiality in either direction examines dispassionately some of the problems inherent in the use of airborne radar for civil aviation. Very roughly, his conclusions are that the installation of cloud warning radar may be justified on certain routes at certain times of year, but the practicability of its general application is extremely doubtful.

No doubt, however, there will be considerable technical development in this field. A device combining the functions of radio-altimeter and cloud-warning indicator, with sequential scanning in different planes and simultaneous but independent presentation of the two kinds of information, should not be beyond the bounds of technical practicability.

"Chameleon" Oscillator

Versatile Modified Hartley Circuit Giving
High Frequency Stability

By THOMAS RODDAM

ALTHOUGH you might not think so, if you took these columns as a statistical guide, oscillators are our bread and butter: or perhaps our bread, with modulators playing the role of butter. Without these two essential devices the whole of the radio field would be non-existent. It is rather surprising, therefore, how rare it is to see any description of a newish oscillator circuit, while every variant of a variant of an amplifier circuit is described in detail. One reason is that oscillators are fairly easy to build, and, apart from the traditional reversal of the feedback winding, they usually work after a fashion as soon as they are connected. When the oscillator is to work over a frequency range the requirements for stability are normally fairly lax, and any of the textbook circuits will do.

For more advanced work there is always the crystal oscillator, the Meacham bridge circuit,¹ the Gouriet circuit² or the Tillman circuit.³ But these are complicated, or difficult to design, or use a lot of components, or give rather a small output, or don't give a sinusoidal output. There appears to be room for a good middle-class oscillator giving a fairly large sinusoidal output and good stability, and not using too many components.

The oscillator described in this article appears to me to offer all these advantages. The stability against variations in valves and supplies is high, so that the frequency can be trusted to a few parts in 10^4 without supply stabilization, or better than 1 part in 10^4 if the anode supply is stabilized. It uses relatively few components in its basic form, produces all the output the valve can give, and has a very low distortion content. To date it has been tested at frequencies from 500 c/s to 10 Mc/s, using exactly the same design method, and has worked according to plan every time. This last feature, designability, is one which is often ignored in oscillator circuits: my own view is that if you can't design it you can't trust it.

The title I have chosen for this article reveals one difficulty: there are several different ways of approaching the circuit, all equally valid and all stressing different aspects of the operation. Rather than prejudge the issue, I evade it.

The basic circuit of the oscillator is shown in Fig. 1. Apart from the resistance R , it is just a cathode-coupled Hartley circuit, and the addition of R might be regarded as a bit of whimsy intended to make things more complicated. This is not so, however, because the introduction of R ties the whole circuit down to an optimum design. It also enables us to transform the circuit in several different ways: we shall come back to this point later.

Fig. 2 shows the equivalent circuit, with the valve regarded as a cathode follower and the grid connection dotted. The valve becomes a generator $\frac{\mu}{\mu+1} e_g$ with

internal impedance $1/g_m$, acting in series with R : the losses in the tuned circuit are represented by the resistance R_2 , which is the dynamic impedance of the circuit at anti-resonance.

The design problem is obviously to determine where the tap A should be on the coil, and what value of R should be used. Clearly a large value of R will be advantageous, because R and $1/g_m$ are in series, so that the bigger we make R , the more we swamp $1/g_m$ and the less effect this term will have on the behaviour of the circuit. A high value of R will help to keep the valve out of the circuit.

The coil acts as an auto-transformer, with a ratio $1:n$, so that at anti-resonance we shall see across AB a resistance of R_2/n^2 . The voltage at AB is thus

$$\frac{\mu}{\mu+1} \cdot e_g \left(\frac{R_2}{n^2} \right) / \left(\frac{R_2}{n^2} + R + \frac{1}{g_m} \right)$$

and as the auto-transformer has a step-up of n times, the voltage across BC is

$$n \cdot \frac{\mu}{\mu+1} \cdot e_g \left(\frac{R_2}{n^2} \right) / \left(\frac{R_2}{n^2} + R + \frac{1}{g_m} \right)$$

This, of course, is just e_g , so that we must have

$$\frac{n\mu}{\mu+1} \cdot \frac{R_2}{(R_2 + n^2 R + n^2/g_m)} = 1$$

For any practical valve, μ is large enough for $\mu/(\mu+1)$ to be taken as unity, within a few per cent.

Fig. 1. Skeleton of the modified Hartley circuit: the lettering is carried over to Fig. 2.

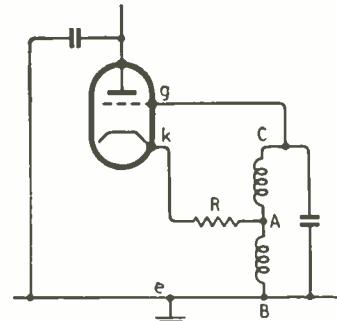
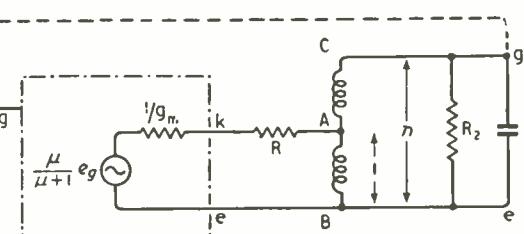


Fig. 2. (below): Equivalent circuit, for calculation purposes. R_2 is the loss in the coil.



¹ Bell System Technical Journal, Oct. 1938.

² Wireless Engineer, April 1950.

³ Wireless Engineer, Dec. 1947.

We intend to have R very much greater than $1/g_m$, to decouple $1/g_m$ from the circuit. A fairly good approximation, therefore, is that

$$\frac{nR_2}{R_2 + n^2 R} = 1 \text{ or } R = \frac{n-1}{n^2} R_2$$

In this equation R_2 is fixed, because it is a property of the coil. The maximum value of R is then obtained if $n = 2$, when $R = R_2/4$. You can check by plotting the graph of $(n-1)/n^2$ that the maximum is a fairly flat one, so that the result is not particularly disturbed by the approximations we have made, and subject to these approximations we find that the centre-tapped coil is the best solution.

We are still rather in the air, however, because the design simply says "take one coil." Can we find out anything more? We have seen that across AB we now have a resistance of $R_2/4$, and at the cathode of the valve we shall see $R + \frac{R_2}{4}$ or $R_2/2$. We know

that a high μ will help to make $\mu(\mu+1)$ more independent of μ , and a high g_m will keep $1/g_m$ small, so that we can choose a valve. The CV455 (ECC81, 12AT7) has a g_m of 5 mA/volt and a μ of about 50 (each section), so that $\mu(\mu+1)$ is 0.98 and $1/g_m$ is 200 ohms. A good load for this valve is about 25,000 ohms, which gives a compromise between gain and power output. We must therefore take $R_2 = 50,000$ ohms, so that $R = 12,500$ ohms. Of this, 200 ohms is in the term $1/g_m$, leaving 12,300 ohms. Even so, we haven't taken account of the $\mu(\mu+1)$ term, which would reduce the 12,500 ohms to 12,250 ohms, giving $R = 12,000$ ohms as a pretty close approximation.

That final dubious piece of arithmetic, with 50 ohms disappearing up my sleeve, is justified by the fact that the coil is yet to be calculated. We know that we want R_2 to be 50,000 ohms. The next step is to choose a coil type, knowing the order of Q to be expected, and from this value of Q and the value of R_2 just determined calculate the inductance. Since $Q = R_2/2\pi f L$ we have

$$L = R_2/2\pi f Q \quad \text{and} \quad C = 1/(2\pi f)^2 L$$

Having calculated the coil and constructed it, with its centre-tap, the actual value of Q can be determined, and from this the true values of R_2 and R . That is why the calculation of R above was scamped—the data lacked precision, anyway.

It is, unfortunately, necessary to add some more components, because with 10 kΩ odd in the cathode the valve current will be so small that the mutual conductance will be much lower than we have assumed. The necessary modifications are shown in Fig. 3, and as you can see, they are just a conventional cathode bias resistor R_k , which forms part of the total R , and a grid capacitor and leak resistor. The bias resistor should be the ordinary Class A amplifier bias resistor, chosen to ensure that the valve will cut off rather than run into grid current. The grid circuit should be generously proportioned, with $2\pi f C_g R_g \gg 1$ to avoid any phase shift which might alter the operating frequency. And there is the oscillator circuit, all worked out.

A particular design, operating at 1,600 c/s, made use of a dust-iron cored coil with a Q in the region of 50. For this case, assuming still that we want $R_2 = 50,000$ ohms, we have $L = R_2/2\pi f Q = 50,000/10,000 \times 50 = 100$ mH.

When tested, the coil was found to have a Q of 60, making $R_2 = 60,000$ ohms and the approximate value

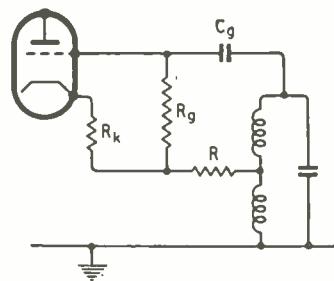


Fig. 3. Adding R_k , R_g and C_g to get the valve biased to the best point.

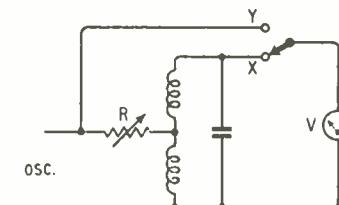


Fig. 4. No Q-meter! You can use this circuit to find the value of R needed in the oscillator. V must be a high-impedance valve voltmeter.

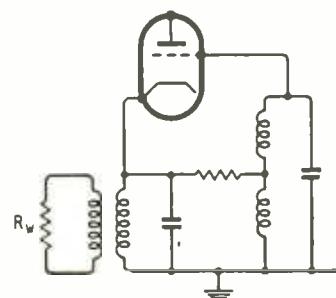


Fig. 5. A transformer in the cathode makes it possible to get the full voltage across the valve: more out, more stable.

of $R = 15,000$ ohms. No attempt was made to calculate the exact value, but a normal-tolerance 15 kΩ resistor was used and the appropriate value obtained by adding in parallel a resistance box covering the range up to 1 MΩ. A final test showed that 330 kΩ could be used for this position.

Measuring "Q"

The next stage in refinement gives further advantages, but before continuing with this it is worth noticing that a Q-meter is not needed in the design of this circuit. It can perfectly well act as its own Q-meter and, indeed, for some types of core material it is necessary to use this technique. The only apparatus needed is an oscillator, a high-impedance valve voltmeter, and a variable resistance unit. The circuit is shown in Fig. 4. The valve voltmeter is first connected to X, and the oscillator, or the circuit tuning, adjusted until a maximum reading is obtained. The switch is then moved to the position Y, and a convenient deflection obtained on the valve voltmeter. Then switching between X and Y the value of R is adjusted to obtain the same reading at both points. By the mathematics already given, $R = R_2/4$, so that Q can easily be calculated. This circuit is also very useful for studying core materials in which the loss varies with the level, because the value of R_2 for any voltage across the coil is easily, and directly, measured.

The ordinary Q-meter is only useful if the Q does not depend on the signal level.

A disadvantage of the oscillator circuit as it appears in Fig. 3, is that a lot of supply power is wasted in R_s , and that there is nowhere to connect a load. The other half of the CV455 can be used as a buffer amplifier, of course, but it would be advantageous to find some way of keeping the d.c. out of R_s , for economy, to avoid changes in R_s caused by heating and to keep g_m high by passing more current through the valve. With the values discussed above only about one-third of the supply voltage is available between anode and cathode, which is a severe limitation. The circuit shown in Fig. 5 was evolved to deal with this question. The transformer primary is chosen to have a resistance equal to the required bias resistance in low frequency designs, and has an added series resistor, which is not shown, in high frequency designs. A tuning capacitor is provided, but the tuning is extremely coarse, since the valve presents a very low impedance in shunt across the circuit. Power can be taken off in a secondary load R_w , thus avoiding the need for a buffer amplifier.

It was found that even though now loaded directly, the performance of the oscillator was not degraded, owing to the fact that the full supply voltage now appeared across the valve. The problem was then to calculate the cathode transformer. As before,

of supply voltage from 150 V to 300 V produced only about 1 part in 1,000 change in frequency. Small changes of anode voltage had very little effect on the frequency, and quite elaborate equipment was needed to measure the changes.

All the best oscillator designers incorporate a.g.c. in their designs: none is used in this oscillator. The reason why it is not needed here is in the vital inequality $R \gg 1/g_m$. Viewed at the point A in Fig. 1, the negative feedback is very large, and the valve is either operating in the linear region, or it is cut off. Even when the valve is not cut off, the impedance at the grid is very high, because of the cathode-follower action: when the valve is cut off, the impedance is, of course, even higher. As a result, the tank circuit is free to swing for a fraction of a cycle, and driven through a high resistance over the rest of the cycle. There isn't really very much which can upset the frequency.

Having decided that this circuit, which doesn't seem to have been analysed anywhere else, though it is mentioned in "Waveforms" (B. Chance *et alia*, M.I.T. Series, McGraw Hill), is a good one, there remains the problem of why it is quite so good. After staring at the circuit for quite a time it became clear that it can be drawn in the form shown in Fig. 7(a). I do not propose to go through the analysis of what

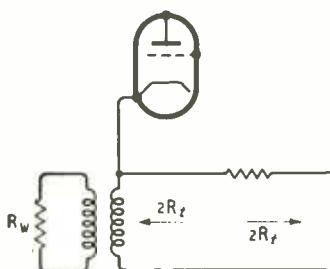
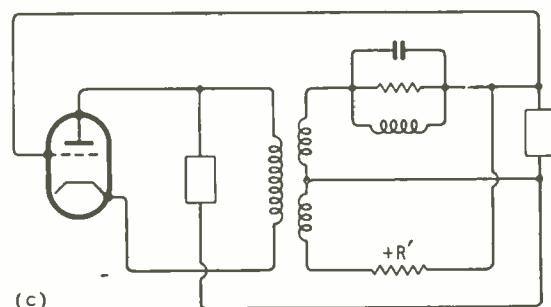
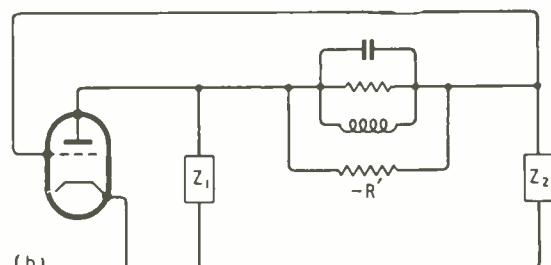
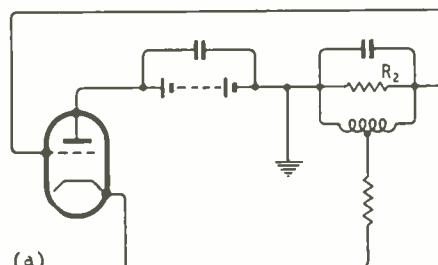


Fig. 6. The bottom of Fig. 5 looks like this as we calculate the cathode transformer.

Right: Fig. 7. Drawn as in (a) the circuit shows the bridged-T form. After the T- π transformation (b), and a further rearrangement (c), the circuit assumes a bridge form.

we must choose the load which is to be presented to the valve, and we will usually be free to take some compromise between maximum gain and maximum power, leaning now towards the conditions for maximum power. Let us call this optimum load R_* . If all the power goes into the load, and none into the oscillatory circuit, the oscillator will not be stable: if all the power goes into the oscillatory circuit and none into the load it will not be very useful. As a compromise, let us split the power equally between the load and the oscillator itself. This gives us the conditions indicated in Fig. 6, so that if we know R_w , the actual load, the output transformer must have a ratio of $\sqrt{2R_*/R_w}$. The oscillator circuit must be recalculated, with R now equal to R_* , and $R_2 = 4R_*$. This does not make so very much difference, because R_* will be lower than the optimum load for gain alone. In a particular design, the one for which the numerical example above was actually used, the value of R_* , for a CV455 was taken as 25,000 ohms, and in the embodiment of this design it was found that a change



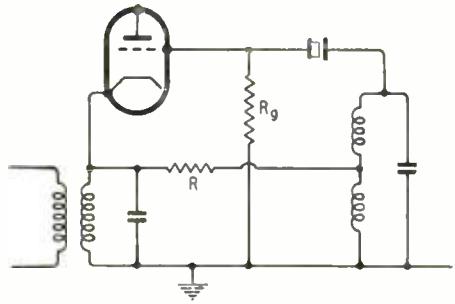


Fig. 8. You want to add a crystal? Just plug it in, and add a grid leak. The value of R needs to be reduced by a few per cent.

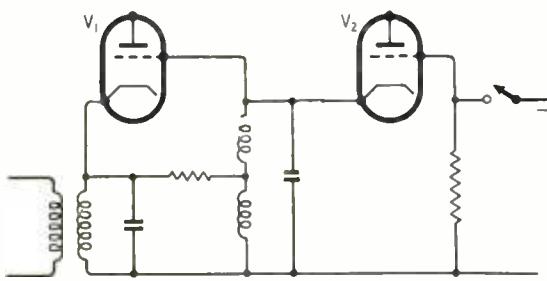


Fig. 9. The triode V_2 can be used to key the oscillator and provide the same starting phase to each pulse.

happens next, but by means of $T-\pi$ transformation the network can be converted into the form of Fig. 7(b), with the shunt arm R transforming to a negative resistance $-R'$: this is the method used to obtain an infinite-Q rejection circuit, and it was described in *Wireless World* some years back¹. A further operation gives us the equivalent circuit shown in Fig. 7(c), with a transformer providing a phase reversal on one side so that a positive R' can be used.

Now we can see what is happening. The resistance R' produces positive feedback from anode to grid, but this is offset by the negative feedback through the LCR circuit, except at the anti-resonant frequency of the LCR circuit. At this frequency the negative feedback through R_2 is not quite enough to prevent oscillation: at harmonic frequencies, of course, there is a lot of negative feedback, so that harmonics, and hum, too, are suppressed. Drawn in this way the circuit is obviously a bridge and has all the advantages of a bridge circuit. The reader may wonder why the oscillator does not include a thermistor for amplitude control, thus ensuring completely Class A operation. The answer is simple: thermistors with a suitable characteristic are hard to come by. For the example we have discussed the thermistor, which would replace the resistor R , would need to be about 12,000 ohms with an applied voltage of about 10 volts—a dissipation of the order of 10 mW. Furthermore, the resistance must rise with applied level. If this B-type characteristic were readily available it might be worth reconsidering the design to see if we could apply thermistors.

An interesting extension of the oscillator is to crystal control. It is not, I suppose, one of the very best

crystal circuits, but it has a feature of extremely great value: the crystal current is predetermined quite accurately, so that there is no reason why the crystal should be overloaded. The necessary modification for crystal control is shown in Fig. 8. The circuit without the crystal is designed in the way already described, and is set up to give oscillations at the required frequency. The amplitude of oscillation is adjusted by trimming R . Suppose that this amplitude is 20 V, and that the recommended maximum crystal current is 25 μ A. By choosing $R_g = 1 \text{ M}\Omega$, the crystal current cannot exceed 20 μ A, because the grid swing, which is equal to the cathode swing, can only drive this current through the crystal and R_g in series. When the crystal is inserted, of course, the oscillator will probably not oscillate, because R will be just too high. A very small reduction of R will be needed to make up for the loss in the series resistance of the crystal. In this circuit the crystal is operating in its series mode, and I can see no reason why it should not be worked on an overtone, although I have not yet tried this.

One final variant is shown in Fig. 9. This is actually better known than the oscillator itself. It is a method of keying this oscillator to produce a very clean square wave-train which always starts with the same phase. When the key is down, V_2 is completely backed off, and the oscillator functions quite normally. When the key is up, the grid of V_2 goes to earth, V_2 conducts and damps the tank circuit so heavily that the oscillations just stop. Each time the key is operated, therefore, the cathode of V_2 drops sharply, brings the grid of V_1 down with it, and the circuit is all set at a peak of the sinusoid, free to oscillate. This form is described in "Waveforms," referred to above.

The modified Hartley oscillator described in this article is an extremely simple and good circuit. As we have seen, it can be described as a bridge circuit; and it might also be well described as an over-balanced rejector circuit oscillator.

Measuring Interference

DIFFICULTIES have for some time been experienced both in Germany and in this country in correlating the data on the measurement of interference from motor vehicles obtained in each country. Tests were, therefore, arranged through the Electrical Research Association and the Fernmeldetechnisches Zentralamt, with the co-operation of Joseph Lucas, Ltd. and the Bosch Co., in order to compare the behaviour of the British and German measuring equipment under identical conditions.

A comparison of the two types of equipment, as a result of tests which were carried out in January last year at the F.T.Z. at Darmstadt, is given in a report published by the E.R.A. This report (M/T123) entitled "Radio Interference from Motor Vehicles," by A. H. Ball and S. F. Pearce, shows that the British interference measuring equipment (Post Office measuring set RI2) will give indications of field strength from an ignition system approximately 20 db lower than that obtainable with the German set.

The results of the tests show why more elaborate suppression was required in Germany to meet the proposed limit of 120 μ V/m than has usually been found necessary to conform to the British limit of 50 μ V/m. Experience in Germany would be comparable with that in Great Britain if the proposed German limit were increased to 500 μ V/m.

The report is obtainable from the British Electrical and Allied Industries Research Association, Thorncroft Manor, Dorking Road, Leatherhead, Surrey, price 10s 9d by post.

¹ June 1950, p. 223

By S. KELLY*

The Transistor in

DURING the five years since the introduction of transistors, considerable effort has been expended not only in the development of the transistors themselves but also in circuit techniques and associated components. The prime advantages of the transistor are the ability to work at very low power levels with high efficiency, small size and light weight. The disadvantages of currently available transistors are higher noise level than equivalent vacuum valves, rather bad temperature coefficient, and greater variability of characteristics than vacuum valves. So far as can be seen at present, the first and last of these criticisms are a question of manufacturing techniques and will be overcome as quantity mass production of transistors becomes fact. The question of temperature coefficient appears to be bound up in the nature of the beast and, for the time being at any rate, must be suffered. Variations in transistor characteristics and temperature coefficient can be compensated by circuit design, but are usually wasteful of gain, and with the present high cost of transistors cannot usually be justified on economic grounds for commercial applications.

It is important to appreciate that the transistor behaves almost as the dual of the familiar vacuum valve.¹ Additionally, there is considerable reaction

* Cosmocord, Ltd.
R. L. Wallace and G. Raisbeck. B.S.T.J. April, 1951

between the input and output circuits coupled to the transistor, which is almost entirely absent in vacuum valve circuits at low frequencies, thus requiring an entirely different approach to circuit design. Unfortunately, junction transistors have not so far been generally available in this country, with the consequence that practical experience, which alone can give familiarity with any technological process, has been denied to the majority of designers.

Apart from specialist uses, such as for military requirements, computers, and the telephone industry, the main outlet for transistors in the domestic field in the next few years would appear to be in hearing aids and miniature "personal" radio receivers, where the high initial cost of the transistor is more than outweighed by the considerable saving in running costs. So far as can be seen, the transistors will all be of the junction type.

An output power of 2.5mW at 10 per cent distortion can be obtained from available junction transistors for a current consumption of 2mA at 3V, or an efficiency of 42 per cent. A modern hearing aid sub-miniature output pentode gives 0.95mW output at 10 per cent distortion for a total battery power consumption of 15.25mW with an efficiency of only 6 per cent. The significance of the transistor will be appreciated by those who have not already had experience of maintaining small battery-operated devices, when it is realized that the cost of "high-tension" power from batteries may cost as much as £5 per kilowatt hour as compared with, say, 1d from the national electricity supply grid.

Because of the low voltages and currents involved, the design of really sub-miniature components becomes a practical proposition, and the reader is referred to the article "Components for Transistors," by G. W. A. Dummer (*Wireless World*, May, 1953). These components, however, have been developed for the Services, and are not yet generally available.

Transistors can be used in various ways: (a) earthed base, (b) earthed emitter, and (c) earthed collector. Fig. 1 shows their approximate equivalent vacuum valve circuits.

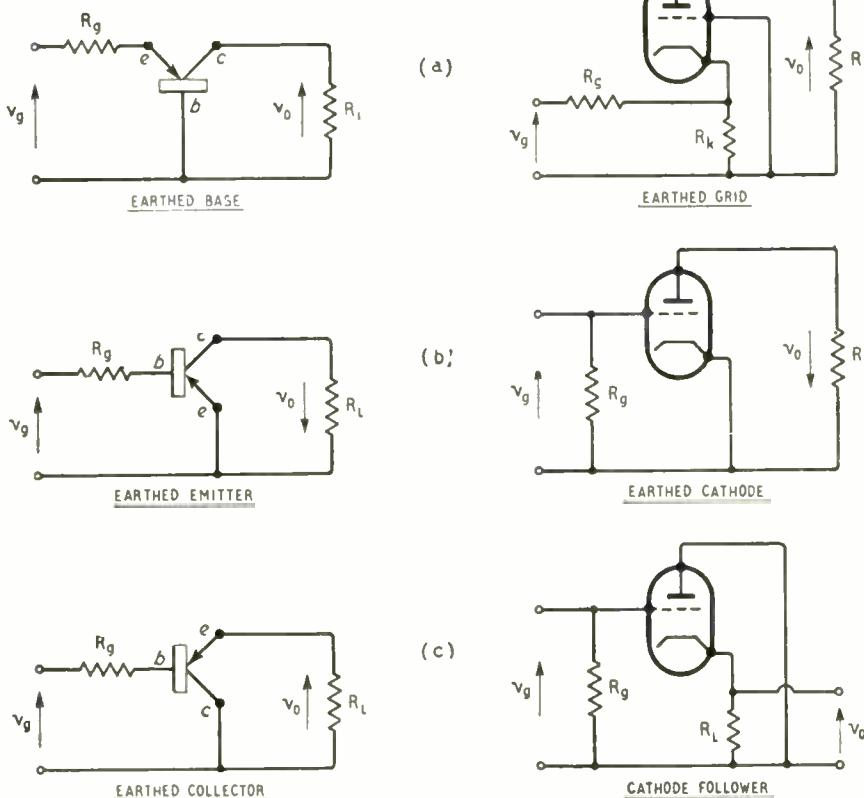


Fig. 1. Transistor circuits and their approximate valve duals.

Hearing Aids

*Its Impact on
the Design of
Components*



It is emphasized that these are approximate only, but they are a good practical working guide. Application of feedback to the equivalent circuits can give an exact correlation,² but it is not justified in this dissertation.

When used as an earthed base amplifier, the input resistance lies between 40 and 100Ω and the output resistance between $100k\Omega$ and $300k\Omega$; the power gain will vary from 10 to 20db for a variation in load impedance of 1,000 to 10,000 Ω . As shown in Fig. 1 (a), this form of connection behaves very much the same as an earthed grid triode.

The earthed emitter gives the same general effect as a normally connected triode with the cathode at earth potential. The input resistance is 500 to $1,200\Omega$, the output $20k\Omega$ to $100k\Omega$; the power gain is 20 to 30db for a source resistance of 800 to $1,200\Omega$, and a load resistance of $15k\Omega$ to $25k\Omega$ (Fig. 1 (b)).

When used as an earthed collector, Fig. 1 (c), the cathode follower configuration is approximated. The input resistance will vary from $10k\Omega$ to $200k\Omega$ when the load resistance is varied from 500 to 10,000 Ω , the power gain being almost constant at about 10db for a variation in load resistance of 300 to 10,000 Ω .

Circuit Design

From the above it is seen that there is considerable interaction between the input and output circuits, and the determination of the operating point, particularly when using a single power source (which is dictated by the ease of battery replacements, servicing, etc.), becomes a complicated affair. However, for the majority of audio-frequency applications, the earthed emitter configuration is used and the circuit designed backwards (i.e., decide power output, determine the best load resistance, then work towards the front end).

As we have seen, the input resistance of the average transistor working as an earthed emitter is of the order of $1,000\Omega$ as against, say, 0.5 to $5M\Omega$ for the grid resistance of a vacuum valve. The output impedance of the transistor will usually be of the order of $20,000\Omega$, and for maximum power gain the load resistance should approximate this value. In cascade circuits, some form of impedance transformer will therefore be required to couple the stages. Were transistors not so costly, it would be possible to use an earthed collector transistor as the impedance-transforming device between the earthed emitter units. Under present conditions it is more economic to use a transformer.

The transformer shown third from the left in the

² R. F. Shea, "Transistor Circuits" Chapter 15.

Some typical transistor hearing aid components. (Left to right) $6\mu F$ electrolytic coupling capacitor, junction transistor, coupling transformer, bias cell, on-off switch and low-resistance logarithmic volume control.

photograph measures $0.375\text{in} \times 0.375\text{in} \times 0.25\text{in}$. The stack of 0.008in thick Mumetal laminations has a core cross-sectional area of $0.096\text{in} \times 0.096\text{in}$ and the bobbin is 0.25in cube. The primary is wound with 3,500 turns of 49 s.w.g. and the secondary with 800 turns of the same gauge of wire. The insertion loss of the transformer at 3,000c/s is 2.7db under working conditions, the primary inductance being 6 henrys when measured with 0.1 volt a.c. across it.

The coupling condenser, which is of the electrolytic type, has a value of 5 to $10\mu F$, in order to maintain the bass response with the low value of the load resistance. Compared with the remainder of the components, the electrolytic condenser is somewhat large, and some Continental manufacturers have replaced it with a modified form of bias cell (fourth from left in the photograph). This requires the circuit constants to be slightly rearranged so that a maximum potential difference of 1.2 volt across the cell terminals is not exceeded. Under these circumstances, the bias cell behaves as a capacitance of $30\mu F$ at 3,000c/s, the impedance being approximately constant with frequency and the leakage current negligible.

One of the severest headaches encountered to date has been the provision of sub-miniature volume controls with a low resistance value of $5,000\Omega$ and a logarithmic track. These are now available in production quantities and when used between the first and second stages of the amplifier, the noise level is considerably less than that due to associated circuits.

Choice of Microphone

Valve-operated hearing aids almost invariably use piezo-electric microphones, the input resistance of the amplifier is usually of the order of 10 to $30 M\Omega$, and the design of the microphones is directed to obtain the highest practical open circuit voltage sensitivity. To this end, small crystals using series elements are used, resulting in an output of approximately 3 millivolts with a source capacity of 300 to 500pF . But the transistor has a low input impedance and must be thought of as a power-operated rather than a voltage-operated device.

Crystal microphones can be used successfully with transistors by using an appropriate matching trans-

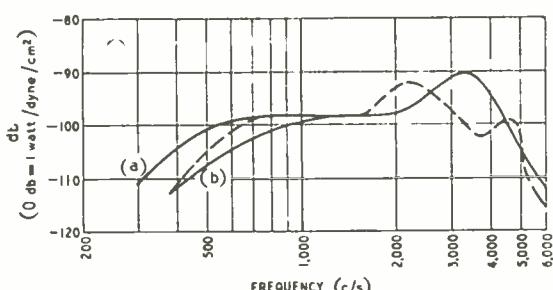


Fig. 2. Response of parallel-connected crystal with transformer working into 1,000-ohm load. Microphone capacitance (a) 4,000pF, (b) 2,000pF. A typical magnetic microphone response is shown dotted.

former. If a normal type of hearing aid microphone is used, the primary inductance of the transformer would need to be between 100 and 200H for adequate bass response. This high value of primary inductance can be reduced to approximately 20H or even less if certain elementary modifications are made to the crystal assembly. It can be shown that if a parallel combination of crystal elements instead of the usual series arrangement is used, the voltage is reduced by half, and the capacitance increased by four times—which, in terms of available power, is exactly the same as the first case. If the crystal is further subdivided, into a total of four elements, the capacitance is increased 16 times and the voltage output reduced to a quarter. (These two latter combinations giving between 2,000 and 4,000pF and 10,000 and 20,000pF respectively.)

Coupling Transformers

It thus becomes a practical proposition to design a sub-miniature matching transformer to couple the microphone to the transistor. In the case of the four-element crystal, the transformer previously described functions quite satisfactorily, but the crystal element is a rather costly proposition. The two-element parallel crystal can be used successfully if the primary inductance of the coupling transformer is approximately 20H. The absolute value is arranged to resonate with the microphone crystal capacitance at the low-frequency end of the spectrum (the -3db point). This has been taken as 750c/s for hearing aids, and without any secondary loading there will be a resonant rise in current at this frequency. The turns ratio is adjusted to give the maximum power transfer at 1,000c/s, resulting in a virtually aperiodic system, and

a fall of 6db per octave below 750c/s. The actual transformer winding consists of 6,000 turns of 50 s.w.g tapped at 600 turns, and is used as an auto-transformer to conserve space.

The sensitivity of the microphone plus transformer is -100db referred to 1 watt per dyne per cm² at 1,000c/s and can be maintained easily to 6kc/s (Fig. 2). It should be noted that the high-frequency performance of these miniature transformers is extremely good, considering their simple construction, some units being only -1db at 20kc/s referred to the 1-kc/s level.

Magnetic-type microphones, which can be manufactured quite economically for low-impedance working, are quite a practical proposition, the coil being wound to give the correct source impedance for matching the input impedance of the transistor. The majority of present-day magnetic microphones are very similar in construction to the magnetic telephone receiver with the addition of an auxiliary diaphragm. The power sensitivity of these units is the same as the crystal microphone, being approximately -100db referred to 1 watt per dyne per cm². With one or two notable exceptions, the high-frequency response is not good, there being a rapid cut-off above the main resonant frequency, which is usually about 2,500c/s.

The modern insert magnetic telephone receiver is characterized by high power sensitivity, good low-frequency response, and low distortion; but the high-frequency response could, with advantage, be improved. In most units the peak sensitivity is at about 2kc/s with a very rapid fall-off in sensitivity beyond 2.5 to 3kc/s. They can be wound to any required impedance between about 25 and 10,000Ω and can therefore be connected directly in the transistor collector feed circuit without an isolating transformer. Excellent impedance match can be obtained and they will give an output in excess of +120db referred to 0.0002 dyne per cm² (threshold level) for 2 milliwatts input power. This is usually adequate for most hearing aid and miniature receiver requirements.

Fig. 3 shows a complete hearing aid amplifier circuit which has performed satisfactorily with both American and British junction transistors.

Maximum power output, whilst keeping within the limiting values imposed by the transistor manufacturers, requires rather critical control of the base bias resistor, and it has usually been necessary to vary this resistance for optimum conditions, the value usually lying between 5kΩ and 30kΩ. Once the optimum value has been determined, it can be considered fixed for the life of the transistor, provided that the unit has not

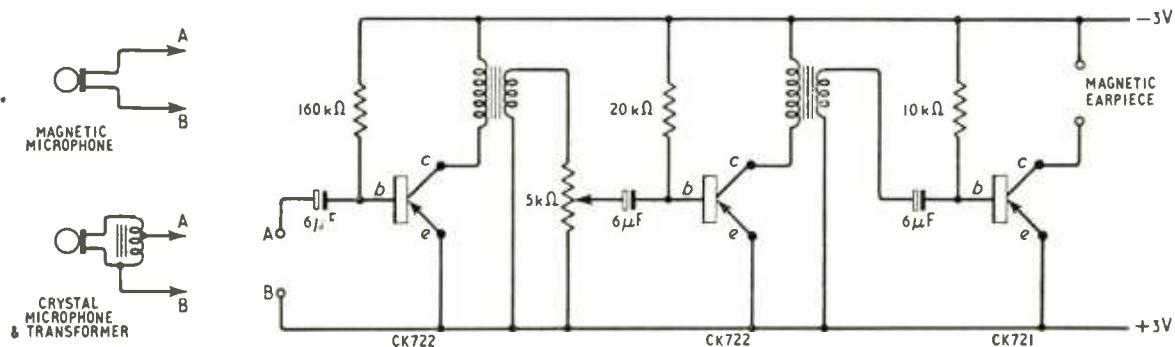


Fig. 3. Hearing aid circuit which gives good results with many makes of junction transistor.

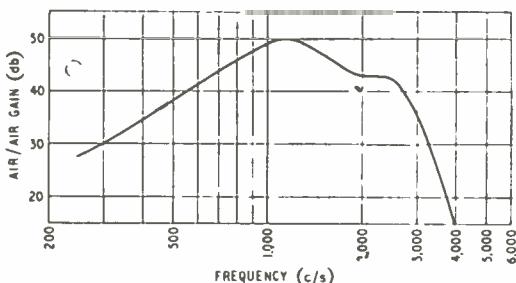


Fig. 4. "Air-to-air" overall gain of the hearing aid whose circuit is given in Fig. 3.

been exposed to temperatures in excess of about 60 deg C. It has been found easier to adjust the resistance until the collector current is of the order of 2 to 2.2mA, although for greater power output it can be adjusted for a maximum of about 4mA. This results in a reduction of the input impedance of the transistor and the coupling transformer turns ratio must be adjusted accordingly.

The second stage is not critical, but the adjustment of the base resistor can vary the overall gain quite considerably. Here, however $20k\Omega$ has proved more satisfactory.

Noise Reduction

Either magnetic or crystal-cum-transformer microphones may be used, and the circuit is generally self-explanatory. There are, however, one or two points which need amplification. Usually the first transistor has to be carefully selected for noise and it has been found expedient to vary the base bias resistor for optimum results—about $160k\Omega$ results in the best compromise between maximum gain and maximum signal-to-noise ratio.

The coupling transformers are the units previously described, and the maximum working gain is of the order of 80 to 85db. It is flat from about 500c/s to 15,000c/s. With care, the noise level can be dropped within 20db of Johnson noise. Transistor noise differs from other common types such as thermal and shot noise in that transistor noise per unit bandwidth varies approximately inversely with frequency,³ (i.e., each octave of the frequency range contains the same noise power). The representative value of the collector open circuit noise voltage is 5 to 15 microvolts; the emitter open circuit voltage is usually 30 or 40db below this value. The total noise is, however, very dependent upon the operating point. The emitter noise is almost independent of the collector voltage whilst the collector noise depends strongly on it. In addition to this dependence on operating conditions, noise is also very dependent upon operating temperature, and, generally, the increase in noise is such as to detract considerably from the use of transistors in fairly low level circuits for use in temperatures in excess of 40 deg C. Additionally, the transistor parameters vary very considerably with temperature. For example, the collector resistance under a given set of conditions can vary from $100k\Omega$ to $50k\Omega$ over a temperature range of 20 deg to 70 deg C. The latter is considerably above normal ambient temperatures and will

not usually be reached with transistors working under low power conditions, but this temperature can certainly be obtained if the transistor is called upon to deliver more than a few milliwatts of power.

Fig. 4 shows the air-to-air response of the complete hearing aid receiver, and before the high-fidelity enthusiasts raise their hands in pious horror, a word of explanation may be offered. The amplifier portion is quite flat in the high-frequency region, and the very rapid fall off with frequencies above the peak is due almost entirely to the insert telephone receiver. The low-frequency cut-off is deliberately engineered in the microphone circuit in order to provide the most desirable frequency response of +12db per octave which, according to the Medical Research Council Report No. 261, results in optimum articulation efficiency for deaf people. The overall performance is by no means ideal, but is comparable with the average two-valve and some of the three-valve hearing aid units being offered to the public today. The high-frequency response could be materially improved with a better high-frequency performance on the part of the telephone receiver. It may be thought possible to compensate for this lack of high-frequency response by altering the frequency characteristic of the amplifier or microphone, and this would be satisfactory if the unit were not required to run at peak power over the whole frequency band. Obviously, if the output transistor is delivering peak output at 1,000c/s and a rise in frequency characteristic is built into the pre-amplifier, it will be grossly overloaded at these higher frequencies although, at lower levels, the measured frequency response may appear superior.

Much remains to be done in component development for use with transistors and, in this country at least, it can be said that generally transistor development is ahead of associated components. But, to revert to the introductory remarks, it is a pity that more transistors were not generally available earlier, because they are delightful little beasts and tend to grow upon one.

PRODUCTION CONTROL

IN the report of the specialist team* on production planning and control which visited the United States in 1951, the use of radio as an aid to production control—in some quarters erroneously called radio control—is strongly recommended to British industry.

One of the first engineering concerns to employ radio communication to co-ordinate the movement of goods in its factories was Davey, Paxman and Company, of Colchester, Essex. Their installation, which includes five mobile units and a control station, was initially installed by Pye two years ago. Operating on 172.2 and 182.2 Mc/s, which are shared with (among others) a London taxi organization, the fixed station can readily be received at Harwich Quay, over 25 miles away. Its main use, however, is for the co-ordination of movement of heavy cranes and fork lifts within the main works and the conveyance of goods between the two factories which are about a mile-and-a-half apart.

With the proposed clearing of Band 3 to make room for an alternative television service, the position of such users is threatened and the recently formed Mobile Radio Users' Association is strongly contesting the users' case.

* Among the 12 members of the team were representatives of Plessey, B.T.H., E.M.I. and Automatic Telephone & Electric Co.

³ H. C. Montgomery. *Bell Lab. Record* Sept., 1949.

Measuring Non-Linearity

By D. C. PRESSEY, B.Sc. (Lond.)*

DISTORTION arises as a result of non-linearity in the input versus output characteristic of apparatus, and has been the subject of two recent articles in *Wireless World*^{1,2}. This article has been written with the object of supplementing them with a method of measuring non-linearity that is simple, and has found numerous applications.

When the input is sinusoidal the output contains harmonics of the input frequency as well as the fundamental, and to measure or examine the distortion the fundamental must be somehow removed.

For the purpose of diagnosis, Wigan¹ has described a rather elaborate method for subtracting the fundamental; it requires both filters and phase-shifters. Tyler² uses a fairly simple valve filter to remove the fundamental.

The disadvantages of filters are that they may shift the phase of harmonics, and that they restrict the test frequency to that for which the filters were designed.

In the following method the subtraction is carried out by a frequency-insensitive element, so that tests may be carried out from zero-frequency upwards and without the need, in general, of pure sine-wave test signals.

The basic principle is simply that if the apparatus is linear, and of gain A, the output may be cancelled by adding to it a voltage A times the input voltage, but in

* Southern Instruments Ltd., Camberley, Surrey.

Fig. 1. Illustrative input/output characteristic.

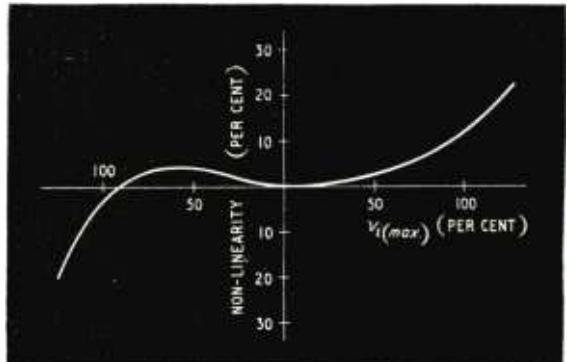
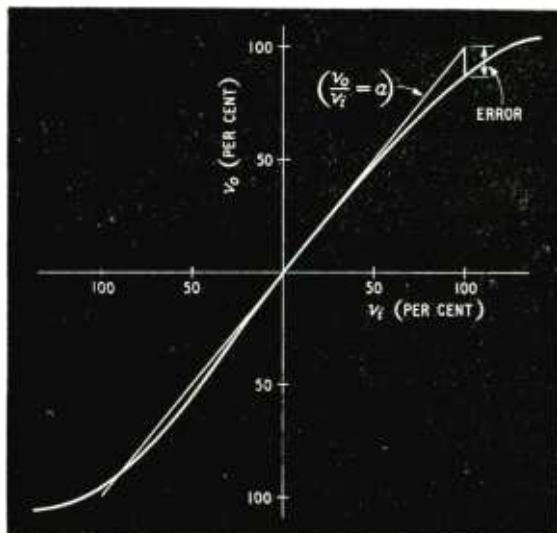


Fig. 2. Here, the non-linearity of the characteristic of Fig. 1 is plotted as a percentage of the nominal maximum output $aV_{i(\max)}$, against the input V_i . These two figures incidentally illustrate the difficulty of observing non-linearities of below 3% on c.r.t. displays corresponding to Fig. 1.

anti-phase to the output. If the apparatus is non-linear incomplete cancellation results, the difference being exactly equal to the amount of the non-linearity for every value of the input voltage.

This method was developed particularly to measure the non-linearity of d.c. computing amplifiers and other units having non-linearities of the order of 1% or less, but it is entirely suitable for less rigorous tests.

The process can be formulated mathematically as follows. The relationship between output and input can be written :—

$v_o = av_i + bv_i^2 + cv_i^3 + \dots \dots \dots$ (1)

where the coefficient a defines the gain, and b , c , etc., are the coefficients of the non-linear terms. This relationship is depicted in Fig. 1, showing also that a is the slope of the tangent to the curve at the origin. If the apparatus were linear the output would be av_i , and adding $-av_i$ to equation (1) gives :

$$v_o - av_i = v_e = bv_i^2 + cv_i^3 + \dots \dots \dots \quad (2)$$

Strictly, the percentage non-linearity is given by :

$$N = (v_e/av_i) \times 100\% \quad \dots \dots \dots \quad (3)$$

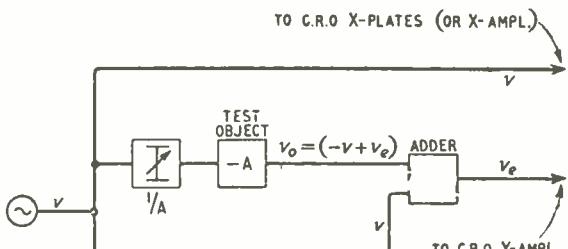


Fig. 3. Suitable experimental arrangement.

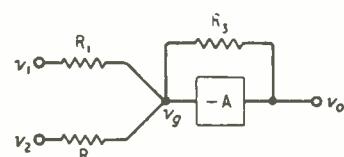


Fig. 4. Amplifier connections to provide an output proportional to the sum of two inputs. Typically $R_1 = R_2 = R_3 = 1M\Omega$.

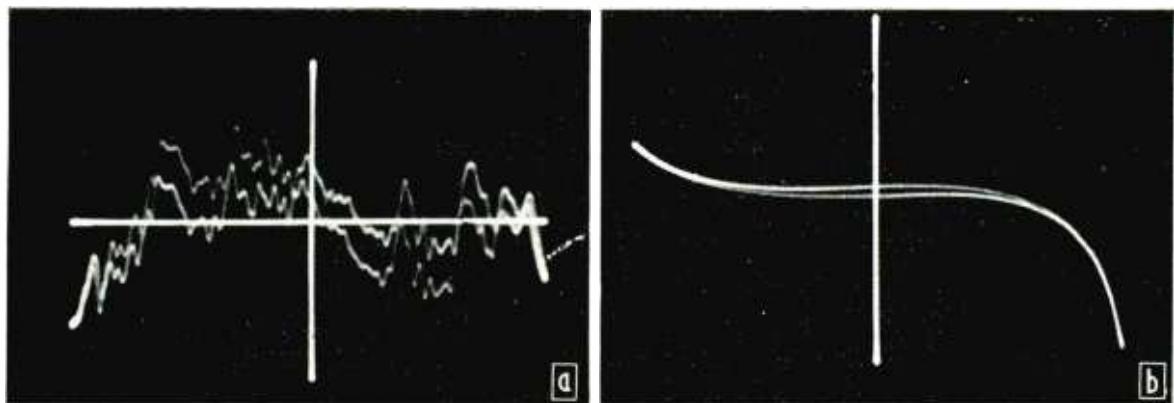


Fig. 5. The trace (a) shows the error in the output of an analogue multiplier. The irregularities are due to a scanned edge, and the separation of the traces is due to hum. The gain has been taken as the value which gives minimum peak-peak value to the error voltage. The amplitude of the calibration line is $\pm 0.5\%$. In (b) is shown the error of a paraphase amplifier adapted from the circuit of Fig. 6(a) by applying the input to R_1 and omitting R_2 . In this case the error curve is horizontal at the origin. The amplitude of the calibration line is $\pm 1\%$.

but it is more convenient, and more usual, to calculate the non-linearity as a percentage of the nominal maximum output; i.e., $av_{i(\max)}$ is used in place of the term av_i in equation (3). The non-linearity of the curve in Fig. 1, is plotted on this basis in Fig. 2.

This way of defining the gain leads to the simplest mathematics, and is correct for audio amplifiers and many others. For other applications (e.g., oscilloscope amplifiers) it is more convenient to define the gain as the slope of the best straight line, which, in this case, is that straight line drawn through the origin which gives minimum errors at all points throughout the working range.

In d.c. amplifiers for analogue computers the quantity v_e is frequently called the "error" due to the amplifier, leading to the name "error curve" for the curve of Fig. 2. As it shows the departure from true linearity of the apparatus this term is thought to be more descriptive than "difference diagram," as used by Wigan. Furthermore, the error of a meter is expressed in this way, $av_{i(\max)}$ corresponding to full-scale deflection.

Experimental Arrangement. The simplest and most accurate arrangement for testing a phase-

reversing amplifier by this method is shown in Fig. 3. If the attenuator is adjusted till the error curve is horizontal at the origin, or till the errors are minimal, depending on the application of the unit, the attenuation is then equal to $1/A$, A being the gain of the test object. The value of N is found by calibrating the Y-amplifier by means of a suitable fraction of v . The adding unit is of the type used in analogue computers. For d.c. tests the oscilloscope X and Y amplifiers can be replaced by meters.

Fig. 5 shows some of the results obtained.

The adding unit is a negative-feedback amplifier connected as in Fig. 4. For $R_1 = R_2 = R_3$ and a sufficiently high gain the output approximates to the sum of the inputs, i.e.,

$$v_o \approx (v_1 + v_2) \quad \dots \quad \dots \quad \dots \quad \dots \quad (4)$$

For example, for $A = 150$, $v_o \approx 0.98 (v_1 + v_2)$, which is sufficiently accurate for many purposes. If required, perfect addition may be obtained by making

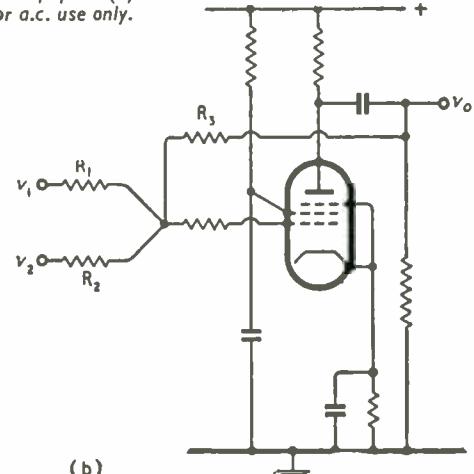
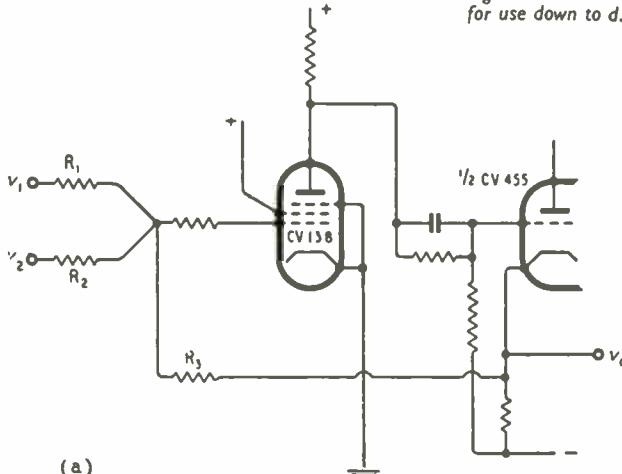
$$R_3 = R(A - 1)/(A + 2) \quad \dots \quad \dots \quad \dots \quad (5)$$

where $R_1 = R_2 = R$

These formulæ are derived in Appendix 1.

A suitable circuit is shown in Fig. 6 (a). For a.c. use only, the simpler circuit of Fig. 6 (b) can be used.

Fig. 6. Circuits of adding amplifiers (a) for use down to d.c. (b) for a.c. use only.



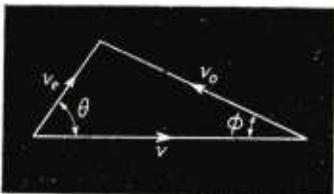


Fig. 7. Vector diagram for the equation $v_e = v + v_o$. The amplitudes and phase angles are shown. If v is taken as the reference phase, then conventionally, both v_o and ϕ are negative for the case shown.

In the computer field such arrangements are known as "adders," or "adding amplifiers."

For the a.c. tests of non-phase-reversing units the problem of phase-reversal is simply solved by the use of a centre-tapped transformer to supply test signals to the adder and the test object in antiphase. For d.c. tests a paraphase amplifier must be inserted between the attenuator and the unit under test, except when this has a gain of less than unity, when it is best to insert it in the lead to the adder, as it then has to handle smaller signals. The non-linearity of this unit has to be added to the measured error; its non-linearity being simply measured by first omitting the test object and attenuator.

The attenuator may be dispensed with when the gain of the unit under test does not differ greatly from unity by adjusting the ratio of (R_1/R_2) .

Requirements of Test Apparatus and Precautions.—It is essential for the adder and Y-amplifier (and X-amplifier and attenuator if used) to be free from phase shift at the test frequency. At 50 c/s, or even 1,000 c/s, this presents little difficulty. When testing at mains frequency, it is advisable to observe the c.r.o. trace before applying the test signal to the adder and the test object in order to note any hum. If the test object introduces any phase-shift the error curve will take the form of a loop.

A saw-tooth test signal may be used (e.g., a c.r.o. time-base) providing that the frequency response of all units, including the one under test, is flat over the range of frequencies contained in the saw-tooth. This is quite a stringent requirement as harmonics up to twenty times that of the recurrence frequency will normally be present.

Accuracy.—The method is inherently very accurate provided that the adder is carefully adjusted to give no output for equal and opposite inputs. Subsequent errors in measurement of the error voltage are of secondary importance. Thus if a paraphase amplifier giving a nominal 50 volts out has a measured error voltage of 50 millivolts then the non-linearity is 0.1%, but if there is, say, a 10% high error in the measurement of the error voltage the true figure for the non-linearity is 0.09%. If the output had been measured directly, however, and the measuring instrument had given a 10% high figure (i.e., 55.05 volts) the figure for the non-linearity would have appeared to be 10.1% instead of 0.1%.

Measurement of Phase-Shift.—Phase-shift is usually accompanied by a change in the output level. To measure these it is necessary to use a pure sine-wave input and to decrease the input level until the test object is substantially linear. The c.r.o. display will then be elliptical if the phase shift is present. The amplitude and phase angle of the error voltage are then determined^{3,4}. If these are v_o and θ then the amplitude error is given by $(v - v_o)$, which may be expressed as a percentage or as a number of decibels in the usual way, where v_o is given by :

$$v_o = \sqrt{(v^2 + v_r^2 - 2vv_r \cos \theta)} \dots \quad (6)$$

and the phase angle is given by .

$$\phi = \cot^{-1}[(v/v_r) \operatorname{cosec} \theta - \cot \theta] \dots \quad (7)$$

The formulae are derived in Appendix 2.

Further Applications.—It is possible to apply this technique of error measurement to the testing of servo-mechanisms providing that the input and output are, or can be converted into, voltages. It is thought that it may be possible to carry out what have been referred to as two-terminal tests¹ by the provision of a reference signal.

Acknowledgements.—The author wishes to record his indebtedness to his colleagues and to Mr. J. A. Colls for helpful discussions.

APPENDIX 1

The analysis of the circuit of Fig. 4 is as follows. Denoting the gain of the amplifier by $-A$, we have

$$(v_o + v_r) R_3 = (v_1 - v_r) R_1 + (v_2 - v_r) R_2 \quad (1)$$

and $v_o = -Av_r$ (2)

From (1), putting $R_1 = R_2 = R$ (3)

$$v_o = [(v_1 + v_2)R_3/R] - v_r(1 + 2R_3/R) \quad (3)$$

From (2) and (3)

$$v_o = (v_1 + v_2)(1 - 1/A - 2R_3/AR) \dots \quad (4)$$

showing that the output is equal to the sum of the inputs multiplied by a constant factor. For $R_3 = R$, this reduces to

$$v_o = (v_1 + v_2)(1 - 3/A) \dots \quad (5)$$

which approaches unity as A approaches infinity. If required, perfect addition is obtained by making the factor exactly unity, and the condition for this is

$$R_3 = R(A - 1)(A + 2) \dots \quad (6)$$

APPENDIX 2

Relationships between error voltage and output voltage.

Fig. 7 shows the vector relationship of the voltages involved. For the case shown, if v is taken as positive, then v_o and ϕ are negative, ϕ being a phase lag.

Clearly, for v_o we have

$$v_o = \sqrt{(v^2 + v_r^2 - 2vv_r \cos \theta)} \dots \quad (1)$$

Also $v = v_r \cos \theta + v_o \cos \phi \dots \dots \dots \quad (2)$

and $v_o \sin \theta = v_r \sin \phi \dots \dots \dots \quad (3)$

therefore $v_o = v_r \sin \theta \sin \phi \dots \dots \dots \quad (4)$

whence $v = v_r \cos \theta + v_o \sin \theta \cot \phi \dots \dots \dots \quad (5)$

∴ $\cot \phi = (v - v_r \cos \theta)/v_o \sin \theta \dots \dots \dots \quad (6)$

or $\phi = \cot^{-1}[(v/v_r) \operatorname{cosec} \theta - \cot \theta] \dots \quad (7)$

REFERENCES

- Wigan, E.R., "Diagnosis of Distortion," *Wireless World*, Vol. 59, p. 261, June 1953.
- Tyler, V. J., "Simple Distortion Meter," *Wireless World*, Vol. 59, p. 431, September 1953.
- Scroggie, M. G., "Radio Laboratory Handbook" (5th Edition), p. 247 (Iliffe & Sons Ltd.).
- Benson, F. A., "Phase Angle Measurements," *Wireless World*, Vol. 59, p. 157, April 1953.

Centimetre-wave Oscilloscope

FREQUENCIES of the order of 9,500 Mc/s can be displayed on an experimental c.r. oscilloscope which has recently been built at Manchester. Described in a letter to *Nature* (5th December, 1953) by B. Jackson, D. R. Hardy and R. Feinberg, it uses a special 6-in aluminized c.r. tube with a highly actinic blue phosphor screen. The vertical electrostatic deflection system is formed by a twin-wire transmission line passing through the tube at right angles to its axis. This reduces the transit time of the electron beam in the deflection field and permits correct matching to the signal source. The deflection sensitivity of the tube is about 0.006mm per volt. A single-sweep time base of 1.3 milli-microseconds duration is used, giving a sweep width of about 4cm, and with this the writing speed amounts to approximately 5×10^6 cm per second. The tube is magnetically focused and its trace is about half a millimetre wide.

WIRELESS WORLD, FEBRUARY 1954

The D.C. Component in Television

Video-Stage to C.R. Tube Coupling

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

IN a recent paper¹ D. C. Birkinshaw has stressed the importance of the d.c. component of the television signal to the correct reproduction of pictures and he illustrated his theme by a most convincing series of photographs. He pointed out that although considerable attention is paid to the maintenance of the proper level of the d.c. component in the B.B.C. transmissions it is considerably attenuated in many commercial receivers.

Out of 26 sets tested, only seven reproduced the d.c. component fully. Eight reproduced it with from 15% to 40% attenuation, six with 50%, three with 62% to 70% and two with 100%.

The d.c. component is, of course, the part of the picture signal which governs the mean brightness of the picture. Its absence or appreciable reduction means that the brightness control of the receiver will require re-adjustment whenever the mean brightness of the transmitted scene changes. If such re-adjustment is not carried out some pictures will be too dark, with a lack of detail in their darker parts, and others will not be dark enough and will have washy blacks and visible frame-flyback lines.

In view of this, it seems surprising that deliberate attenuation is often introduced in commercial receivers. As Birkinshaw states, however, it is often done with the aim of reducing aircraft flutter. It is, however, not essential to attenuate the d.c. component to do this; it is possible to reduce flutter in other ways,² the use of a.g.c. being probably the best method. In his paper, Birkinshaw did not consider how the d.c. component should be retained; he confined himself to showing the bad effect of attenuating it and he did this most convincingly. However, he did make one statement about circuit performance which is actually incorrect. He is hardly to be blamed for this, because most designers believe the circuit in question to be a satisfactory one and, until quite recently, the writer did also.

¹"The Importance of the D.C. Component," *J. Televis. Soc.*, July-September 1953, Vol. 7, No. 3, p. 105.

²See "Television Interference by Aircraft," by A. H. Cooper, B.Sc., *Wireless World*, April 1949, Vol. 55, p. 142, for a discussion of the subject. Because of the input impedance of the c.r. tube the particular circuit and component values given in this article are unlikely to permit full retention of the d.c. component.

The reference is to the common circuit (Fig. 1) in which the cathode of the c.r. tube is fed from the anode of the video stage through a voltage divider. This is done to keep the heater-cathode voltage of the tube within its rating and it inevitably reduces the d.c. component of the signal below the value existing at the anode of the video valve. To overcome this, the d.c. component is equally over-amplified at the anode of the video valve, usually by a correct choice of value for the anode decoupling resistor.

What has been overlooked in the past, and what makes it impossible to obtain the correct level for the d.c. component with this circuit, is the fact that a.c. tube which is fed at the cathode has a fairly low input resistance. Moreover, it has an input resistance which varies greatly with the signal voltage.

The circuit in question is the well-known one of Fig. 1. In an a.c./d.c. set, the heater of the tube must usually be at chassis potential and the maximum allowable difference of potential between heater and cathode is usually 150 V; in some of the older tubes it was

considerably less. The anode potential of the valve may well be 150-200 V and the voltage divider brings the cathode potential to $R_4(R_3 + R_4)$ of this figure.

At all frequencies within the picture signal, the capacitors are large enough to be short-circuited. The load on the valve is then R_1 in parallel with R_4 and, since R_4 is large compared with R_1 , it is virtually R_1 alone. At d.c. the capacitors form open-circuits and the load on the valve is $R_1 + R_2$. The amplification at d.c. is $1 + R_2/R_1$ times as great as at higher frequencies, but only $1/(1 + R_3/R_1)$ of it is passed on to the tube. The d.c. component is fully retained if $R_2/R_1 = R_3/R_1$. In addition, if C_1 and C_2 are related in a certain way the overall amplification is constant at all frequencies. However, by a proper choice of their values, the amplification can be made to fall off at very low frequencies nearly to d.c. and the circuit can then give proper representation to the d.c. component while also reducing aircraft flutter.

All this is in accordance with the usual circuit theory and supposes that the c.r. tube has an input resistance which is very large compared with R_3 .

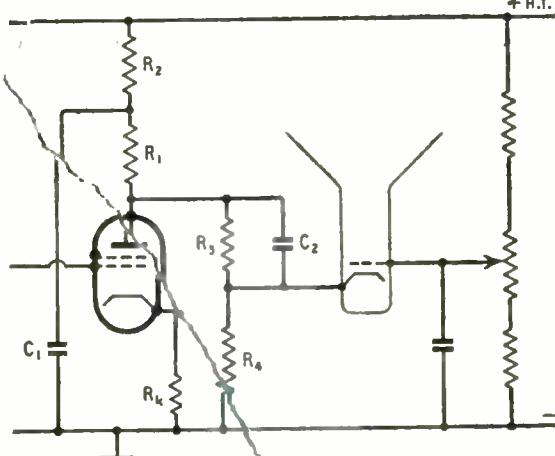


Fig. 1. A commonly-used video-stage to tube coupling. If the tube resistance is very high, the coupling is compensated and gives equal gain at all frequencies. The compensation is spoilt in practice by the input resistance of the tube.

and R_1 in parallel. Quite normal circuit values would be $R_1 = R_2 = 3.5 \text{ k}\Omega$ and $R_3 = R_4 = 100 \text{ k}\Omega$.

Tube Input Impedance

Now a cathode-ray tube is exactly analogous to an ordinary valve as far as its electrical characteristics are concerned. Although figures for them are not usually quoted, it has a mutual conductance g_m and an anode a.c. resistance. It is well known that when a valve is used in a cathode input (earthed-grid) circuit it has a low input resistance of the order of $1/g_m$; it is commonly $100\text{--}500 \Omega$. A cathode-ray tube also has an input resistance of $1/g_m$ but, because the mutual conductance is small compared with that of a valve, the input resistance is correspondingly high. It is not often less than $50 \text{ k}\Omega$.

The mechanism by which this comes about is quite simple. If the cathode voltage is changed by some small amount in a direction to increase the anode current (that is, cathode voltage changing negatively) this same voltage is operative between grid and cathode where it also acts to increase the anode current, but by μ times as much. The change of current is thus

$$i_a = \frac{e_k}{r_a} (1 + \mu)$$

where r_a and μ are the anode a.c. resistance and amplification factor of the tube. This current flows from the circuit which feeds the tube. An equivalent resistance R_{in} for the tube is one which, if connected to the driving circuit in place of the tube, would draw from it the same current. Therefore

$$R_{in} = \frac{e_k}{i_a} = \frac{r_a}{1 + \mu} \approx \frac{1}{g_m}$$

It is possible to obtain figures for g_m from the ordinary tube maker's grid-volts-anode-current characteristics. At an operating voltage corresponding to peak white, the mutual conductance is usually about 0.02 mA/V , which makes $R_{in} = 50 \text{ k}\Omega$.

Like those of a valve, the tube characteristics are curved and the mutual conductance falls as the tube is biased back for reduced brightness, consequently the input resistance rises as the brightness decreases. Unlike a valve, however, a cathode-ray tube cannot be operated only over the straight part of its characteristic, for the beam current must be nearly, if not quite, cut off for picture black. As the signal varies the brightness between white and black, therefore, the input resistance must change from a minimum of the order of $50 \text{ k}\Omega$ to a high value approaching infinity.

In the circuit of Fig. 1, this tube resistance appears in shunt with R_1 . At high frequencies, where the capacitors are short circuits, the load on the valve is R_1 , R_2 and R_{in} all in parallel. If R_1 is $3.5 \text{ k}\Omega$ and R_2 is $100 \text{ k}\Omega$, the load is $3.5 \times 100 / 103.5 = 3.38 \text{ k}\Omega$ in the dark parts of the picture where R_{in} is very large. At peak white, if R_{in} is $50 \text{ k}\Omega$ the load falls to $3.38 \times 50 / 53.38 = 3.17 \text{ k}\Omega$. The gain near white is about 94% of that near black. The effect on the tone graduation of the picture is that changes near white are not quite as great as they should be.

The magnitude of the effect is very small, however, and is both smaller and in the opposite sense to that brought about by curvature of the tube characteristics. It is therefore negligible.

At d.c., however, matters are quite different, for the tube is fed from R_3 and R_4 which have values of

the same order of magnitude as R_{in} . Near black level R_{in} is large and will have comparatively little effect upon the circuit so that the d.c. component will be present at the tube cathode at very nearly its proper level. At peak white, however, matters are very different. Suppose $R_1 = R_2 = 3.5 \text{ k}\Omega$, $R_3 = R_4 = 100 \text{ k}\Omega$ and $R_{in} = 50 \text{ k}\Omega$. Then R_1 and R_{in} in shunt come to $33.33 \text{ k}\Omega$, and the loading of the voltage divider on $R_1 + R_2$ ($7 \text{ k}\Omega$) is $133.33 \text{ k}\Omega$. The load on the valve is $7 \times 133.33 / 140.33 = 6.65 \text{ k}\Omega$. At high frequencies the load is $3.17 \text{ k}\Omega$, so the gain to the valve anode is at d.c. $6.65 / 3.17 = 2.1$ times the gain at high frequencies. The reduction factor to the tube cathode is $133.33 / 140.33 = 0.25$ and so the d.c. component is $2.1 \times 0.25 = 0.525$ of its proper level.

The result of using this circuit in practice is that if the brightness control is initially adjusted correctly on a rather dark picture, then when a picture of greater mean brightness comes along the brightness does not increase proportionately. The dark parts of the picture are too dark and the detail in them is lost. The brightness control has to be turned up for proper reproduction. Conversely, if the brightness control is initially adjusted on a bright picture then when a dark one is transmitted it will be reproduced too brightly; black will not be black, but dark grey, and the frame flyback lines will show. These effects are quite noticeable in practice.

It will now be clear that with the circuit of Fig. 1 a reduction of the d.c. component to 50% of its proper value is quite likely even when the designer has the intention of retaining it fully. Because of the variable nature of R_{in} it is not possible to compensate for it by any practicable change in the values of the components. Because the resistance is variable, its effect can be made negligible only by feeding the tube from a circuit having a resistance low compared with the lowest value of R_{in} . This is a condition which exists in Fig. 1 only at high frequencies and it is one which must be made to exist at d.c. also.

In the circuit of Fig. 1 this could be done if it were practicable to reduce R_3 and R_4 to about $10 \text{ k}\Omega$ only. They would then shunt R_1 and R_2 so much that these two resistors would have to be increased in value. The reduction of R_3 and R_4 , coupled with the increase of R_1 and R_2 , would require an increase of h.t. supply voltage to maintain proper operation of the valve. In an a.c./d.c. set this is usually impossible.

In commercial practice circuits of the form of Fig. 1 are often used but with values deliberately chosen to reduce the d.c. component. Quite often, for instance, R_2 is omitted. Even without the effect of the input resistance of the tube the d.c. component may then be reduced to 50% of its proper value; when the tube resistance is taken into account the reduction may be to 25% of the correct level. As already stated, this reduction is often deliberate and is introduced to alleviate aircraft flutter.

We are not concerned here with the question as to whether or not it is desirable to do this. There is no doubt that where aircraft flutter is not experienced it is desirable to retain the d.c. component fully. There is also very little doubt that it is desirable to remedy aircraft flutter, not by reducing the d.c. component, but by employing a.g.c. Whether or not it is commercially practicable to do so this is quite another matter.

For the present, therefore, we shall consider only how best to retain the d.c. component. It is clear that the use of the circuit of Fig. 1 is inadmissible. Two alternatives present themselves. The first is to utilize the circuit of Fig. 1 but to include a cathode follower between R_3R_4 and the tube. The second is to omit R_3R_4 and to join the cathode of the tube directly to the anode of the valve, adopting some other means of keeping the heater-cathode potential within bounds. The cathode follower is used in at least one commercial set, but mainly for other reasons. The second alternative is used in a good many sets and is applicable wherever it is possible to use a separate winding on a transformer to supply the heater of the tube. It is only in the case of the a.c./d.c. set, where the heater must be at chassis potential, that difficulty may arise with it.

Practical Cathode-Input Circuit

We shall not discuss here the cathode-follower circuit, because the design of the complete video stage plus cathode follower is quite an intricate matter. We shall deal only with the second circuit in detail. Before doing so, however, it may be as well to remark that if the video signal is fed to the grid of the tube instead of to the cathode all these difficulties disappear. A capacitance coupling with a d.c.-restoring diode can be used. Because the video signal must then be of opposite polarity, however, difficulties arise in the sync separator and an extra valve in this circuit would probably be needed to obtain a normal performance. The use of d.c. restoration with cathode input to the tube does not seem practicable because of the low input resistance of the tube. The use of capacitance coupling to the tube cathode with a pulse-operated black-level clamp might, however, be practicable but has not been investigated.

The form of circuit which we shall now consider in detail is shown in Fig. 2. At all but the lowest frequencies and d.c., that is, at what we shall for convenience term high frequencies, the capacitors are all short-circuits and the video stage gives an amplification of

$$A = \frac{g_m R_1}{1 + F_k} \dots \dots \dots \quad (1)$$

where g_m and g_T are respectively the mutual conductance of the valve connected as a pentode and as a triode and $F_k = g_T R_k$. At d.c. the internal resistance of the h.t. supply, shown as R_2 , plays a part, for it is common to both screen and anode circuits. The

voltage developed across it appears on the cathode of the tube and a fraction $R_5/(R_4 + R_5)$ of it is also applied to the grid (via the brightness control) where it acts in opposition; only the fraction $R_4/(R_4 + R_5)$ of the voltage across R_2 is, therefore, effective in operating the tube.

The voltage across R_3 and R_k , and also any across R_3 , acts on the screen grid where it produces negative feedback tending to reduce the gain. On balance, R_2 tends to increase gain and R_3 to reduce it. It is possible, therefore, by a proper choice of R_3 to make the gain at d.c. the same as at higher frequencies.

It is not difficult to work out the d.c. gain. Between the grid of the valve and the cathode-grid circuit of the tube it is

$$A_{DC} = \frac{g_m R_1 \cdot g_T R_2 \alpha}{1 + F_s + F_a + F_k} \dots \dots \dots \quad (2)$$

where

$$\alpha = \frac{R_1}{R_1 + R_5}$$

$$F_k = 1 - g_T R_k$$

$$F_s = (g_T (R_2 + R_3 + R_k) - g_m R_3)/\mu_{12}$$

$$F_a = [(R_2 + R_k) g_T g_m + R_1] r_a$$

r_a = anode a.c. resistance of the valve as a pentode.

μ_{12} = amplification factor of the valve between control and screen grids.

The gain at d.c. relative to that at high frequencies is

$$\frac{A_{DC}}{A} = \frac{1 + \frac{g_T R_2 \alpha}{g_m R_1}}{1 + \frac{F_s + F_a}{1 + F_k}} \dots \dots \dots \quad (3)$$

In a pentode r_a is normally very large and the term F_a can usually be neglected. If the gains at a.c. and d.c. are to be equal equation (3) must be unity. Neglecting F_a , the condition for this is

$$R_3 = \frac{\frac{g_T R_2 \mu_{12} \alpha (1 + g_T R_k)}{g_m R_1} - g_T (R_2 + R_k)}{g_T - g_m} \dots \dots \dots \quad (4)$$

As an example, suppose $R_1 = 3.5 \text{ k}\Omega$, $R_k = 220 \text{ }\Omega$, $R_2 = 500 \text{ }\Omega$, $\alpha = 0.6$, $g_m = 6.5 \text{ mA/V}$, $g_T = 8.5 \text{ mA/V}$, and $\mu_{12} = 75$. Inserting values, we get $R_3 = 9 \text{ k}\Omega$.

It may or may not be possible to use this value for R_3 . It depends on the h.t. voltage and the required screen voltage. If R_3 is zero, the relative gain works

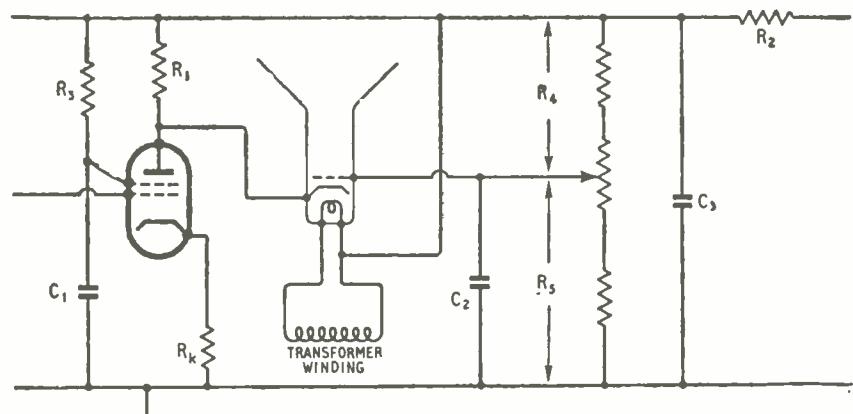


Fig. 2. This circuit can give nearly perfect reproduction of the d.c. component if R_3 is correctly chosen. It is, however, very good even without R_3 . The resistance R_2 represents the resistance of the h.t. supply. Care must be taken over the tube-heater supply if the heater-cathode rating is not to be exceeded.

out at 1.08 to slide-rule accuracy. Without any attempt at compensation by choosing a particular value of R_s , therefore, the excess of d.c. component is only about 8%.

The basic tendency with this circuit is for the d.c. component to be slightly over-amplified. The excess, however, is not critically dependent on the values of components or the valve characteristics as long as the two right-hand terms in numerator and denominator of equation (3) are a good deal smaller than unity. Consequently, it is not necessary to employ close-tolerance components. In the circuit of Fig. 1, however, close tolerances, or at least closely matched components are necessary; with normal components errors of 40% in the d.c. component level are possible.

Taking into account both performance and cost, the circuit of Fig. 2 seems to be unquestionably the best one. Generally speaking, it seems to be an unnecessary refinement to choose R_s in accordance with equation (4) and it is sufficient to choose it only to suit the screen voltage required by the valve. Often this will be the full voltage of the h.t. line and then both C_1 and R_s can be omitted.

It must be emphasized that the practicability of the circuit of Fig. 2 is often restricted to receivers in which it is possible to supply the heater of the tube from its own private winding on a transformer. The heater can then be joined to any required point on the h.t. supply to minimize the heater-cathode potential difference. As shown in Fig. 2, this will often be positive h.t.

In an a.c./d.c. set, however, the tube heater must usually be at chassis potential. It is safe to use the circuit in such sets, therefore, only when the h.t. supply is of lower voltage than the heater-cathode rating of the tube.

In neither Fig. 1 nor Fig. 2 have the high-frequency compensating components been shown. They are irrelevant to the present discussion but, in practice, R_1 will usually have an inductance in series with it, or there may be one in series with the cathode lead of the tube; sometimes both are used. Then R_k quite often has a small capacitance in shunt with it. All these things have no effect at all at d.c. or at the lower picture frequencies; they play their part at frequencies over 2 Mc/s.

Ionosphere Review: 1953

Short-wave Propagation Changes : Approaching the Sunspot Minimum

By T. W. BENNINGTON*

IT is now nearly ten years since the last sunspot minimum—ten years during which the solar activity has passed through nearly all its changes and is now approaching a minimum again. It was in April, 1944, that the last sunspot minimum values were recorded, after which the activity rapidly increased to a maximum of almost unprecedented intensity in May, 1947. Almost unprecedented, that is, when compared with the intensities of the previous maxima shown in the records available, records which exist on a continuous basis for just over 200 years. In that time 19 sunspot maxima have been recorded, and only one of these was of greater intensity than that of 1947—a fact which may or may not be of significance. Who can say, for what is 200 years in the life of the sun?

Since 1947 the average sunspot activity has been declining towards another minimum and it might be thought, observing that the mean duration of the cycles is about 11.1 years, that the coming minimum is a year away. But there is no certainty about this; the length of the sunspot cycles varies very considerably, ranging for the 17 cycles for which we have complete records from about 9.1 to about 13.6 years. Thus the time of the occurrence of an approaching minimum cannot be foretold on the mere basis of the lapse of time since the preceding

minimum, or indeed of that since the last maximum. It is, in fact, impossible to forecast its occurrence with accuracy on any known basis, though, as we shall see later, indications of some value on this point may be obtained from a study of the past cycles. There are also some of greater value directly provided by the sun itself.

Fig. 1 shows the twelve-month running average of the sunspot number for each monthly epoch from Jan./Feb., 1947, to June/July, 1953; the twelve-month running average of the noon critical frequency of the ionospheric F_2 layer and the twelve-month running average of the midnight critical frequency of the layer, for the same periods. The sunspot number is obtained from the observations made at a number of astronomical observatories (or, in the case of the last 12 values, at the Royal Greenwich Observatory alone) and is a measure of the sunspot activity on the sun's visible disc. The critical frequency of the F_2 layer is the highest frequency returned from the layer (which is the principal transmission medium in short-wave communication) when the measuring waves are sent vertically upwards. The two curves are compiled from the measurements made at the Slough station of the D.S.I.R. The

* British Broadcasting Corporation.

object of presenting the curves in the form of twelve-month running averages is that by smoothing out the month-by-month variations in sunspot number and the regular seasonal variations in critical frequency enables the long-period changes in both sunspot number and critical frequency to be more clearly seen. The last available number given by this method is, of course, that for a period six months back from the time of the last observation; i.e., in the present case six months back from December, 1953, to the epoch June/July, 1953. The dotted portion of the curve which carries it forward into 1954 will be referred to later.

It is seen that since the sunspot maximum in 1947 the sunspot number has fallen from about 150 to one of somewhat less than 20, though during the last twelve months it fell only by about 15. During all this time the critical frequency curves have followed the decreasing sunspot activity in a very faithful fashion, decreasing, in the case of the noon curve, from about 10.4 Mc/s to about 5.5 Mc/s and in the case of the midnight curve from about 5.7 Mc/s to about 3.1 Mc/s. It was pointed out, at the end of 1952, that the critical frequency had already attained "quasi minimum" values, and indications were that the noon critical frequency would fall by about 1 Mc/s only between then and the sunspot minimum. As can be seen, during the past year the fall in noon critical frequency is of the order of 0.5 Mc/s only, whilst that in the midnight value was correspondingly smaller. It appears, therefore, that the critical frequencies are likely to undergo only a very small further decrease between now and sunspot minimum.

All of which means, of course, that there is not likely to be much change, due to the sunspot cycle, in the frequencies at present of use for short-wave

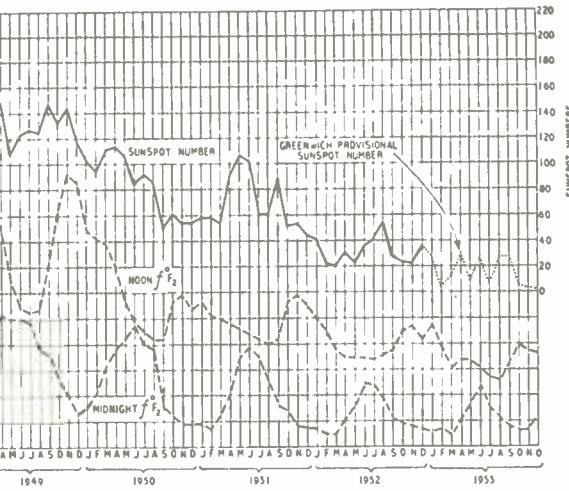


Fig. 1. Twelve-month running averages of sunspot numbers and noon and midnight F_2 critical frequencies since the last sunspot maximum, with possible future values of sunspot number (dotted extension).

communication until after the coming minimum. These have decreased very considerably since the 1947 sunspot maximum, and, whilst the actual decrease varies widely for different circuits, with the seasons and with time of day, some idea of the order of things can be obtained from the figures given here. The decrease in noon critical frequency implies that the mean noon m.u.f. for transmission over the longest possible one-hop trajectory, with the ionosphere over Slough as its apex, has decreased since sunspot maximum by about 15 Mc/s, whilst the midnight figures indicate that the mean midnight m.u.f. has fallen by about 8 Mc/s. These large decreases have necessitated drastic alterations in the conduct of all kinds of long-distance services, which are now generally confined to the lowest short-wave frequencies, having regard to season and time of day. But, as has been said, no further appreciable reduction in their working frequencies is likely to be necessary.

For those who may be interested in more details of the changes which have occurred over the past few years the curves of Fig. 2 are given. These show the monthly means of the sunspot number and of the

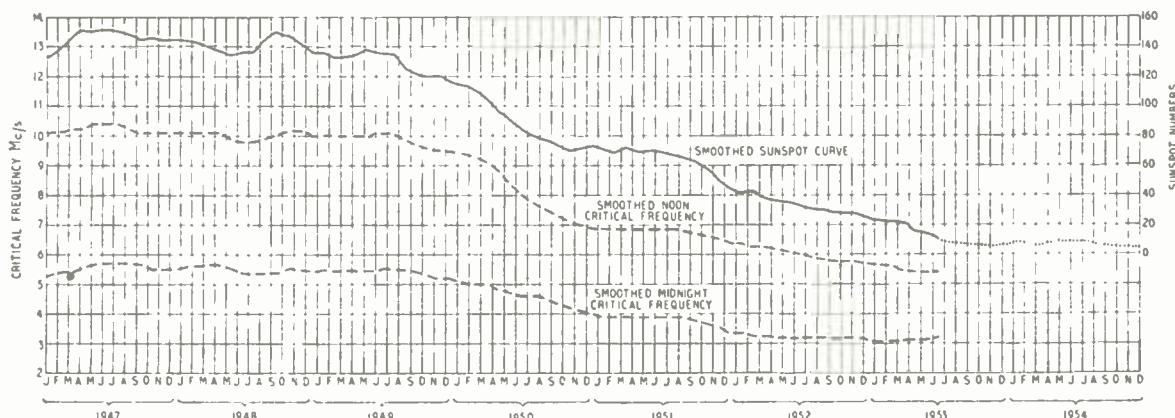


Fig. 2. Monthly mean sunspot numbers and noon and midnight F_2 critical frequencies since the last sunspot maximum.

F_2 critical frequencies as measured at Slough. Some of the variations in the latter are rather interesting. For instance the noon critical frequency, which reaches its lowest values during the summer months, and its highest about mid-winter, is seen to have decreased by a very much greater amount since the sunspot maximum during the winter than during the summer. In fact it has decreased by about 8 Mc/s for winter and by about 3 Mc/s for the summer. On the other hand the midnight critical frequency decreased by about 1 Mc/s for the winter and by about 3 Mc/s for the summer. These differences may be ascribed to the differing effects of the sun upon the layer, either in kind or degree, at different times of the day and the year, but the net result on the usable short-wave frequencies is clear. They must vary over the sunspot cycle to the greatest extent during the winter day, to a lesser extent during the summer day and night, and least of all during the winter night. Of course these variations are much modified by the behaviour of the ionosphere in different terrestrial regions, and by the varying conditions over a long transmission path. But broadly speaking the variations in usable frequencies over the sunspot cycle are of the kind described.

Transferring our attention to Fig. 1 again and remembering our conclusion that it is unlikely there will be much further variation in critical frequencies or maximum usable frequencies until after the coming sunspot minimum, we are naturally concerned to know when that event will occur. But, as has already been stated, there is no way of telling this with any real accuracy. However, a classification of the sunspot cycles of which we have record would appear to indicate that the present one belongs to the class with high maximum and medium long duration. By matching it to a "representative" cycle of this class—which is the mean of all previous cycles of the same class—one can extrapolate it towards the minimum, and the result of this is shown in the dotted extension of the curve. This indicates possible future values of the 12-month running average sunspot number and places the sunspot minimum at November/December, 1954. The curve should, of course, be accepted with reserve.

Signs of the New Cycle

However, some additional and stronger evidence that sunspot minimum may occur within a year or so has now been obtained from observations of the sun itself. Towards the end of a sunspot cycle the sunspots belonging to that cycle all appear in positions relatively near to the solar equator, but when the new cycle commences the spots appear in relatively high solar latitudes. Furthermore the spots of the new cycle have opposite magnetic polarity to those of the old one. These high latitude sunspots (belonging to a new sunspot cycle) usually begin to appear some considerable time before those of the old cycle have ceased, and, in fact, about a year before the sunspot minimum is reached.

According to a report from America† there was observed on August 13th, 1953, a very small sunspot in solar latitude 52° N by members of the staff of the McNath-Hulbert Observatory, Michigan, which it would seem may have been the first spot of the new cycle. It is also reported that magnetic observa-

tions of the sun made in Pasadena increase the probability that this sunspot belongs to the new cycle. If this is so the observations would indicate that, on the basis of similar observations made towards the end of past cycles, the sunspot minimum might be expected between about March, 1954, and April, 1955. Therefore, whilst it still is not possible to be precise about the time of the minimum, the implications of the observations do not appear to conflict very much with the dotted part of the curve of Fig. 1.

The frequencies at present of most use for communication over various circuits—such as 17, 15 and 11 Mc/s for daytime broadcasting, 9 Mc/s for summer night-time and 7 and 6 Mc/s for winter night-time use—are thus likely to remain so during 1954. And even after sunspot minimum does occur it would seem unlikely that the sunspot activity will begin rapidly to increase for several months, or perhaps for a year. So it looks as if the present "rock bottom" conditions are likely to remain for a considerable time yet and perhaps, to hazard a guess, till towards the end of 1955.

Transistor and Valve Circuitry

BECAUSE there is a good deal of functional similarity between the transistor and the thermionic valve, people have been tending to think of the process of "transistorization" as little more than pulling out valves and inserting transistors in their place, after making very slight circuit modifications. This impression has been greatly strengthened by various theories about the duality between valves and transistors and how it can be utilized in the design of transistor circuitry. Engineers are now beginning to realize, however, that this duality idea is not a good thing to follow slavishly, as it tends to restrict what can be done with the transistor. The valve automatically becomes the yardstick, and by comparison the transistor sometimes appears as rather a poor substitute. It would be more profitable to take the transistor for what it is, and build an entirely new type of circuit technique around it. For example, it has been suggested that since the transistor operates very efficiently in pulse and trigger circuits we should attempt to transform our existing linear circuits into this type of operation—rather as we can use a.c. techniques for amplifying d.c. fluctuations after making the d.c. discontinuous.

This new outlook was implicit, if not stated in so many words, in a recent I.E.E. discussion meeting "Will Transistors Oust Receiving Valves?" opened by E. H. Cooke Yarborough. One example which was mentioned of a departure from established valve-circuit technique was a new transistor digital computer at Manchester University. As a result of the new approach there were actually fewer transistors in this computer than there would be valves in an equivalent "thermionic" computer doing the same job. It was also pointed out by several speakers that greater flexibility should be possible in transistor circuits because of the reversible functions of the collector and emitter—a feature not possessed by the equivalent electrodes of thermionic valves.

At the same time, of course, the transistor must emulate the valve in some respects and be able to bear comparison with it. The limit on operating frequency is one problem here (resulting from the lower electron transit time in semiconductor materials) and to get comparable results the electrode spacing has to be very much smaller. However, one speaker at the meeting mentioned that an experimental transistor had been made to operate at 80 Mc/s, and there were hints from others that the limit could be pushed to well over 100 Mc/s. The restriction on power output was another difficulty, although it was mentioned that transistors dissipating as much as 20 W were being produced in the U.S.A.

† Publications of the Astronomical Society of the Pacific, Oct., 1953, Vol. 65, No. 386, p. 256.

LETTERS TO THE EDITOR

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

Ignition Interference in U.S.A.

HAVING read the letter from Mr. Morse on ignition interference with TV in this country (your October issue) and your subsequent editorial comments, coupled with those of my friend "Diallist," I feel driven to enter the controversy, if only to keep the record straight.

As an English immigrant to the U.S.A. of less than two years standing, I can claim to have seen TV on both sides of the ocean, and, quite impersonally, would like to make these comments.

There is no doubt that interference does exist in fringe areas, but it is a growing problem to find a fringe area, as new transmitters going into service are a frequent occurrence on the u.h.f. band. Mr. Morse probably speaks as he finds things. In nearly two years of TV, I have yet to see visual interference on my screen derived from auto ignition. Up to two months ago, I lived on an eight-lane super highway, with autos passing four abreast in each direction at the usual thirty-foot intervals, and never had reason to complain of interference. My experience when visiting with friends or in various cities across this country has been the same; no visual signs of ignition interference. As several million TV sets are in constant use, I feel sure, knowing the Americans, that if auto interference was a problem something would be done about it, and we would know.

My feeling is that it must be standard practice for all interference-forming machines to be adequately suppressed by the maker before sale. My car, a cheap one, was suppressed as delivered from the factory. So was my vacuum-cleaner, my washing machine, the clothes drier, the dish-washer, the refrigerator and all the small kitchen power tools. I have heard auto interference myself, particularly when following a pre-war car along open highways, showing as a superimposed crackle on the car radio. However, this has never been heard when following post-war automobiles.

I am not prepared to argue American v. British design, as I have a foot in both camps, but I will back Mr. Morse fully when he says he has never seen auto TV interference, I never have either, nor have any of my friends. So shall we put the matter to bed by saying electrical appliance makers suppress their products adequately before sale, here in the U.S.A.?

Ferguson, Mo., U.S.A.

R. LINCOLN OSTER.

Skin Effect

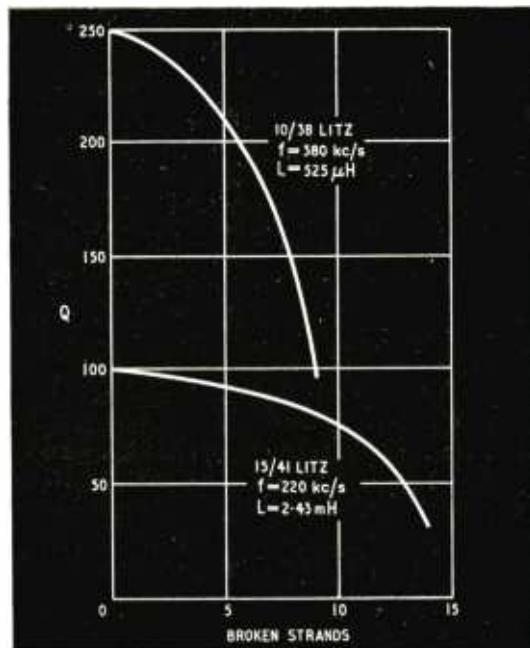
IN the final paragraph of his article "Skin Effect" (*Wireless World*, November, 1953), "Cathode Ray" observes that the effective resistance of litz wire rises appreciably when some of the strands are broken. While actual values are not stated, the reader is given the impression the resistance will increase in proportion to, or even exceed, the increase in d.c. resistance.

This popular misconception seems to appear periodically in the literature. Theory, however, does not substantiate this argument: in fact, there is ample evidence which disproves it.^{1,2}

The accompanying curves show the effect of broken strands in a universal type coil wound with 10/38 litz, and in a single-layer solenoid wound with 15/41 litz. The frequency in each case was sufficiently low to ensure efficient use of the litz wire.

Hund and De Groot, *Bur. Stds. Tech. Paper* 298, Vol. 19, p. 651, 1925.

¹Morecroft, J. H., "Principles of Radio Communication," 3rd Ed., p. 195.



Curves showing effect of broken strands of litz wire in two different types of coil.

From the curves it is evident that the broken strands are not completely divorced from the circuit. Some current remains in the broken strands owing to the tight coupling between strands.

It is interesting to note the curves are somewhat similar when compared on a percentage basis.

Fairlawn, N.J., U.S.A.

R. E. LAFFERTY.

[*"Cathode Ray"* writes: I am much obliged to Mr. Lafferty for correcting me in the matter of the rise in resistance when strands of "litz" wire are broken. It would be interesting to know what was the basis for the common belief that a few broken strands cause a disproportionate increase in r.f. resistance. I have been unable to trace it.—ED.]

Why No Prices?

WHY are so many of your advertisers so cagey about the prices of the goods they are trying to sell? One can, perhaps, understand it where a maker of resistors or condensers offers hundreds of different sizes, types and capacitances and is only interested in attracting makers of radio or electronic equipment; but there are many makers of other types of gear—testing sets, amplifiers, loudspeakers, recording tape, new types of valves and so on, who omit from their advertisements any suggestion of the price. Even the women's magazines now give one an idea of the prices of the creations advertised, "This dinky little model chapeau in *fer blanc*, about nine-and-a-half-guineas," but there isn't even that suggestion in many of your advertisements.

Surely the AVO people, Vortexion, Marconi Instruments and Trix don't expect to sell their products whole-

LETTERS TO THE EDITOR

continued

sale by the gross—or do they? Even if they did, an indication that the retail price is so-and-so would be of interest to many readers, and would still not debar the large user from negotiating other terms.

Cambridge.

G. W. IRWIN.

Crystal-Transistor Link?

IT is difficult to disagree with anything that Dr. Armstrong, the distinguished pioneer of regeneration, super-regeneration and the superheterodyne principle, says in his letter published in your January issue. "Major" Armstrong (as he will always be to me) helps to get the perspective right. The valve made little impact on the radio art until the introduction of regeneration, which turned it into a receiving device of hitherto undreamed-of sensitivity. The regenerative triode detector was the heart of the radio receiver for many years, and was not finally displaced until the short-lived neutralized triode (which quickly gave way to the screened-grid tetrode) provided us with effective r.f. amplification.

But is Dr. Armstrong right in implying (his penultimate paragraph) that the originators of the transistor obtained no inspiration from the crystal detector? I am inclined to submit that if they did not, there was little excuse for their failure. The oscillating zincite crystal, which aroused some interest in the early 1920s (I cannot con-

firm the date*) surely served, or should have served, as a fairly obvious connecting link between the humble crystal detector and the transistor.

"RADIOPHARE."

* Editorial footnote.—Several articles on oscillating crystals, including one from the Russian originator Lossev, appeared in *Wireless World* during 1924.

Historical Relic

MAY I correct "Free Grid's" dates? The German-made coherer unit which he illustrates on his page in your January issue was certainly on sale in either 1911 or 1912. I became the proud owner of one, with its accompanying spark-coil transmitter, about two years before the outbreak of the first World War. These sets were sold, I believe, by more than one shop dealing in electrical novelties for schoolboys.

The relay fitted to the receiver unit was for actuating the de-coherer, which at the same time rang a bell and so gave a clearly audible signal. I think "Free Grid" is wrong about the morse inker, which was not used with my set.

With careful adjustment of relay and de-coherer, a range of 20 or 30 yards was obtainable.

Manchester.

A. M. FISHER.

INTERNATIONAL MARINE V.H.F.

AT the Atlantic City Conference of the International Telecommunication Union in 1947, frequency modulation was made compulsory for marine v.h.f. communication on certain frequencies in Region 2 (the Americas), but not in Regions 1 (Europe) and 3 (Far East). Subsequently, in 1949, it was announced by the Post Office that it had been decided to specify amplitude modulation for all v.h.f. maritime services of the United Kingdom using the international simplex channels (156.8 and 156.6 and 156.3 Mc/s), or the proposed international two-frequency public correspondence channel (157.4 Mc/s mobile and 161.9 Mc/s fixed) and associated national two-frequency public correspondence channels (157.5, 157.6, 157.7 and 157.8 Mc/s mobile and 161.5, 161.6, 161.7 and 161.8 Mc/s fixed), or the group of two-frequency channels reserved in this country for the use of harbour docking and pilotage authorities (158.6 to 159.4 Mc/s mobile and 163.6 to 164.4 Mc/s fixed).

Not only was a.m. adopted by this country, but it was widely recommended by the U.K. to other countries in Regions 1 and 3.

According to facts given in a report issued by Rees Mace Marine these opposing decisions have resulted in a position where some 40 base stations and 330 mobile stations in North America (mostly on the Great Lakes) have been equipped with f.m. gear while over three times as many stations in the rest of the world have been fitted with a.m. equipment.

The Assistant Postmaster-General recently stated in the House, in reply to a question, that "The shipping industry and the radio industry (with the exception of one manufacturer) have agreed that it would be in the national interests to resume discussions internationally with a proposal in favour of standardization on frequency modulation, and there is at last some prospect of reaching agreement and of removing the uncertainty."

The Rees Mace report summarizes the present position and formulates a plan for the solution of the impasse. A truly international decision on a unified system of modulation cannot be arrived at until the next meeting of the I.T.U. which, at the earliest, will not be held until 1957. The view is, therefore, expressed that it would be wrong

for changes to be introduced in the interim as these would not be internationally binding; on the other hand, it is pointed out that it would be quite unthinkable to stop fitting v.h.f. gear during this period. There must, therefore, be some co-ordinated interim plan, but, as pointed out by the General Council of British Shipping, such a plan must not only permit the continued growth of the use of v.h.f. but must ensure that any eventual change can be made with a minimum of inconvenience. It is, therefore, suggested that the problem can be solved by the production of dual-modulation equipment. During the interim period it will be necessary for only a small proportion of British ships to install dual-purpose equipment, in fact only those sailing to Region 2.

The report lists some of the problems which have to be solved before international standardization can possibly be achieved. They include (a) frequency allocation (at present only three channels have been internationally allocated); (b) simplex or duplex working; (c) a standardized selective calling system, and (d) transmitter and receiver specifications. Rees Mace consider that it would cause less disruption to British manufacturers to market dual equipment for a.m. and f.m. than it would to adopt American standards. "It is, therefore, at least as important to find out American views on international standards as it is to find out their views on modulation."

It is claimed that the Admiralty will support any plan which will permit British merchant ships to continue fitting v.h.f. and will facilitate v.h.f. inter-communication with ships throughout the world. The plan formulated in the report also leaves the door open for the integration of v.h.f. services for air/sea rescue purposes.

PUBLICATION DATE

In future *Wireless World* will be published on the last Monday (instead of the last Tuesday) of the month preceding that for which it is dated.

RUSSIAN TELEVISION

Some Notes from the U.S.S.R. on Equipment

LITTLE has been published in this country on the development of Soviet television, and it was, therefore, refreshing to find a delegate to this country during the recent British-Soviet Friendship Month who was able to give some factual information.

It is, of course, general knowledge that the U.S.S.R. is employing the "European" standard of 625 lines, 50 frames per second and f.m. sound, but using a bandwidth of 8 Mc/s. Transmissions are horizontally polarized.

It would appear that while there are a considerable number of communal receivers installed in the service areas of each of the four stations (Moscow [2], Leningrad and Kiev) there is a growing demand for domestic receivers. The large majority of sets are for direct viewing, but some projection models are available and both forward and back projection is employed.

In addition to the two transmitting stations, Moscow now has a television theatre which regularly shows the transmitted programmes on a big screen.

Each of the present stations originates its own programmes, but can be linked with other transmitters by radio and cable. Undoubtedly one of the biggest and most important problems for the Soviet broadcasting authorities is the relaying of television programmes in such a vast country. The shortest distance between any two of the present three centres is 500 miles. The same applies to the new stations being constructed in Stalingrad and Sverdlovsk.

Russian television sets give a certain impression of the earlier American practice. The screens are fairly small—9in being about the average size—and are often made to look even smaller by the large loud-speaker grilles which appear alongside them on the fronts of the cabinets. There are usually four, five or six controls brought out for the viewer to adjust, and apart from the usual brightness, focus and sound volume these often include such things as contrast, frame-hold, wave-change and tone control. Modern

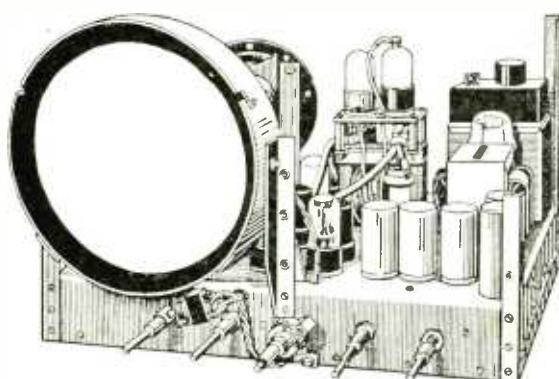
sets are still being built with mains transformers and there is no evidence of the a.c./d.c. transformerless technique.

While most of the receivers are superhets, a good many straight sets are still being made for short-range reception. These usually have about ten valves to the superhets' 20. Some models have provision for receiving a.m. and f.m. sound broadcasts as well as the f.m. television sound transmissions. Few, if any, extra valves are needed for this, as some of the sound-channel stages are used for double purposes. One recent prize-winning design, for example, has a valve which acts as a limiter on the f.m. signals and as a diode detector for the a.m. sound broadcasts.

Blocking oscillators are popular for both frame and line time-bases and scanning coils are often directly fed from the anodes of their appropriate output valves. An unusual feature of one fairly typical receiver is the use of an efficiency diode to recover energy, not for the scanning system, but to energize the focus coil. It seems there is no difficulty in getting enough scanning power for the deflector coils since the cathode ray tubes are fairly small with narrow deflection angles.

American-type metal valves with octal bases are widely used in receivers and the 6.3-V heater appears to be standard. Some of the valves have well-known American type numbers and equally familiar characteristics, while others have numbers which are not recognizable but are obviously based on the same system. Components generally have much the same appearance as ours.

With horizontally polarized transmissions the receiving aerials are naturally T-shaped, as in America. A good many people, however, make use of indoor aerials which are disguised to look something like electric bowl fires. The bowl reflectors are actually used to give a directional effect, so that the aerials can be adjusted to find the best angle for



On the left is a sketch of a recent prize-winning Russian receiver, reproduced from the Soviet journal "Radio," and on the right is a fairly typical table model in its cabinet.



reception. Naturally the directivity is not very great because the reflectors are relatively small compared with the wavelength. In blocks of flats communal aerial systems are used, as the authorities have the same objections to forests of dipoles on the roofs as they have in this country.

Colour television will be starting up soon, apparently on the frame-sequential system, and adaptors with rotating colour filters are being made for use with existing black-and-white receivers.

One type of interference which is not experienced by town dwellers in the U.S.S.R. is flutter caused by aircraft; flying is prohibited over built-up areas.

Gregory Alexandrov, our informant, who was leader of the delegation from the U.S.S.R., is a professor at the Central Film Institute, Moscow, and has directed a large number of Soviet films. He told us, incidentally, that they have experimented with the use of electronics in the production of films, but have abandoned the project.

Television Society's Exhibition

New Circuitry and Devices

HELD in London on 7th-9th January, the annual exhibition of The Television Society included 39 exhibitors. As in previous years, it was noteworthy for the number of demonstrations of an experimental and educational nature.

One of particular interest to sufferers from ignition interference was the "grey spotter" circuit of G.E.C. The circuit is shown in Fig. 1; V_1 is the video stage coupled in the usual way to the cathode of the c.r. tube. The signal from V_1 is also applied to the cathode of V_2 , and appears at the anode in the same phase, whence it is passed to the grid of the tube. If the complete signal were passed it would, of course, cancel the cathode signal, but the limiting action of V_2 and V_3 makes the grid signal one of interference only. V_2 is biased to be non-conductive during the video signal proper and to conduct only during noise pulses of amplitude greater than peak white. It then conducts and amplifies and if it were not for the diode V_3 it would be a "black spotter" for, because of the amplification in V_2 , the noise pulse applied to the grid of the tube would be greater than that applied to the cathode. V_3 , however, is biased to act as a second limiter, this time of the noise pulse amplitude applied to the grid. The result is that the effective level of noise on the tube is held at a level corresponding to grey in the picture and as this is the average level of illumination the contrast between the noise and the picture brightness is reduced. In a demonstration the circuit appeared very effective.

A circuit which enables a direct visual comparison to be made between two aerials was demonstrated by Belling & Lee. It enables the top half of a normal television picture to be reproduced from a signal received on one aerial while the bottom half is provided by a signal received on a second aerial. It has the great merit of

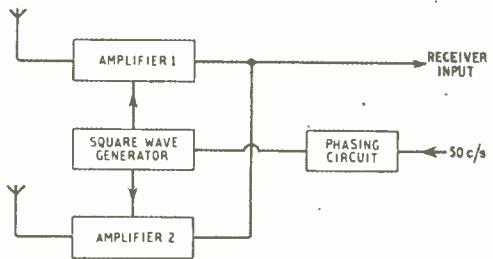


Fig. 2 Belling-Lee electronic switch for aerial comparison.

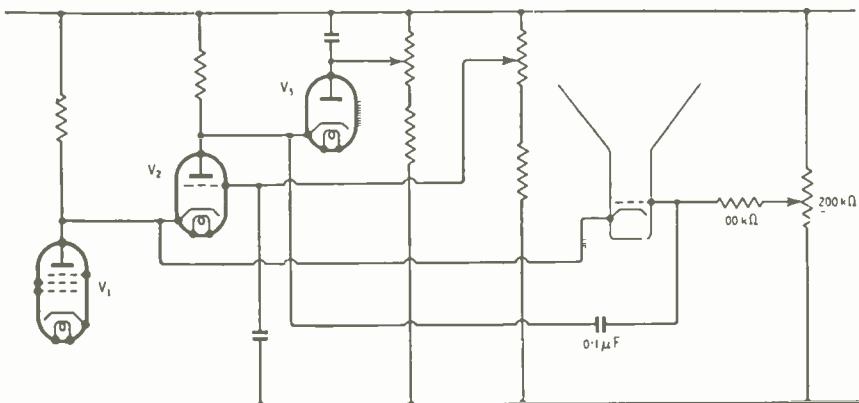
enabling a direct comparison of two aerials, particularly as to their susceptibility to interference, to be made under proper viewing conditions.

The arrangement is sketched in Fig. 2. Each aerial feeds an r.f. amplifier the outputs of which are commuted and taken to the input of any television receiver. The two amplifiers are rendered alternatively inoperative by a biasing pulse. A 50-c/s square-wave generator is used for this and is locked at 50 c/s through a phasing circuit which enables the change-over to be adjusted to the required point. One change-over occurs during the frame fly-back, the other half-way through the picture. In the demonstration an artificial source of interference was impressed on the input signal to one amplifier, the input to the other being free of interference. This gave a good idea of the capabilities of the method, which

appears to be a valuable one for assessing the practical value of television aerials whenever it is possible to have the two to be compared erected simultaneously.

Apart from ignition interference, aircraft flutter is probably a major cause of interference, especially in certain districts. A circuit to reduce its effect on the picture was demonstrated by G.E.C. Under the somewhat artificial conditions of the demonstration, where the signal fluctuations were provided by an input attenuator which was varied regularly at a

Fig. 1 Circuit of G.E.C. "grey spotter"



slow rate, the circuit made an enormous improvement to the picture, although it did not completely eliminate the effects of the flutter.

The circuit is shown in Fig. 3 and is extremely simple. The video signal is fed back through an RC network comprising a cascade of integrator and differentiator type circuits which form a frequency-selective circuit. Neither picture-frequency signals nor d.c. is passed. Slow variations of the signal in the region of 10 c/s are passed, however, and vary the bias, and hence the gain of the i.f. amplifier, so that as the output increases the gain decreases and vice versa. It is a form of a.g.c.

The care that is needed in television receiver production is brought home by the elaborate apparatus shown by Bush for r.f. amplitude and phase characteristic tests. A combination of step and pulse methods is used. This same firm also showed an experimental recording wobulator which enables a permanent record of the response curve of a television receiver to be made by means of a pen recorder. A variable-frequency oscillator is used to produce the signal and there are several crystal-controlled marker frequencies.

Bush showed a receiver using a direct-drive line-scanning circuit to show the simplicity resulting from this arrangement and G.E.C. demonstrated a set using an experimental 12-in c.r. tube with a 90° deflection angle. Small external magnets are used to correct for pincushion distortion.

The possible advent of new television stations in Band 3 was reflected at the show by a 12-channel tuner (Cyclon) covering the frequency range 50-220 Mc/s, and two new Mullard valves specifically designed for use in such circuits. These valves were the PCC84 double triode and the PCF80 triode-pentode, both on the B9A base. The PCC84 is intended for use as a cascode low-noise r.f. amplifier with an h.t. voltage of 180V. In the cascode circuit the two triodes are connected in series across the h.t. supply so they get only 90V each, but in spite of this low operating voltage each triode has a slope of 6mA/V and an amplification factor of 24, permitting a gain of about 12 db from the circuit. A difficulty of the cascode circuit is that a high voltage is placed across the heater-cathode insulation of the top earthed-grid valve. This has been catered for in the PCC84, which has a heater-cathode voltage rating of -250V and +90V.

The PCF80 triode-pentode is intended for use as a frequency changer following the PCC84, and in a typical circuit it is claimed to give a conversion gain of 20 db working with an input frequency of 200 Mc/s. The triode and pentode sections are placed side by side instead of one above the other as in earlier Mullard valves.

This combination of PCC84 cascode r.f. amplifier and PCF80 frequency changer is actually used in the Cyclon tuner. The unit is based on the American type of turret tuner and has a rotating drum carrying 12 aerial and 12 r.f. coupling and oscillator coils. These coils are mounted on low-loss Bakelite contact strips which are clipped on to the turret, and rotating the turret brings the desired set into circuit, leaving the others isolated.

Mullard were showing how the difficult and complicated processes of frequency-changer design can be simplified and made more exact by an interesting type of "three-dimensional" display which presents a large number of characteristics of a mixer valve (actually the PCF80) in their correct relationship on a single chart. It is called the "contour line method"

Fig. 3 G.E.C. anti-flutter circuit with selective RC network.

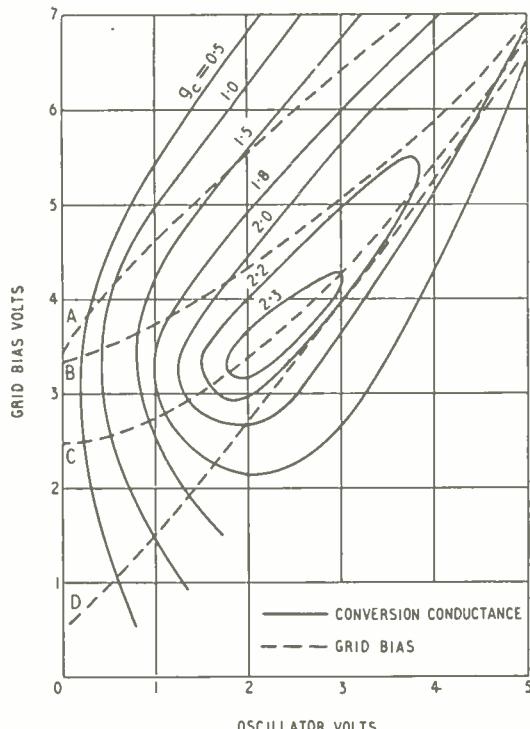
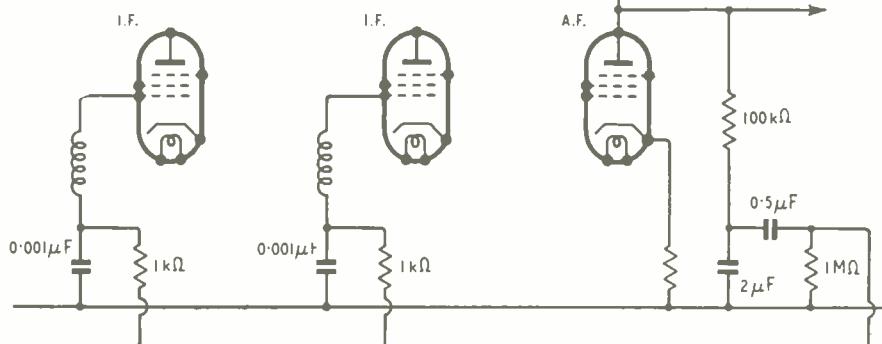


Fig. 4 "Three-dimensional" display of PCF80 characteristics. Control-grid bias of pentode section for different values of cathode resistor and grid resistor (A, B, C, D), plotted against oscillator volts, with superimposed "contour" lines of constant conversion conductance.

because on an ordinary two-dimensional graph are superimposed lines joining points of equal conversion conductance. Looking at Fig. 4 one can, in fact, imagine it as a bird's eye view of a relief map, with a "hill" rising to its summit in the middle at a conversion-conductance "height" of just over 2.3 mA/V. The dotted lines A, B, C, D represent different values of grid leak and cathode resistor. While the maximum conversion conductance lies on curve C, at an oscillator voltage of 2.3 V and a control-grid bias of -3.6 V, its value is affected considerably by changes in oscillator voltage. Optimum conditions are given by curve B, which runs almost parallel to the contours (along the side of the "hill") instead of straight up and down the slope) and is reasonably near the maximum conversion conductance.

Radar in Airliners

Is it a Practicable Aid to Extra Safety in the Air?

THE use of airborne radar as an aid towards safer air travel has recently attracted some attention in the daily Press; but it has been under consideration by the airlines ever since the end of the war, and a lot of work has been done towards developing a suitable set. In general terms, the requirement is to extend the "range of vision" from the aircraft, and to indicate clearly the presence of obstructions to flight. With increasing speeds of transport aircraft—up to 500 m.p.h.—the need for a lot of clear airspace is apparent, because transport aircraft, and their loads, are not normally subjected to violent manoeuvres.

The routes which airliners follow are, of course, selected to avoid all dangerous ground, or else to fly over it at a height which provides a large margin of safety against a possibility of partial loss of power. Flying between mountain peaks is not airline business, and following an established route is an everyday exercise in air navigation, presenting neither novelty nor difficulty in normal circumstances. In fact, it is doubtful whether the use of aircraft radar as a form of map-painter will be any advantage, because the information on the radar screen is not detailed and the navigation systems available, such as for instance the Decca system, give precise information about position. In case of doubt, though, radar information can be used as confirmation of orthodox navigation, but it would be rather like using a watch to confirm the Rugby time signals.

Dangerous Cloud Formations

However, there is one particular application which can only be met in a satisfactory way by using radar, and this application is being followed up, with trials taking place at present by the Royal Canadian Air Force in a Comet. This application is the avoidance of obstacles which occur seasonally, and which are not stationary—dangerous clouds.

In and near the tropics at certain seasons the weather conditions produce a type of thundercloud (cumulo-nimbus) which has a core with a high percentage of water in it, and where the vertical currents are very severe, up to 60-80 feet per second. These clouds are avoided by aircraft, because of the very disturbed air around the cloud, which would cause a very rough ride. The interference increases as the aeroplane speeds are raised, and with high-speed jet aircraft it could become very troublesome.

As long as these clouds can be seen, they may readily be avoided, but at night they may be so severe as to cause flying to be suspended. Experiments with radar have shown that the dangerous clouds produce

strong echoes on the radar screen (and so do some non-dangerous clouds); so by fitting radar, aircraft may be able to fly by night in areas where "stuffed clouds" are likely to be, with sufficient warning of the presence and locality of the hazards to allow the aircraft to avoid them. This is an appreciable advantage.

A radar set has been developed in England, by Ekco* working with the Ministry of Supply, and it has been extensively tested as it has been developed. It has a maximum range of 40 miles, and has detected clouds, presumed to be dangerous, at maximum range. The equipment needs about 650 VA of power, and its output is 10 kW peak, on a wavelength of 3 cm, with 700 pulses per second, each of 1-microsecond duration.

The strength of the echo from clouds depends on the size of the water drops in the cloud, and on the wavelength of the radar. Experimenters in U.S.A. have found that in some cases a wavelength of about 6 cm produces a much stronger echo than does the 3-cm radar, and they have built an aircraft set to use these longer waves. It has rather more range, for the same power, than the 3-cm radar, but has the great disadvantage that the aerial assembly is so very much bigger. This will make the equipment difficult to accommodate in an airliner, for a very large section of the nose would not only become useless as stowage space, but would have to be encased in Perspex or something similar.

Economic Problems

Space and weight are at a premium on every aeroplane, and the British equipment weighs about 200 lb, installed. This is about the same as the weight of a passenger, so it is clear that even to carry the radar implies a substantial cost to an airline; it must only be carried where it can serve a useful purpose. This would be equivalent to reducing the payload in some localities to cater for weather hazards, as is done in ships which are less deeply laden for winter in the North Atlantic than elsewhere.

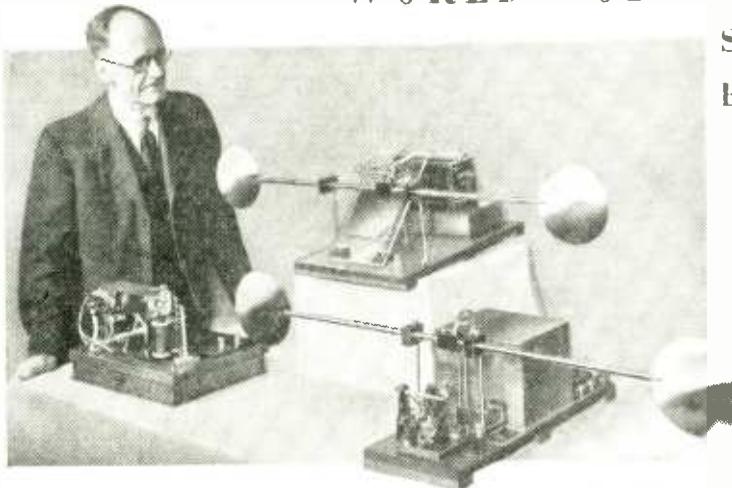
Aircraft radar has occasionally been suggested as a valuable preventer of collisions between aircraft, but the information displayed is not specific enough for collision prevention. However, collision between aircraft is not a serious hazard; there are few localities where air traffic is dense enough to create collision risks, and in all these localities there is an effective and rigid system of air traffic control, using ground radar as one of its principal tools. By means of two-way radio telephony, aircraft are given instructions on route and height, and the only danger would arise from an intrusion by an aircraft without two-way radio telephony. Such an intrusion is forbidden, but it has happened, though radar on aircraft would be of little value in such a case.

I have tried to show that there is a case for aircraft radar, which can be a useful aid in certain circumstances. This is far from recommending that all airliners should be fitted with radar as a permanent fixture, or from suggesting that without radar any operations carried out at present are less safe than they might be. The contrary is the case, and certainly radar will be used where its use is justified. The provision of a suitable equipment is actively being pursued, but the total costs will be so high that the article will have to be very good.

J. M.

* "Radar Cloud Detector" *Wireless World*, December 1950

WORLD OF WIRELESS



Instruments and Components

ANNUAL London exhibitions of the Radio and Electronic Component Manufacturers' Federation and the Physical Society will overlap by only one day this year. The R.E.C.M.F. components show will be held at Grosvenor House, Park Lane, W.1, from April 6th to 8th. Some 130 exhibitors will be participating in the exhibition. Admission is by invitation, limited to those interested in the industrial, scientific or trade aspect of components. The show will be open on each of the three days at 10.0 and will close at 6.0, 9.0 and 5.0 respectively. Tickets are obtainable from the Federation at 22, Surrey Street, Strand, London, W.C.2.

Tickets for the 38th Physical Society exhibition of scientific instruments and apparatus, which will be held at the Imperial College of Science and Technology, Imperial Institute Road, S.W.7, from April 8th to 13th, will be available from the Society from the beginning of March. As in previous years, tickets will be valid for specific sessions and days. The exhibition will open daily at 10.0 and will close at 8.0 on the 8th, 9th and 12th and at 5.0 on the 10th and 13th. On the opening day admission will be limited to Fellows and the Press from 10.0 until 2.0. The handbook covering the exhibition will be available on March 1st, from the Society, 1, Lowther Gardens, Prince Consort Road, London, S.W.7, price 6s, postage 1s 3d.

V.H.F. Broadcasting

THE LONG-AWAITED report of the Television Advisory Committee on v.h.f. broadcasting has, it is understood, been received by the Postmaster General. It is not known whether the findings of the Committee will be published, as, of course, the report has been prepared solely for the guidance of the Government and is not in itself a statement of Government policy. It is, however, known that the Committee recommends, as was anticipated, the use of frequency modulation, although there is an adverse minority report.

New Zealand Television

BRITISH 405-LINE TELEVISION standards having been recommended by a Government departmental committee for adoption in New Zealand, Pye recently shipped to Wellington complete transmitting equipment and a number of receivers to provide demonstration transmissions during the Wellington Show and Industrial Fair (January 7th-27th).

The Minister in Charge of Broadcasting has, however, stressed that there is no likelihood of the Government taking immediate action to establish a television service.

Show News • Record Radio
Exports • V.H.F. Report •
TV Pioneer Honoured

MUSEUM-PIECE V.H.F. — A working model of the apparatus used by Marconi in his early experiments has recently been presented by the Marconi Company to the Science Museum, South Kensington, where its operation is being demonstrated to visitors. The apparatus, seen here with its maker, R. W. Piper, of the Marconi Marine Company, comprises a spark transmitter (top) and a coherer receiver (right). Operating frequency is 85 Mc/s

Radio Exports

ACCOUNTS for November recently issued by the Board of Trade show that the total value of radio exports during the month was £2,677,912, which, for the second successive month, broke previous records. The figure for the eleven months of 1953 (£23,328,347) is within £1.2m of the total for the whole of 1952.

The November figure and the eleven-month total (in £m) for each of the four sections of the industry are:

Transmitting and radio navigational gear	1.245	9.866
Components and sound reproducing equipment ..	0.955	8.222
Domestic receivers	0.276	3.225
Valves and c.r. tubes	0.202	2.015

Faraday Medallist

ISAAC SHOENBERG is to receive the 32nd award of the Faraday Medal of the I.E.E. "for his distinguished work in electrical engineering, in particular the outstanding contributions which he has made to the development of high-definition television in this country."

Mr. Shoenberg, who is director of research of Electric and Musical Industries, led the team (including A. D. Blumlein, C. O. Browne, G. E. Condliffe and J. D. McGee), which was responsible for the development of the 405-line television system and ancillary equipment adopted by the B.B.C. in 1936.

Born in Russia in 1880, Mr. Shoenberg was chief engineer of the Russian Wireless Telegraph and Telephone Company, Leningrad, from 1905 until he came to this country in 1914 as consulting engineer to the Marconi Company of which he became joint general manager. He has held his present position since the formation of E.M.I. in 1931 through the amalgamation of the Gramophone Company and the Columbia Graphophone Company of which he had been joint managing director for three years.



European Broadcasting Problems

DURING the meeting of the Technical Committee of the European Broadcasting Union at Monte Carlo in November, E. L. E. Pawley (B.B.C.) chairman of the

Committee, presented a report on the studies of a working party concerned with v.h.f. broadcasting, especially in relation to the Stockholm Plans. In its future studies this working party will consider the problems regarding the securing of the 216-223 Mc/s channel for television (this will extend Band 3 by 7 Mc/s) and the co-ordination of investigations into the use of Bands 4 and 5.

Three new working parties, were set up during the meeting. One will deal with the operational use of magnetic-tape recording, including its applications in television; another with the expansion of the television network in Europe, with special reference to the location and responsibility for standards-converters for international relays; and the third will be responsible for collaboration between the E.B.U. and the C.I.S.P.R.

The report of the Brussels Technical Centre given at the meeting included references to the standard of musical pitch, the choice of i.f.s for television sets, stereophony and the compilation of a bilingual technical glossary.

"W.W." Index

COPIES of the index to the 1953 volume of *Wireless World* are now available from our Publishers price 1s (postage 2d). Cloth binding cases are also obtainable with index, price 6s 5d by post. The binding of readers' own issues can be undertaken by our Publishers, the cost, including binding case and index, being 17s 6d plus 1s 4d postage on the bound volume.

NEW YEAR HONOURS

Dr. W. G. Radley, C.B.E., Post Office engineer-in-chief, received a Knighthood in the New Year Honours. He joined the Post Office in 1920, was for five years controller of research and was appointed E.-in-C. in 1951. He is chairman of the Technical Sub-Committee set up by the Television Advisory Committee.

Norman C. Robertson, M.B.E., who recently concluded his two-year term of office as director-general of electronics production at the Ministry of Supply and returned to E. K. Cole, Ltd., where he has been deputy managing director since 1945, has been appointed a Companion of the Order of St. Michael and St. George (C.M.G.).

Rear-Admiral (L) C. P. Clarke, C.B., D.S.O., R.N.(ret.), and **Cdr. S. S. C. Mitchell, C.B., O.B.E., R.N.(ret.)**, are created Knights Commanders of the Order of the British Empire (K.C.B.). Commander Mitchell has been controller of guided weapons and electronics (M.O.S.) since 1951 and has been in charge of all research, development and production of guided weapons in this country.

G. J. S. Little, G.M., an assistant engineer-in-chief, Post Office, and **G. Darnley Smith**, managing director of Bush Radio and Cinema Television, are among the new Commanders of the British Empire (C.B.E.). Mr. Darnley Smith is chairman of the Radio Industry Council and is one of the two representatives of the industry on the Television Advisory Committee.

Among the new Officers of the Order of the British Empire (O.B.E.) are **T. H. Baines**, deputy director radio equipment (production), Admiralty, **A. S. Mitson**, assistant director electronics production, M.O.S., and **M. J. L. Pulling**, senior superintendent engineer (television), B.B.C. Mr. Pulling has been in his present position since 1949 and was previously superintendent engineer (recording) for eight years. He recently visited the United States and gave his impressions of American television in our January issue.

New M.B.E.s include **O. H. Barron**, engineer, Planning and Installation Department, B.B.C., **D. J. Bowman**, B.B.C. Monitoring Service, **F. Clark**, Marconi Radio Officer in m.v. *Isipingo*, **W. H. F. Griffiths**, chief engineer, **H. W. Sullivan**, Ltd., who has contributed articles on standard measuring equipment to both *Wireless World* and *Wireless Engineer*, **H. J. Harbou**, test controller, Radio Division, E. K. Cole, Ltd., and **G. Houghton**, chief technical instructor, Radar Section, Technical Training College, Indian Air Force, Jalahalli.

Recipients of the British Empire Medal include **W. McLaren**, leading technical officer, P.O. Radio Station, Cupar, and **G. Wilkins**, experimental mechanician, McMichael Radio.

PERSONALITIES

Ernest Leete has been elected an Honorary Member of the I.E.E. "for his services as Honorary Treasurer . . . and also for his work on behalf of the Benevolent Fund of the Institution." Mr. Leete joined the London Electric Wire Company and Smiths, Ltd., in 1904 and subsequently became managing director.

H. Faulkner, C.M.G., B.Sc., M.I.E.E., has retired after forty years' service in the Post Office where he has been deputy engineer-in-chief since 1948. He was a member of the team responsible for the design of the Rugby Station and was its first officer-in-charge (1925). Mr. Faulkner was chairman of the recent London meeting of the C.C.I.R. and is a member of the Technical Sub-Committee of the Television Advisory Committee. He has accepted the office of director of the Telecommunication Engineering and Manufacturing Association (see opposite page).

A. H. Mumford, O.B.E., B.Sc.(Eng.), M.I.E.E., succeeds Mr. Faulkner as deputy E.-in-C. at the Post Office, having been an assistant E.-in-C. since 1951. He joined the Post Office Engineering Dept. as a probationary assistant engineer in 1924, and after a short period at Headquarters went to the Dollis Hill laboratory. He took charge of the Radio Branch in 1928. Mr. Mumford is succeeded as assistant E.-in-C. by **C. F. Booth**, O.B.E., who has been deputy director, External Telecommunications Executive, for the past eighteen months. Both Mr. Mumford and Mr. Booth have been chairmen of the I.E.E. Radio Section. (Portrait opposite.)

Rudolph Kompfner, the originator of the travelling-wave valve which he described in the November, 1946, issue of *Wireless World*, is now at the Bell Telephone Laboratories, Murray Hill, New Jersey, U.S.A., where he is working on microwave valves and has recently contributed an article on backward-wave valves in the *Proceedings of the I.R.E.* He came to England from Austria in 1934 and joined the Admiralty as a temporary experimental officer in 1941, undertaking research in the Physics Department of Birmingham University. From 1944 until 1952 he was in the Clarendon Laboratory of Oxford University.

RECIPIENTS OF NEW YEAR HONOURS



DR. W. G. RADLEY
(Knighthood)



NORMAN C. ROBERTSON
(C.M.G.)



M. J. L. PULLING
(O.B.E.)



W. H. F. GRIFFITHS
(M.B.E.)

W. R. Nash, M.Inst.R.E.(Aust.), who has been London manager of Amalgamated Wireless (Australasia), Ltd., for the past seven years, has returned to Sydney as an assistant to the managing director of A.W.A. He is succeeded by **D. Craig**, who joined A.W.A. in 1936 after five years with Raycophone, Ltd. From 1937 to 1946 he was in the company's research laboratory where he was concerned with development work on crystal manufacturing machinery, aircraft equipment and mobile f.m. gear. For the past seven years he has been in the Technical Services Section.



A. H. MUMFORD



D. CRAIG

A. I. Bray, B.Sc.(Eng.), A.C.G.I., A.M.I.E.E., who joined the engineering staff of the B.B.C. in 1935 and was attached to the London Outside Broadcasts Section, has been appointed engineer-in-charge Television Outside Broadcasts (London). During the war he served in the R.A.F., attaining the rank of Squadron Leader, and returned to Television O.B.s in 1946.

L. Evans has been appointed engineer-in-charge of the Isle of Man television transmitter. He joined the B.B.C. in 1941 and has served at a number of the Corporation's sound and television stations, including Sutton Coldfield and Wenvoe.

OUR AUTHORS

S. Kelly, chief engineer of Cosmocord's electro-acoustic division, who writes on components for transistors in this issue, was on radar research at R.A.E., T.R.E. and at the Massachusetts Institute of Technology for the major part of his wartime service in the R.A.F. He was subsequently senior radar officer, Transport Command Development Unit. Before the war Mr. Kelly was in the development laboratories of Standard Telephones & Cables and Philco.

D. C. Pressey, author of the article on page 60, is at present developing analogue computing devices at Southern Instruments, which he joined in 1950. He commenced his radio career in 1944 at R.R.D.E. (now Radar Research Establishment), Malvern, where most of his work was concerned with the radio proximity fuse. Two years later he went to the Nuffield Department of Anaesthetics, Oxford University, where he undertook research on the application of electronics to medical problems, as a result of which an instrument for the recording of respiration rates and volume was developed.

T. W. Bennington, whose annual survey of the ionosphere appears in this issue, was from 1939 until recently in charge of the ionospheric and short-wave propagation work of the Overseas and Engineering Information Department of the B.B.C. He is now engaged on similar work in the Corporation's research department. He helped in 1930 to inaugurate the first long-distance ship-shore radio-telephone service and was in charge of the radio-telephone service in R.M.S. *Majestic*. Mr. Bennington, who joined the B.B.C. in 1934 after a period in the radio industry, is author of the book "Short-wave Radio and the Ionosphere."

H. S. Jewitt, contributor of the article on wideband i.f. amplifiers on page 86, worked on anti-aircraft radar while in the army from 1939 until invalidated out in 1942. He then undertook research work on v.h.f. and a.f. until September, 1945, when he went to Queen Mary College, London University. He graduated in 1949 as B.Sc.(Eng.) and joined Ferranti's as development engineer working on pulse circuitry. Since mid-1952 Mr. Jewitt, who is now 31, has been with Decca Radar where he is senior engineer in charge of the receiver design group at the radar research laboratory, Tolworth, Surrey.

IN BRIEF

Receiving Licences.—During November the number of television licences in Great Britain and Northern Ireland increased by 119,157, bringing the total to 2,846,227. The total number of broadcast receiving licences, including sound, vision and 202,676 for car radio, was 13,216,644 at the end of the month.

East Anglian Transmitter.—A new low-power transmitter at Hempstead, near Cromer, was brought into service by the B.B.C. at the end of December. The 2-kW station, which operates on 434 metres (692 kc/s), has been provided with a directional aerial system designed to give a good service in Sheringham, Cromer, North Walsham and Aylsham without affecting reception of the Moorside Edge transmissions in north-west Norfolk and along the Lincolnshire coast.

Farnborough 1954.—The annual flying display and exhibition of the Society of British Aircraft Constructors at Farnborough, which is fast becoming the focal point for aeronautical radio, will this year be held from September 7th to 12th.

The Daventry Third Programme Transmitter (647 kc/s), the aerial of which had been undergoing repair for some time, resumed transmission on full power at the end of the year. Further adjustments to the aerial system are being made to reduce the fading which is experienced after dark in the more remote areas.

The Physical Society is organizing a conference on the Physics of the Ionosphere, to be held at the Cavendish Laboratory, Cambridge, from September 6th to 9th. Details of the Conference, which will be devoted to discussions on the lowest ionosphere, irregularities and movements in the ionosphere, the F2 layer and the mathematics of wave propagation, may be obtained from J. A. Ratcliffe, F.R.S., Cavendish Laboratory, Cambridge.

T.E.M.A.—The Telecommunication Engineering and Manufacturing Association, of which H. Faulkner has been appointed director (see "Personalities"), is concerned mainly with general policy matters in the telecommunication industry. Among the members of the association, which was formed in 1943, are A. T. & E., Creed, Ericsson, G.E.C., Plessey, S.T.C., Siemens and T.M.C. The address of T.E.M.A. is Stafford House, 40-43, Norfolk Street, London, W.C.2.

Magnetic Tape Standards.—A revised British Standard (BS1568:1953) has been issued on "Magnetic Tape Sound Recording and Reproduction for Programme Interchange." Dimensions are now included of an adaptor to permit the use of American N.A.B. spool hubs on machines designed primarily for European standard spools. Copies, price 2s 6d, are obtainable from the British Standards Institution, 2, Park Street, London, W.1.

Amateur Colour Television pictures have been transmitted over a closed circuit by C. G. Dixon, of Ross-on-Wye. The home-built equipment works on the frame-sequential system with rotating colour discs in front of the camera and c.r.t. monitor, and the scanning rate is 100 colour frames per second or 33½ complete pictures per second of 150 lines (non-interlaced) each.

Richmond Readers interested in the "technical aspects of the reproduction of music" might like to know that a group of music enthusiasts in the district is holding monthly meetings. Details may be had from B. J. Davis, 18, West Park Avenue, Kew Gardens, Richmond, Surrey.

As already announced, the fourth Mechanical Handling Exhibition and Convention, organized by Mechanical Handling, will be held at Olympia, London, W.14, from June 9th to 19th.

A booklet on the benefits of V.H.F. Mobile Radio-telephones in business and public services has been prepared by the Radio Communication and Electronic Engineering Association. It includes a list of the members of the Association supplying mobile radio equipment.

Amateur Call Book.—The winter edition of the R.S.G.B. Amateur Radio Call Book, which contains the calls, names and addresses of some 7,500 amateurs in the British Isles and Eire, is now available by post from the Society, price 2s 9d.

A new Mullard Film dealing with the technicalities of valve design and manufacture is now available for showing to clubs, colleges and schools. The "Manufacture of Radio Valves" as it is called, can be borrowed from Mullard's, Technical Publications Department, Century House, Shaftesbury Avenue, London, W.C.2.

Details of specialized Higher Technological Courses in a variety of subjects including electronics, high vacuum techniques, semi-conductors and transistors, which are available

at 26 establishments in London and the Home Counties, are given in a Bulletin issued by the Regional Advisory Council, Tavistock House South, Tavistock Square, London, W.C.1. The price is 1s 6d.

INDUSTRIAL NEWS

Belling & Lee are arranging to give talks to the trade on the reception problems associated with the proposed introduction of an alternative television programme. They will be given in areas in which it is intended to erect transmitters and will cover aerial adaptors, feeders, input arrangements, etc.

Marconi Marine Company has appointed as manager of its Grimsby Depot, J. W. Dalton, who commenced his service with the company as a sea-going operator in 1928. He was manager of the Cape Town Depot of Marconi (South Africa), Ltd., from 1946 to 1953.

An order valued at over £100,000 has been placed with E.M.I. Factories by the French Air Ministry for 100 airborne Rebecca Mark IV sets with spares and associated test gear.

A complete Pye duplex multi-carrier radio-telephone system has been installed in South Turkey for the police. The installation consists of a 15-watt control station at Adana which controls two 50-watt repeaters installed at points where maximum coverage can be obtained. A further fixed station at the port of Mersin is linked by radio with the police headquarters at Adana 75 km away.

A further three complete Emiton mobile television microwave radio links have been ordered by the Swiss Post Office from E.M.I.

Ediswan's Glasgow district office is now at 167, St. Vincent Street, Glasgow (Tel.: Central 0687). The cathode-ray tube service depot is at the same address, but its new telephone number is Central 2206. The company has also opened a c.r.t. service depot at 39-41, Jacksons Row, Manchester, 3 (Tel.: Blackfriars 2969).

Wharfedale Wireless Works, of Bradford, Yorks, celebrated in December the 21st anniversary of its formation.

MEETINGS

Institution of Electrical Engineers

London.—Faraday Lecture "Electro-Heat and Prosperity" by O. W. Humphreys, B.Sc., at 6.0 on February 16th at Central Hall, Westminster, S.W.1. (Admission by ticket obtainable from Savoy Place, W.C.2.)

"The Manchester Kirk o'Shotts Television Radio Relay System" by G. Dawson, B.Sc., L. L. Hall, K. G. Hodgson, B.A., R. A. Meers, O.B.E., T.D., and J. H. H. Merriman, on February 4th.

Radio Section.—"Basic Ground-Wave Propagation Characteristics in the 50-800 Mc/s Band" by J. A. Saxton, B.Sc., Ph.D., and "Ground-Wave Field Strength Surveys at 100 and 600 Mc/s" by J. A. Saxton, B.Sc., Ph.D., and B. N. Harden, M.Sc., on February 10th.

Discussion on "Acceptable Standards of Quality in Sound Broadcast Transmission and Reception"; opener, J. K. Webb, M.Sc. (Eng.), B.Sc.Tech.

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

Cambridge Radio Group.—"The Use of Radio in the Ascent of Everest" by G. C. Band, at 6.30 on February 16th at the Cambridgeshire Technical College.

North-Eastern Radio Group.—"Technical Arrangements for the Sound and Television Broadcasts of the Coronation Ceremonies" by W. S. Proctor, M. J. L. Pulling, M.A., and F. Williams, B.Sc., at 6.15, on February 15th, at King's College, Newcastle-upon-Tyne.

North Midland Centre.—"Special Effects for Television Studio Productions" by A. M. Spooner, B.Sc.(Eng.), and T. Worswick, M.Sc., at 6.30, on February 9th at the British Electricity Authority, 1, Whitehall Road, Leeds.

"Ignition Interference with Television Reception" by A. H. Ball and W. Nethercot at 7.15 on February 25th at the Yorkshire Electricity Board, Ferensway, Hull.

North-Western Radio Group.—"The Reproduction of Signals Recorded on Magnetic Tape" by E. D. Daniel, M.A., and P. E. Axon, M.Sc., Ph.D., at 6.30, on February 17th, at the Engineers' Club, Albert Square, Manchester.

South Midland Radio Group.—"What is an Amplifier?" by D. A. Bell, M.A., Ph.D., at 6.0, on February 22nd, at the James Watt Memorial Institute, Great Charles Street, Birmingham.

Rugby Sub-Centre.—"Technical Arrangements for the Sound and Television Broadcasts of the Coronation Ceremonies" by W. S. Proctor, M. J. L. Pulling, M.A., and F. Williams, B.Sc., at 6.30, on February 3rd, at the Rugby College of Technology and Arts.

Southern Centre.—Faraday Lecture "Electro-Heat and Prosperity" by O. W. Humphreys, B.Sc., at 6.30, on February 18th, at the Guild Hall, Southampton.

"Technical Arrangements for the Sound and Television Broadcasts of the Coronation Ceremonies" by W. S. Proctor, M. J. L. Pulling, M.A., and F. Williams, B.Sc., at 7.30, on February 24th, at the R.A.E. Technical College, Farnborough.

Western Centre.—Faraday Lecture "Electro-Heat and Prosperity" by O. W. Humphreys, B.Sc., at 6.30, on February 1st, at Sofia Gardens Pavilion, Cardiff.

"Technical Arrangements for the Sound and Television Broadcasts of the Coronation Ceremonies" by W. S. Proctor, M. J. L. Pulling, M.A., and F. Williams, B.Sc., at 6.0, on February 8th, at the South Wales Institute of Engineers, Park Place, Cardiff.

South-Western Sub-Centre.—"Printed and Potted Electronic Circuits" by G. W. A. Dummer and D. L. Johnston, B.Sc.(Eng.), at 4.30, on February 11th, at Dowlish Ford Mills, Ilminster, Somerset.

British Institution of Radio Engineers

London Section.—"Electronics in Film Making" by W. D. Kemp and B. R. Greenhead (High Definition Films), at 6.30 on February 17th at the London School of Hygiene and Tropical Medicine, Keppel Street, London, W.C.1.

Scottish Section.—"Electronics in Film Making" by W. D. Kemp and B. R. Greenhead (High Definition Films), at 7.0 on February 4th at the Institution of Engineers and Shipbuilders, 39, Elmbank Crescent, Glasgow, G.2.

North-Western Section.—"Police Radio, Its Past, Present, and Future Possibilities" by I. Auchterlonie (Manchester City Police) at 7.0 on February 4th at the Reynold's Hall, College of Technology, Manchester.

North-Eastern Section.—"Some Aspects of Micro-Wave Aerial Design" by J. Bilbrough (Microwave Instruments), at 6.0 on February 10th at the Neville Hall, Westgate Road, Newcastle-upon-Tyne.

Mercyside Section.—"Micro-Wave Test Gear" by J. Bilbrough (Microwave Instruments), at 7.0 on February 4th at the Electricity Service Centre, Whitechapel, Liverpool, 1.

West Midlands Section.—"Applications of Electronic Techniques to the Testing of Magnetic Materials" by J. MacFarlane (Guest, Keen & Nettlefold), at 7.15 on February 23rd at the Wolverhampton & Staffordshire Technical College, Wulfruna Street, Wolverhampton.

British Sound Recording Association

London.—"Stereophonic Sound Reproduction" by J. Moir, at 7.0 on February 19th at the Royal Society of Arts, John Adam Street, London, W.C.2.

Manchester Centre.—"The Problems of Hearing" by J. E. J. John (Manchester University), at 7.30 on February 15th at the Engineers' Club, Albert Square, Manchester.

Television Society

London.—Fleming Memorial Lecture on "Colour Television" by G. G. Gouriet, B.Sc., at 7.0 on February 10th and 24th at the Royal Institution, Albemarle Street, London, W.1.

Leicester Centre.—"Modified Murphy Receiver Using 24-in G.E. Tube" by H. Fairhurst (Murphy Radio), at 7.0 on February 28th at the College of Art and Technology, The Newarkes, Leicester.

Institute of Navigation

"The Requirements for Marine Pilotage" by Commander L. W. Akerman and R. F. Hansford, at 5.0 on February 19th at the Royal Geographical Society, 1, Kensington Gore, London, S.W.7.

Institution of Production Engineers

Wolverhampton.—"Electronics in Production Engineering" by D. R. Whatley, B.Sc. (Eng.), at 7.15 on February 3rd at the Wolverhampton and Staffordshire Technical College, Wulfruna Street, Wolverhampton.

Edinburgh.—"Electronics in Industry" by G. Horsfall, at 7.30 on February 17th at the North British Station Hotel, Edinburgh.

Radar Association

"Some Unsolved Radar Problems" by K. E. Harris (Cossor) at 7.30 on February 10th in the Anatomy Theatre, University College, Gower Street, London, W.1.

Institute of Practical Radio Engineers

Midlands Section.—"Ultra Television Receivers" by H. G. Trapp (Ultra), at 7.30 on February 1st at the Crown Hotel, Broad Street, Birmingham.

Radio Society of Great Britain

London.—"Practical Aspects of Tape Recording" by S. A. Lacey (Murphy Radio), at 6.30 on February 26th at the I.E.E., Savoy Place, London, W.C.2.

Electron Optics

By "CATHODE RAY"

How Electron Paths are Controlled by Electric Fields

WHAT is electron optics? Well, for one thing it is a contradiction in terms. My dictionary says that "optics" is derived from a Greek word meaning "pertaining to sight; visible." Now one of the most obvious things about electrons is that they are *not* visible. You may perhaps have read somewhere that the fluorescent screen in a cathode-ray tube is for rendering the electron stream visible, but of course that is not literally true; it is the effect of their impact that is visible, not the electrons themselves. But "electron optics" does not even mean the technique of rendering effects visible. It is often very closely connected with such technique, notably in the cathode-ray tube, but it is really quite a distinct science. Roughly it could be defined as doing with electrons much the same kinds of things as can be done with light. Such things as focusing and deflecting rays. But I would like to make it clear from the start that "optics" only comes into the title on the strength of an analogy, and what is called electron optics could quite well be practised if there were no such thing as optics or even light. The analogy between optics and electron optics is by no means perfect and can actually mislead. One might almost as well call the subject of ordinary current electricity "electron hydraulics" because there is an analogy between electric currents and water. As we shall see, optics is not the only analogy that can be used in explaining "electron optics." However, that is the name it is known by, for good or ill, so we shall just have to use it.

I suppose we had better begin by establishing the resemblance between electron optics and optics, or electron rays and light rays; and the customary starting place is the Maltese-cross experiment, described by Sir William Crookes (as he later became) in 1879. This experiment, as you probably well know, was performed with a glass vacuum tube (Fig. 1) in which "cathode rays" were produced by applying a high voltage between two electrodes. The glass of the tube fluoresced under the impact of the rays, except where it was protected from them by the anode, which cast a shadow. The anode was in the form of a Maltese cross, but as far as I can see there is no special merit in that shape; it could just as well be a silhouette of Marilyn Monroe, and in fact that would probably ensure closer attention to the demonstration; though, in that comparatively unsophisticated age, the cross seems to have made such a hit that a less picturesque demonstration of the same phenomenon no less than ten years earlier by a man named Hittorf was quite overshadowed. However it did show strikingly that what was coming from the cathode bore some resemblance to light, notably in normally travelling in straight lines and in being stopped by metal. There was, even in 1879, a strong suspicion that these rays consisted of negatively charged particles, which were later (after the suspicion had been confirmed) named electrons.

The study of light had shown that its rays can be bent ("refracted" is the scientific term) by various

means, such as lenses; and when it was found that similar things could be done with electron rays (though not by the same means) there was enough of an analogy for people to begin to talk about "electron optics," "electron lenses," and so forth. The tie-up with light was made practically unbreakable by the arrival of the electron microscope, which does the same sort of thing as a light microscope only more so. Some of the vast existing store of knowledge about optics has been used to develop electron optics, but it needs a good deal of adaptation, and much of it cannot be applied at all.

We shall probably be doing well enough if we confine this first view of electron optics to its use in cathode-ray tubes, for that is what interests most of us. In their raw state, the cathode rays would just make a splodge of light on the screen, which would be no use for anything (beyond the childish pastime of throwing electronic shadows). A prime necessity is to focus the rays to a fine point—the very words emphasize the analogy with the "burning glass." But the

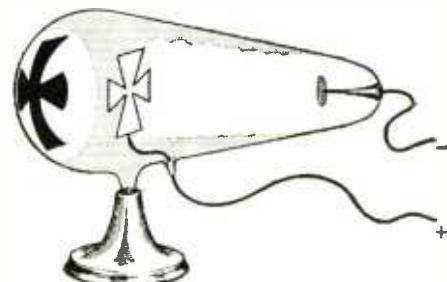


Fig. 1. The celebrated Maltese-cross experiment, by which Crookes demonstrated that cathode rays resemble light in travelling in straight lines and being stopped by metal. The cross casts a shadow on the fluorescent glow caused by the rays.

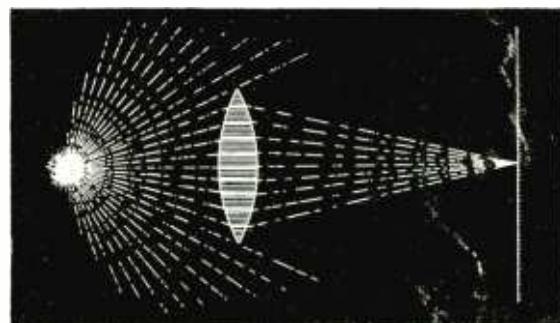


Fig. 2. Light rays can be focused on a screen by means of a glass lens, which bends the rays. Any device that does the same thing for cathode rays is called an electron lens.

resemblance is more in the results than in the means for achieving them. So I think it would be a mistake to spend a lot of time studying optics as a preliminary to electron optics, much though I would enjoy illustrating it in terms of the effects of local boggy ground on the movements of columns of troops. But I don't want to be classed with the lecturer on electricity whose students complained that they learnt a great deal from him about water in pipes but not very much about electricity. All we need, I think, is a passing glance at the probably very familiar diagram, Fig. 2, which shows a lens focusing a diffuse beam of light by bending its rays so that they all converge on the same point. The corresponding kind of electron lens is one that makes electrons do the same thing, and that is the kind we are going to consider.

Bending Electron Paths

The principle used in an optical lens for bending the rays of light is the change in speed of light when it passes from one medium to another, such as from air into glass. How are the paths of electrons bent? There are two means—electric fields and magnetic fields. So here once more we find ourselves confronted with these twin fantasies that seem so elusive and unreal and yet are the basis of everything electrical—and in fact of the whole universe. Our understanding of things electrical—including emphatically electron optics—can be no better than our understanding of fields. Unfortunately, being basic, there is nothing more basic that can be used for describing them, and in the attempt to "unscrew the inscrutable" one is almost bound to make use of imaginary things shown as lines drawn on paper. It must be remembered all the time that such things are no more than artificial aids towards apprehending something whose ultimate nature may be beyond our grasp but about whose behaviour there is no doubt.

However, let's get down to it. Most electrical people have a more or less clear picture of the workings of Ohm's law. And even though it is nearly always applied to circuit elements such as wires, where one does not have to bother much about the sideways distribution of current but only the length, it ought not to be too difficult to visualize what happens in wide conductors. (There is no need to fear another departure into "skin effect"; we shall be considering d.c. only!) Suppose we were to coat a rectangular sheet of plastic with a perfectly uniform layer of carbon, and connect a 100-V battery to opposite ends, using strips of copper to make sure that the whole width was at the same potential (Fig. 3). Then if we were to reckon the lower edge as zero potential, the top edge would be at +100 V, and the potentials in between would be proportional to the height up the strip. If we had a voltmeter that took no current at all we could quite easily check this by applying point probes to the carbon surface. We could, in fact, map out the surface with "equipotential lines," as shown dotted. But in this simple case we can easily fix their positions theoretically by Ohm's law.

We might also draw another kind of dotted line to show the directions in which the current would flow as a result of this potential pattern. The current, of course, consists of free electrons in the carbon, and they take the shortest route towards a more positive potential. Or, more correctly, what appears at the moment to be the shortest route. Like J. H. Newman, they say "I do not ask to see the distant scene; one

step enough for me." And what appears to the short-sighted electron to be the shortest route is *always at right angles to the equipotential lines*. Fig. 4 is an enlarged view of a bit of Fig. 3, and it must be obvious that a stationary electron at A will take the shortest route to the higher potential, viz., along AB, and, of course, that shortest route is at right angles to the dotted lines. Any other route would necessitate sideways movement, and that could not take place without a sideways attraction, and if there were any sideways attraction, the potential pattern could not be as shown.

With such a simple set-up as Fig. 3 one could hardly go wrong. The equipotential lines and the lines of electric force (for that is what the electron paths are called) together make a sort of squared-paper pattern. But what happens when the short view and the long view disagree; that is to say, when the equipotential lines are not parallel to one another. Suppose the carbon sheet had the shape shown in Fig. 5. A zero-potential electron at A, if it were farsighted, would see that the nearest maximum-potential point was B and would make straight for it along the chain-dotted line. But this would mean that during the first stage of the journey it would *not* be taking the shortest route between 0 V and +10 V. The electron can only respond to the direction of the attractive force where it actually happens to be at the moment, and that force is beckoning not from the +100-V line, nor the +10-V equipotential line (which is visibly out of parallel with the 0-V "starting grid"), nor even the +1-V line, but from a line so close in front as to be practically parallel to the 0-V line; and so the electron moves off at right angles to that line. But as it progresses the increasing inclination of the equipotentials bends its path around, so that when complete it is the curve leading to B'.

Potential Gradients

Does that mean that there will be just as much current flowing along the outer edge of this wide track as along the shorter inner path? Certainly not, if Ohm's law is true, for the total voltage is the same for every path, whereas the resistance is proportional to the length of the path. So the current density is greatest on the inside and decreases towards the outer edge in the same proportion as the distance increases. (The current density along a surface is the amount of current per small unit of width.) Another way of putting it is to say that the current density increases with the closeness of the equipotential lines. One advantage of this way is that if one knows anything at all about contour maps a very pretty analogy fairly leaps to the mind. Contour lines, of course, are lines

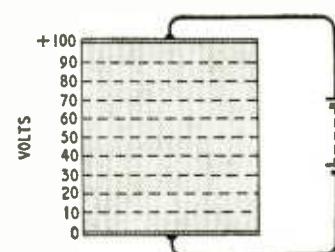


Fig. 3. Equipotential lines (dotted) of electric field along a uniformly conducting strip having a difference of potential between the ends.

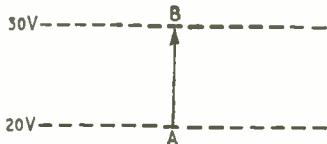


Fig. 4. An electron starting from rest at A tends to take the shortest path to a more positive potential, and in doing so always moves along the line of force and at right angles to the equipotential line passing through its position.

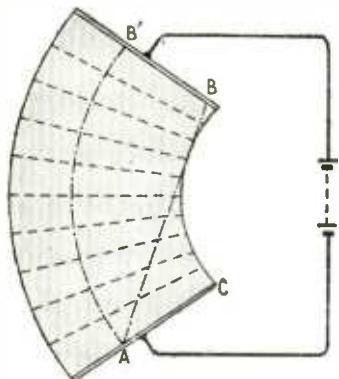


Fig. 5. When the equipotential lines are, as here, not parallel to one another, the electron does not take the shortest route (AB) to the highest potential. It still tends to keep at right angles to its own equipotential line, which means a curved path (AB').

joining all points at the same height above sea level, so they might be called equi-height lines; and since electrical potential is often likened to height the analogy is obvious. A steep gradient is revealed on the map by the contour lines being close together. The steeper the gradient the stronger the pull of gravity along the surface. That pull always acts at right angles to the contour lines; one might say that the lines of gravitational force are at right angles to the equi-height lines. Fig. 5 can now be regarded as a plan diagram of a spiral stairway, except that instead of steps we must imagine a smooth slope, to correspond with the smoothly continuous change of electrical potential along the carbon strip. If the slope is downwards from A, a marble released there does not roll straight to B; it cannot see, so it does not know anything about B, all it knows about is the slope where it actually is, at A, and that slope is at right angles to CA, so it starts off on the AB' curve, just like the electron in the carbon strip. Will it then, like the electron, follow that line all the way to B'?

You have only to try it—or perhaps even imagine it—to realize that it will not. Because the slope is smooth, the marble gains speed, and the direction of its movement is then determined not only by the direction of the slope but also by the direction in which it was moving when it reached that slope. The marble always tends to go straight on, and cannot respond immediately and fully to a change in direction of slope. The faster it is going the less readily it responds.

The electron in the carbon conductor can be likened to a marble rolling down a slope thickly studded with pins, rather like a Corinthian bagatelle

board but with no permanent stops. Every time it hits a pin its journey is interrupted and it has to start afresh, so its speed is no greater at the end than at the beginning. Its average speed is so low that its movement is controlled almost entirely by the slope, and when the slope stops the marble stops. Similarly the electron in the carbon is constantly bumping into carbon molecules, and so is kept down to a constant average speed, which as we saw last month is very low. It continues to move only so long as it is on a potential slope. If the strip in Fig. 3 were extended beyond the 100-V terminal into a sort of blind alley, would they go on into it? Not they!

Introducing Free Electrons

But what we are supposed to be studying is the movement of electrons that are *not* hindered by resistance. So our carbon conductor, although it may serve as an introduction to electric field and equipotential lines, is actually a complication. If we throw it out of Fig. 3, leaving only the battery and copper electrodes, the potential pattern remains. The space between the electrodes is still occupied by an electric field, and any free electrons there are attracted along nearly the same lines of force as before. The trouble is that there aren't any free electrons there. So we have to introduce some. A convenient way of doing this is to coat the negative electrode (i.e., the cathode) with a suitable material such as barium oxide, and heat it. Electrons then boil off, but their space trip is complicated by encounters with air molecules, so to give them a clear run it is necessary to put the electrodes in a glass bulb and pump the air out. Then, at last, the electrons can really display their own simple nature, which is (as Newton saw long before electrons were thought of) to remain in a state of rest or uniform motion in a straight line unless acted upon by external forces, and to accelerate in proportion to any acting force. The particular force we are concerned with just now is the electric field.

In the carbon or any other resistance the electron speed is very limited because it gives rise to a kind of frictional force that neutralizes the force of the electric field, and directly it is fast enough to do so exactly there is no net force and the electron continues uniformly at that speed, in accordance with Newton's first law. But in the clear vacuum it continues to gain speed, like the marble, as long as it is falling down a potential gradient.* As we saw last month, the speed it gets up depends only on the voltage it "falls" through, and if that voltage is denoted by V the speed reached from a standing start is $593\sqrt{V}$ kilometres per second, which is $368\sqrt{V}$ miles per second. The analogy with marbles rolling down frictionless slopes holds good, for the speed they acquire in losing height to the extent of h feet is $8\sqrt{h}$ feet per second, regardless of whether the slope is gradual or precipitous; and when they have acquired it they continue at that speed indefinitely on the level. But whereas in practice friction always interferes with rolling balls (otherwise the game of bowls would be unplayable) our electrons in a vacuum really do keep on accelerating so long as the voltage is rising, and in a constant-potential region they keep up the speed and direction with which they entered it. (They are

* It may be necessary to remind ourselves that because an electron is negative a downward gradient to it is one that becomes increasingly positive. Any confusion in the fact that a "rising" potential is (from the electron's point of view) a downward slope is the fault of whoever persuaded everybody to call the electron-attracting end "positive."

so light that the force of gravity on them can be neglected.) The only restriction on their speed is that when they have accelerated through about 10,000 volts (to 59,300 kilometres per second) their increase of mass due to "relativity" begins to become appreciable, and this makes the speed curve flatten off to an absolute limit of 299,792 km/sec, which would be reached if the voltage were infinite. But even in modern high-voltage cathode-ray tubes the relativity correction is quite small, so we shall not bother about it here.

Steering the Electrons

We can sum up our knowledge of electron optics so far by saying that we know how many volts we need to accelerate electrons to any desired speed (up to about 40,000 miles/sec, anyway!), and having got them up to speed can keep them going in a straight line at that speed, simply by arranging for their route to be at a constant potential. Presumably also we can retard them as desired, using a negative voltage; for retardation is just negative acceleration. But all that is not enough to gain us an electron-driver's licence. We must now tackle the much more difficult problem of steering. Unlike electrons in wires, those in space are not "vehicles steered by their own tracks." Nor is it enough to lay down lines of electric force in the required directions (though that may seem difficult enough, seeing they are imaginary!) because there can be no lines of force without change of potential, and change of potential causes change of speed, and the quickness of response to changes in direction of the lines of force depends on the speed. It is no more use expecting a high-speed electron to follow a sharp bend in a line of force than it is to expect a car to get round a sharp corner at 80 m.p.h.

But let us get back to our marbles. Suppose we release a gentle cascade of them from the top of a long straight ridge, AB in Fig. 6. If the contour lines of the slope were parallel to AB all the way down, the lines of gravitational force would run at right angles to AB and parallel to one another, and the cascade of marbles, though gaining speed, would continue to spread thinly over the whole width. But hollowing the slope out, as shown by the curving inwards of the contour lines CD etc., would make the lines of force converge. If the marbles followed these lines exactly (as they would were it not for their momentum) they would take the paths at right angles to the contour lines as shown, and converge into a raging torrent of marbles at P. Note that it would not be necessary to continue the slope all the way to P; provided that the marbles were going in the right directions by the time they reached the line KL the ground from there on could be perfectly flat.

Near the start, before the marbles had time to get up much speed, their actual paths would follow the lines of force fairly closely; but as they gained momentum they would respond less and less to the inward curvature of the slope. So it would seem to be a good idea to do the focusing as near the start as possible; partly because least curvature would be needed, and partly because the marble tracks could be predicted the most accurately from the lines of gravitational force, which can be plotted by means of a simple slope-indicating device or arrived at from the contour lines. But of course one would not really care to leave the matter quite so vague as this; what exactly is the principle determining the actual paths taken by the marbles?

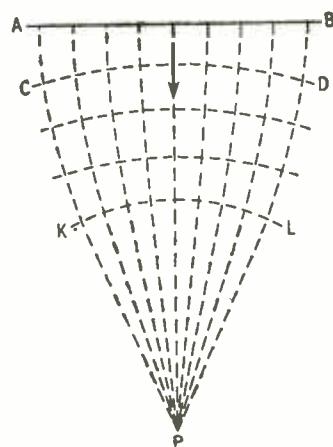


Fig. 6. Contour lines (CD, etc., to KL) of a hollow downward slope that would make marbles released along AB converge towards P. If their directions are correct by the time they reach KL the rest of the run can be flat, as shown by absence of further contour lines.

Well, this is really a matter of mechanics, and if that is a totally unknown subject it is a little late to give a full course on it here and now. But I suppose most *Wireless World* readers are sufficiently knowledgeable to need only an outline, at most. Suppose then that A in Fig. 7 is the position of a marble—or electron—which is travelling with a known velocity in the direction AB. If there were no other influence it would arrive at B after a certain interval of time. But suppose that a certain gravitational—or electric—field is acting in the direction AC. This force can be resolved in the usual way into one force acting along AB and another at right angles to it, along DC. The marble—or electron—is therefore accelerated in both of these directions in proportion to the separate forces. If the length AC represents the combined force the component forces are represented by AD and DC. The acceleration in any direction is equal to the mass of the marble—or electron—multiplied by the force acting in that direction. So the effect of the force here is to increase the velocity along AB so that the position in that direction after the interval of time is not B but E, and the right-angles acceleration has meanwhile carried it a distance EF, so the actual position is F. By plotting the position after different intervals of time, its track can be found—the dotted curve. All this may sound rather complicated, but such tracks are familiar from our earliest youth, for a ball thrown into the air is a body with an initial velocity in an arbitrary direction, combined with a steady acceleration (downwards). The faster the ball is thrown horizontally, the less is its curvature downwards and the longer it takes to come into line with the gravitational lines of force.

Designing the Electrodes

Given a field pattern, the foregoing principles can be used to calculate the track of an electron from any point in it. But that is not quite the problem; usually one is given the desired electron tracks and wants to find the arrangement of electrodes and voltages that will provide the field pattern that will produce those tracks. And that is quite a different matter. It is

usually solved by a combination of calculation, intelligent guesswork, and experiment.

The first stage is to find the field patterns between various electrodes. For a few specified configurations they can be calculated mathematically; some fairly easily, others not so easily. Usually the easier they are to calculate the less likely they are to be directly useful in practical c.r. tube design. It is not very helpful, for example, to have to accept a proviso that the electrodes are infinitely large, or that there is nowhere for connecting the sources of p.d. Even a pair of parallel plates does not provide a simple rectangular field pattern, unless the plates are infinitely large; with finite plates the lines barrel out at the edges, something like Fig. 8. We can easily guess, however, that one way to obtain a converging or diverging pattern is to make one electrode smaller than the other, as in Fig. 9. Note that the potential changes more rapidly where the lines of force are close together. This is what one would expect by analogy with the carbon sheet; if the lower electrode in Fig. 3 were made smaller than the upper, the greater current density near it would cause a greater voltage drop per inch there than near the wider electrode. As we have already noted, one could actually use a uniform carbon sheet to plot field patterns experimentally, by placing electrodes on it—preferably lead, so that they could easily be bent into different shapes—and plotting the potentials with a pointed probe and “infinite-input-impedance” voltmeter; but to simulate infinite space the sheet would have to be much larger than the inter-electrode space. Another and better method is to use a tank of liquid instead of the carbon.

Final Adjustments

Having found the field pattern around the electrodes being studied, one can make a slope model with contour lines coinciding with the equipotentials, and try rolling marbles down it, or, better still, ball-bearing balls. This shows the tracks of electrons, and gives some idea of how the electrodes should be modified to get nearer the desired result. Alternatively, there are graphical methods of plotting the electron tracks on the field patterns, and even more or less automatic apparatus for plotting them direct from the electrolytic tank.

Fortunately a good focus does not depend on the electrode system having been manufactured dead right in the first place. Electron lenses are, so to speak, flexible, like the little optical lenses forming the fronts of our eyeballs, which change shape without conscious effort when changing our distance of looking. The

Fig. 7. How to find the net result of constant speed along AB and constant acceleration along AC.

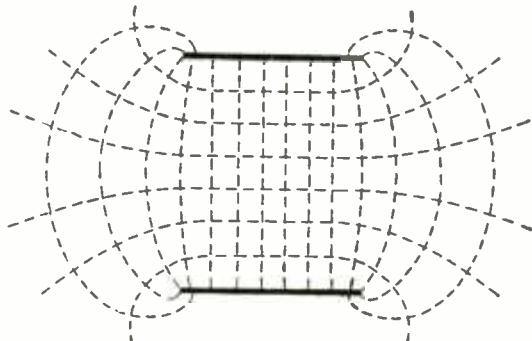
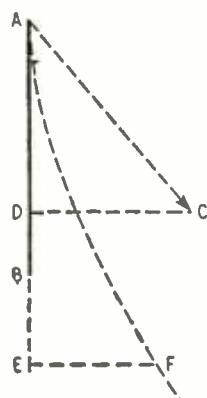


Fig. 8. Pattern of lines of electric force and equipotential lines between and around a pair of parallel charged plates.

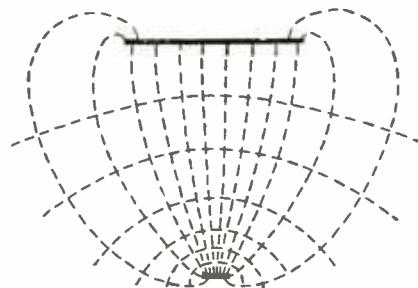


Fig. 9. The pattern when one plate is relatively small.

focus of electric lenses can be varied within considerable limits by adjusting the voltages applied to the electrodes.

Obviously the plate kind of electrode we have been thinking about is not likely to be much good in an electron lens, however useful it may be in a valve; nor is the grid kind, because it stops some of the electrons altogether and on those that get through it imprints a pattern of its mesh. Most of the electrodes forming lenses in electrostatically focused c.r. tubes are hollow cylinders, rings, or disks with holes in the middle.

Rolling-Ball Analogy

Time is just about up, and we have not yet looked at any examples of electric lenses, still less the more difficult subject of magnetic focusing. They will have to wait till next month.

In the meantime, to stop anybody writing in to complain that I am deluding the proletariat by giving the impression that the analogy between rolling balls and flying electrons is perfect, I would mention that whereas the electric force on an electron is inversely proportional to the distance between equipotential lines, the gravitational force on a ball is inversely proportional to the distance *along the slope* between the contours, not the horizontal distance shown on the contour plan. But provided the gradient does not exceed 1 in 7 the difference is less than 1 %. There is also a discrepancy due to the fact that rolling balls roll and thereby acquire some rotational energy, but this also makes little difference.*

* "Determination of Electron Motion in Two-Dimensional Electrostatic Fields," F. H. J. A. Kleynen, *Philips Technical Review*, 1937, p. 338.

Magnetic Tape Recording

Problems of Standardization : Accidental Printing Phenomena

EXCELLENT as are the results obtained with magnetic tape as a medium for high-quality reproduction of sound, it is nevertheless liable to irregularities and inconsistencies which assume importance when attempts are made to measure and standardize a recording characteristic—which is necessary when tapes have to be exchanged between broadcasting organizations.

A systematic study has been undertaken by the B.B.C. and an outline of some of the results was given in a recent lecture to the British Sound Recording Association, "Problems of Magnetic Tape Reproduction," by P. E. Axon, M.Sc., Ph.D. One of the main difficulties is that the surface intensity of magnetization on the tape can be measured only indirectly, and that the flux is modified by association with the reluctance of the magnetic core used in the normal type of pick-up head. This manifests itself in discrepancies between the slopes of curves taken with short and long gaps—even after allowance has been made for variations of eddy-current losses with frequency.

Better agreement is found when a non-magnetic single-turn head is used for calibration. This consists of a thin strip of copper foil between ebonite clamps mounted edge-on to the tape and supplied with thicker soldered leads at the ends. A series of minima appear when the thickness of the conductor equals an integral number of wavelengths, but unlike the magnetic head the "effective" gap is equal to the physical thickness of the conductor, and the frequencies of the minima are all harmonically related.

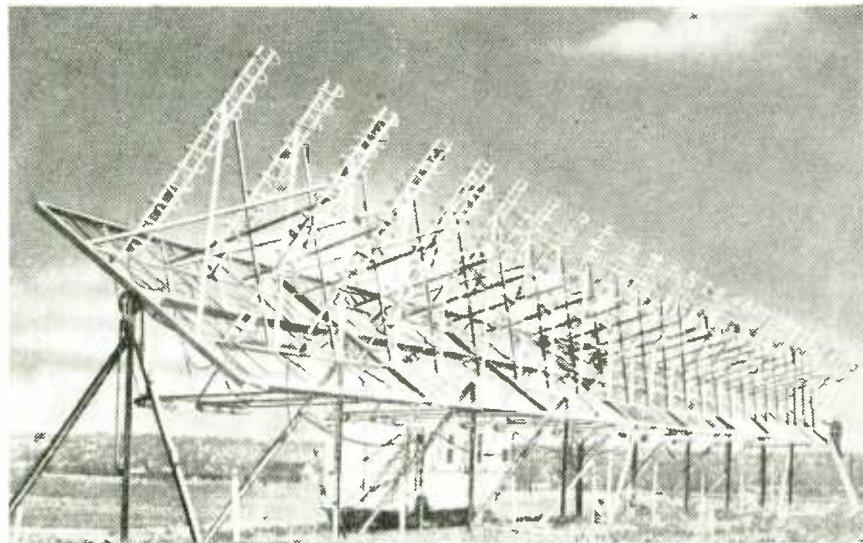
The virtue of the single-turn head is that with it a tape can be recorded and calibrated with a surface induction rising exactly at the theoretical rate of 6 db/octave, and this standard tape can be used

subsequently to calibrate existing iron-cored heads.

Intimate contact between tape and head is of great importance in all calibration work, and both the tape and the head in the region of the gap must have a smooth surface finish if consistent measurements are to be made. It has been calculated that the loss due to separation is about 55 db per wavelength (λ) of the recorded frequency. At 7.5 in/sec and 7.5 kc/s, $\lambda = 0.001\text{in}$, and a separation between tape and head of only a tenth of this distance gives a drop in signal strength of nearly 6 db. Under normal recording conditions such irregularities manifest themselves as amplitude modulation noise.

Mr. Axon also discussed the phenomenon of accidental printing, and showed that the print level between adjacent layers could increase nearly 10 db after a rise of temperature of 10°C lasting only 5 minutes. Other factors known to affect printing are external magnetic fields and the physical tension of the tape during spooling.

Fortunately, accidental prints, made without h.f. bias, were less stable than the master signal and showed a tendency to decrease rapidly over a period of minutes from the instant of separation. The stability of the print increases with the duration of contact before separation, and all effects which tend to increase the printing level also increase its stability. Provided that the accidental print is not too deeply established, successful differential erasure between the wanted and unwanted signals is possible, using a weak h.f. field in the erasing head. This may even force the print below the noise level of the system, without reducing the main recording more than a few db. It is always worth while to re-spool immediately before replaying and at intervals during the storage life of the tape.



RADIO
TELESCOPE

THIS broadside array of 48 helical beam aerials mounted on a pivoted earth screen has been built by the Ohio State University, U.S.A., for studying celestial radio sources. It has a beam width of only 1.2 degrees at 250 Mc/s. Each helix has 10 turns and is 10ft long by 15in in diameter. Receiving equipment is in the van underneath.

(Photo: Courtesy Electronics)

Megawatt Transmitter

*Dependable World-wide Communication
on Very Low Frequency*

A GIANT radio transmitter which has taken six years to build was recently handed over by the Radio Corporation of America to the United States Navy. It was conceived with the idea of providing dependable communication with U.S. Fleet units in any part of the world at any time of the day or night and under all atmospheric conditions.

This requirement is best fulfilled by a powerful, very low frequency transmitter, as such frequencies are far less dependent on changeable wave propagation conditions than any of the frequencies normally used for long-range communications. If the power is great enough and the wavelength long enough signals will penetrate to arctic and tropical outposts and to submerged submarines, despite magnetic storms and ionospheric disturbances of the worst kind.

Special Valve

This transmitter is designed for operation on frequencies between 14.5 and 35 kc/s and is capable of a maximum power output of 1,200 kW. It consists of two nominal 500-kW units operating in parallel and arranged so that each can be used independently if required. The transmitters were designed around the special RCA Type 5831 high-vacuum transmitting triode. Each of the two r.f. amplifier units employs three of these valves, two in a push-pull circuit with the third as spare. The valves measure 10 in in diameter and 38 $\frac{1}{4}$ in high, weigh 135 lb and are water cooled. The six-volt filament structure of thoriated tungsten requires 13 kW. Each valve needs 500 watts of grid driving power for 285 watts output at 80% anode efficiency with an anode voltage of 11.5 kV.

The design and erection of the aerial system constituted a gigantic task. The site chosen was the Jim Creek Valley, situated in rough country some 55 miles north east of Seattle. The station lies in a valley at the foot of twin 3,000-ft mountain peaks from which is suspended an impressive aerial system.

Bird's eye view through steel framework of 200-ft summit ridge tower shows transmitter building in a valley between 3,000-ft mountain peaks.

Prior to the erection of the aerial thousands of trees were felled on the valley slopes to facilitate rigging work and eliminate possibilities of forest fires. Most important of all, however, was the necessity to improve the transmitter efficiency as trees tend to absorb large amounts of r.f. energy radiated by nearby aerials.

The actual aerial consists of ten trans-valley spans each over a mile in length and forming a zig-zag pattern high above the floor of the valley. Twelve 200-ft steel towers erected along the crests of the twin mountains support the aerial. Owing to the tapering nature of the valley the spans are of unequal length; the longest measures 8,700 ft and the shortest 5,640 ft.

Like the transmitter, the aerial system is divided into two parts, each independent of, and isolated from, the other. This arrangement makes it possible to operate one-half of the transmitter and one-half of the aerial system in the event of repairs being required to the other halves.

With an aerial at such a great height there is a marked tendency to pick up static electricity from the air and if left unearthing for any time voltages can build up to a point where sparks a foot or so long will jump gaps in the system. As a safety measure the system is kept securely earthed when not employed for transmission. More than 200 miles of copper wires, cables and screens are buried in an intricate pattern across the valley floor to provide an efficient "earth."



Wide-Band I.F. Amplifiers

By H. S. JEWITT.* B.Sc. (Eng.)

Design Technique Using Negative Feedback

In many electronic systems using pulses the trend at present is towards the use of shorter pulses, and pulse lengths of 0.1 microsecond and less are now common in the radar field. This development has necessitated the design of intermediate frequency amplifiers of large bandwidths, so that the reproduction of such short pulses will not be degraded. Bandwidths (to the -3db points on the response curve) for amplifiers are now commonly greater than 10 Mc/s, and the problem of achieving wide bandwidth and higher gain, yet producing an amplifier which is an economic possibility to manufacture, is very real and pressing. On the one hand the designer must use a large number of valves and tuned circuits to obtain the required gain and bandwidth; on the other, he is pressed to design his amplifier in such a way that it is easy to manufacture and maintain in service.

There are two methods of obtaining wide bandwidths in common use, one utilizing transformers as the tuned elements and the other frequency-staggered circuits. Both of these give satisfactory results as far as obtaining the necessary gain and bandwidth is concerned, but both tend to give difficulty in manufacture and service. These difficulties arise from one major cause, which is the tolerances to be expected on the parameters of the valves used. The difficulty is that

an i.f. amplifier may be aligned with a given set of valves before it leaves the laboratory or factory to be put into service: if a valve fails in service and has to be replaced it is only too probable that the alignment process will then have to be repeated to restore the original bandwidth, as the capacitances of the new valve will differ from those of the old one. Alignment in the field is not easy on wide-band amplifiers: in the transformer-coupled case the difficulty of adjusting the inductances of the two windings and the coupling factor between them is considerable; in the staggered amplifier the frequencies of individual circuits and their damping resistors need adjustment.

In assessing the value of any particular circuit configuration the desirability of "pre-plumbing" must not be overlooked. By this term is meant the manufacture of the amplifier from components of reasonable tolerance without provision for any aligning: the amplifier when fitted with valves from stock should then give the required performance within the permissible limits. Clearly, if this can be achieved valve-changing in service will no longer be a problem.

A means of obtaining wide bandwidths in i.f. amplifiers which has been known for a considerable time, but which appears to have been somewhat neglected in comparison with those noted above, is the application of negative feedback. That the use

* Decca Radar.

TABLE I: COMPONENT VALUES FOR FEEDBACK PAIRS

$$\begin{aligned} B &= -3 \text{ db bandwidth of response curve} \\ C &= \text{Total capacitance} = C_{in} + C_{out} + C_{stray} \\ g_m &= \text{Valve mutual conductance} \end{aligned}$$

$$\text{from which } R_T = \frac{1}{2\pi CB} = \text{effective damping required}$$

$$\text{and } G = g_m R_T = \text{approximate gain per stage}$$

$$K = \text{Shape coefficient}$$

	FIGURE 1		FIGURE 2	
	$R_1 (= R_3)$	R_2	$R_4 (= R_6)$	R_5
General Case $2 > K > -2$	$\frac{4GR_T}{2(\sqrt{2} + K)G - (2 - K)}$	$\frac{4GR_T}{2 - K}$	$\frac{4GR_T}{2 - K + 2(\sqrt{2} + K)G}$	$\frac{4GR_T(2 - K)}{4G^2(2 + K) - (2 - K)^2}$
Special Cases $K = 0$ (flat pair)	$\frac{2GR_T}{\sqrt{2}G - 1}$	$2GR_1$	$\frac{2GR_T}{1 + \sqrt{2}G}$	$\frac{2GR_T}{2G^2 - 1}$
$K = -1$ (pair in flat triple)	$\frac{4GR_T}{2G - 3}$	$\frac{4GR_T}{3}$	$\frac{4GR_T}{3 + 2G}$	$\frac{12GR_T}{4G^2 - 9}$
$K = +\sqrt{2}$ (pairs in flat quadruple)	$\frac{4GR_T}{3.7G - 0.58}$ $4GR_1$	$6.9GR_T$	$\frac{4GR_T}{0.58 - 3.7G}$ $4GR_T$	$\frac{2.32 GR_T}{13.7G^2 - 0.335}$ $13.7GR_T$
$K = -\sqrt{2}$	$1.52G - 3.42$	$1.17GR_T$	$3.42 + 1.52G$	$\frac{2.32G^2 - 11.6}{13.7G^2 - 11.6}$

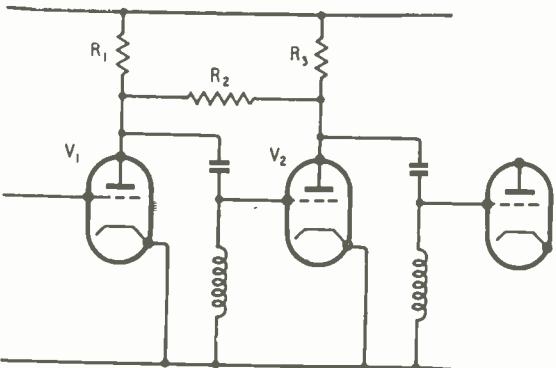


Fig. 1. Simple negative feedback amplifier with feedback applied through R_2 .

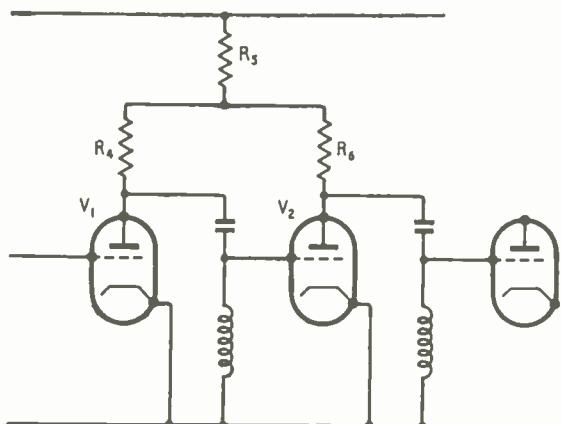


Fig. 2. Modified version of Fig. 1, giving more symmetrical response curve.

of negative feedback will broaden the response curve of an amplifier is immediately apparent from consideration of the effect of the feedback. If all stages of the amplifier are tuned to the same frequency (the centre i.f.), then the feedback will be strongest at this frequency. Provided that the feedback circuit is not frequency-sensitive, the feedback will decrease on each side of centre frequency, thus increasing the response at off-centre frequencies. The shape of the resultant response curve depends upon the degree of feedback used: for small amounts of feedback the curve will exhibit one peak at centre-frequency, but as the feedback is increased the curve will become first flat-topped and then double-humped, with humps spaced equally about the centre frequency.

The original conception of this method appears to have been a chain of amplifier stages, over each of which the feedback was applied, but this has been simplified to the application of feedback over alternate stages. Thus the amplifier is divided up into a series of pairs of valves, the first valve of each pair operating without, the second valve with, feedback. It will be seen, then, that this type of amplifier will produce the flat-topped response curve usually associated with the staggered pair or transformer-coupled amplifier. It will be shown that the flatter, steeper-sided curves given by staggered triples, quadruples and so on can also be produced.

The feedback amplifier has been analysed mathematically,[†] and Table I, which is a simplification of the results of this analysis, gives the required component values for the circuit with a minimum of computation. The expressions are accurate enough for normal design processes. It should be particularly noted that the shape and width of the response curve and the gain of the amplifier are governed solely by the relative values of the resistors whose values are given. In comparison with the two other methods mentioned above, the use of single-tuned circuits eliminates the difficulties of the i.f. transformer, and since these circuits are all tuned to the centre i.f. there are no problems of accurate maintaining of stagger frequencies or different Q-factors in individual circuits.

The simple feedback pair of Fig. 1 shows how the feedback is applied. V_1 and V_2 are the valves forming the pair, R_1 and R_3 being their respective anode loads. The resistor R_2 is for applying feedback across V_2 . From the practical point of view this circuit has dis-

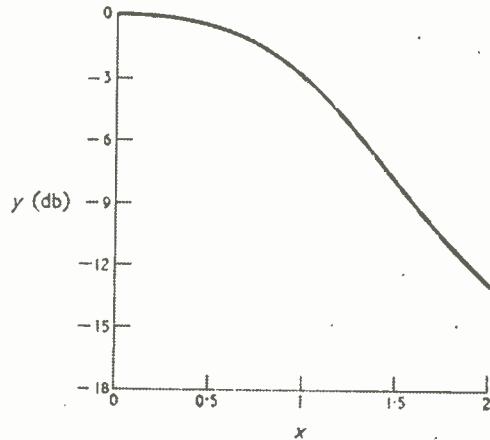


Fig. 3. Flat pair response curve. Only one half is shown as the curve is symmetrical about $x = 0$.

advantages, however. It was noted above that the feedback circuit should not be frequency-sensitive; if this condition does not hold the feedback will be greater on one side of centre frequency than on the other, and the resultant response curve will be tilted instead of being symmetrical about the i.f. Returning to Fig. 1, the resistor R_2 possesses self-capacitance (of the order 0.5 pF) which causes such a tilt; in addition the anode-grid capacitance of V_2 is in parallel with the feedback resistor, which increases the tilt.

The resistor network R_1 , R_2 , R_3 of Fig. 1 may be replaced by its T-equivalent, producing the circuit of Fig. 2. In this circuit the feedback is produced by the voltage drop across R_5 due to anode current in V_2 , R_5 being common to the anode circuits of both valves. Now the effect of capacitance across R_5 will be to reduce its apparent value, and hence the feedback, at higher frequencies, so that the output of the amplifier will increase above centre frequency. The effect of the anode-grid capacitance of V_2 is to reduce the feedback at lower frequencies and increase the response below centre frequency. Thus the effects of these unavoidable but unwanted capacitances tend to cancel each other. Cancellation may be made complete by

[†] "Vacuum Tube Amplifiers" by Valley and Wallman, Chapter 6. (M.I.T. Radiation Laboratory Series, Vol. 18), McGraw Hill.

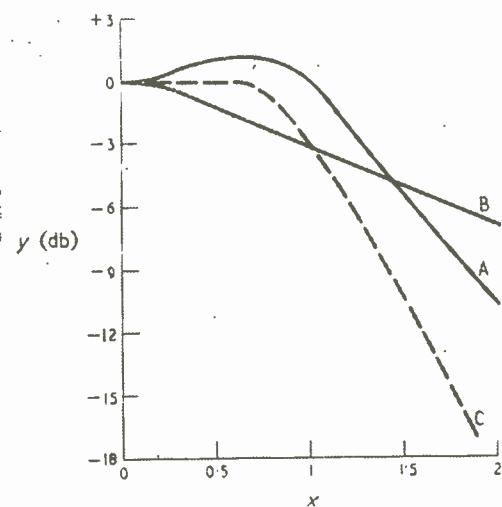


Fig. 4. Synthesis of flat-topped curve (C) associated with staggered or feedback triples.

increasing one or the other capacitance as indicated by the response curve tilt, and a symmetrical response curve may thus be obtained.

It was stated above that a wide variety of response curves can be produced according to the relative values of the resistors. One such curve is the flat-topped curve usually associated with the staggered pair, the mathematical expression of which is

$$y = \frac{1}{\sqrt{1+x^4}}$$

where x represents frequency difference from centre frequency and y is the relative amplitude at the frequency considered (x). Clearly, $y = 1$ at centre frequency ($x = 0$), and where $x = \pm 1$, $y = \frac{1}{\sqrt{2}}$. In

other words, $x = \pm 1$ gives the -3db points on the response curve and hence the bandwidth. This curve is shown on Fig. 3. The feedback pair to produce it has been found to be very non-critical and may be easily pre-plumbed. Slight staggering of the tuned circuit frequencies (due, for instance, to valve capacitance variation) has little effect on the response curve beyond broadening it.

To produce other curves of the flat-topped form a process of synthesis must be used, as is done with staggered circuits. The difference between the two types of circuit in this respect lies in the fact that a feedback pair, correctly designed, will generate a double-humped response curve with its circuits all tuned to the same frequency, whereas in the staggered system one circuit must be tuned to each side of centre frequency and appropriately damped to produce such a curve. The idea of synthesizing a flat-topped curve from two curves which are not flat-topped may be better understood from Fig. 4. This diagram illustrates the synthesis of the flat-topped curve associated with staggered triples or feedback triples. Three circuits are used (hence "triple"): two, in a feedback pair, give curve A, while the other circuit on its own gives curve B. These circuits are cascaded, and the resultant overall response may therefore be obtained by adding the two curves (a decibel scale

being used for relative amplitudes). Curve A is slightly double-humped, the rise each side of centre frequency boosting the falling response of curve B. The result of the addition is the flat-topped curve C, which, if compared with the flat pair curve of Fig. 3, shows flatness over a wider range together with steeper sides. The first characteristic, flatness, is generally the desired one in this application, as several such circuits may have to be cascaded to obtain the necessary overall gain. Each additional circuit added will narrow the overall bandwidth, but the bandwidth narrowing will be less for the curve with the wider flat top. The mathematical expression for the triple curve is

$$y = \frac{1}{\sqrt{1+x^8}}$$

and $x = \pm 1$ again gives the -3db bandwidth.

In general, any curve of the form

$$y = \frac{1}{\sqrt{1+x^{2n}}}$$

may be synthesized, and n indicates the number of stages required in the synthesis. The general expression for the response curve of a feedback pair is

$$y = \frac{1}{\sqrt{1+Kx^2+x^4}}$$

in which x and y have significance as before.

The constant K , which may be called the "shape coefficient," determines the form of the response curve obtained. One case already discussed, that of the flat pair, is seen to correspond to $K = 0$ when the above expression reduces to that for the flat pair curve. Other values of K will give different forms of response curve: K can lie between $+2$ and -2 . The value $K = 2$ corresponds to no feedback. Such a pair is identical with two single-tuned stages on the same frequency and should give the same response curve. Mathematically, this may be checked by substituting $+2$ for K and observing that

$$\frac{1}{\sqrt{1+2x^2+x^4}} = \frac{1}{\sqrt{1+x^2}} \frac{1}{\sqrt{1+x^2}}$$

and that $y = \frac{1}{\sqrt{1+x^2}}$ is the equation describing the single-tuned circuit response curve. Negative values of K give a double-humped curve: positive values give a single-peaked response. The value of shape coefficient for the synthesis of other flat-topped curves may be easily found. The expression for the desired flat-topped curve is first set down, for example

$$y = \frac{1}{\sqrt{1+x^8}} \text{ for a flat quadruple.}$$

Now, the general expression, with shape coefficients K_1 , K_2 , etc., may be used to build up the desired equation:

$$\frac{1}{\sqrt{1+x^8}} = \frac{1}{\sqrt{1+K_1x^2+x^4}} \times \frac{1}{\sqrt{1+K_2x^2+x^4}}$$

In this case only two pairs are needed because the final term of the right side of the equation is x^8 , as required on the left side. By multiplying the terms on the right side together, we obtain:

$$1 + x^8 = 1 + (K_1 + K_2)x^2 + (2 + K_1K_2)x^4 + (K_1 + K_2)x^6 + x^8$$

The left side contains no terms in x^2 , x^4 and x^6 , so

that the coefficients of these terms must be zero, and hence

$$\begin{aligned} K_1 + K_2 &= 0 \\ 2 + K_1 K_2 &= 0 \end{aligned}$$

and from these equations $K_1 = +\sqrt{2}$, and $K_2 = -\sqrt{2}$. Therefore a flat-topped quadruple curve will be produced if two pairs are cascaded, one having shape coefficient $+\sqrt{2}$, the other $-\sqrt{2}$. Fig. 5 shows these two curves and the resultant curve. Similarly, curve C of Fig. 4, the curve of a triple, is generated by putting the equation of the triple curve

$$y = \frac{1}{\sqrt{1+x^6}} = \frac{1}{\sqrt{1+K_1 x^2 + x^4}} \times \frac{1}{\sqrt{1+x^2}}$$

and, following the same process, finding that $K_1 = -1$ so that the triple is built up from a pair with shape coefficient -1 and a single-tuned stage of the desired bandwidth.

Table I gives component values for certain commonly used values of shape coefficient, and enables flat feedback pairs, triples or quadruples to be quickly designed. For other curve shapes, the first line gives the general values of the components in terms of the shape coefficient K . As an example of the use of this table, the design of a typical amplifier may be carried out thus :

Bandwidth (to -3db) required (B) = 10 Mc/s.

Total parallel capacitance present = $C_{in}(V_2) + C_{out}(V_1) + C_{strays}(C)$ = 15 pF.

Valve mutual conductance (g_m) = 7 mA/V.

Curve shape decided to be flat quadruple form, using circuit of Fig. 2.

From the above

$$\begin{aligned} R_T &= \frac{1}{2\pi CR} = \frac{10^6}{2\pi \times 15 \times 10} \text{ ohms} \\ &= 1060 \text{ ohms} \end{aligned}$$

and $G = g_m R_T = 7 \times 1.06 = 7.4 = 17\text{dB}$
Since the curve is to be of flat quadruple shape, $K_1 = +\sqrt{2}$, $K_2 = -\sqrt{2}$.

First Pair ($K_1 = +\sqrt{2}$)

$$R_4 = R_6 = \frac{4GR_T}{0.58 + 3.7G} = 1120 \text{ ohms}$$

$$R_5 = \frac{2.32GR_T}{13.7G^2 - 0.335} = 24 \text{ ohms}$$

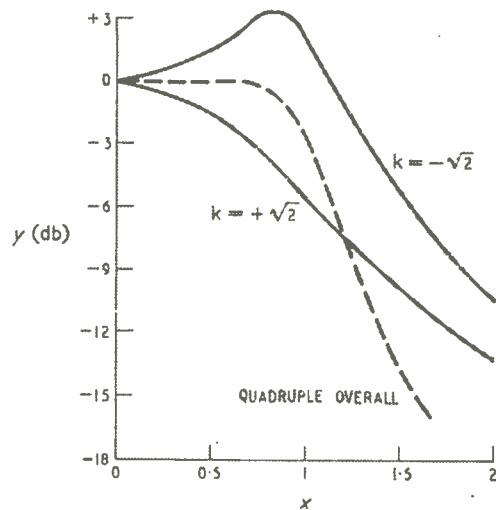


Fig. 5. Synthesis of flat-topped curve from two curves with different shape coefficients.

Second Pair ($K_2 = -\sqrt{2}$)

$$R_4 = R_6 = \frac{4GR_T}{3.42 + 1.526} = 2140 \text{ ohms}$$

$$R_5 = \frac{13.7GR_T}{2.32G^2 - 11.6} = 930 \text{ ohms}$$

and the two pairs are so designed. In practice the nearest standard values of resistors in the 5% range would be used. The complete circuit would be as shown in Fig. 6 ; the inductors (L) of Fig. 6 would be wound to resonate with 15 pF at the chosen centre frequency. The overall gain will be approximately 68db (4 \times 17db). If gain control is desired, it must be applied to V_1 or V_3 or both.

As is to be expected, the use of negative feedback is accompanied by a loss of gain. Except for extremely wide bandwidths, this loss is very small indeed and is usually within the normal uncertainties of gain computation. The feedback has a slight effect in stabilizing the gain of the amplifier, an effect which increases as bandwidth increases, but this stabilization

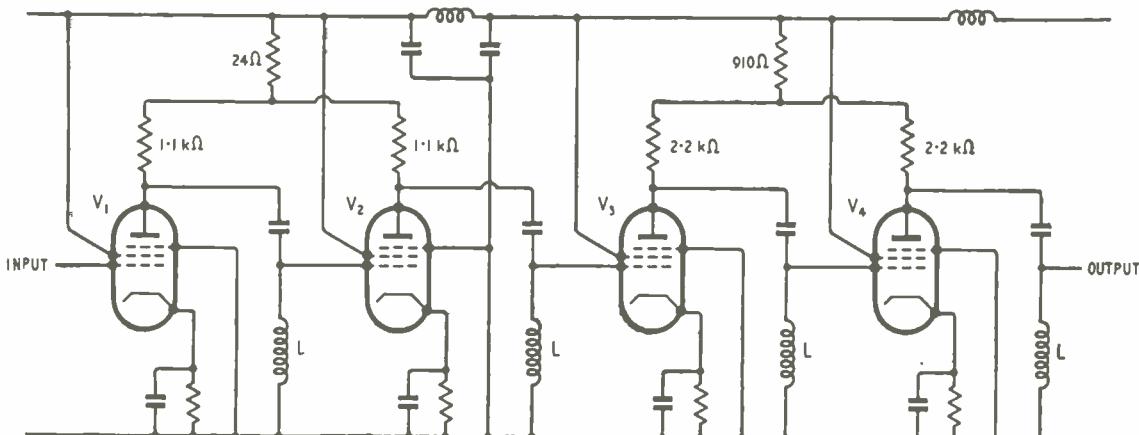


Fig. 6. Complete circuit of an amplifier designed to give a flat quadruple response curve with a bandwidth of 10 Mc/s.

is not enough to compensate for changes of mutual conductance in the valves. An additional disadvantage is that gain control can only be applied to those stages to which feedback is not applied. This is not normally serious as amplifiers of the type for which such circuits are used commonly have many stages, and control of two or three alternate valves gives an adequate gain control range. Application of bias to the feedback stages may, however, be used as a bandwidth control. The use of feedback pairs often results in a saving of decoupling components as stages may be decoupled in pairs. All amplifiers so far built have been found to be exceptionally stable, compared with amplifiers of similar characteristics using other methods of obtaining wide bandwidths.

The original setting-up procedure is very simple. The amplifier is built with resistor values chosen as detailed above. The feedback is removed (short circuiting R_5 in Fig. 2) from each pair in turn and the tuning coils within each pair are adjusted to tune to the centre i.f. In practice, it is found that adjustment of one coil is sufficient, all others then being wound to be identical with the correct coil. If feedback-resistor capacitance or valve anode-grid capacitance effects produce an objectionable tilt in the response curve a small capacitor is added (usually on one or two pairs only) across the appropriate points, and is adjusted until the curve is flat. If the feedback resistor capacitance is the controlling factor in curve tilt, the response is greater on the high frequency side of the centre i.f., as previously stated, and compensation is applied by adding a small

capacitance between the anodes of V_1 and V_2 (Fig. 2) to reinforce the anode-grid capacitance of V_2 . Similarly, if the inter-electrode capacitance of V_2 is the controlling factor and the tilt is from low- to high-frequency, then capacitance must be added in parallel with the feedback resistor R_5 .

A number of amplifiers of various bandwidths have been constructed using this system, and all have been satisfactory. After a long alignment process needed for the previously-used staggered amplifier, the time and effort saved by adopting the feedback system has been most noticeable, as have the excellent response curves obtained. Amplifiers have been built with centre frequencies of 30, 45 and 60 Mc/s, with bandwidths ranging from 5 to over 20 Mc/s. In one particular instance the i.f. amplifier, of twelve stages, had a bandwidth of 20 Mc/s to -1db at a frequency of 60 Mc/s and used a quadruple curve. The overall gain at i.f. was about 90db. In order to find out whether change of valves affected this amplifier, all twelve valves were changed *en bloc*. Twelve valves of a different make were inserted and the response curve was measured again. This was done for six sets of valves, the final set being a mixture of valves produced by various English and American manufacturers. The worst response curve change was a rise of 1db on one side of centre frequency. When a duplicate amplifier was built, the only adjustment needed was in the tilt-compensating capacitance, a small 5-pF trimmer. In most instances Mullard EF95 valves have been used, but some amplifiers have been built using the EF91.

EDUCATION AND TRAINING

WE are all prone to be insular and this is particularly noticeable in many Londoners, who tend to think of the metropolis as England. It was, therefore, refreshing for *Wireless World*, which so often attends discussions and meetings in London, to hear educationists in the Provinces discuss the question of "Education and Training in the Radio and Electronics Industry." The meeting, which was convened by the Merseyside Section of the British Institution of Radio Engineers, was addressed by representatives of Liverpool's University and Technical College, the Post Office, the Radio and Television Retailers' Association and the Automatic Telephone and Electric Company. There followed a lively discussion during which it was obvious that the speakers had their feet on the ground. It is also true that the speakers did not "pull their punches"; we doubt if we would hear a London graduate forcefully criticize the training scheme of the firm in which he was a student apprentice during a meeting attended by the company's training and education officer.

Both the introductory speakers and those taking part in the general discussion interpreted the title as including education both for and in the industry. We were particularly pleased to see the stress laid upon the need for a pass in English as an essential for apprentices. Technicians should be able to lucidly convey in writing their findings to others.

J. Durnford (Liverpool University) concluded his introductory remarks with these questions: (a) Are the Universities in fact giving the right sort of training? (b) Are there enough graduates being turned out? (c) Does industry in general know how to use its graduates to the best advantage? and (d) Should there be a period of practical training before as well as after a University course?

Some felt that the training was not sufficiently

specialized, and to this end students should be encouraged to take part-time vocational training in industry, possibly between the "inter" and degree courses.

The question of technical qualifications, which is now being debated in our correspondence columns, and the confusion which exists regarding professional status in the industry was discussed. In this connection it may not be generally known that the Burnham Committee, which decides teachers' salaries, accepted some time ago associate membership of the Brit.I.R.E. (with certain provisos) as a degree equivalent for teachers in further education establishments.

CLUB NEWS

Cambridge.—The February meetings of the Cambridge University Wireless Society (G6UW), which will be held at St. John's College, include lectures on electron microscopy (1st), electronic organs (8th) and miniaturization (15th). The club plans to visit the Pye radio works on February 17th. Sec.: R. C. Marshall, St. John's College, Cambridge.

Cleckheaton.—At the meeting of the Spen Valley and District Radio and Television Society on February 10th, D. Skirrow (G3GFD) will speak on "Principles of Radar 1945-52." Meetings are held on alternate Wednesdays at 7.30 at the Temperance Hall, Cleckheaton. Sec.: N. Pride, 100, Raikes Lane, Birstall, Nr. Leeds.

Southend.—J. Missen, of the G.E.C. Research Laboratories, who recently described in *Wireless World* a circuit for a push-pull transistor amplifier, is to speak on transistors at the meeting of the Southend and District Radio Society on February 5th. At the meeting on February 19th, H. T. Stott (Bulgin) will speak on "Time Standard Upon NH." Meetings are held at 7.45 at the Municipal College Laboratories, Queen's Road, Southend. Sec.: J. H. Barrance, 49, Swanage Road, Southend-on-Sea.

Eliminating C.W. Interference

Some Experiments in a Television Fringe Area

By B. L. MORLEY

AMONG the many trials and tribulations of the fringe area viewer is the marring of the picture by continuous wave interference. The radio interference branch of the Post Office is very helpful in these matters, but it has no powers of compulsion and if the owner of the offending apparatus is unhelpful there is very little that can be done to remedy matters.

A case of this kind led to the experiments described in the following paragraphs. In this instance the interference caused bright bands of light, the thickness of one or two lines, to cover the whole of the picture. The lines not only made the scene appear as though it was being viewed through prison bars but it also played havoc with the line synchronization.

Another form of interference which was cured was the appearance of a broad band of light across the screen which was from $\frac{1}{2}$ to $\frac{2}{3}$ in wide. This was intermittent; sometimes on for a few minutes, sometimes on for an hour or more like the first type, but it yielded to the treatment to be described.

The receiving point was located almost at sea level 80 miles from Sutton Coldfield. A Yagi aerial array comprising director, folded dipole and reflector spaced 0.1 and 0.15 wavelength respectively was in use. The array was mounted on a 16-ft mast fitted to the chimney stack; a typical domestic type of installation.

Now the obvious answer to unwanted c.w. is simply a matter of filtering, so the first step was to construct filters of various forms which were inserted in the aerial circuit. The filters completely eliminated the interference—and the picture! It appeared that a circuit with a sufficiently high "Q" could not be obtained. The method was abandoned.

The next approach to the problem was on a different line. It is a well-known fact that each transmission line has a certain propagation velocity which directly affects its electrical length. In the television aerial the incoming signal generates currents and voltages which are carried down the transmission line to the receiver. An interfering signal will also generate in the aerial a current and a voltage which likewise are carried down the transmission line. At the receiving end we may have the position shown in Fig. 1.

The phase relationship between the two signals

remains substantially the same throughout the whole length of the line and the time taken for the two to reach the receiver will depend upon the length of the line.

The physical length of a transmission line corresponding to the electrical length is given by:—

$$L = \frac{984V}{f}$$

where,

L= length in feet

V=velocity factor of the line

f=frequency of the signal in Mc/s.

It will be seen, therefore, that the time taken by the signals to traverse the length of the line depends upon the velocity factor of the line and the frequency of the signals.

TV signals occupy a broad band of frequencies but if the interference covers a single or narrow band then matters can be so arranged that the interference is eliminated without detracting too seriously from the quality of the picture; indeed it is generally preferable to sacrifice some quality in order to get rid of the interference.

The method employed was to arrange that the signal plus interference arrived at the receiver on two separate paths, the electrical length of the second path being such that the arrival phase of the interference was 180 deg out of phase with that in the first path (Fig. 2).

In the experiment an "X" aerial's feeder was connected directly to that of the Yagi array at the aerial socket of the receiver. The electrical length of the secondary path was adjusted quite simply by the rather laborious method of cutting one inch from the end of the line, testing, then cutting a further inch and so on until the correct conditions were found.

Eventually a stage was reached where the two signals completely cancelled each other and the picture, though decreased in strength by a small amount, was quite clear. The actual loss of quality was not noticed as the bandwidth of the vision receiver had been adjusted to just under 2 M/cs so as to obtain as much gain as possible. (This reduction in bandwidth is

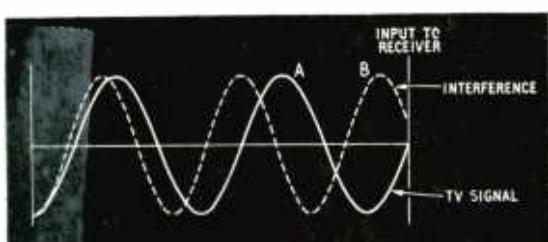


Fig. 1. Wanted (full line) and unwanted (broken line) signal currents flowing along the feeder of a typical television aerial.

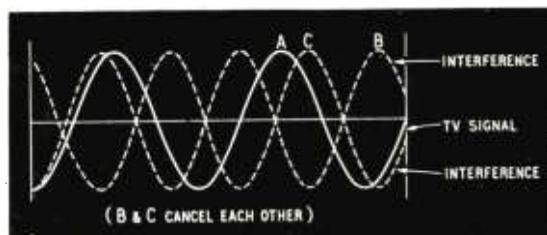


Fig. 2. If a second aerial is used and its feeder cut to the proper length the interfering signals can be cancelled out at the receiver.

not really so serious as it may appear at first sight, as generally the picture quality at extreme ranges leaves much to be desired, except on very rare occasions.

The system worked on both types of interference, the "prison bars" and the broad white band being eliminated from the screen, the single secondary path serving for both.

The word "eliminated" has been used deliberately; the interference was not merely obliterated; picture detail which had been concealed previously by the broad white band was once again visible, and beyond a slight loss in picture brightness (restored by adjustment of the contrast control) there appeared to be no

noticeable deterioration in the overall quality of the picture.

For those who would like to try the scheme for themselves it will be found that, during the process, points will be found where (a) the picture is seriously attenuated, (b) the sound is seriously attenuated, (c) both are seriously attenuated, but a point can be reached where the interference alone is attenuated, there being little effect on the sound or the picture.

The writer does not claim that this is an ideal arrangement though it works quite well in practice. There are other methods of producing the necessary reversal of phase between the two signals—there is plenty of scope for the keen experimenter!

"Plug and Socketry"

A Plea for New Standardization of Nomenclature

By C. LISTER

"**W**HEN is a plug not a plug?" From the evidence to hand at this moment the answer would appear to be, "When it is a socket."

Consider Fig. 1. A is a device equipped with metallic contact pins and intended for attachment to the end of a cable. B is a device equipped with metallic contact-pin receptacles and intended for mounting in some relatively fixed position. C is a device equipped with metallic contact-pin receptacles and intended for attachment to the end of a cable. D is a device equipped with metallic contact pins and intended for mounting in some relatively fixed position.

There appears to be no argument whatever about the nomenclature of A and B: A seems to be universally accepted as a plug, B as a socket. The difference of opinion arises over C and D. Party No. 1 maintain that C is a socket and D is a plug. Party No. 2 maintain that C is a plug and D is a socket. In effect, Party No. 1 see a common factor in the physical appearance of certain constituent parts of the objects, whilst Party No. 2 see a common factor in the function and location of the object as a whole.

The main argument appears to go as follows:—

Party No. 1. The device known in electrical work as a "pin" may be inserted into a receptacle of similar size and shape which it will fill completely. The pin is then by dictionary definition a plug (something fitting into and filling a hole) whilst the receptacle is a socket (a hole for something to fit into). It therefore appears reasonable that the term plug should be applied as a collective noun to any assembly of such pins, whilst the term socket should similarly be applied to any assembly of such receptacles.

Party No. 2. From the dictionary definition just given, X in Fig. 2 is clearly a plug whilst Y is a socket. Whatever arrangement of smaller plugs and sockets we make on the two surfaces 1, 2 and 3, 4 should not alter the names already given to the

two devices X and Y. Whichever way the smaller plugs and sockets are moving X will still be plugged into Y, and X will still be attached to the end of a cable whilst Y will still be mounted in some relatively fixed position.

If we accept the recommendations of the first party, then we must find some way of indicating whether we require our plug (or socket) to be "loose" (i.e. cable attached) or "fixed." Each manufacturer appears to devise his own method of effecting this discrimination and their catalogues reveal such descriptions as, "with mounting brackets," "chassis mounting," "flex-mounting," "cable mounting," "panel mounting" etc.

If we accept the recommendations of the second party then we must find some means of indicating whether our plugs (or sockets) are equipped with pins, or pin-receptacles. One method which has been in satisfactory use in some factories for many years utilizes the term "male" to indicate pins and "female" to indicate pin-receptacles. Thus A, B, C, D, (Fig. 1) are described as "male-plug," "female-socket," "female-plug," and "male-socket" respectively.

Support for Party No. 1 is found in the drawings of

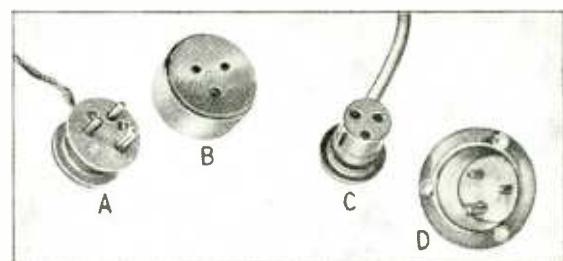


Fig. 1. Some plugs and sockets in common use.

some Government departments and in the catalogues of some manufacturers whilst support for Party No. 2 comes from other Government departments and other manufacturers.

Let us see what the British Standards Institution has to say on the subject. We look up British Standard No. 205 "Glossary of Terms Used in Electrical Engineering." Part 3 (1943) Section 3, Sub-section 37. It looks at first sight as though the issue has been very carefully side-stepped, for reference 3701 reads : "Plug-and-socket. A device consisting of two portions, a plug and a socket, having metallic contacts and arranged to engage with each other, so that it forms a ready means of connecting or disconnecting current-using apparatus to or from a source of supply." However, looking further, we discover the following :—

- " 3706. Outlet plug-and-socket. A plug-and-socket intended for use at a supply point.
- 3707. Inlet plug-and-socket. A plug-and-socket intended for use on current-using apparatus.
- 3708. Outlet socket. One portion of an outlet plug-and-socket, intended for mounting at a supply point and provided with untoachable metallic contact-tubes.
- 3709. Outlet plug. The other portion of an outlet plug-and-socket, intended for attachment to a cable and provided with metallic contact-pins.
- 3710. Inlet plug. One portion of an inlet plug-and-socket, intended for attachment to a cable and provided with untoachable metallic contact-tubes.
- 3711. Inlet socket. The other portion of an inlet plug-and-socket, intended for mounting on current-using apparatus and provided with metallic contact-pins."

Clearly in the light of these definitions the British Standards Institution regards our original C and D (Fig. 1) as plug and socket respectively. In other words it supports Party No. 2. At the same time, however, it introduces these terms "inlet" and "outlet" which, in my personal view, tend to confuse the issue rather than to clarify it.

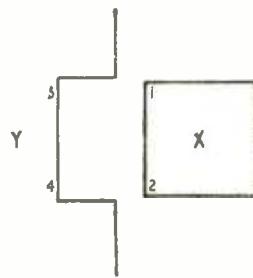
Consider the two references 3709 and 3711. In each the following words appear "provided with metallic contact-pins" (Similarly in both the references 3708 and 3710, the words "provided with untoachable metallic contact-tubes"). With a common factor in the description we might, therefore, reasonably expect to find a common factor in the accepted titles ; instead of which we find "outlet-plug" and "inlet-socket"—two precise opposites.

The trouble arises here, I think, from use of the terms "inlet" and "outlet." I have already suggested that once we accept the arguments of Party No. 2 (as the B.S. clearly does) all that we then need consider is how to indicate which device has the pins and which the pin-receptacles. To my mind the terms "outlet" and "inlet" do not perform this function in a sufficiently clear-cut manner. On the other hand the terms "male" and "female" leave no one in any doubt. Moreover, the argument of "no common factor in the titles" cannot be levelled against "male-plugs" and "male-sockets" (which would be the equivalent of references 3709 and 3711).

What we might term this "physiological system" would appear, at first sight, to be the most logical for standardization. However, further consideration now leads me to the conclusion that we have readily available an even simpler method of differentiation.

Suppose we wish to purchase the device which answers the description of reference 3709. If we belong to Party No. 1, and we stroll up to the counter and ask for "a plug" the assistant will immediately

Fig. 2. Illustrating one method of defining a plug and socket.



come back at us with either two or three questions :

- (a) How many pins?
- (b) Cable mounting or fixed mounting?
- (c) (If it is a power plug) What current rating?

If we belong to Party No. 2 and ask for "a male-plug" we shall still be asked question (a). If we belong to the B.S.I. section of Party No. 2 and ask for "a outlet-plug" question (a) will still be fired at us. Does it not seem reasonable, then, that, whatever party we belong to, our title for the device which we require should contain a term specifying the number of connections that we desire this plug-and-socket to be capable of handling?

"But," it might be objected, "this we already do ; we don't ask for things in the vague manner suggested above." Taking "n" as representing any number, if we belong to Party No. 1 we ask for an "n-pin plug"; Party No. 2 "an n-pin male-plug"; and Party No. 2 (B.S.I.), "an n-pin outlet-plug". In reply I should say "I agree with you entirely : that is precisely what we all do ; and look at the redundancy that we involve."

Take Party No. 1 member. He asks for an "n-pin plug"; and yet the whole basis of the argument which divides Party No. 1 from their fellows is "that the device with the pins is *always* the plug." He is on an even stickier wicket when he asks for "an n-pin socket," for then redundancy gives place to inconsistency. If he changes from "an n-pin socket" to "an n-hole socket" he is back to redundancy again.

Precisely similar arguments apply to the terms put forward by both sections of Party No. 2. In the expressions "an n-pin male plug" and "an n-pin

Designation	Definition	Equivalent BS205 Number
N-hole socket	One portion of a plug-and-socket, intended for rigid mounting, and having n untoachable contact-tubes.	3708
N-pin plug	The other portion of a plug-and-socket, intended for attachment to a cable, and provided with n metallic contact-pins.	3709
N-hole plug	One portion of a plug-and-socket, intended for attachment to a cable, and having n untoachable contact-tubes.	3710
N-pin socket	The other portion of a plug-and-socket, intended for rigid mounting, and provided with n metallic contact-pins.	3711

outlet plug" neither "male" nor "outlet" contributes one iota to our specification of the device which we require, once we have accepted the main contention of Party No. 2 that the portion of a plug-and-socket which is designed for attachment to a cable is the plug, whilst the portion which is designed for more rigid mounting is the socket.

What sort of definitions, then, do these considerations suggest? Surely something on the lines indicated in the table.

Well, that is my system. Until I meet a simpler system that is how I, as an individual, shall classify these objects within my own mind. If you, dear reader, can produce an even simpler system, good luck to you. I for one shall be only too happy to discard mine and to embrace yours. Meanwhile I think I have written sufficient to indicate that a problem exists and requires attention. If it does not receive attention then it would seem that we are to be faced for ever with the state of affairs in which drawings of plugs and sockets made by one Government department are converted to sockets and plugs by a second Government department, only to be converted back to plugs and sockets again when they are passed on to the manufacturer. Moreover, as the last British Standard on this subject was in 1943, I feel that the time may now be ripe for once again reopening discussion of this matter.

In closing I must hasten to take evasive action against the reader who is even now reaching for his scissors to clip out that extraordinary "plug-and-socket" recently advertised in an American contemporary. I've already seen it, and I suggest that, in the terms of the "physiological" system the most apposite title would appear to be the "hermaphrodite" plug.

Manufacturers' Literature

Switches, lampholders, jacks, knobs, connectors and other chassis fittings listed in a new revised catalogue (No. 192) available from A. F. Bulgin & Co., Bye Pass Road, Barking, Essex; price 1s including postage.

Television Pre-amplifier with gain control, available with any number of coaxial outlets up to eight. Leaflet from the Rainbow Radio Manufacturing Co., Mincing Lane, Blackburn.

Miniature Plug and Jack (approx. 1½in long) and a B7G plug are amongst new products listed in a catalogue of Ediswan Clix chassis fittings available from The Edison Swan Electric Company, 155, Charing Cross Road, London, W.C.2.

Television Pattern Generator (40-70 Mc/s) with simple controls, giving patterns of seven horizontal bars and six vertical bars, described in a leaflet from Homelab Instruments, 615-617, High Road, Leyton, E.10. Seven types of test can be carried out.

Circuit-symbol Stamps for rapid printing of circuit diagrams; mounted on transparent blocks so that the user can see where he is placing them. Leaflet describing a complete kit from John Griffin Company, 2157, James Avenue, St. Paul 5, Minn., U.S.A.

Aircraft Intercommunication Equipment consisting of three units weighing 8½lb (total) capable of operating up to ten headsets. Specification and general description on a leaflet from Airmec, Ltd., High Wycombe, Bucks.

Signal Generator covering 100 kc/s to 100 Mc/s on fundamental frequencies in six ranges, with output variable from 1 µV to 100 mV. Specification on a leaflet from Advance Components, Back Road, Shernhall Street, London, E.17.

Books Received

TV Repair Techniques. Gernsback Library No. 50. Collection of hints by practising servicemen on unusual faults occurring in American television receivers. Pp. 128; Figs. 98. Price \$1.50. Gernsback Publications, 25, West Broadway, New York, 7.

Introduction à l'Électronique by P. Gran, L.ès S. Survey of electron tube devices and their applications. Pp. 212; Figs. 205. Price 1,650 Fr. Dunod, 92, Rue Bonaparte, Paris, 6.

Cours Practique de Télévision by F. Juster. Vol. 1. Design of wide-band r.f. amplifiers for use in television. Pp. 127; Figs. 71. Price 490 Fr. Editions Techniques et Professionnelles, 18 bis, Villa Herran, Paris, 16.

Cours sur les Ondes Ultra-Courtes by Y. Place. Elementary theory and practical application of metric, decimetric and centimetric waves. Pp. 186, Figs. 232. Price 1,300 Fr. Edition Eyrolles, 61, Boulevard Saint-Germain, Paris, 5.

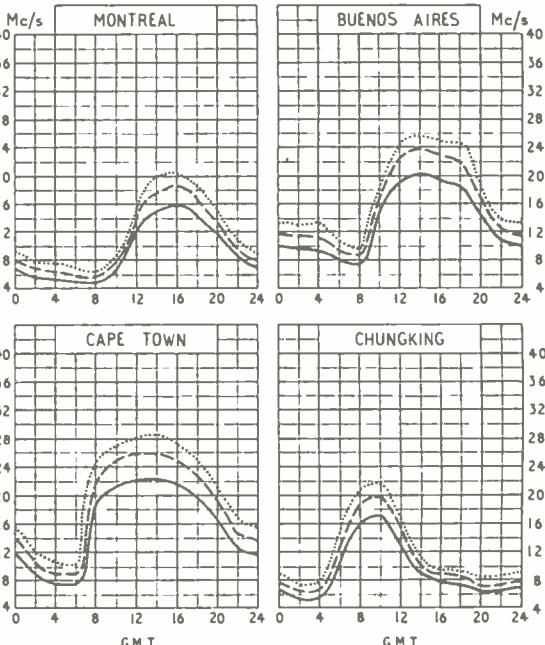
Industrial Electronics, by R. Kretzmann. Survey of vacuum and gas-filled valves, photocells, voltage stabilizers and cathode-ray tubes and their application as relays, counting and control devices, etc., in industrial processes. Sections are devoted to radio-frequency heating of dielectrics and metals. Pp. 236; Figs. 266. Cleaver Hume Press, 31, Wrights Lane, London, W.8. Price 25s.

Short-wave Conditions

Predictions for February

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

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



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

Resistances in Parallel

Calculating Effective Values on the Slide Rule

By FRANCIS OAKES,* M.Inst.E.

A NUMBER of methods for rapid calculation of the equation

$$R_{1,2} = \frac{R_1 R_2}{R_1 + R_2}$$

have been published in recent years. Unfortunately these suffer either from considerable inaccuracy (particularly when R_1 and R_2 are of different orders of magnitude) or when they have the drawback of necessitating tiresome intermediate calculations, such as the finding and adding of reciprocals, adding of resistance values, or calculation of auxiliary currents. The method described here suffers from neither of these disadvantages, and lends itself readily to a number of further applications.

To find the numerical solution of the equations above, proceed as follows :

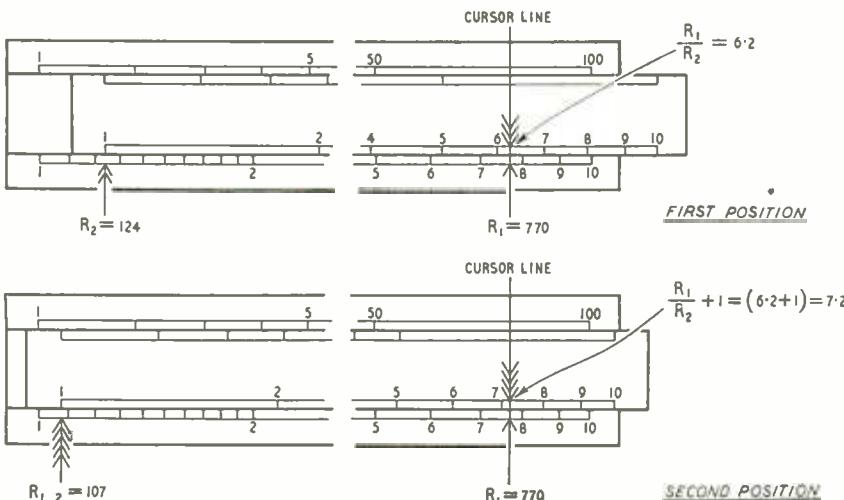
- (1) Bring cursor line over R_1 on the stock (Fig. 1, one arrow).
- (2) Move the end-mark of the slide (1 or 10 as required) over R_2 on the stock (two arrows).
- (3) Read R_1/R_2 on the slide under the cursor line (three arrows) and add 1 to this reading.
- (4) Move the slide so as to bring this sum, i.e. $R_1/R_2 + 1$ under the cursor line (four arrows).
- (5) Read result $R_{1,2}$ on the stock under the end-mark of the slide (five arrows).

In the example shown in Fig. 1 the following numerical settings are indicated :

$R_1 = 770$, $R_2 = 124$, $R_1/R_2 = 6.2$, $R_1/R_2 + 1 = 7.2$ and the result $R_{1,2} = 107$.

Proof: 1st step : The section on the slide between

Fig. 1. Slide rule settings for calculating the effective value of 124 and 770 ohms in parallel. Answer 107 ohms.



the end-mark and R_1/R_2 is equal to the section on the stock between R_1 and R_2 . Therefore $\log R_1/R_2 = \log R_1 - \log R_2$.

2nd step : The section on the slide between the end-mark and the new setting $R_1/R_2 + 1$ is equal to the section on the stock between R_1 and $R_{1,2}$, thus

$$\log R_{1,2} = \log R_1 - \log \left(\frac{R_1}{R_2} + 1 \right)$$

$$\therefore R_{1,2} = \frac{R_1}{\frac{R_1}{R_2} + 1} = \frac{R_1 R_2}{R_1 + R_2}$$

A series combination of capacitances C_1 and C_2 is equivalent to a capacitance $C_{1,2} = C_1 C_2 / (C_1 + C_2)$. It is therefore obvious that the same method can be used also for the solution of series-capacitance problems. An analogous relationship holds good for parallel inductances.

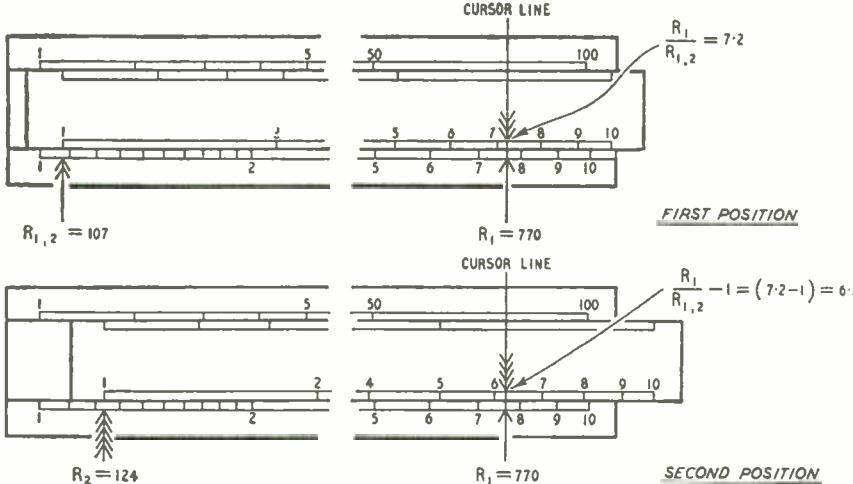
It should be observed that the settings are so arranged that the result appears on the stock. This is of importance when more than two resistances are connected in parallel, or more than two capacitances in series.

If, for example, the parallel equivalent $R_{1,2,3}$ for the three resistances R_1, R_2, R_3 is required, the calculation is started by finding $R_{1,2}$ in the manner described above. To continue, the cursor line is moved over $R_{1,2}$ and the process repeated with $R_{1,2}$ instead of R_1 , and with R_3 instead of R_2 . In other words, $R_{1,2}$ is considered as one single resistance to be shunted by R_3 . The result $R_{1,2,3}$ then appears in the same way as $R_{1,2}$ was found in the original example. In this way any number of resistances in parallel, or capacitances in series, can be worked out.

A similar process, with the only difference of subtracting 1 instead of adding, can be used to find the shunt value R_2 required to reduce a resistance R_1 to a desired value $R_{1,2}$. This is illustrated in Fig. 2 on the next page and is carried out as follows :

- (1) Bring cursor line over R_1 on the stock (one arrow).
- (2) Move the end-mark over $R_{1,2}$ on the stock (two arrows).
- (3) Read $R_1/R_{1,2}$ on the slide under the cursor

* Ferguson Radio Corporation



line (three arrows) and deduct 1 from the reading. (4) Move the slide so as to bring this difference, i.e. $R_1/R_{1,2} - 1$ under the cursor line (four arrows).

(5) Read resulting shunt resistance R_2 under the end-mark of the slide (five arrows).

The proof is quite analogous to the additive operation. Similarly, as the result falls on the stock, it can

be used as a starting point for further calculations.

The subtractive method can be used for numerical solution of resonant circuit problems. Since the reactance of a parallel resonant circuit above resonant frequency is a capacitive reactance of magnitude

$$X_u = X_L X_C / (X_L + X_C)$$

and below resonance of the

magnitude $X_b = X_L X_C / (X_C - X_L)$ inductive reactance, the method described is obviously valid. Other problems of this kind, having the same mathematical formalism, and therefore being solved by the same slide rule operations, are the equivalent admittance of a series resonant circuit off tune, or the equivalent resistance of a positive and a negative resistance in parallel.

Manufacturers' Products

NEW EQUIPMENT AND ACCESSORIES FOR RADIO AND ELECTRONICS

Recording Amplifier

DESIGNED for use with the leading makes of tape recording mechanisms, the "Elpico" Model AC/54 Mark II amplifier is suitable for use with either high- or low-impedance heads, and alternative levels of bias and erasing output are provided. Wide-range tone compensation circuits enable an overall characteristic level from 80 to 8,000 c/s, within ± 4 db, to be obtained at a tape speed of $7\frac{1}{2}$ in/sec.

In this redesigned version, the negative feedback has been increased, and precautions have been taken to

"Elpico" Model AC/54 Mark II tape amplifier



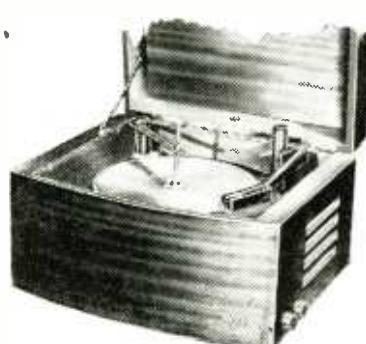
prevent audio frequencies from getting into the erase head via the bias feed network. A biased neon lamp level recorder is fitted, and calibrated on each individual amplifier.

The makers are Lee Products, 63 Great Eastern Street, London, E.C.2, and the price is £16 16s.

High-quality Record Player

AN unusual disposal of two identical loudspeakers in opposite sides of a $\frac{1}{2}$ -inch thick mahogany cabinet is said to give "presence" and the

Pye "Black Box" record player.

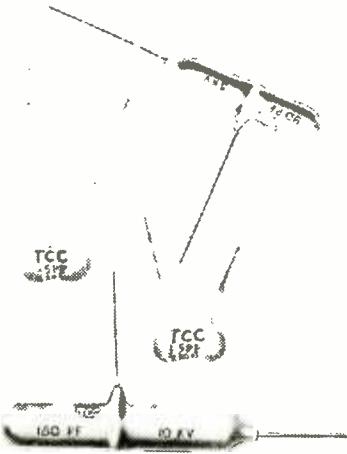


atmosphere of the concert hall in the reproduction from the "Black Box," the latest record player, produced by Pye, Radio Works, Cambridge. A "Monarch" three-speed record changer is incorporated and the push-pull amplifier is provided with tone and volume controls. The record changer will play up to ten 7in, 10in or 12in records mixed at any one of the following speeds: 33 $\frac{1}{3}$, 45 or 78 r.p.m. The price is £40 19s (including tax).

New Ceramic Capacitors

AMONG the new capacitors introduced recently by the Telegraph Condenser Co., Ltd., Wales Farm Road, North Acton, London, W.3, are two series of ceramic types of unusual interest. One consists of small-capacitance tubulars (Type CC125A) primarily intended for "top-end" coupling in bandpass filters. Capacitances range from 0.5 pF to 5 pF at 500 V d.c. working, the closest tolerance being $\pm 10\%$, for all except the 0.5-pF model, for which it is $\pm 20\%$. Overall size is 0.5 in $\times \frac{3}{8}$ in (approx) and side exit connecting wires of No. 22 s.w.g. are fitted.

The other series is for high working voltages, such as the e.h.t. positions in television sets and pulse-feed capacitors in radar transmitters and



T.C.C. high-voltage tubular and small capacitance tubular capacitors, both are ceramic types.

receivers. These are tubular ceramics also but with one axial wire and one centrally wrapped connecting wire.

Working voltages range from 1 kV to 10 kV and capacitances from 50 pF to 620 pF according to type and voltage rating. The largest capacitance for 10-kV working is 180 pF and for 1-kV 620 pF. They are quite small considering the high working voltages, a 250-pF, 3.5-kV capacitor, for example, measuring 1 in long and $\frac{1}{8}$ in diameter.

Redesigned Record Changer

WHILE retaining the essentially simple and reliable design of the earlier mechanism, and its quick-changing characteristics, the latest version of the "Monarch" three-speed changer has been given a more attractive appearance. The pickup pivot and corner trip mechanisms are now housed in a single "streamlined" moulding, and an ivory finish is standardized.

More important from the technical point of view, the record release arm has been reshaped and is now made in Perspex instead of metal to give more silent operation. The pickup arm has also been reshaped to give better accessibility to the centralized control knob.

Redesigned "Monarch" three-speed record changer.



The price of the "1954 Monarch" is £16 10s 3d (including tax), and the makers are Birmingham Sound Reproducers, Claremont Street, Old Hill, Staffs.

New Loudspeaker Enclosure

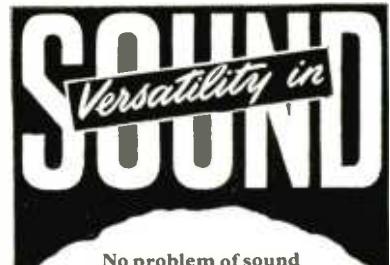
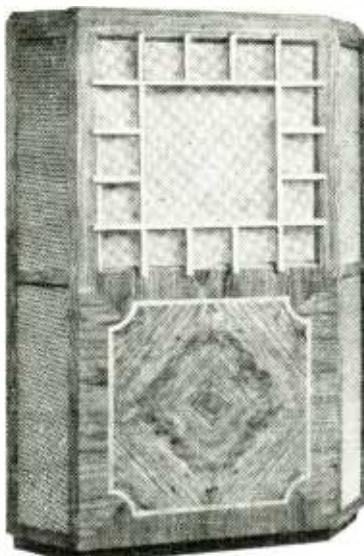
IN order that the full potentialities of the Dual Concentric loudspeaker unit may be realized, Tannoy have recently developed a new enclosure which provides horn loading throughout the frequency range. Hitherto the horn principle has been applied only above 1,000 c/s, but now the front of the large cone is loaded by a short horn with a flare efficient down to 200 c/s, while the back of the diaphragm is coupled to a larger folded horn covering frequencies from 200 c/s downwards. Radiation above 200 c/s from this larger horn is deliberately restricted by absorption at the discontinuities in the direction of the emerging sound.

The result is twofold: there is a noticeably "tight" control of transients and freedom from excitation of cavity resonances, often apparent in vented enclosures; and there is an effect of spaciousness consequent on the increase of source area. Since frequencies above 200 c/s are radiated from the single central source, there is no incongruity when speech or solo voices are being reproduced.

A 15-inch Dual Concentric unit is used, and this has now been redesigned for ease of dismantling and is fitted with a new phenolic-resin impregnated corrugated centring device. Plug-in connections are provided for the cross-over filter unit.

The makers are Tannoy Products, Norwood Road, West Norwood, London, S.E.27.

Tannoy "expanding source" enclosure for the Dual Concentric loudspeaker.



No problem of sound reproduction is too large or too small for the TRIX organisation to solve. Whether for Indoors or Outdoors, Mains or Batteries, Portable or Permanent installations, TRIX equipment will give lasting, efficient service. Consult the TRIX Catalogue, therefore, or ask for our expert advice.



Model RE48. A heavy duty reflex type weatherproof horn speaker with exceptional range and performance. Very suitable for all public address work.



Enclosed rack type equipment RGA4/633. Combines 30 watt amplifier with pre-set radio, priority microphone control and 3-speed changer.

SERVICE IN SOUND BY



The TRIX ELECTRICAL CO. LTD.
1-5 MAPLE PLACE, TOTTENHAM CT ROAD,
LONDON, W.I. Phone: MUSEUM 5817
Telegrams and Cables: TRIXADIO, WESDO, LONDON

RANDOM RADIATIONS

By "DIALLIST"

Sticking My Neck Out?

A LETTER in a recent issue of the *Wireless Trader* called attention to the inconvenience caused to servicemen by a method of soldering leads to tags used in many—if not most—of our radio and television factories. This consists in securing the wire to the tag by twisting or hooking before the solder is applied. The serviceman's complaint is that it makes the substitution or replacement of components always a slow, and sometimes an exasperating business. One can see, and to some extent sympathize with the manufacturers' point of view. In the absence of that third hand which all solderers would like to possess, the preliminary securing of wires to tags speeds up the work. In most kinds of soldering, too, it is sound practice to make joints mechanically strong before the solder is applied. Manufacturers feel, no doubt, that sets made in this way are more likely than others to stand up to the shocks and bumps that come their way in transit. True; but I couldn't agree less that this kind of soldered joint is the right one to use in *factory-made* apparatus. Why? Well, because it can, and too often does, enable a dry joint to be passed as sound by inspectors applying the usual tests. Sooner or later a dry joint, even though the wire is twisted to the tag, is likely to give rise to one of those horrible intermittent faults which are responsible for the entry of so many black marks in the Recording Angel's notebook.

Alarm and Despondency

TRYING OUT a television set the other day on Test-card C, I was surprised to find it suffering from what appeared to be a markedly jittery frame scan. In particular, the black and white rectangles of the horizontal borders were quite unstable in their height. They just wobbled. A 'phone call to the Alexandra Palace elicited the information that film was being used and that a slight up-and-down movement was to be expected. Now, I don't think that that's quite fair. Test-card C should be something on whose faithful transmission experimenters and servicemen can bank. It should surely be *the* television image whose

faultless transmission is guaranteed. Things become pretty difficult if this isn't so.

A Little Learning

THE VAST MAJORITY of radio dealers are first-rate fellows, who know their job and do well by their customers. But there is, more's the pity, nothing to prevent any Tom, Dick or Harry with a small amount of capital from taking a shop and erecting a sign describing himself as an "electrical, electronic, radio and television engineer," even though his knowledge of the very elements of any of these wide fields is of the scantiest and his practical experience *nil*. He can, without let or hindrance, undertake the wiring of houses and the installation and maintenance of electrical equipment of all kinds. The result is too often that electricity, the best and safest servant that Man has yet devised, becomes a menace to life and to property. One evening, long after the shops had closed, a neighbour came, with many apologies, to seek my help: with a child seriously ill in his house, all the lights had "gone"; fuses blew as soon as they were replaced. What I found left me gasping. One of these dabblers

had sometime previously put electric light into two rooms. Since then the lighting had been extended by him to the rest of the house simply by tapping off the original cables. One fuse-box served not only all the lights, but also numerous 2-pin wall sockets feeding a variety of gadgets, such as a couple of 1-kW heaters and a washing machine. The whole 5-amp wiring system had been "strengthened" by fitting 15-amp fuses in the single fuse-box. . . .

When it Comes to TV

It is a lamentable fact that up and down the country thousands of non-technical owners of radio and television receivers are completely at the mercy of these black sheep. I can't think why manufacturers don't exercise more care in appointing retailers of their wares; for there is no question that a first-rate make of radio or television set can gain a quite undeserved local reputation for lack of reliability through the misdeeds of one ignorant or unscrupulous dealer. Here are a few cases that have come to my knowledge. (1) The typical horizontal bars of sound-on-vision ascribed to camera faults; (2) Five radio and television sets installed by one dealer in a 230-V area with the mains tappings at 200 volts; (3) A new c.r. tube fitted, at a cost of over £20, to "cure" distorted reproduction of sound; (4) Poor results with an elaborate aerial array found, on investigation by its manufacturer, to



"WIRELESS WORLD" PUBLICATIONS

	Net Price	By Post
GUIDE TO BROADCASTING STATIONS. Compiled by "Wireless World." 7th Edition	2/-	2/2
INTRODUCTION TO VALVES. R. W. Hallows, M.A. Cantab., M.I.E.E. and H. K. Millward, B.Sc., Lond., A.M.I.E.E.	8/6	8/10
TELEVISION ENGINEERING: Principles and Practice. VOLUME ONE: Fundamentals, Camera Tubes, Television Optics, Electron Optics. A B.B.C. Engineering Training Manual. S. W. Amos, B.Sc.(Hons.), A.M.I.E.E. and D. C. Birkinshaw, M.B.E., M.A., M.I.E.E., in collaboration with J. L. Bliss, A.M.I.E.E.	30/-	30/8
WIRELESS WORLD TELEVISION RECEIVER MODEL II: Complete constructional details with notes on modernizing the original design	3/6	3/9
WIRELESS WORLD DIARY, 1954. Leather	5/10	6/-
RADIO INTERFERENCE SUPPRESSION as Applied to Radio and Television Reception. G. L. Stephens, A.M.I.E.E.	4/1	4/3
SOUND RECORDING AND REPRODUCTION. J. W. Godfrey and S. W. Amos, B.Sc. (Hons.), A.M.I.E.E.	10/-	10/11
ADVANCED THEORY OF WAVEGUIDES. L. Lewin	30/-	30/8
FOUNDATIONS OF WIRELESS. M. G. Scroggie, B.Sc., M.I.E.E. 5th Edition	30/-	30/7
TELEVISION RECEIVING EQUIPMENT. W. T. Cocking, M.I.E.E. 3rd Edition	12/6	13/-
A complete list of books is available on application.	18/-	18/8

Obtainable from all leading booksellers or from
ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1.

be due to an error of some 40 deg. in its orientation; (5) An H-type array erected with its reflector towards the transmitting station. And I could go on and on.

Battery Operated TV

ONE FIRM of manufacturers of television receivers demonstrated at the Earls Court Radio Show that any of their sets could be operated from a pair of 12-volt car starter accumulators, or from a private lighting plant, if sufficient "juice" could be spared. For all that, I'm not persuaded that a standard television set, with power requirements of the order of 150 watts, is suitable for use in this way. I've put up the idea for a genuine battery-and-converter receiver to several firms without arousing any marked enthusiasm. What I'd like to see is a set equipped mainly with battery miniature valves, whose requirements in the way of power are very small indeed. It would probably be necessary to use specially designed battery valves with high-consumption filaments for most of the functions. I'm told that there wouldn't be a big enough market to make such a set worth while. That I just don't believe. I live in a small country town and I can think right away of over a score of people within a few miles of my home who want television and would have it if reasonably economical battery operation were possible. And that's just one small town. There must be tens of thousands of folk in television service areas—townsmen, villagers and farmers—who would give no uncertain welcome to such a set, if it became available.

Soldering Aids

HERE ARE TWO soldering aids that I've found most useful since I made them a good few years ago. The first is a 230V-12V step-down transformer, mounted on a rectangular switch block. The primary and the core are connected by heavy flex to a 3-pin plug. The secondary connections go to a 2-pin socket, mounted on the same block. Each of my three small 12-V irons has a 2-pin plug at the end of its flex. The second gadget enables one to use the larger irons at some distance from a wall-socket. It is the simplest thing you can imagine. Just a 3-pin socket mounted on a circular switch block, which is itself attached to a plywood disc. To the contacts of the socket a 3-pin plug is connected through four yards of good flex.

INTRODUCING THE NEW

SILVER-DIAL

RANGE OF CONTROL-KNOBS



A NEW Range of Instrument Knobs and Dials. Manufactured in the finest-grade polished Bakelite, with frosted aluminium "Silver-Dial" dials.

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

List No.	Item	Dimensions, etc.
K.401	Knob	1 1/2" (28.6 mm.) Ø × 11/16" (17.5 mm.) high
K.405	Skirt	1 1/2" (38.1 mm.) Ø = 17/32" (6.8 mm.) thick
K.411	Dial	2" (50.8 mm.) Ø = 21 S.W.G., engraved 0-10 over 270°
K.411 P	Dial	ditto, not engraved

List No.	Item	Dimensions, etc.
K.402	Knob	1 1/2" (41.3 mm.) Ø × 11/16" (19.9 mm.) high
K.406	Skirt	2 1/2" (52.4 mm.) Ø = 17/32" (6.8 mm.) thick
K.412	Dial	2 1/2" (69.9 mm.) Ø = 21 S.W.G., engraved 0-100 over 180°
K.412/P	Dial	ditto, not engraved

List No.	Item	Dimensions, etc.
K.403	Knob	2 1/2" (60.3 mm.) Ø × 3 1/16" (24.6 mm.) high
K.407	Skirt	3" (76.2 mm.) Ø = 17/32" (6.8 mm.) thick
K.413	Dial	4" (101.6 mm.) Ø × 21 S.W.G., engraved 0-100 over 180°
K.413 P	Dial	ditto, not engraved

BULGIN

THE CHOICE OF CRITICS



Further details available in the NEW 114 page Catalogue. Price 1/- post free. Ref. 192, WW.

MANUFACTURERS OF RADIO AND ELECTRONIC COMPONENTS

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

Telephone: RIPPleway 3474 (5 lines)

UNBIASED

By FREE GRID

Plastic Plumbing

A KINDLY READER has sent me a bunch of cuttings from the local paper at Barnet, where they appear to be having a lot of trouble separating the Light and the Home Service programmes. Apparently the trouble is due to a rectification effect set up by the corroded joints in the guttering and piping and also in the metal window frames of Barnetonian houses. Such corrosion exists in all districts, of course, and doesn't have any serious effect but Barnet is so close to Brookman's Park that the resultant rectification causes the two main B.B.C. programmes to break through on each other in hopeless fashion.

It is astonishing that nobody seems to have thought of any really drastic method of tackling the problem. Irritating palliatives of doubtful efficiency seem to be all that the local experts can suggest. The obvious solution, of course, is to scrap the offending pipes and to substitute plastic plumbing; metal window frames and guttering could be similarly dealt with. The benefit to the nation of the large supplies of scrap metal which my plan would make available would be enormous and would more than justify the Treasury in making a substantial grant towards the cost out of the ill-gotten 15 per cent blood money which it squeezes out of the B.B.C.

Patients' Preference

ON MORE THAN one occasion in these columns I have complained of the inadequacy of hospital radio. In many of the cases brought to my notice the maintenance of the equipment has apparently been nobody's responsibility. When the hospitals were nationalized in 1948 the Government, through the various hospital boards, took over responsibility for all such necessary services as the plumbing and the electric lighting, but not apparently the radio installation—judging by the sorry state in which I have found it in certain cases. In some hospitals the headphones are in a bad state of repair; very often too, the reproduction is far too loud and an individual volume control for each patient is an unheard-of luxury.

It was, therefore, an agreeable surprise recently when I found a new installation being put in at an establishment which I had previously criticized. It is designed to give each patient a separate volume control and the choice of no fewer than four programmes.

I was unable to obtain any official information as to what these programmes were to be, but as the installation was being carried out by a well-known radio relay company I presume that the programmes—which I understood are to be fed to the hospital by landline—will be the usual ones that are "on tap" to subscribers to this particular company.

I cannot help feeling, however, that each of our large hospitals should reserve one of their audio channels for its own internal programme provided by gramophone records chosen by the patients themselves; in other words a "patients' preference" or "sufferers selection" service. The number of patients in even the largest hospital is infinitesimal compared with the B.B.C.'s listeners, and, therefore, each patient would have a certainty of hearing his own favourite record played. There would be little difficulty, I think, in obtaining the services of amateur disc jockeys from the local branches of voluntary organizations like the W.V.S.

I suppose that one day a TV screen will be found at the foot of every hospital bed or on the ceiling above. The expense of installation would be very great, but I do wonder why our cinema magnates do not seize their opportunity to boost business by bringing movies to each patient's bedside by means of a scanning unit in the local cinema and a closed-circuit link to the local hospital. Patients would almost certainly tell all their visitors to be sure and see such-and-such a film. Maybe commercial TV could be tried out in this way using films and a scanning unit in the hospital.

Baseless Ballyhoo

THE AMERICANS ARE a very likeable people and I number a great many among my readers and my friends—not always the same thing. But certain of them have the irritating habit of thinking that nothing ever happens or has its being outside "God's own country." Incidentally I may remind them that even the use of this expression to describe their homeland is not original. It was first employed by Dick Seddon, a famous premier of New Zealand, to describe that delectable land and is in fact recorded on his tomb in Wellington; it was probably shown to the Queen on her recent visit.

I recall being very irritated on one occasion by an American who had just been on a visit to what he kept on referring to as Cairo, Egypt. Eventually exasperation got the

better of my manners and I pointed out that few people were ignorant of the fact that Cairo was in the land of the Pharaohs, but he promptly floored me by blandly explaining that there was another Cairo in the U.S.A., as indeed there is. Needless to say, I gave up.

After this incident it scarcely surprised me a few months ago when, at an international radio gathering, a tribute paid by the chairman to Franklin, the pioneer of long-distance beam telegraphy, drew vociferous applause from the Americans present. It was clear that the chairman ought to have said C. S. Franklin of England, as the applauders obviously thought that he meant that gifted American Benjamin Franklin who, in the 18th century, drew sparks from a kite

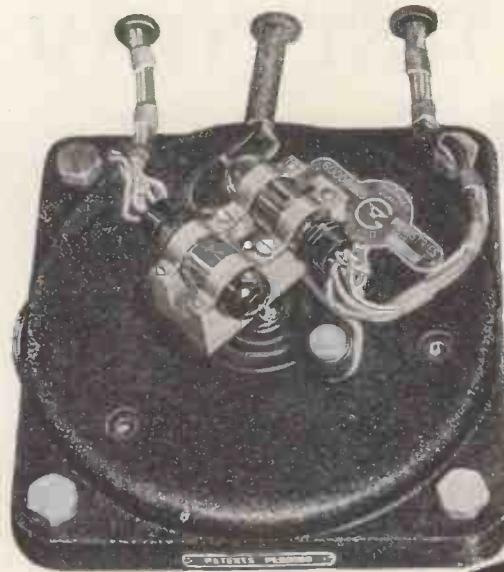


"They have the irritating habit . . ."

string. Maybe they were not altogether wrong to think of him as, after all, Marconi, when he first used an aerial for wireless purposes, was possibly not unmindful of Franklin's work.

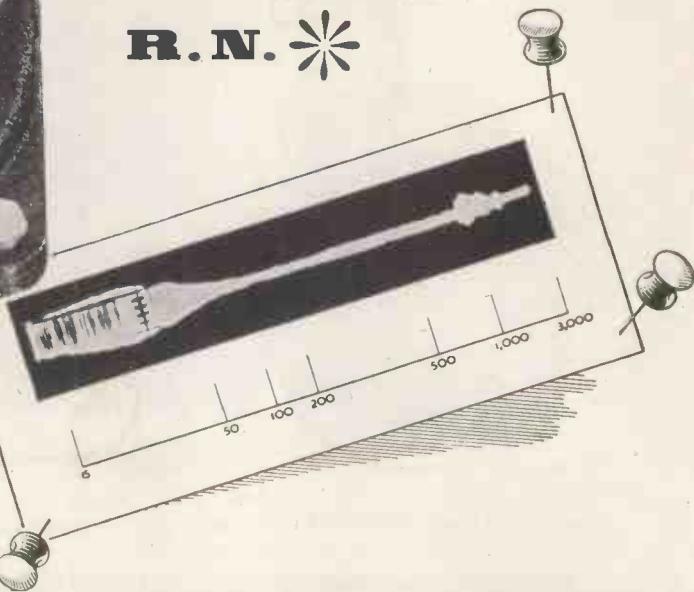
However, it is not about Franklin that I wish to write but of the ballyhoo that is being made in the U.S.A. about the recording of TV programmes on magnetic tape. This is undoubtedly a first-class achievement and is without question "pregnant with possibilities," as one typical writer puts it. I would, however, remind people not only in the U.S.A. but over here also that Baird recorded television on discs some twenty years ago and I think it is axiomatic that what can be recorded on discs can also be done by means of tape, film or any other recording media.

I hope my American readers will not regard my remarks as unmannly. No doubt they suffer equal irritation at certain of our national habits and are exasperated at instances of our unjustified ballyhoo.



BRIMAR

Pin down
R.N. *



Illustrations by courtesy of Standard Telephones and Cables Limited who say, "These vibrators have been chosen as they give a faithful reproduction of the input wave form and enable high accelerations at any frequency to be obtained."

with **GOODMANS**

RESONANCE NOISE describes a particular factor in a valve which can very seriously impair its otherwise good characteristics. Only when "R.N." is negligible can a valve operate strictly according to its published "curve" and data.

Complete investigation of this phenomenon is only possible by subjecting the valve to *controlled vibration* throughout a wide frequency range. If the valve is operated in a Class A circuit, and the A.C. noise voltage appearing at the anode of the valve is presented on an oscilloscope, a resonance diagram against input frequency can be obtained. By this means it is possible to excite the valve in the range of frequencies 20 to 10,000 c/s, and the resonance noise performance checked. By the use of a twin mounting as illustrated, comparisons of valves can be made under identical conditions.

VIBRATORS

Just another of the wide applications of Goodmans Vibration Generators. Perhaps "controlled vibration" can serve you also.

The range includes models developing a force of ± 300 lbs. to the midget model with a force output of ± 2 lbs. for optical-cell research and hairspring torque testing etc. Full technical data available from "Vibration Division W"



GOODMANS INDUSTRIES LIMITED
AXIOM WORKS, WEMBLEY, MIDDX.

Phone : WEMbley 1200 (8 lines)

GD

transistors for circuit experiments

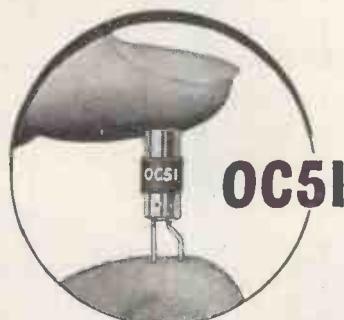
a choice of

two
point-contact types

In the OC50 and OC51 point-contact transistors Mullard have varied point spacing to produce two transistors of markedly different characteristics. This choice of point-contact transistors now offered by Mullard will greatly assist electronic engineers to adapt to their own needs the circuits described in existing literature, and also to create new circuits of their own design.

Although, at the present state of development, some transistor parameters tend to be temperature-dependent and to vary between transistors of the same type, these effects can be largely overcome by suitable circuit design. Circuit engineers will find that they are able to achieve good results when they take the unfamiliar characteristics of the transistors fully into account. The Mullard circuit research and development organisation is actively exploring transistor circuit techniques, and designers interested in the OC50 and OC51 are invited to avail themselves of the assistance of the Industrial Technical Service Department at the address below.

- The OC50 and OC51 are readily available for experimental purposes at a price comparable with that of subminiature valves.



Point-contact transistor type No.	OC50	OC51
Max. negative collector-to-base voltage (V)	30	50
Max. collector current (mA)	-12	-15
Max. dissipation (mW)	120	100
Max. emitter current (mA)	10	12
Max. ambient temperature (°C)	40	55
Max. frequency (for α 3db down) (Mc/s)	1.0	1.5
"Full-on" voltage across transistor	★	
Collector "cut-off" current		★

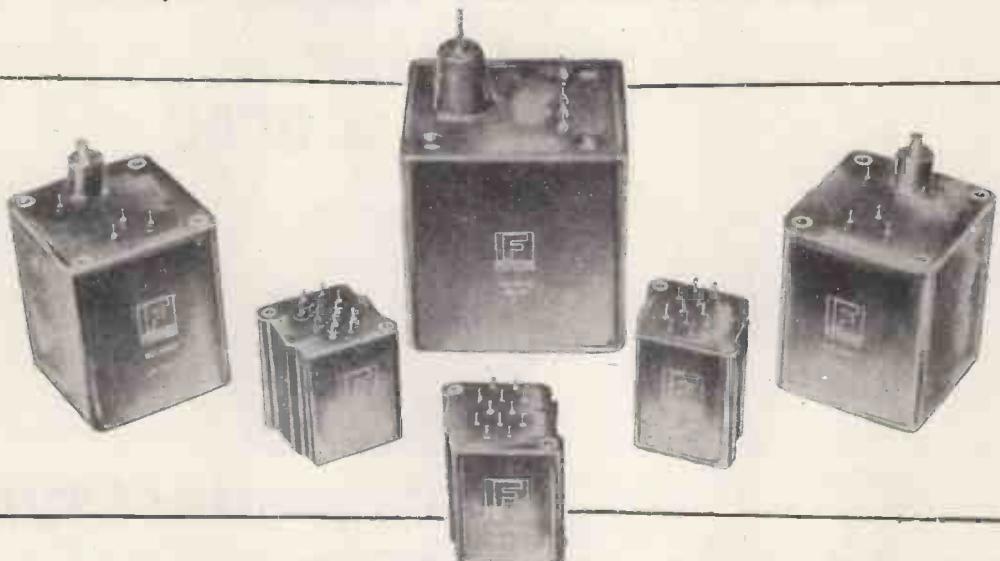
★ Superior type for this characteristic

Mullard



MULLARD LTD., COMMUNICATIONS AND INDUSTRIAL VALVE DEPT., CENTURY HOUSE, SHAFTESBURY AVENUE, LONDON, W.C.2
MVT149

A COMPLETE TRANSFORMER SERVICE TO THE ELECTRONIC EQUIPMENT MANUFACTURER



THE NEW "PENTLAND" SERIES RESIN CAST TRANSFORMERS & CHOKES

Complete assembly sealed in resin block—suitable for incorporation in every type of electronic equipment—designed to meet, at low cost, the stringent requirements of Specification RCS.214—saving in weight and volume—suitable for power, signal, pulse and high voltage applications—designed to individual specification.



"H" SERIES—hermetically sealed oil-filled components. "C" core construction, conforming with RCL.215.



"K" SERIES—impregnated open type "C" core construction, conforming with RCL.216



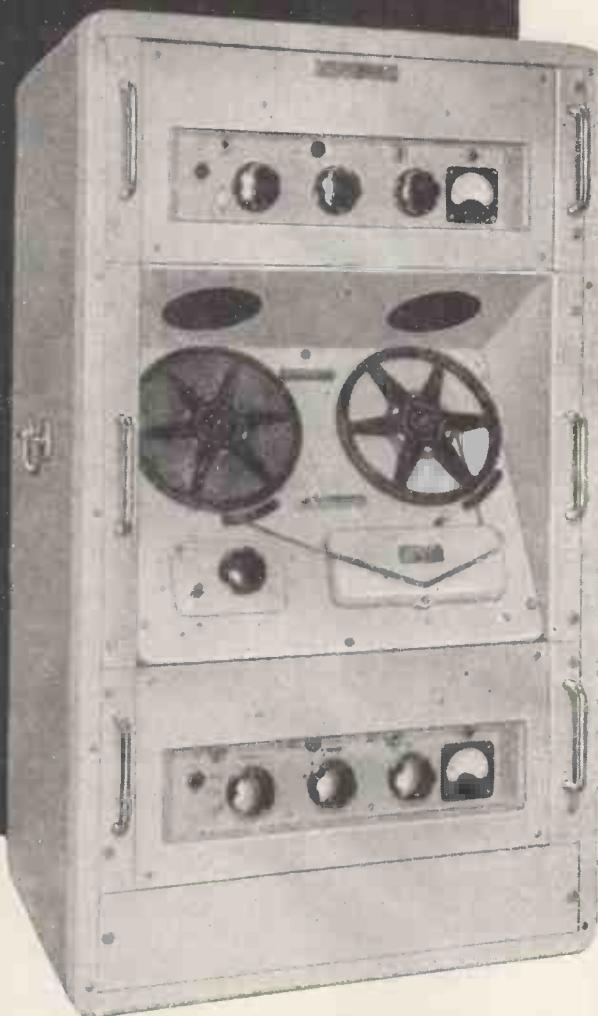
"M" SERIES—hermetically sealed miniature type for power and signal applications.

FERRANTI



Enquiries to Technical Sales Dept :

FERRANTI LTD - CREWE TOLL - EDINBURGH 5



Equipment

Type YDC

*A simultaneous
dual-channel
Recorder / Reproducer*

. . . offering special facilities to those engaged in analysis problems in the medical, aeronautical and scientific fields.

Besides the fairly normal ability to record time pulses on one track and intelligence on the other, it will become immediately obvious that comparative measurements, stereophonic sound and indeed any two activities capable of translation into electrical phenomena within the frequency and phase shift limitations, can be recorded and replayed simultaneously.

It is also possible easily to convert the equipment for endless loop working so that the last few minutes of any activity are recorded for ultimate continuous replay and analysis.

GENERAL SPECIFICATION

SUPPLY VOLTAGES : 100-120 volts and 200-250 volts A.C. 50 c.p.s. (60 c.p.s. by special pulley).

TAPE SPEEDS : 3 $\frac{3}{4}$ " and 7 $\frac{1}{2}$ " per sec. Alternatively 7 $\frac{1}{2}$ " and 15" per sec.

SYNCHRONOUS CAPSTAN MOTOR giving long term speed stability of 0.5%.

TRACK WIDTH : 0.1" displaced to one edge.

NUMBER OF TRACKS : 2 accommodated side by side.

RUNNING TIME (50 c.p.s. supply) 30 mins at 7 $\frac{1}{2}$ " per sec, pro rata for other speeds.

REWIND & WIND-ON TIME : Less than 1 min. for full reel.

FREQUENCY RESPONSE : At 7 $\frac{1}{2}$ p.s., 50-11,000 cycles and correspondingly increased at higher speed.

INPUT IMPEDANCES AND LEVELS : A. Line Input—600 ohms. Balanced, by P.O. Gauge B jack via built-in isolating transformer. Minimum signal level 0.07 volt peak.

B. Microphone Input—1 megohm unbalanced, or using external plug-in matching transformer, 25 ohms balanced. Minimum signal level .002v at high impedance socket.

OUTPUT IMPEDANCES AND LEVELS : A. Main Output—600 ohms Balanced. P.O. Gauge B jacks. 1 watt available into external 600 ohms if necessary. B. Monitor Loudspeaker—1 watt to internal 5" speaker. Can be switched out if desired.

SIGNAL TO NOISE RATIO : A. In the range 200-8000 cycles, for 1 watt main output (full depth recording) 50 D.B. approximately. B. Unweighted signal to noise, better than 40 D.B.

DISTORTION : At 1 watt output, 400 c.p.s. less than 5% total. "WOW" AND FLUTTER (expressed as change in tape velocity) : Less than 0.2% at 7 $\frac{1}{2}$ p.s.

ERASE AND BIAS FREQUENCY : 51 K/c/s nominal.

FINISH : Light battleship grey, British Standard Colour 631.

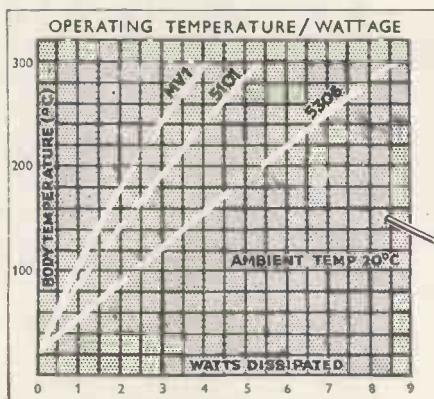
SIZE : 24" x 15" x 36" high.

WRIGHT & WEAIRE LTD

138 SLOANE STREET · LONDON · S.W.1 · Telephone: SLOANE 2214/5



By Appointment to the Professional Engineer

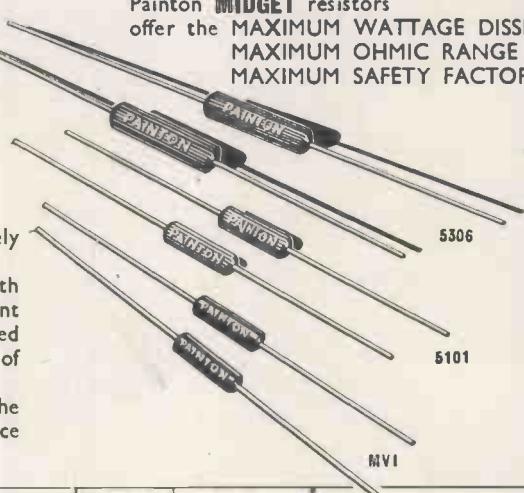


In the Heavy Duty MIDGET Range, the extremely high wattage dissipation is achieved by:
 (a) the use of a sintered alumina ceramic former, with thermal conductivity approximating steel (Patent 626128), in conjunction with a Painton glaze developed to match the thermal and mechanical properties of sintered alumina,
 (b) the exceptional strength and conductivity of the Painton "Intermediate Wire Process" of resistance termination (Patent 575297).

MIDGET WIREWOUND VITREOUS RESISTORS

MINIATURE EQUIPMENTS
DEMAND MIDGET RESISTORS

Dimensionally
Painton MIDGET resistors
offer the MAXIMUM WATTAGE DISSIPATION
MAXIMUM OHMIC RANGE
MAXIMUM SAFETY FACTOR



Range	Type	Resistance Range Ohms		Tol.	Rating Watts		Max. Working Temp.	Temperature Coefficient	DIMENSIONS			
		Min.	Max.		Normal 20 °C.	Tropical 70 °C.			Length	Diam.	Lead	
											Length	Material
Standard	MVI	1 10	9.99 4700	10% 5%	4	3	300 °C.	BELOW 100°— NEGLIGIBLE ABOVE 100° 0.01% / °C.	15 32	13 64	1 1/4"	20 S.W.G. Silver Clad Copper Wire
Heavy Duty	5101	1 10	9.99 4700	10% 5%	5.5	4	350 °C.	BELOW 100°— NEGLIGIBLE ABOVE 100° 0.01% / °C.	15 32	13 64	1 1/4"	
Heavy Duty	5306	10	15,000	5%	8.5	7	350 °C.	BELOW 200°— NEGLIGIBLE ABOVE 200° 0.01% / °C.	13 16	9 32	1 1/2"	

PAINTON
Northampton England

ATTENUATORS AND FADERS • STUD SWITCHES • FIXED AND ADJUSTABLE WIREWOUND RESISTORS
WIREWOUND POTENTIOMETERS • MIDGET R.F. CHOKES • HIGH STABILITY CARBON RESISTORS • TERMINALS
PLUGS AND SOCKETS • KNOBS, DIALS AND POINTERS • TOGGLE SWITCHES • PUSH BUTTON SWITCHES

A N N O U N C E M E N T

Arrangements have recently been concluded whereby the products of

SORENSEN Inc.

Connecticut, U.S.A.

will be manufactured in the United Kingdom under licence by J. LANGHAM THOMPSON LTD. These products comprise a range of A.C. and D.C. voltage and current regulators of extremely high accuracy, (up to 0.01%), and cover a wattage range of 150 watts to 15 KVA per phase. Immediately available will be the 1000.2S Sorensen Voltage Regulator, brief specification of which is given below.

Although in the initial stages it will not be possible to manufacture the complete range, this is intended at an early date. Engineers will be interested to learn that this range of exceptional instruments is now to be made available without dollar expenditure; descriptive literature will gladly be sent on request.

Sorensen 1000.2S Voltage Regulator

Specification

RATING	1 KVA	REGULATION ACCURACY	$\pm 0.1\%$ max.
INPUT VOLTAGE	190-260	RECOVERY TIME	0.1 secs.
INPUT FREQUENCY	50 c/s $\pm 10\%$	HARMONIC DISTORTION	3% max.
OUTPUT VOLTAGE	220-240 (adjustable)	P.F. RANGE	Down to 0.7
LOAD RANGE		No load to full load	

J. LANGHAM THOMPSON LIMITED

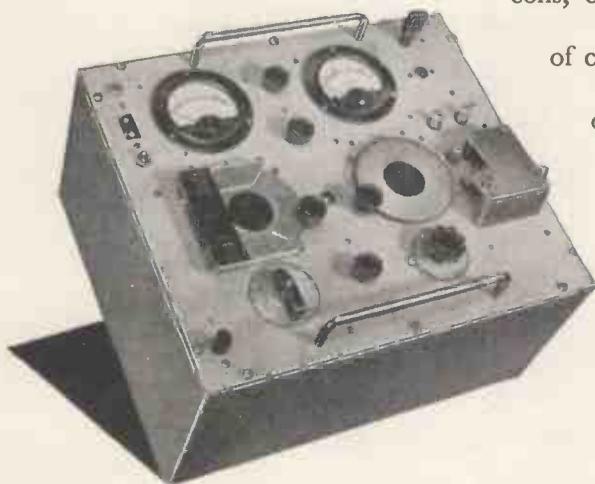
BUSHEY HEATH · HERTFORDSHIRE

Telephone: Bushey Heath 2411

Circuit Magnification Meter TF 329G



For the measurement of the Q of a circuit, there are no better instruments than Marconi. Model TF 329G applies to the frequency range 50 kc/s to 50 Mc/s. In addition to direct Q readings, the TF 329G can be used for a considerable range of indirect measurements carried out by the normal resonance methods. These include inductance of coils, capacitance and phase defect of condensers, the characteristics of transmission lines. Special jigs are available for investigating dielectric losses.



MARCONI INSTRUMENTS

SIGNAL GENERATORS • BRIDGES • VALVE VOLTMETERS • FREQUENCY STANDARDS
WAVE METERS • WAVE ANALYSERS • BEAT FREQUENCY OSCILLATORS • Q METERS

MARCONI INSTRUMENTS LTD. • ST. ALBANS • HERTS • TELEPHONE : ST. ALBANS 6161/7

Midland Office : 19 The Parade, Leamington Spa. Northern Office : 30 Albion Street, Kingston-upon-Hull.

Export Office : Marconi House, Strand, London, W.C.2



Look to the future

with **DECCA** ...

Excellent Opportunities for the right men

We are a young firm just four years old. In these four years we have achieved an outstanding reputation for a vigorous policy of research, development, production and commercial enterprise. Working as a team we have secured the position of the world's leading marine radar company.

Our present programmes embrace a wide field of radar research, covering some of the most advanced techniques in the world, and the breadth and scope of these programmes ensures our future success. Our achievements have been won by team work, and we have now a unique group of men, able, experienced and, above all, enthusiastic and energetic. Our expanding activities however demand that we seek more men of this type.

Excellent opportunities exist at various levels in all branches of our organisation, and particularly in our Research and Development Laboratories for radar and electronic engineers, mechanical designers and draughtsmen. If you are experienced in these fields or feel you have qualifications which would enable you to make a real contribution to our activities please write to us at once. There is plenty of scope for men of ability to move forward in this progressive company. Your letter which will be treated in the strictest confidence should be addressed to :

The Managing Director **DECCA RADAR LIMITED**, 1-3, BRIXTON ROAD, LONDON, S.W.9.

D.R.335



No Second Chance . . . ?

When there's a special recording to be done . . . when there's no chance of a second take, or repeats will send costs soaring — that's when you need the M.S.S. White Label Master Disk.

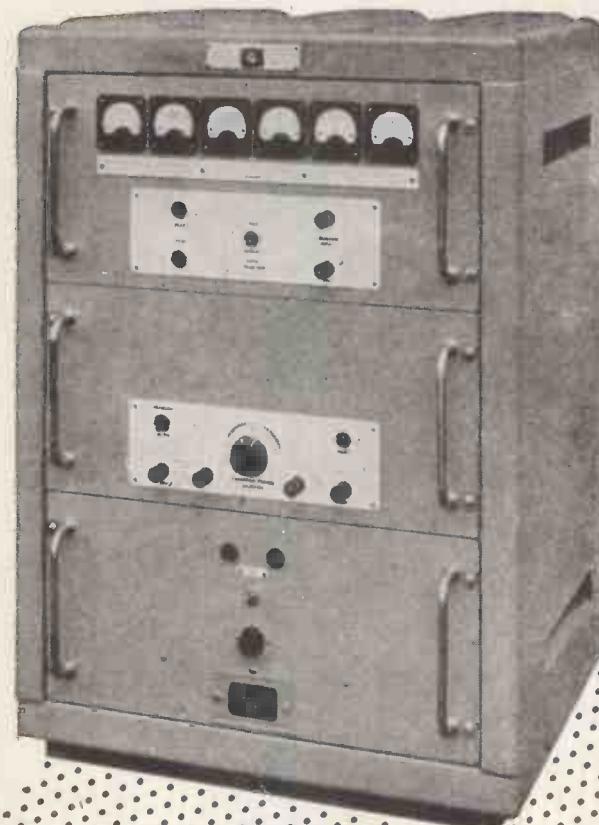
Out of every hundred recording disks made at M.S.S. most are graded as excellent for direct play-back, but only about three meet our stringent demands for master recordings. That will give you an idea what we mean by perfection! And that is why so many of the World's recording and broadcasting companies rely upon M.S.S. Disks. There is a range of M.S.S. Disks to suit all types of recording work. May we send you further information?

MSS DIRECT RECORDING DISKS



M.S.S. RECORDING COMPANY LTD, POYLE CLOSE, COLN BROOK, BUCKS, ENGLAND. COLN BROOK 284.
MANUFACTURERS OF SOUND RECORDING EQUIPMENT

**A U T O M A T I C
F R E Q U E N C Y
M O N I T O R (1 Mc/s)**



Designed for the measurement of any frequency in the range 10 c/s to 1 Mc/s with a basic accuracy of $\pm 0.005\%$ ± 0.1 , 1.0, or 10 c/s.

Higher accuracies available if required. The unknown frequency is determined by counting the number of cycles that pass through a 'gate'

open for a selectable time interval of 0.1, 1.0, or 10 seconds. The result is presented on six panel mounted meters each scaled 0 to 9 and is in decimal notation. Full information available on request.

CINEMA-TELEVISION LIMITED

A Company within the J. Arthur Rank Organisation

WORSLEY BRIDGE ROAD · LONDON · SE26

Telephone HItter Green 4600

SALES AND
SERVICING AGENTS

F. C. Robinson & Partners Ltd.,
287 Deansgate, Manchester, 3

Hawnt & Co. Ltd.,
59 Moor St. Birmingham, 4

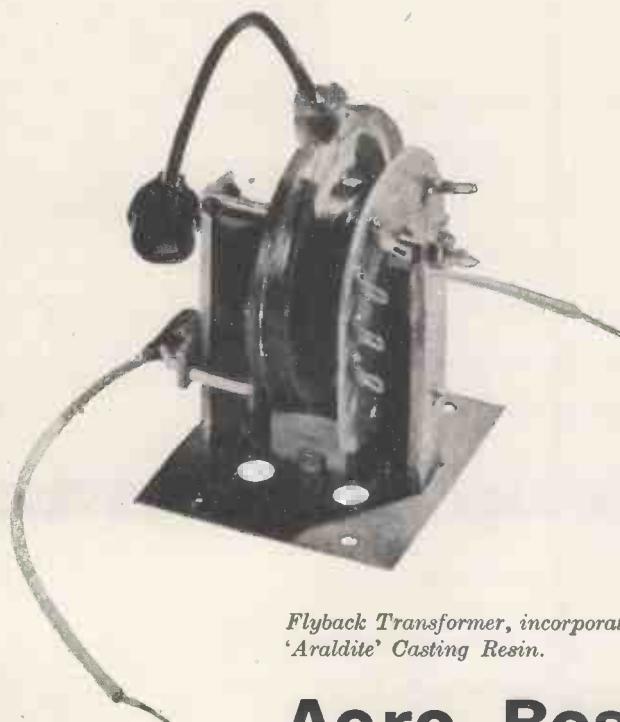
Atkins, Robertson & Whiteford Ltd.,
100 Torrisdale Street, Glasgow, S.2

'Araldite' epoxy resins for potting electrical equipment

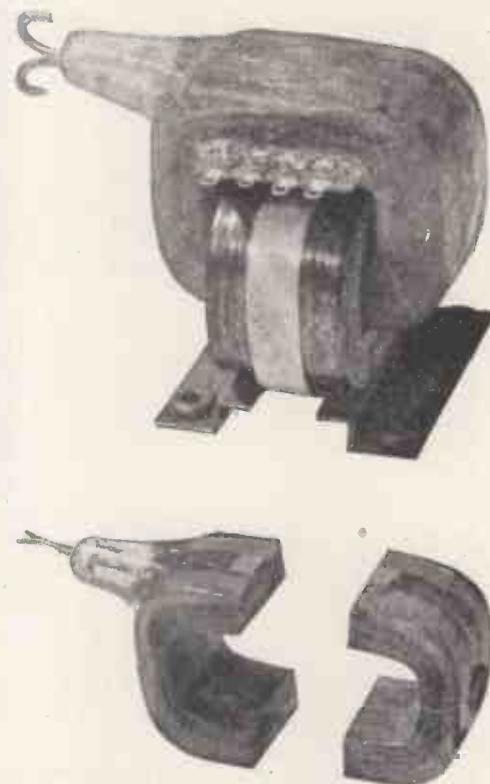
The most important properties required for potting transformers, capacitors, motor windings and other electrical equipment are now available in one and the same resin — 'Araldite' Casting Resin.

'Araldite' offers outstanding adhesion to metals, porcelain, mica, quartz and other non-porous materials. It provides good resistance to "tracking" combined with excellent insulating qualities. Equipment enclosed in 'Araldite' is sealed against moisture and protected against high temperatures and corrosive agents.

Simple to use, 'Araldite' hot- and cold-setting ethoxyline resins are proving especially suitable for large-scale production processes. No water or volatile substances are given off during setting and shrinkage is therefore extremely low.



*Flyback Transformer, incorporating
'Araldite' Casting Resin.*



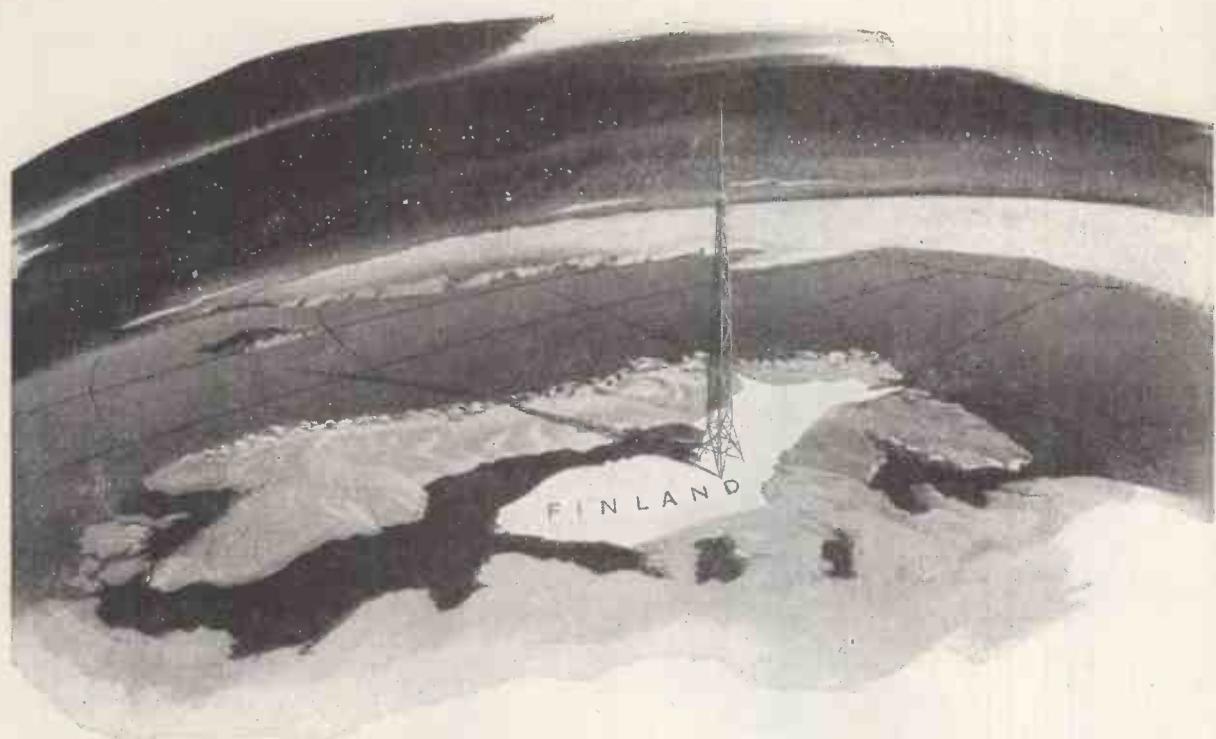
The potting of transformer coils makes good use of 'Araldite's excellent dielectric properties combined with outstanding adhesion to metals.

Note: 'Araldite' (Regd.) is also available in the form of hot- and cold-setting adhesives for bonding metals, ceramics, etc., and as a surface coating resin for the protection of metal surfaces.

Aero Research Limited

A Ciba Company, Duxford, Cambridge Telephone: Sawston 187

264/35A



Finland expands her radio services with 19 RCA Transmitters

Frequency Modulation Network Broadcasting aids her people

ONCE AGAIN, Finland's traditional foresight has carried her people forward in the march of progress.

From Lahti—where Finland's new broadcast center is growing toward completion—a *Frequency Modulation* network will reach out to all parts of the land. The network's nineteen RCA FM transmitters will carry the benefits of modern radio to Finnish people from Helsinki on the Gulf of

Finland to Utsjoki in the far North.

The Radio Corporation of America is proud of the opportunity to have cooperated in this significant achievement and joins Havulinna Oy, its distributor in Finland, in saluting the Government of Finland, and the Finnish Broadcasting Company . . . a pioneer in FM networking on the European continent.



RCA INTERNATIONAL DIVISION

RADIO CORPORATION of AMERICA

RCA BUILDING

30 ROCKEFELLER PLAZA, NEW YORK, N.Y., U.S.A.

"Marca Registrada"

Designed to obtain the best results from Modern Gramophone Technique

THE BURGOYNE R.G.1.

8 VALVE SUPERHET Custom Built RADIOPHONIC CHASSIS



Price **22 gns.**

We offer this de luxe radiogram chassis made by Tape Recorders (Electronics) Ltd., confident that you will gain the greatest satisfaction from the superior quality of both radio and record reproduction. So sure are we of the R.G.1's reliability that we offer with every chassis a TWO YEAR GUARANTEE (valves subject to the usual makers' guarantee).

SPECIFICATION

- ★ Illuminated full vision coloured tuning scale 11½in. x 6in.
 - ★ Negative feedback.
 - ★ Designed for minimum mains hum.
 - ★ Bass and Treble controls for cut and lift.
 - ★ 200-250 v. A.C. 50 c/s (110 v. A.C. available for export).
 - ★ Wavebands 16-50, 190-550, 1,000-2,000 metres.
 - ★ Magic eye tuning indicator and precision fly-wheel tuning.
 - ★ 8 watts push-pull output.
 - ★ 3 or 15 ohms impedance output to choice.
- We recommend high quality 10in. or 12in. Goodmans, Wharfedale and W.B. speakers for use with this chassis (3 or 15 ohms). All these available from stock.

H.P. Terms and Credit Sale

H.P. Terms : Deposit 154/- with 12 monthly payments of 29/-.
Credit Sale Terms : No Deposit, 9 monthly payments of 59/-, the first payment being sent with your order.
Carriage & Packing 7/6 extra.

Export

We specialise in speedy shipment to any overseas destination. Our price (exclusive of P.T.) for export buyers is £17/10/- sterling ex works.

HAVE YOU TOLD YOUR FRIENDS about the M.O.S. PERSONAL CREDIT PLAN?

Any type of equipment in our vast range of merchandise may be purchased under this plan which is essentially a personal one, as everyone has different requirements.

★ Two methods of purchase are available :—CREDIT SALE OR HIRE PURCHASE. The first allows you to own your equipment on payment of a first instalment of nine which are spread over 9 months. We quote the first instalment as one-ninth of the total purchase price, but if you so desire the first instalment can be any sum you please (within reasonable limits).

★ The second method secures delivery on payment of one-third of the cash price and the balance plus charges spread over any period up to 18 months. Again, we quote payments spread over 12 months but this may be varied.

★ Our range of electronic equipment is unequalled by any other firm, and can be inspected at your leisure in our spacious modern showrooms.

★ Your enquiries and orders will be dealt with confidentially whether by mail or personal shopping. We have years of experience behind us to advise and help you on your choice of goods. Carriage and packing is extra, all prices quoted being ex warehouse and subject to market fluctuations. Comprehensive lists are available upon request.

★ We specialise in export, and, having a world wide market for our merchandise, we have had to create a special export packing department, which, having had long experience of all types of packing for all markets, will ensure that your order reaches you safely wherever you are.

★ Satisfaction is always guaranteed to our customers, no matter how small the order, it will be valued by us.

Send us your Enquiry or Order Today !

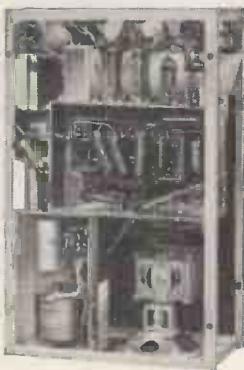


E. & G.

Telephone: MUSEum 6667.

MAIL ORDER
THE RADIO CENTRE.

Why we recommend the "EDITOR"



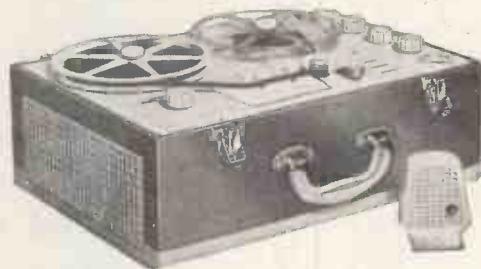
start with...

a new lightweight chassis—embracing the latest techniques of recorder construction. It has an output of 4 watts and achieves high quality reproduction with negligible wow and flutter. Precision built, the ingeniously planned circuitry is mounted on a steel frame that is easily removed from the case for inspection and maintenance in 30 seconds.



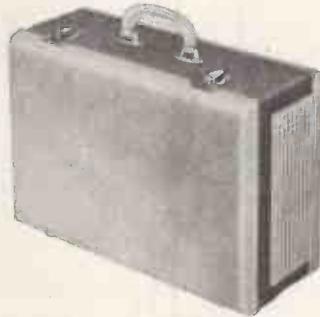
add a case...

only 5in. high of sturdy but lightweight construction with a strong carrying handle. It is available in various combinations of two tone leather-cloth with attractive gilt fittings.



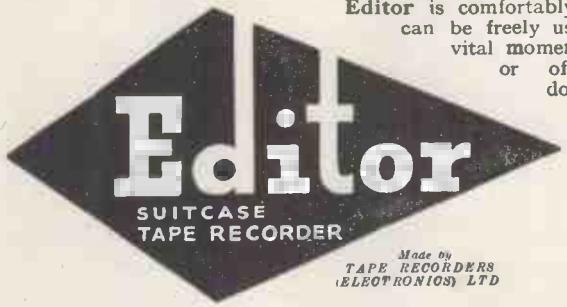
add a lid...

an integral part of the case, secured by neat clips—but is completely detachable. This allows unrestricted access to the easily operated controls. A magic eye ensures balanced recording and listening. High speed rewind motors facilitate ease of playback selection.



and you have...

The Editor—the smallest lightweight mains operated fully automatic tape recorder—and only 45 gns! Weighing 33 lbs., the Editor is comfortably portable and can be freely used to capture vital moments of business or of social and domestic events.



PRICE
ONLY **45** gns.

SPECIFICATION. ★ Tape speed 7½ in. per second. ★ Mullard miniature valves. ★ Twin track heads. ★ Three high grade specially designed recording motors give fast forward run and 50 sec. rewind without unlacing tape. ★ Independent Bass and Treble Controls for recording and playback. ★ Overall negative feedback. ★ 1,200ft. reel of tape gives over ONE hour playing time. ★ Amplifier may be used independently for very high quality record reproduction and public address. ★ High fidelity Record head. ★ Special high grade speaker. ★ Provision for external speaker. ★ Speaker muting switch. ★ 4 watts output—brilliant reproduction. ★ Positive servo braking on all functions. ★ Size only 16½in. x 12in. x 7in. (with lid). ★ Radio/gram and microphone inputs.

H.P. TERMS. £15.15.0 Deposit,
12 monthly instalments of 60/- Or 18
monthly instalments of 42/-.

CREDIT TERMS Send only £6
to secure with further monthly
payments of £6.

ACCESSORIES. The "Editor" is supplied complete and ready for use with a crystal desk microphone made specially for this equipment by RONETTE. The Coronation microphone can be supplied as an alternative if desired. A 1,200ft. reel of high coercivity specially recommended BURGOYNE tape is also issued with every recorder. Extra reels are available at 35/- per 1,200ft. reel 21/- per 600ft. reel.

SEE IT—AND HEAR IT—AT THE RADIO CENTRE



SUPPLY COMPANY

The Radio Centre, 33 Tottenham Court Road, London, W.I. Telephone MUSEum 6667

*in design—
and performance!*

HUNTS "THERMETIC" MIDGET METALLISED PAPER CAPACITORS WITH A TRUE HERMETIC SEAL

TEMPERATURE RANGE: -100°C to +120°C

and to CATEGORY 'A', CLASS H.I

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

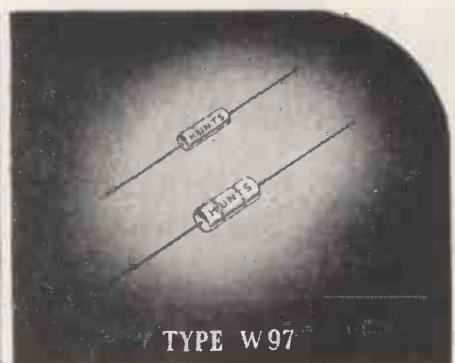
Construction is the well known Hunts "castellated" metallised paper with rugged end connections ensuring freedom from intermittent open circuit and open circuits at low voltage. The capacitor unit is sealed in a metal tube with Hunts "Thermetic" compound, which also ensures mechanical rigidity of the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

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

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

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

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



TYPE W97

TYPE W97 STANDARD RANGE

LIST NO.	CAP. μ F.	DIMENSIONS (inches)	L	D.
		200 volts D.C.	Wkg. up to 100°C.	
		150 volts D.C.	Wkg. up to 120°C.	
BM7	0.002	0.610	0.135	
BM8	0.004	0.610	0.135	
BM11	0.004	0.500	0.180	
BM9	0.005	0.610	0.135	
BM12	0.005	0.500	0.180	
BM10	0.01	0.610	0.135	
BM13	0.01	0.500	0.180	
BM14	0.02	0.610	0.180	
BM15	0.03	0.610	0.260	
BM16	0.04	0.610	0.260	

	400 volts D.C.	Wkg. up to 100°C.
	300 volts D.C.	Wkg. up to 120°C.
BM4	0.0004	0.610
BM5	0.0005	0.610
BM6	0.0001	0.610
BM17	0.001	0.500
BM18	0.002	0.500
BM19	0.003	0.500
BM20	0.005	0.610
BM21	0.01	0.610

	600 volts D.C.	Wkg. up to 100°C.
	450 volts D.C.	Wkg. up to 120°C.
BM22	2.5 pF.	0.500
BM23	4 pF.	0.500
BM24	10 pF.	0.500
BM25	50 pF.	0.500
BM1	0.0001	0.610
BM26	0.0001	0.500
BM2	0.0002	0.610
BM27	0.0002	0.500
BM28	0.00022	0.500
BM29	0.00025	0.500
BM3	0.0003	0.610
BM30	0.0003	0.500
BM36	0.0004	0.500
BM31	0.0005	0.500
BM32	0.001	0.500
BM33	0.002	0.610
BM34	0.003	0.610
BM35	0.004	0.610

A. H. Hunt (Capacitors) Ltd, Wandsworth S.W.18-BAT 1083

REGISTERED TRADE MARK

HUNTS
CAPACITORS

THE TRADE MARK OF RELIABILITY

READ WHAT USERS SAY

" May I tender my thanks to you for providing such an excellent job at a price which poor mortals like we can afford. It certainly is a big step towards realism in sound reproduction which until now I considered out of my reach. More power to your elbow ".

" I have purchased one of your H.F.1012 speakers, the results from which have astounded me. At the time of purchase I was sorely tempted to pay a much higher price for another make of speaker, but fortunately, I was able to try both under varying conditions, good and bad, and then there was no hesitation about the decision. If the H.F.1012 has a good life, and there seems no reason why it should not, then it is a most outstanding achievement in performance and price ".

" After reading P. Wilson's report of your new 10" speaker, H.F.1012, in the *Gramophone*, I immediately purchased one. Used in conjunction with a Leak Amplifier and a Leak Pick-up, the results were indeed remarkable. One would be tempted to say that at three times the price it would be exceptional ".

Stentorian HIGH FIDELITY UNITS

WITH THE PATENTED
CAMBRIC CONE

MODEL H.F.610. 6" Steel unit, incorporating 10,000 gauss magnet. Handling capacity, 3 watts. Frequency response, 60 c.p.s.-12,000 c.p.s. Bass resonance, 70 c.p.s. Price £2.10.6 (Tax Paid)

MODEL H.F.810. 8" Steel unit, incorporating 10,000 gauss magnet. Handling capacity, 5 watts. Frequency response, 50 c.p.s.-12,000 c.p.s. Bass resonance, 65 c.p.s. Price £3.0.6 (Tax Paid)

MODEL H.F.912. 9" Die-cast unit, incorporating 12,000 gauss magnet. Handling capacity, 7 watts. Frequency response, 40 c.p.s.-13,000 c.p.s. Bass resonance, 45 c.p.s. Price £3.7.0 (Tax Paid)

MODEL H.F.1012. 10" Die-cast unit, incorporating 12,000 gauss magnet. Handling capacity, 10 watts. Frequency response, 30 c.p.s.-14,000 c.p.s. Bass resonance, 35 c.p.s.

Price £3.13.6 (Tax Paid)

Transformer available if required
All models available either 3 or 15 ohms.



Prov. Pat.
10037/53

*...and remember
what the experts said:*

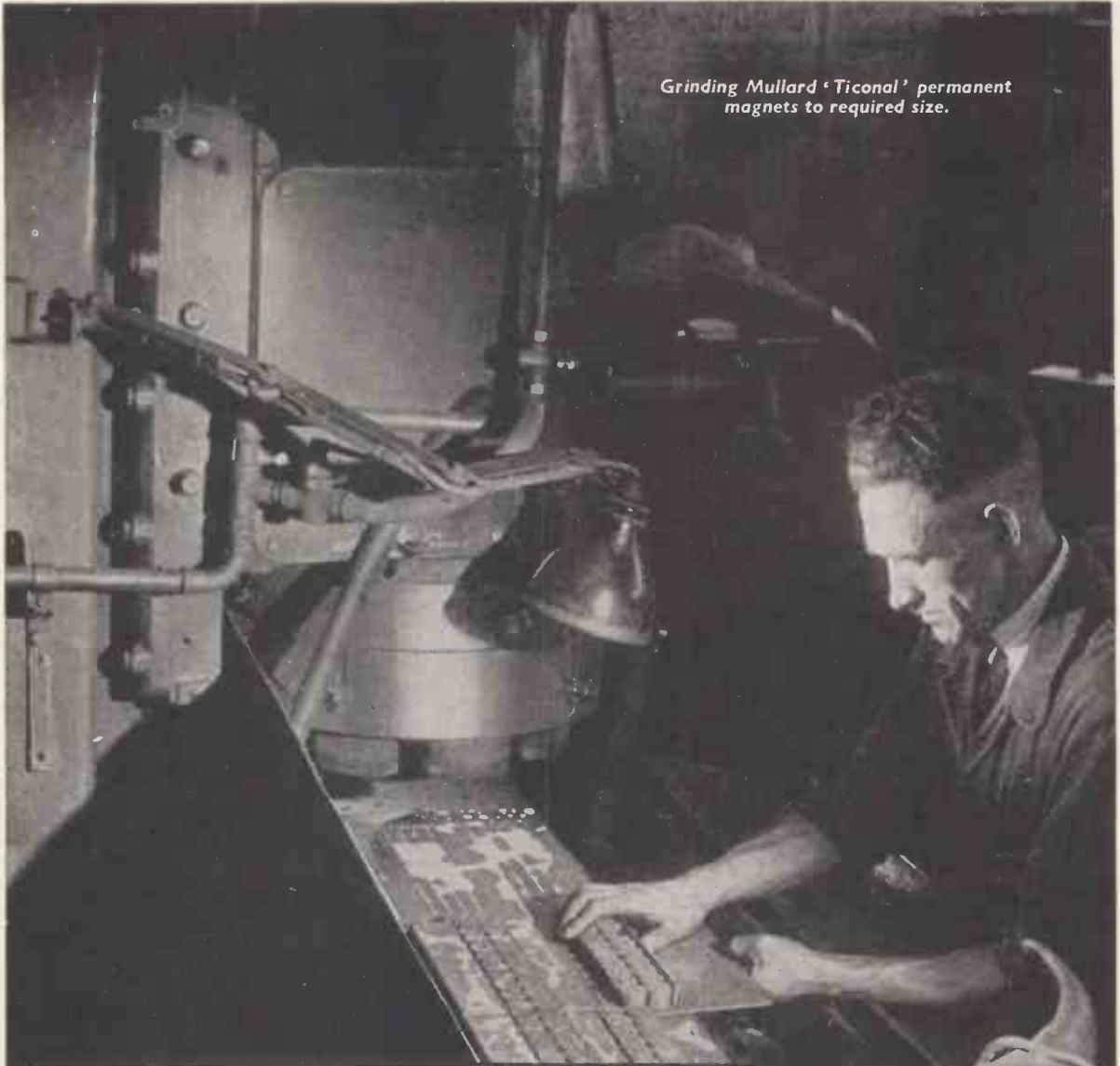
These new speakers have scored a sensational success : even we are amazed at the enthusiasm they have aroused. Hear what the experts say : "A great advance in speaker technique" (F. J. Camm); "A new thrill in high fidelity reproduction" (John Gilbert); "An extension of the bass-response which is truly remarkable" (H. J. Barton-Chapple); "The smoothness of response is one of the really remarkable characteristics" (P. Wilson).

This consensus of opinion proves that the introduction of the cambric cone represents an amazing advance in loudspeaker design and performance. This achievement by W.B. engineers crowns thirty years' experience and progress in sound reproduction.

● Write for leaflet giving full technical details, or ask your dealer to demonstrate. Alternatively, these speakers may be heard at our London Office, 109 Kingsway, W.C.2, any Saturday between 9 and 12 noon.

WHITELEY ELECTRICAL
RADIO CO. LTD.
MANSFIELD · NOTTS





Grinding Mullard 'Ticonal' permanent magnets to required size.

MAGNETIC MATERIALS Extensive research and manufacturing facilities have established Mullard as the leading producers of magnetic materials. They were the first, for example, to introduce Ferroxcube, the world's most efficient magnetic ferrite; 'Ticonal' anisotropic permanent magnets, renowned for their high stability and high energy output; and Magnadur, an entirely new type of permanent magnet with the insulating properties of a ceramic.

The wealth of experience gained from these developments is available to all users of magnetic materials through the Mullard advisory service. An enquiry to the address below will put a team of specialised engineers at your disposal.



Mullard

'TICONAL' PERMANENT MAGNETS • MAGNADUR (Formerly Ferroxdure)
PERMANENT MAGNETS • FERROXCUBE MAGNETIC CORE MATERIAL

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

To start you talking —and listening



A booklet
describing the
QUAD II
is available
on request from

 **ACOUSTICAL**
MANUFACTURING CO LTD
HUNTINGDON · HANTS · TEL: 361

Those who have followed the growth of high quality reproduction in recent years may wonder how it is possible to improve still further the amplifier part of the system. Yet, like its predecessor, the QUAD II introduces entirely new features of importance to the final objective—features anticipating trends in design of both amplifier and associated equipment.

Engineers will readily appreciate among the many salient points of design of this amplifier, the complete stability under all load conditions. They will delight too in the unique low noise pickup matching system and in the new wide range filter developments.

The gramophone enthusiast will be pleased to find that his moving coil pickup no longer requires a transformer; that each of the seven playback characteristics is accurately provided at the touch of a button; that the logical system of filter control gives him low distortion without the sacrifice of correct musical balance.

Above all, the musician will find that the QUAD II gives the closest approach to the original sound. . . . The QUAD II booklet will tell you why.



PRICE £42.0.0 RETAIL

ADVANCE COMPONENTS LTD., BACK ROAD, SHERNHALL STREET, LONDON, E.17

Telephone : LARKswood 4366/7/8



*The Advance type HI Audio
Signal Generator completely covers the
unusually wide range of 15 c/s to 50,000 c/s.*

*It is characterised by its extremely low
distortion and level output over the
entire range; provides both sine
and square wave output. A robust,
reliable and accurate instrument for
the discriminating service engineer*

- Accuracy $\pm 1\%$, ± 1 c/s. ● Distortion less
than 1% at 1,000 c/s. ● Output from
200 microvolts to 20 volts with accuracy of
 ± 2 db. ● Weight 14 lb. ● Size $13\frac{1}{2}'' \times 10\frac{1}{2}'' \times 8''$

*Full technical details
available in Folder W/16.*

THE ADVANCE TYPE HI

Advance
audio generator

ADVANCE COMPONENTS LTD., BACK ROAD, SHERNHALL STREET, LONDON, E.17

Telephone : LARKswood 4366/7/8

Modesty forbids...

...that we reproduce all the letters of appreciation we receive. But when one like this turns up what can we do?

261 Heather Road,
Small Heath,
Birmingham.

Dear Sir,

I do a great deal of record reproducing as a pastime. I have already made a corner cabinet for the AUDIOM 60 and the sound production is simply marvellous, and in my honest opinion I think it is superb.

I have had all different types but never have I found anything to equal the AUDIOM type of reproducer.

What other loudspeaker could bring forth greater genuine praise?—except, perhaps, another Goodmans' High Quality reproducer. What immense versatility this high-powered, single cone AUDIOM 60 has! The secret?—fine sensitivity plus robust construction. The AUDIOM 60 will work as well from a battery set as it does in an Electronic organ. And as for radio and record reproduction of varied input, it will reduce background noise encountered in the playing of vintage recordings—and more—because of its low harmonic and intermodulation distortion the AUDIOM 60 is extensively used as a bass unit in cross over networks, whilst its success as a P.A. unit is widely acclaimed.

AUDIOM 60

BRIEF SPECIFICATION

Fundamental Resonance	75 c/s
Voice Coil Impedance	15 ohms
Power handling capacity	15 watts peak A.C.
Flux density	14,000 gauss
Net weight	12 lb 3 oz.
Price.....	£8 12 6

(Free of Purchase Tax)

Remember there is a loudspeaker in the Goodmans AXIOM and AUDIOM range for every application and you are invited to write for full details, advice and free dimensioned drawings of specially designed reflex cabinets.



GOODMANS

GOODMANS INDUSTRIES LIMITED AXIOM WORKS, WEMBLEY, MIDDLESEX, ENGLAND.

Telephone : WEMbley 1200. Cables : Goodaxiom. Wembley. England.

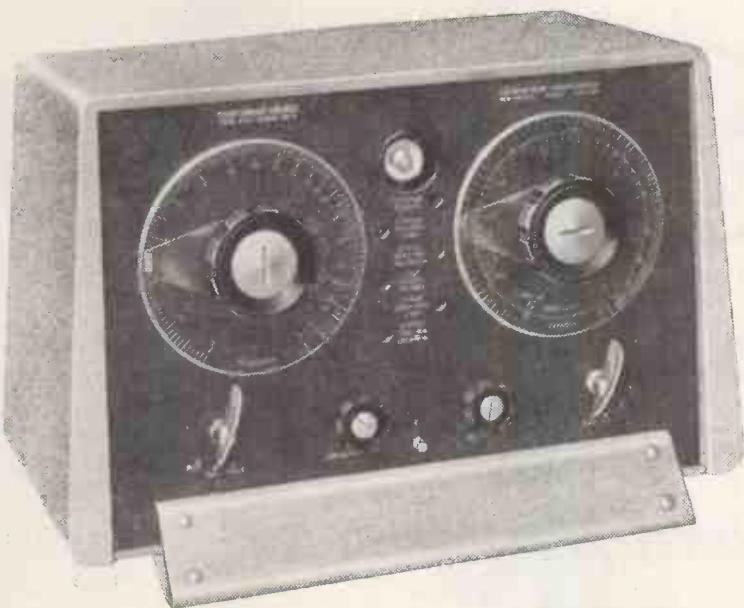
Clatter?

To put up with noise and vibration in machinery is as modern as to ride a bone-breaker with solid-rubber tyres. "Clatter" in a factory shatters nerves, paralyses production, raises maintenance costs. Don't stand for it.

OR WRITE TO RUBBER BONDERS LIMITED DUNSTABLE, BEDFORDSHIRE

We will send our new Flexilant catalogue. This illustrates all the recent progress in the science of bonding rubber to metal—thus deadening noise, killing vibration, cushioning shock. We're also glad to advise on special problems.





A New Component Bridge

THE WAYNE KERR MODEL B.121

A MODERATELY PRICED self-contained instrument, capable of a wide range of accurate measurements.

In addition to giving direct readings of resistance, capacitance, and inductance, it will measure the impedance between any pair of terminals in a three-terminal network, and it can also be used for in situ measurements of component values.

Two individually calibrated dials give simultaneous readings of parallel combinations of resistive and reactive components, with independent scale multiplying of R and C values. The mains supply constitutes the source, and a selective amplifier with sensitive "magic eye" is used for null indication.

Specification

RESISTANCE RANGE: 3 ohms to 1,000 megohms, using six ranges and 3 multipliers of 0.1, 1 and 10.

CAPACITANCE RANGE: 1.0 pF to 1,000 μ F, using six ranges and 3 multipliers of 0.1, 1 and 10.

INDUCTANCE RANGE: 100 mH to 10,000 H in five ranges.

ACCURACY: 2% on all ranges over the major part of the scale. If higher accuracy is required, the instrument can be supplied hand-calibrated.

POWER SUPPLY: 110/115 V. or 200/250 V. at 50 c/s — 10 W. approx.

DIMENSIONS: 17 $\frac{1}{2}$ " x 10 $\frac{1}{2}$ " x 10" high.

WEIGHT: 15 lb. approximately.

Wayne
Kerr

Standard

microphones
maintain the highest standards in
design and performance
for every purpose

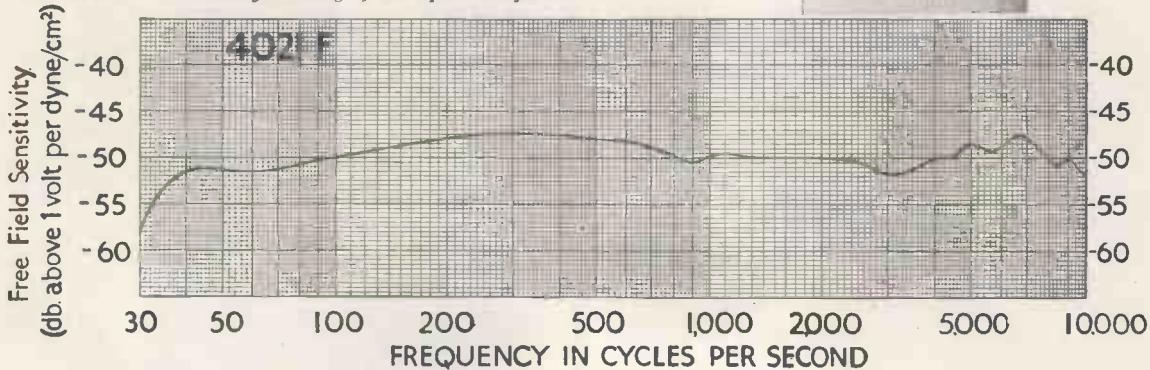
Type 4021

A GENERAL PURPOSE STUDIO MICROPHONE
FOR RADIO, TV., SOUND-REINFORCEMENT
AND RECORDING

This well-known moving-coil microphone has been the subject of continuous research and improvement since 1937. It continues to satisfy a universal demand for an instrument which combines a very high fidelity of response with a mechanically robust design, at a reasonable cost. Extensively used as a calibrated standard for acoustic measurements, each microphone is individually manufactured to very fine limits and is tested after manufacture to conform with the highest laboratory standards.

Alternative front baffles are available to give omni-directional or directional response. Delivery of the latest improved models is ex stock.

*Approved extract from National Physical Laboratory report.
Typical 4021-F microphone showing frequency response
characteristics at secondary winding of an input transformer*



Bulletins and prices of all Standard microphones are available on request to



Standard Telephones and Cables Limited

PUBLIC ADDRESS DEPARTMENT, Connaught House, Aldwych, London W.C.2

PROBLEM-

145 × 2 × 3

SOLUTION-



BRITISH PATENT No. 680632

SAVE your slide rule—the real answer is 870—that's the number of different resistors in the 'T' & 'R' range—145 preferred types in two wattages and three tolerances.

Add to that, the fact that it is necessary to carry stocks of each, it's no wonder the problem of storage is a real headache—unless of course they're LABpak'd.

LABpak continuous storage units solve the whole problem giving positive segregation of ohmic values with finger type selection of card index simplicity. Carded LAB resistors may be added as stocks deplete and are readily obtainable from usual wholesalers. Furthermore, the continuous storage unit is FREE with a small initial order for 180 type 'R' or 240 type 'T' resistors, the values of which YOU can specify.

The scheme's well worth investigating—ask your wholesaler or drop us a line for illustrated list.

RESISTOR SPECIFICATION

Ref.	Type	Loading	Max. Volts	Range	Dimensions
T	½-watt	½-watt	250	10 ohms to 10 megohms	⅛" × ½"
R	½-watt	1-watt	500		⅛" × ⅓"

Tolerance available ±20%, ±10%, ±5%

The Lab Continuous Storage Units are available from your normal source of supply, but more detailed information can be obtained on request.

THE RADIO RESISTOR COMPANY LTD.

50 ABBEY GARDENS, LONDON, N.W.8

Telephone: Maida Vale 5522



*accuracy on a
small scale*

Pullin Miniature Instruments are of unique and robust construction. A new die-cast frame, integral with top bearing bridge-piece and centre iron, permits precision boring of the jewel mounting holes thus ensuring exact alignment of the coil. This gives an evenly balanced scale and a very high standard of accuracy is maintained.

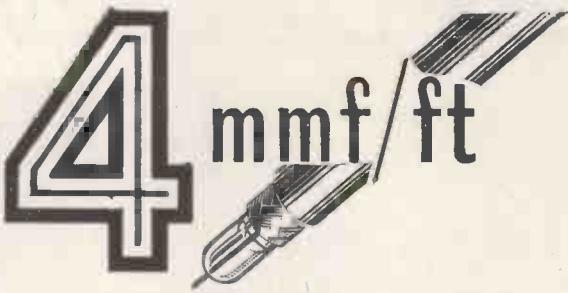


INSTRUMENTATION BY

PULLIN

DYNAMOMETER TESTING SETS MULTIRANGE TEST SETS
MEASURING INSTRUMENTS PORTABLE TESTING INSTRUMENTS
INDUSTRIAL SWITCHBOARD INSTRUMENTS

MEASURING INSTRUMENTS (PULLIN) LTD.
ELECTRIN WKS., WINCHESTER ST., ACTON, LONDON, W.3
Telephone: Acorn 4651 & 4995 Telegrams: Mipulco, Ealux, London.



AIR-SPACED ARTICULATED **CO-A-X** CABLES

offer a unique combination of

- ✓ FRACTIONAL CAPACITANCE
- ✓ HIGH IMPEDANCE
- ✓ MINIMUM ATTENUATION
- ALONG WITH
- ✓ EXCEPTIONAL FLEXIBILITY
- ✓ LIGHT WEIGHT

38 STOCK TYPES

FOR ANY OF YOUR STANDARD
OR SPECIAL APPLICATIONS

A few of the very low capacitance types are:

Type No.	Capacit. $\mu\mu$ F/ft.	Impedance ohms	O.D.
C.44	4.1	252	1.03"
C.4	4.6	229	1.03"
C.33	4.8	220	0.64"
C.3	5.4	197	0.64"
C.22	5.5	184	0.44"
C.2	6.3	171	0.44"
C.11	6.3	173	0.36"
C.1	7.3	150	0.36"

TRANSRADIO
CONTRACTORS TO
H.M. GOVERNMENT
LTD.

138A CROMWELL ROAD, LONDON, S.W.7

REAL HIGH FIDELITY at modest cost . . .

• Manufacturer-to-Consumer policy saves you one-third cost !!

You may have already extended your record reproducer to include the now firmly established L.P. Records. You may be considering doing so. In either case, for real high fidelity at modest cost, it will pay you to consult us. Our aim is not just to sell you equipment but to save you money and to ensure that you get the apparatus most suited to your needs. Discuss

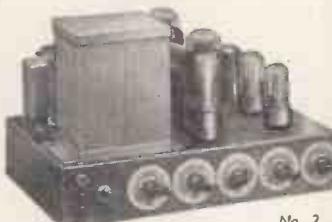
your problem with our Chief Engineer (available daily including Saturdays 11 a.m. to 6 p.m.). Or write enclosing 2½d. stamp. This Technical Guidance Service will cost you nothing and save you pounds.

NOTE: Regarding Pick-up heads to take standard or miniature thorns for 78 r.p.m., these can be supplied with any of the single-record Gram Units or Auto-changers sold by us, if desired.



No. 1

No. 1 "SYMPHONY" AMPLIFIER is a 3-channel 5-watt Gram/Radio Amplifier with astonishingly flexible tone-control. You can lift the treble, the bass, or—and here is the unique feature—the middle frequencies to suit your own ear characteristics and the record or radio programme being heard. It is thus possible to arrange the frequency-response of the amplifier to a curve equal and opposite to the resultant curve of the other items in the chain so that what finally registers in the brain is as per original. This flexibility of control is far more important than mere nominal linear response of the amplifier, as the pick-up, speaker, etc., are not linear. Independent Scratch-Cut is also fitted and special negative-feedback circuit employed. The amplifier can accommodate a wide variety of records from old 78's to new L.P.'s. Input is for all types of pick-up of 0.2v. output or more and there is full provision (and power) for Radio Tuner. It is available to match 2/3 or 15 ohms speakers. Price: 10 gns. (carriage 5/-). Fitted in Portable Steel Cabinet 35/- extra.



No. 2

No. 2 "SYMPHONY" AMPLIFIER as No. 1 but with 10-watt Push-Pull triode output and triodes throughout. Woden mains and output transformers and choke. Full provision and power for Tuner. Output tapped 3, 7.5 and 15 ohms. Competes with the most expensive amplifiers on the market yet costs only 15 gns. (carriage 5/-). Fitted in portable Steel Cabinet 2 gns. extra.



"SYMPHONY" AMPLIFIERS with REMOTE CONTROL. Both the above model Amplifiers are available with all controls on a separate Control panel with up to 4 feet flexible cable which simply plugs into the amplifier. Enables the Amplifier proper to be sat in the bottom of a cabinet whilst the controls are mounted conveniently higher up. Extra cost 2 gns.

THE N.R.S. NO. 2 PUBLIC ADDRESS AMPLIFIER for 200/250 volts A.C. mains gives output of 15 watts audio. Valve line-up: 6SL7, 6SN7, input and phase splitters, feeding 2 x 6V6 beam power tetrodes in push-pull, 5Z4 rectifier. Twin inputs with separate volume controls enabling gram. and mike or twin turntables to be faded in and out. Tone control is fitted and output is for 3, 7.5 and 15 ohms. This amplifier is built on the same de luxe hammer-finish chassis as the Symphony No. 2 and incorporates the same robust Woden mains transformer and choke, ensuring extreme reliability and absolute confidence in the instrument on the job. We can highly recommend this instrument as gramophone, microphone and radio amplifier for dances, socials, etc., in halls, clubs, institutes, etc. Price in Kit form £12. Fully built and tested 13 gns. Carriage 5/-, Hammer-finish Steel Cabinet with handles, 2 gns. extra.

GARRARD 3-SPEED GRAM UNIT MODEL "T." With turnover Magnetic Pick-up Head or Turnover Astatic Crystal Head, £10, post and pack, 2½.

MODEL "TA," as above, but fitted with the latest Radio Show High-Fidelity Acos HGP35 Pick-up Heads (one for Std. and one for L.P.). Price £12/3/9, post and pack. 2½. Heads only, 43/- each, post 1/-.

Model "TB," as above, but with two separate Decca XMS Heads, £13/7/6, post and pack, 2½. Or with two separate Acos GP19 Mk. 2 Heads, £12/10/-, Or with Garrard Head for fibres (78) and Acos GP19 Mk. 2 for L.P., £12/5/-, post 2/6.

GARRARD 3-SPEED AUTO-CHANGERS, Model RC80, plays up to ten records 7in., 10in. or 12in. at 78, 45 and 33½ r.p.m. Stylus pressure on L.P. 10 grammes (adjustable). New ultra-sensitive auto-trip mechanism and heavily loaded turntable to eliminate "wow." Price £14/2/6 or with Garrard Magnetic or Astatic Crystal Turnover Pick-up Head, £16/2/6. With two separate Acos Hi-Fi Heads, £18/2/6. With two separate Decca XMS Heads, £19/7/6. Carriage 5½. Optional Extras: 45 r.p.m. Auto Centre Spindle, 20/9; A.C./D.C. Operation £7/14/- Fitting in de luxe rexine-covered Portable Cabinet, £5. Pick-up Head to take Fibre Needles, 25/- to 35/-.

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

ABOVE GARRARD UNITS are for A.C. Mains but are also available at extra cost as follows: 6v. D.C. 90/-; 12v. D.C. 90/-; 200-250v. A.C./D.C. 153/-.

VIBRATOR POWER UNITS to enable the use of any modern A.C. Record Player together with one of our Symphony Amplifiers from D.C. mains £12 post paid.

GARRARD 3-pin plug-in MAGNETIC PICK-UP HEADS for Fibre or Steel Needles fit Garrard and Decca Arms. Prices: Standard 25/-; Miniature high-impedance 35/-; Miniature low impedance 25/-. Postage 1/-. Garrard Arm 35/-; Decca XMS Arm, 23/6. Post 1/-. Advice re. matching if required.

COLLARO latest model A.C.3/534 3-SPEED GRAM UNIT with new "STUDIO" Pick-up type "O" or "P," £10/6/1, post 2/6.

COLLARO latest model 3RC531 AUTOCHANGER with "STUDIO" PICK-UP type "O" or "P" £15/3/10, carr. 5/-, DITTO but Mixer (3RC532), £17/9/6.

COLLARO "STUDIO" PICK-UP (Arm and Head) type "O" or "P" 74/8, post 2/-

RECORD PLAYER CASES, rexine-covered with hinged lid and carrying handle and fasteners and uncut motorboard. Standard model to spring-mount any Garrard, Collaro or B.S.R./Decca Gram Unit, 57/6, post 2/6. Ditto autochanger size 90/-, carriage 5/- As Standard but extra large for Connoisseur Motor and one or two Pickups 67/6, carr. 5/-

TAPE DECKS. We stock and recommend the latest TRUVOX Mark 3. Price 22 gns., carriage free.

ILLUSTRATED CATALOGUE AND SUPPLEMENT. Our new catalogue just published will save all those considering the purchase of radio or record-reproducing equipment much time, trouble and money. Send two 2½d. stamps for your copy now! Our CHIEF ENGINEER will be pleased to afford TECHNICAL ADVICE where required.

HIRE PURCHASE FACILITIES
NOW AVAILABLE on orders of £15 or over.
Send one-third deposit with order, balance over 6 or 12 monthly instalments. State which required.

NORTHERN RADIO SERVICES

16 KINGS COLLEGE RD., ADELAIDE RD.,

LONDON, N.W.3. Phone : PRImrose 8314

Tubes : Swiss Cottage and Chalk Farm.

Buses : 2, 13, 31, 113, 187.



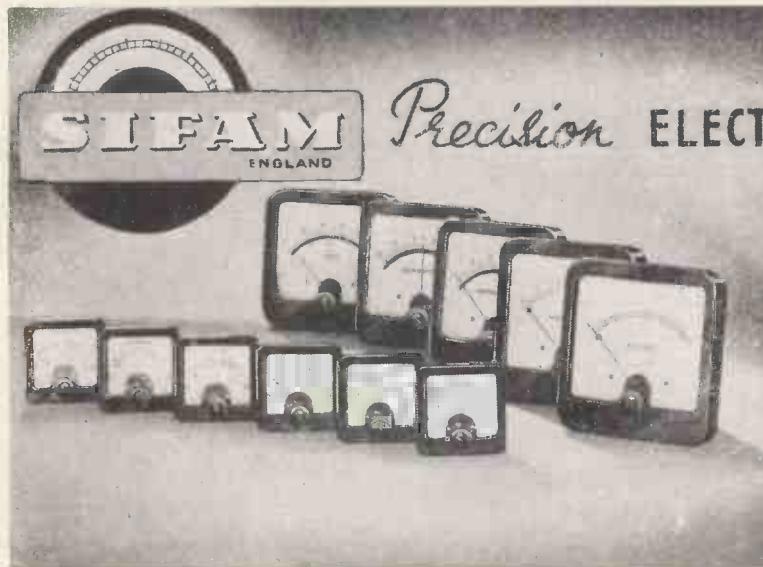
GOODMANS CORNER CABINETS (above) for the AXIOM 150 Mark 2, manufactured by us to Messrs. Goodmans own design. Price: complete kit in plain board with felt, 8 gns. Price ready built, 10 gns. Finished in figured walnut, 16 gns. Other veneers to order. Carriage extra.

"SYMPHONY" BASS REFLEX CABINET KITS. 30in. high, consist of fully-cut 2in. thick, heavy, inert, non-resonant patent acoustic board, deflector plate, felt, all screws, etc., and full instructions. Bin. speaker model, 85/-; 10in. speaker model, 97/6; 12in. speaker model, £5/7/6. The design is the final result of extensive research in our own laboratory and is your safeguard of optimum acoustic results. Carriage 7/6. Ready built, 10/6 extra.



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

For the LABORATORY and PRODUCTION LINE



Precision ELECTRICAL INSTRUMENTS

In addition to our well-known standard ranges of 2in. to 4½in. square and round panel-mounting instruments, the following are a few examples of special types which we have developed to meet industrial requirements :—

- Moving coil rectifier type to suit various frequencies, for laboratory use.
- 6in. and 8in. Portables. Sub-standard or B.S. 1st Grade.
- Pyrometer indicators.
- Thermo-couples for temperature measurement.
- Audible Braille Multi-range mA.
- Contact Voltmeters.
- D.C. Shunts up to 2,000 amperes.

Write for illustrated catalogue detailing the wide SIFAM range.

SIFAM Electrical Instruments fully meet the high standards of accuracy and reliability demanded by modern industrial techniques, production control, laboratory testing, etc.

SIFAM ELECTRICAL INSTRUMENT CO. LTD. Leigh Court, Torquay. Telephone : TORQUAY 4547-8



Facsimile in Sound



3-SPEED MOTOR

3-HEAD PICKUP

Identify each instrument in the orchestra with "Connoisseur" High Fidelity Equipment. Records seem to live when played. The 3-speed motor (33½, 45, 78 r.p.m.) with 12in. turntable is priced (without pickup) at £21/17/3.

The 3-head pickup (if required with one head £5/19/3) extra heads £3/6/3. Spare Armature System with sapphire 13/7.

All prices stated include Tax.

WELL GREEN LANE, BRIGHOUSE, YORKSHIRE
Telephone: Halifax 69169

Connoisseur

High Quality Equipment

**A. R. SUGDEN & CO.
(ENGINEERS) LTD.**

OVERSEAS AGENTS : S. Africa : W. L. Procter (Pty.) Ltd., 63 Strand Street, Cape Town. Australia : J. H. McGrath & Co. Pty., Ltd., 208 Little Lonsdale Street, Melbourne. Canada : The Astral Electric Co. Ltd., 44 Danforth Road, Toronto 13, Ontario. New Zealand : Turnbull & Jones Ltd., Head Office 12/14 Courtenay Place, Wellington. Hong Kong : The Radio People, Ltd., 31 Nathan Road, Hong Kong. Malaya : (Main Distributors) Eastland Trading Co., 1 Prince Street, Singapore.

THE ELAC "DUOMAG" FOCALISER

THE SENSATIONAL NEW ELAC T/V COMPONENT

The DUOMAG focaliser gives precision beam focus and complete picture positioning with minimum effect on scan coils and ion trap assemblies. It is designed for use with magnetically focused tubes having 38 m/m diameter necks.

DUOMAG is a permanent magnet type unit using two concentrically mounted Sintered Oxide ring magnets arranged with opposed magnetic fields.

- Minimum stray magnetic field. Symmetrical, uniform and very low external field.
- Magnets of high electrical resistivity enable the unit to be placed in close proximity to high efficiency scan coils.
- All insulated construction—No risk of high voltage shock.
- Wide range picture shift.

RETAIL PRICES IN U.K.

Low Flux, 37/6 ; Med. Flux, 39/6 ; High Flux, 42/-.

*Leading the
field in TV
components*



ELECTRO ACOUSTIC INDUSTRIES LTD

STAMFORD WORKS. BROAD LANE. TOTTENHAM. N.15 TEL: STAMford Hill 5606-8

ECOUTEZ!
Mesdames et Messieurs

— and **MAKE SURE**
of NATURAL REPRODUCTION

With a **BAKERS**
Permanent Magnet
LOUD SPEAKER

12 in. 15 watt 'DE LUXE'

Frequency Range 18 to 17,000 c.p.s.

Fundamental Resonance

(approx.) 35 c.p.s.

Peak A.C. Input (open baffle)

15 watts.



**15 in. 30 WATT
'AUDITORIUM'**

Frequency Range

20 to 14,000 c.p.s.

Fundamental Resonance

(approx.) 40 c.p.s.

Peak A.C. Input (open baffle)

30 watts.

**12 in. 20 WATT SINGLE
CONE**

Frequency Range 25 to 16,000 c.p.s.

Fundamental Resonance

(approx.) 45 c.p.s.

Peak A.C. Input (open baffle)

20 watts.



The "Selhurst" corner cabinet finished in walnut, oak or mahogany provides the perfect housing for all BAKER Speakers.

5 cu. ft. & 8 cu. ft.
models available.

BAKERS
'Selhurst'
RADIO



Please write for full details to:
24 DINGWALL ROAD,
CROYDON, SURREY
Croydon 2271/2

Sole Distributors for Eire: BRIAN CURRAN, 283 Harold's Cross Road
TERENURE, DUBLIN.

EGEN

MINIATURE POTENTIOMETERS

Designed to meet the demand for Egen reliability within the smallest possible compass, these exceptionally small carbon potentiometers (1" diameter) retain all the desirable features of their standard-size counterparts. The special Egen carbon deposition process ensures a highly stable resistance element of extreme durability.

Double-contact rotor provides firm balanced contact with exceptional freedom from wear and noise. Positively located soldering tags, silver plated for easy soldering. All steel parts rustproofed.

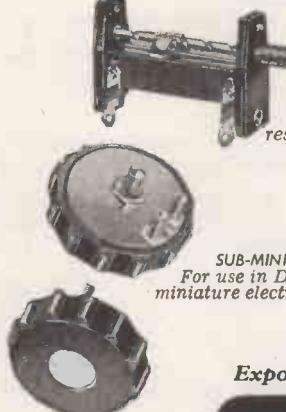
Standard resistance values available, from 5000 ohms to 2 megohms.

Type 105 is identical to Type 115 except that a 2-pole Q.M.B. switch is incorporated.



TYPE 105

PRE-SET RESISTORS
A wire-wound pre-set resistor for panel or chassis mounting



SUB-MINIATURE VOLUME CONTROLS
For use in Deaf Aids and other miniature electronic apparatus

Export enquiries welcomed

EGEN

POTENTIOMETERS

EGEN ELECTRIC LTD.,
CHARFLEET INDUSTRIAL
ESTATE, CANVEY ISLAND, ESSEX • PHONE: CANVEY 691-2

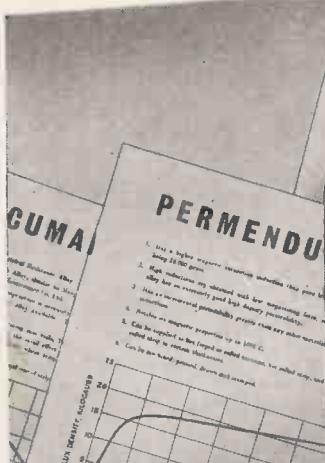
TELCON MAGNETIC ALLOYS

Telcon magnetic and special purpose alloys are used in a vast and ever expanding field of industrial and electrical applications.

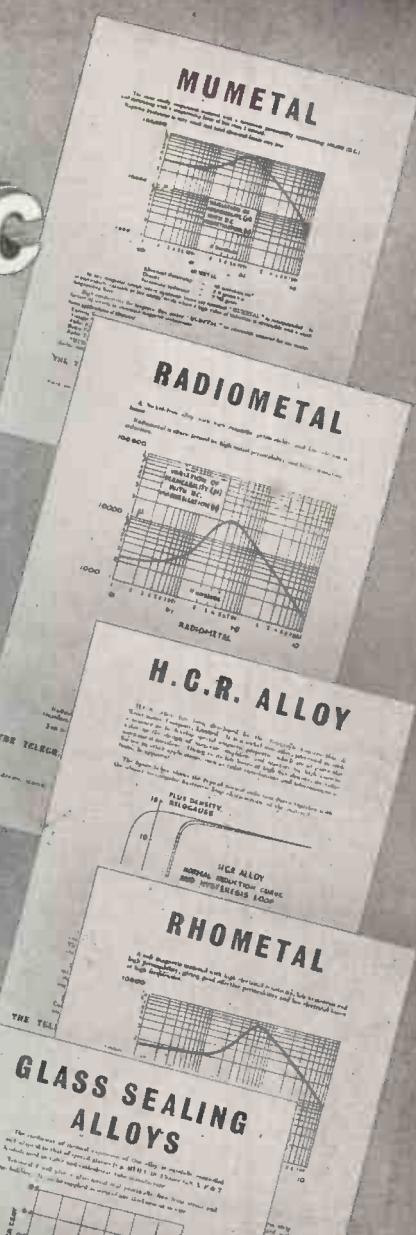
It is almost certain that a Telcon Metal exists to meet your specific needs, but if not, we will gladly co-operate with you in finding the answer to your particular problem.

All Telcon Metals are subject to the most rigorous control and repeated inspection, and this ensures the highest standards of reliability.

The reputation of many world-famous products is solely dependent upon the utilisation of Telcon Metals.



TELCON METALS



The inevitable choice for

MAGNETIC CIRCUITS IN INSTRUMENTS OF ALL KINDS INCLUDING:
CURRENT & VOLTAGE TRANSFORMERS, COMMUNICATION TRANSFORMERS,
RADIO FREQUENCY, RADAR & T.V. TRANSFORMERS, BRIDGE MEASUREMENT
TRANSFORMERS, SPECIAL REACTORS, INDICATING INSTRUMENTS, RELAYS,
MAGNETIC AMPLIFIERS, GALVANOMETER, WATTMETER, C.R.T. AND
TRANSFORMER MAGNETIC SHIELDS, PICK-UP DEVICES, REGULATORS.

*Complete technical data on the full range of Telcon alloys is available
to designers and manufacturers on request.*

THE TELEGRAPH CONSTRUCTION & MAINTENANCE CO LTD

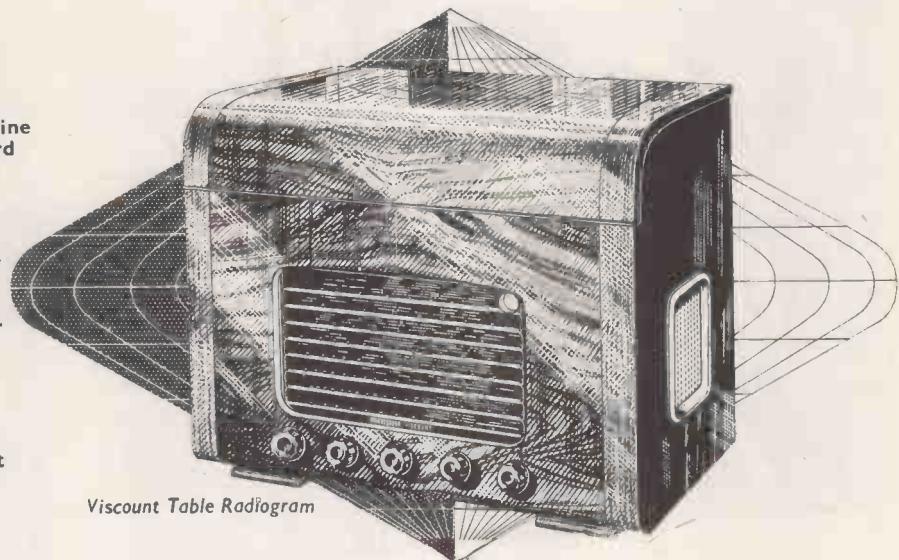
Head Office: 22 OLD BROAD ST., LONDON, E.C.2 Telephone: LONDON Wall 7104
All enquiries to: **TELCON WORKS, GREENWICH, S.E.10** Telephone: GReenwich 3291



for world wide reception

The Viscount Table Radiogram is a new long range nine valve superhet with Garrard 3-speed Autochanger. Six electrically band-spread ranges in the 13, 16, 19-20, 25, 31 and 41 metre bands, M.S.W. and M.W. or M.W. and L.W., A.C. operation, push-pull output. Twin speakers. Large glass dial. 12½ in. scale length each band. Separate bass and treble controls. Tuning indicator.

At present for export only. Available on the home market in March.



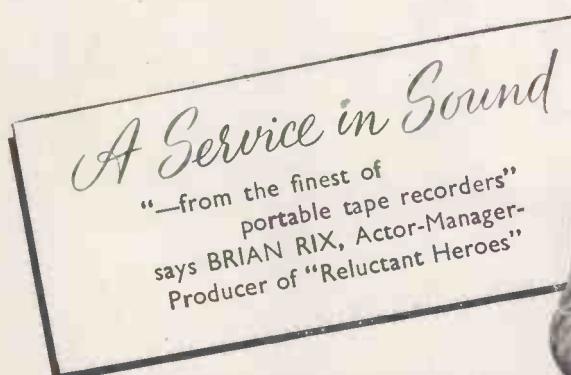
Viscount Table Radiogram

the AMBASSADOR Viscount

AMBASSADOR RADIO AND TELEVISION

PRINCESS WORKS

BRIGHOUSE



Brian Rix, G2DQU, successful impresario with a keen interest in Amateur Radio, has a trained ear for the technical merits of the Baird Tape Recorder. "Here is a portable instrument," he says, "with a performance equal to that of costly professional equipment. Its distortion-free true-to-life recordings are the result of many new and impressive advances in high fidelity technique. The finest of all portable recording instruments, it's invaluable at rehearsals."

Complete with
microphone and
tape 65 gns.

BAIRD
SOUNDMASTER

ALL-BRITISH TAPE RECORDER

BAIRD RECORDING TAPE CEMENT is specially prepared for splicing plastic base magnetic tape. Makes clean, quick-setting joints, which are strong and free from creeping. Each bottle is fitted with a brush for easy application. 3/6d.

(post and packing 6d. extra)

BAIRD TELEVISION LTD · LANCELOT ROAD · WEMBLEY · MIDDLESEX

LETTER FROM *Brazil*

Rio de Janeiro.
24th November 1953.

Dear Mr. Briggs:

About your books; I have all their editions. Their texts are simple, objective, constructive, immune to a common pest which might be called "scientific demagogic." Further, your informal way of exposing ideas, occasionally adorned by a peculiar sense of modesty and humour, are features which make the reading of your texts an attractive occupation. So, and all values duly praised, I believe that the repeated study of the contents of your books, and the execution of lessons therein given, are, to any person interested in matters of sound reproduction, profitable investments of time and mental energy.

About your loudspeakers: The abundant evidences which, within the last five years, I have had participating in merciless comparative tests, technical tests followed by decisive listening tests, have led me to believe that the qualitative performance of loudspeakers, less the realisation of technical specifications than the fruit of art. Otherwise, how could I thoroughly understand, for instance, the very superior performance of the Wharfedale loudspeaker model Super 12/CS/AL?

Well, whatever the cause may be, an important effect is that your loudspeakers have fascinated me. Consequently, let me confess, Wharfedale units, models W15/CS, Super 12/CS/AL and 8/CS, have overwhelming preponderance, in terms of quantity and quality, in the two separate groups of loudspeakers which are installed in my home. Incidentally, by the end of the year a Wharfedale 5in. tweeter should enrich my equipment.

Thank you, Mr. Briggs, for your accomplishments concerning the betterment of the reproduction of sound.

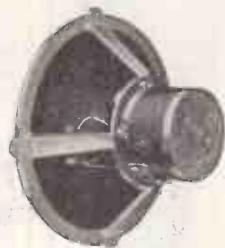
Yours sincerely,
ED. VIDAL.



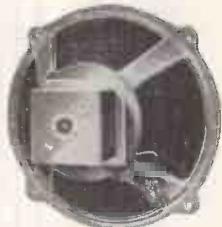
Super 5. Diameter 5in.
Flux density 13,000 lines.
£5 plus P.T. £1/13/3.



Super 8/CS. Diameter 8in. Flux density 13,000 lines. £4/15/-, plus P.T. £1/11/7.



Super 12/CS/AL
Diameter 12in. Flux density 17,000 lines. £17/10/- Tax Free.



W15/CS. Diameter 15in.
Flux density 13,500 lines.
£17/10/- Tax Free.

It is regretted that the price of the Super 12/CS/AL and W15/CS has been increased from the 1st January due to an increase in the cost of the magnets.

32-page Catalogue now ready, containing complete set of response curves all taken under identical conditions. Available on request.

THESE ARE THE FOUR BOOKS REFERRED TO IN OUR LETTER FROM BRAZIL

Sound Reproduction

By G. A. Briggs
Enlarged and revised 3rd Edition. 368 pages, 315 illustrations. Many new chapters; up-to-the-minute advice and information.
17/6 (plus 1/- postage). De Luxe edition 25/- (plus 1/- for postage).

Loudspeakers

By G. A. Briggs.
3rd Edition. 9th Impression. 88 pages, 36 illustrations.
7/6 (plus 3d. postage).

Amplifiers

By G. A. Briggs and H. H. Garner.
Fine art paper. Bound full rexine. 216 pages, 174 illustrations.
15/6 (plus 6d. postage). De Luxe edition 21/- (plus 9d. postage).

Pianos, Pianists and Sonics

By G. A. Briggs
102 Pages. 162 illustrations.
10/6 (plus 6d. postage).

SOLD BY LEADING RADIO DEALERS AND BOOKSELLERS

Published by

Wharfedale

WIRELESS
WORKS

BRADFORD ROAD · IDLE · BRADFORD · YORKS

Telephone: Idle 1235/6 (2 lines).

Telegrams: Wharfdel, Idle, Bradford

SOLDERING INSTRUMENTS AND EQUIPMENT

by

ADCOLA

(Regd. Trade Mark)

mean
SOUND
JOINTS
for
SOUND
EQUIPMENT

Types are available for Factory Bench Line, Maintenance Engineer & Home Constructor

Supplied for any volt range to meet our world-wide consumers' demands

- Heating time: 90 seconds.
- Consumption: 25 watts.
- Weight: 4 ozs.
- High temperature.
- Handle unaffected by element temperature.
- Length of instrument: 9".
- Equally suitable for daily or intermittent use.

1/8" dia. bit Standard Model.
1/4" dia. bit Standard Model.
1/16" Detachable bit Type (Factory Bench Line).

Made in England
Registered Design (British, U.S.A., Canadian) and Foreign Patents.

● Apply Sole Manufacturers and Suppliers

ADCOLA PRODUCTS LTD.

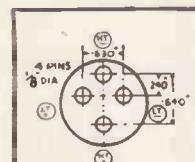
Sales Offices & Works: CRANMER COURT, CLAPHAM HIGH ST., LONDON, S.W.4. MACaulay 4272



THE NEW



for
cheaper
radio listening



Plastic Plug Socket



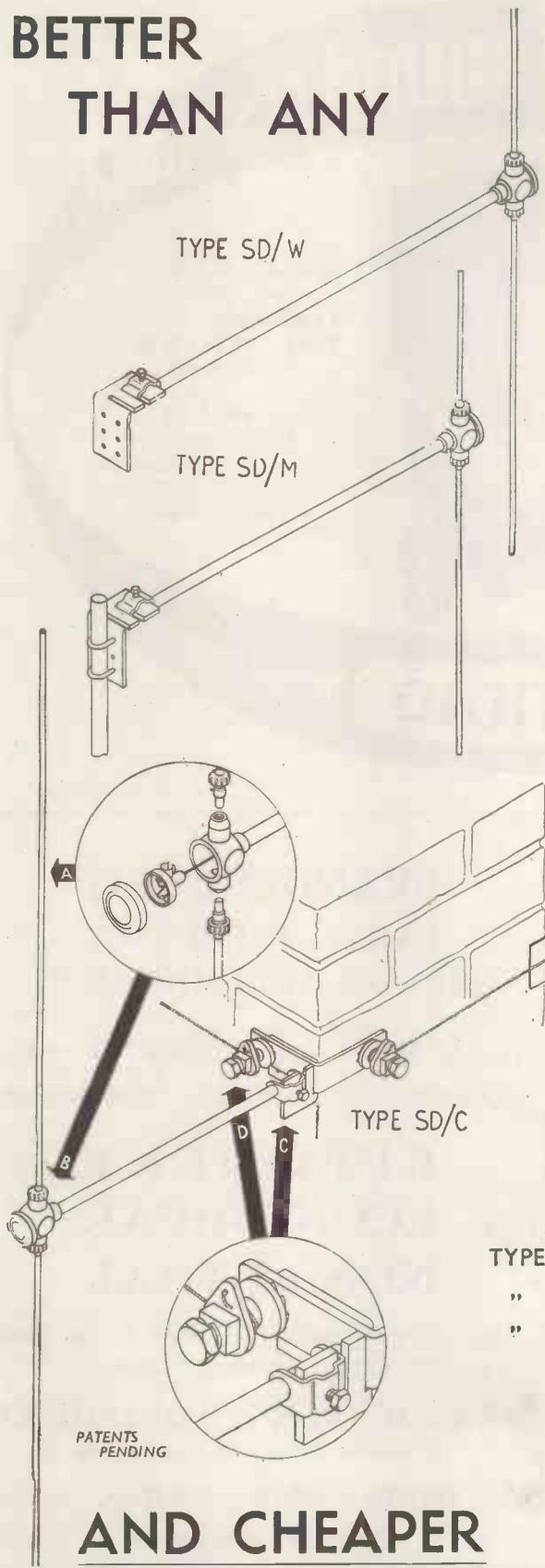
BATTERY PLUG

The new Ever Ready plastic 4 pin battery plug has been specially designed to ensure correct and easy battery connections. Plugs are fitted with four staggered metal pins, also four coloured wires 18" in length. List Price 2/- complete. Suitable for use with BSS. 1766-1951.



EVER READY DRY BATTERIES FOR RADIOS TORCHES · HEARING AIDS · CYCLE LAMPS

**BETTER
THAN ANY**



**ANNOUNCING A
NEW REALLY
UNIVERSAL
EXTREMELY RAPID
MOUNTING
DIPOLE AERIAL**

- A. ELEMENTS SCREW IN.
- B. CLIP-ON CONNECTION ASSEMBLY WITH PRESS-ON WATERPROOF COVER.
- C. ADJUSTABLE EXTRA RAPID BOOM MOUNTING BRACKETS.
- D. RACHET STRAINERS SAVE VALUABLE MINUTES ON ERECTION TIME. A NEW AND POSITIVE FIXING OF IMMENSE STRENGTH.

From simple BASIC design (TYPE SD/W) two additional components convert into either MAST or CHIMNEY mounting Aerials, resulting in a very efficient and cheaper Single Dipole range.

TYPE SD/W	All Channels	..	..	..	27/6
" SD/M	"	..	..	..	29/6
" SD/C	"	..	..	..	42/6



AND CHEAPER

Quadrant Road, Thornton Heath, Surrey
THOrnton Heath 1191-2
BRANCHES THROUGHOUT THE COUNTRY

For high-fidelity sound recording

- Two speeds, giving TWO HOURS perfect speech recording, or ONE HOUR high-fidelity music recording.
- Unique Grundig microphone, as sensitive as the human ear, faithfully reproduces all tone characteristics.
- Push-button control and magic eye tuning give instant mastery of both recording and reproduction.
- Sound Frequency Range: 50-10,000 c/s at 7½ in. per second, 50-6,000 c/s at 3½ in. per second.



GRUNDIG
"Reporter" 700L
TWO-SPEED
TAPE RECORDER

as compact and portable as a suitcase

PRICE 80 GNS
H.P. Terms available

Write for illustrated folder to: Dept. W.W., Grundig (Great Britain) Ltd., Kidbrooke Park Road, London, S.E.3.

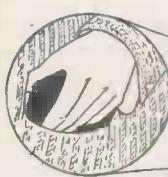
Get a

GRUNDIG

The finest tape recorder in the world

G96

**A workshop
in your
pocket!**



FOR ONLY
25·6
. Post Free

THE
TELEVISION
& RADIO SERVICE

ENGINEERS' MASTER TRIMMER KIT

- 1 End Trimmer ● 1 Side Trimmer
- 1 Yaxley Switch Contact Adjuster
- 1 Low Capacity Trimmer ● 1 Screwdriver
- 1 Set of Feeler Gauges ● 1 Set of Six Box Spanners from 1 to 8 B.A. ● 1 Set of Four Spanners from 0 to 8 B.A.
- In durable black crackle finish metal case.

Export Enquiries invited
J. & S. NEWMAN Ltd.
100 HAMPSTEAD RD., LONDON, N.W.1 Telephone: EUSTON 5176/7



BRANDENBURG RADIO FREQUENCY HIGH VOLTAGE EQUIPMENT

Highly stable supplies made to order.
Quotations to customers' specification.

**EFFICIENT
ECONOMICAL
NON-LETHAL**

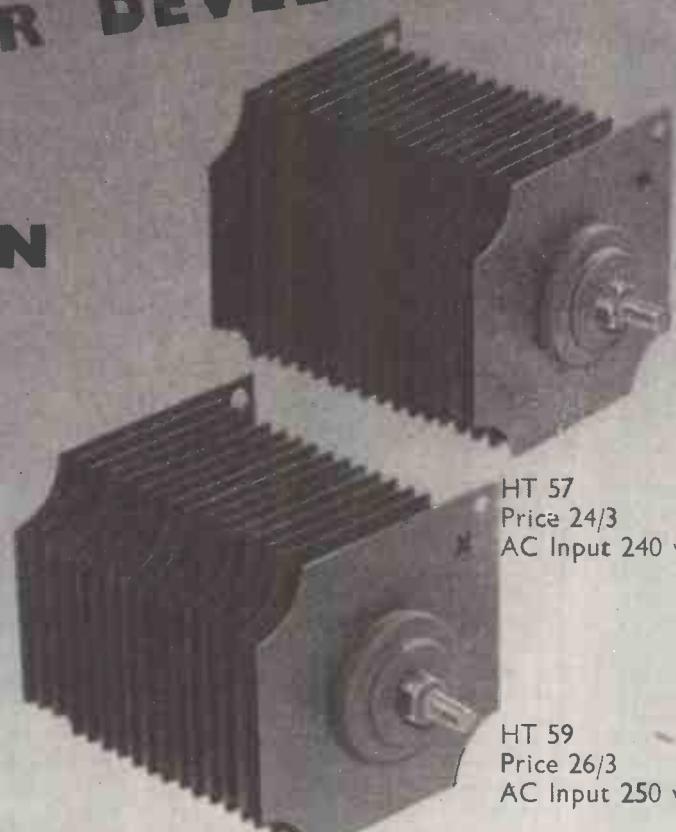
High Voltage Generators · High Voltage Coils
High Voltage Measuring Instruments.

BRANDENBURG EQUIPMENT
TELEONICS (COMMUNICATIONS) LTD.

196 DAWES ROAD, FULHAM, S.W.6.

Telephone: FULham 1534

**New
RECTIFIER DEVELOPMENTS
for
TELEVISION
ANODE
SUPPLIES
and at
less
cost**



HT 57
Price 24/3
AC Input 240 volts.

HT 59
Price 26/3
AC Input 250 volts.



WESTALITE
METAL RECTIFIERS

These new 'Westalite' rectifiers are the answer to every problem confronting the amateur television constructor, either for building into new sets or as replacements. Everything about them is right — price — size — output — efficiency — and, of course, reliability; their generous ratings enabling them to withstand the exceptional conditions experienced in modern television receivers. Both units have a current output of 300 mA and are suitable for maximum D.C. output voltages of 280 and 290 for the HT.57 and HT.59 respectively. They are for use in conventional half-wav circuits and are available EX STOCK. Address all enquiries to

DEPT. W.W.2, WESTINGHOUSE BRAKE & SIGNAL CO. LTD.
82 York Way, King's Cross, London, N.1

ANOTHER GREAT ADVANCEMENT
by
Aerialite

THE **UNEX** T.V. AERIAL
WITH THE **DRIVEN** ARRAY

For simplicity in fitting, high electrical performance and long trouble-free service, the UNEX has no equal.

Like the popular Dublex, the Unex is a driven array with excellent electrical and mechanical features.

Vitally important points to note on the Unex are :—

- **EASY FITTING**—Diametrically opposed elements screw into each other and automatically make contact with downlead terminals.
- **SIMPLE DOWNLEAD CONNECTIONS**—excellent accessibility plus spring loaded braiding clamp ensure speedy and positive connections.
- **HIGH ELECTRICAL PERFORMANCE**—Forward gain of 3dB Front/Back ratio of 25dB guarantee excellent electrical efficiency plus maximum interference rejection.

● **INEXPENSIVE**—Prices are low despite the high quality materials used. 83S—complete with 6ft. alloy mast, single lashing bracket etc. £3 19 6.

83T complete with 10' x 2' lightweight mast, double lashings, etc.....£6 15 0

83F complete with 14' x 2' lightweight mast, double lashings, etc.....£7 12 6

83C complete with cranked arm, single lashing bracket.....£3 19 6

83X array only for own mast fitting...£2 4 0

Above are for all vertical channels. Add 5/- extra for horizontal versions.

Other Aerialite High Efficiency T/V Aerials include: Dublex, Aerfringe, Aerphase, Aeraitch, Aerfold.

Aerialite LTD.

CASTLE WORKS STALYBRIDGE CHESHIRE.



**Smith's
for
current
"know how"**

From Smith's shops and bookstalls you can quickly obtain technical books on the latest developments in circuit design, new components, methods and new theories. Books not actually in stock can usually be supplied within a day or so. Smith's Postal Service can send books to any address at Home or Overseas. Lists of the standard works on any subject gladly supplied upon request.

W. H. Smith & Son
FOR TECHNICAL BOOKS

HEAD OFFICE: STRAND HOUSE, LONDON, W.C.2

ACE
THE LAST WORD IN

TAPE RECORDERS

MODELS

10 & 12 HAVE EVERYTHING

10 WATTS PUSH-PULL HIGH FIDELITY AMPLIFIER
3 INPUTS: CRYSTAL & M/C. MICS. & GRAM.
3 TAPE SPEEDS: 3½, 7½ & 15 INCHES PER SECOND
2 TRACKS PER TAPE - 2 HRS. RECORDING
2 SEPARATE INPUT CONTROLS FOR MIXING
SEND COMPLETELY AUTOMATIC ERASE (ELECTRONIC)
STAMP DETACHABLE SPEAKER UNIT MODEL 12
FOR FULLY FAST REWIND & FORWARD WIND
ILLUSTRATED MONITORED & DIRECT INPUTS
BROCHURE VERY COMPACT MODEL 10 15½" X 10" X 7¾"

MODEL 10 £65
MODEL 12 £66-10-0
Demonstrations from:

ASSOCIATED CINE EQUIPMENTS LTD.
353, BEXLEY ROAD, ERITH, KENT. Phone: Erith 2543.

"VARIAC" voltage regulating transformers

Reg'd. Trade Mark



'VARIAC' infinitely variable voltage-regulating transformers are designed and constructed for many years of trouble-free operation. Not only do they supply perfectly smooth control of voltage from zero, but many types (including 100-R), also furnish output voltages considerably above line voltage while the 100-RM/2B is a dual output type. Illustration left shows Type 100-R, Rating 2,000 va., Input Voltage 230/115. Output Voltage 0-270.



Left—Type 200 C.U.M.

Right—
Type 50-B.



SERIES 100 'VARIAC' TRANSFORMERS

TYPE	LOAD RATING	SPECIFICATIONS			NO-LOAD LOSS	NET + PRICE + £ s. d.
		INPUT VOLTAGE	RATED CURRENT	MAXIMUM		
100-K	2000 va.	115	15 a.	17.5 a.	0-115	20 watts
100-KM	2000 va.	115	15 a.	17.5 a.	0-115	20 watts
100-L	2000 va.	230/115	8 a.	9 a.	0-230	25 watts
100-LM	2000 va.	230/115	8 a.	9 a.	0-230	25 watts
100-Q	2000 va.	115	15 a.	17.5 a.	0-135	20 watts
100-QM	2000 va.	115	15 a.	17.5 a.	0-135	20 watts
100-R	2000 va.	230/115	8 a.	9 a.	0-270	30 watts
100-RM	2000 va.	230/115	8 a.	9 a.	0-270	30 watts
100-LH	1200 va.	480/240	2 a.	2.5 a.	0-480	25 watts
500-L *	1450 va.	180	8 a.	9 a.	0-180	25 watts
2000-K †	1000 va.	125	8 a.	9 a.	0-125	25 watts

* For 500 cycles.

† For 2,000 cycle service.

‡ All 'VARIAC' price plus 20% as from 23rd Feb., 1952.

Write for catalogue V549 which gives full details of "VARIAC" transformers and suggestions for use. REQUEST ALSO OUR 20-PAGE SUPPLEMENTARY CATALOGUE GIVING COMPLETE INFORMATION ON OUR NEW AND COMPLETE RANGE OF AC AUTOMATIC VOLTAGE STABILISERS: THESE RANGE FROM 200 VA TO 25 kVA. PERFORMANCE IS EXCELLENT, FROM NO-LOAD TO FULL LOAD AND STABILITY IS QUITE UNAFFECTED BY FREQUENCY VARIATIONS.

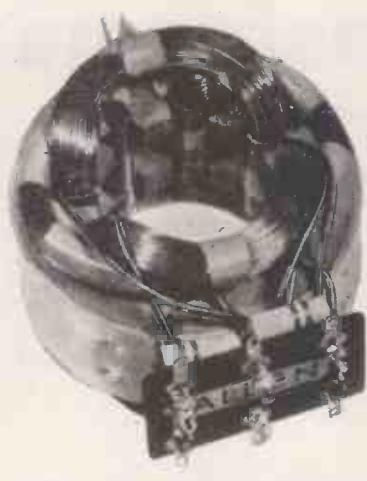
PRICES ARE EXCEPTIONALLY LOW.

CLAUDE LYONS LIMITED

ELECTRICAL AND RADIO LABORATORY APPARATUS, Etc.

180, Tottenham Court Road, London, W.1; and 76, Oldhall Street, Liverpool 3, Lancs.

MAINTAINING A REPUTATION.....



Deflector Coils type DC300/C. As specified for the "Teleking," "Supervisor" and "Magnaview."

Conversion circuits for 14in. and 17in. C.R. Tubes available. Send 9d. and S.A.E.

Every day we read the words: "I am ordering Allen Components because they are so highly recommended by my friends".

We are proud of our reputation. Since we pioneered Wide Angle scanning some years ago we naturally carried on our policy of producing components designed to the highest specification and engineered to the closest tolerance. In these days of shortages and lowered standards such a policy is not easy to carry out and it has necessitated unrelaxed attention to detail in all our departments. The result of this care is apparent in all our products, in which good workmanship is combined with high reliability.

May we suggest you ask your friends?

From all Leading Stockists.

ALLEN COMPONENTS LIMITED

Crown Works, Lower Richmond Rd., Richmond, Surrey
Telephone: Prospect 9013

Send 9d. and S.A.E. for Circuit Diagram

- T/V TECHNOLOGY
- RADIO ENGINEERING
- ELECTRONICS
- RADIO SERVICING

There's a big future in T/V and Radio. Act now! Increase your knowledge. Back up experience with a sound theoretical background. I.C.S. offer courses of instruction in—

T/V TECHNOLOGY ● ADVANCED SHORT-WAVE RADIO ● RADIO ENGINEERING ● RADIO SERVICE ENGINEERING ● RADAR ● ELEMENTARY ELECTRONICS

I.C.S. will also coach you for the following examinations:—
B.I.R.E.; P.M.G. Certificate for Wireless Operators; Radio Servicing Certificate (R.T.E.B.); C. & G. Telecommunications, etc., etc.

DON'T DELAY—SEND COUPON TODAY for free descriptive booklet, stating which subject or examination interests you. Fees include all books needed. Examination students coached until successful.

Reduced terms for H.M. Forces.
Dept. 223D, I.C.S., 71 Kingsway, W.C.2

INTERNATIONAL CORRESPONDENCE SCHOOLS.
Dept. 223D, International Buildings, Kingsway, London,
W.C.2.

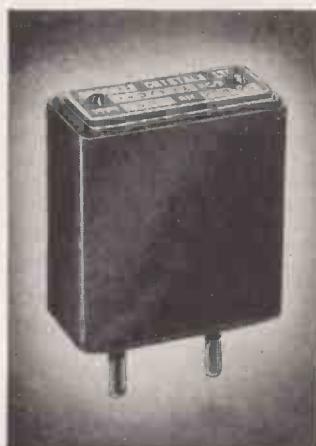
Please send Booklet on subject.....

Name Age
(Block letters please)

Address.....



BROOKES Crystals



mean
DEPENDABLE
frequency
control

Illustrated left is a Type SS Crystal unit from a range covering 100 Kc/s to 15 Mc/s.

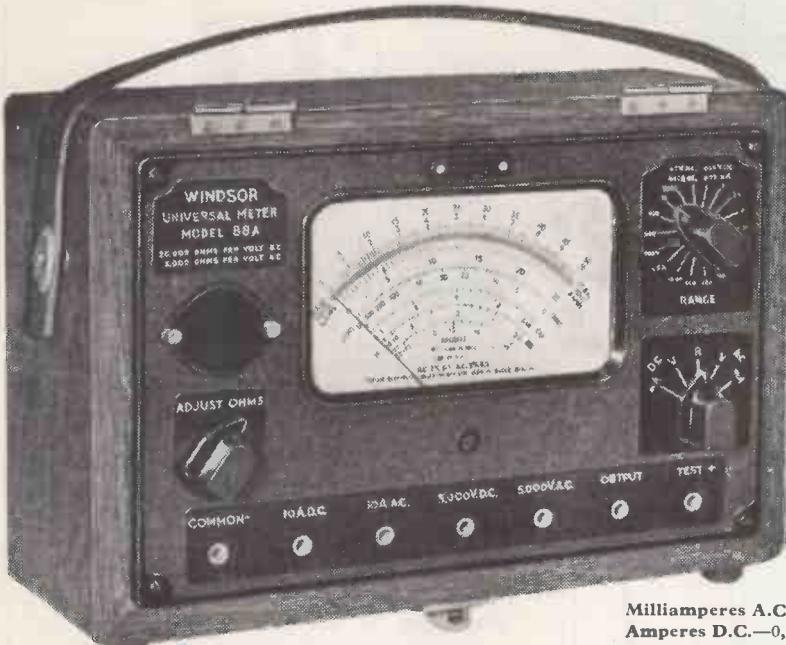
- Frequency 14071.5 Kc/s.
- Black Bakelite case.
- 1½" high x 1⅞" wide x ¾" thick.
- Two ½" dia. pins spaced 1" centres.

All Brookes Crystals are made to exacting standards and close tolerances. They are available with a variety of bases and in a wide range of frequencies. There is a Brookes Crystal to suit your purpose—let us have your enquiry now.



Brookes Crystals Ltd.,
suppliers to Ministry of Supply, Home Office, B.B.C., etc.
EARLSWOOD ST., GREENWICH, LONDON, S.E.10

Telephone : GREenwich 1828
Grams: Xtals Green London. Cables: Xtals London



Taylor Model 88A multirange universal meter

20,000 o.p.v. D.C. 2,000 o.p.v. A.C.

A portable multirange A.C./D.C. instrument providing wide testing facilities.

Five-inch scale with knife-edge pointer and anti-parallax mirror. Instantaneous overload protection on all ranges. Buzzer for quick continuity testing. Supplied complete with leads, crocodile clips and comprehensive instruction manual.

RANGES

Volts D.C.—0, .1, .25, 1, 2.5, 5, 10, 25, 50, 100, 250, 500, 1,000, 5,000.

Volts A.C.—0, 1, 2.5, 5, 10, 25, 50, 100, 250, 500, 1,000, 5,000.

Milliamperes D.C.—0, .05, .1, .25, 1, 2.5, 5, 10, 25, 50, 100, 250, 500, 1,000.

Milliamperes A.C.—0, .25, 1, 2.5, 5, 10, 25, 50, 100, 500, 1,000.

Amperes D.C.—0, 2.5, 10.

Amperes A.C.—0, 2.5, 10.

Resistance.—1 ohm to 5 megohms in 4 ranges.

Decibels.——20 to +69 in 9 ranges. Zero reference level is 6mW into 500 ohms.

Output.—As A.C. volt ranges, except 5,000 volts, via a condenser.

Inductance.—0.2 to 200 henrys in two ranges.*

Capacitance.—1,000 pF to 100 µF in four ranges.*

* External adaptor, Model 313D, required.

Price £22 . 0 . 0

or £3 . 6 . 0 deposit and 10 monthly payments of £2 . 2 . 1 .

Accuracy D.C. ranges 2 per cent. of F.S.D.
A.C. ranges 4 per cent. of F.S.D.

Precision engineered meter with instantaneous overload protection on all ranges. Five-inch easy to read scale with knife-edge pointer. A buzzer is fitted for quick continuity testing. One switch selects both circuit and range. Fitted in moulded black shockproof case.

RANGES

Volts D.C.—0, 3, 15, 75, 300, 750, 3,000.

Volts A.C.—0, 15, 75, 300, 750.

Milliamperes D.C.—0, 15, 150, 1,500.

Milliamperes A.C.—0, 15, 150, 1,500.

Amperes D.C.—0, 15.

Resistance.—1 ohm to 200 K ohms in two ranges with self-contained battery.

Output.—As A.C. volt ranges, via a condenser.

Price £12 . 10 . 0

or £1 . 17 . 6 deposit and 10 monthly payments of £1 . 4 . 0 .

Taylor Model 71A multirange universal meter



Other Taylor Products:
A selection of Multirange A.C.
D.C. Testmeters; Signal Generators;
A.C. Bridges; Circuit Analysers;
Oscilloscopes; High and Low
Range Ohmmeters; Output
Meters; Insulation Testers;
Moving Coil Instruments; T.V.
Test Gear.
WRITE FOR CATALOGUE

Taylor

ELECTRICAL INSTRUMENTS LTD

Montrose Avenue, Slough, Bucks. Slough 21381

for

SELENIUM RECTIFIERS

consult



WHETHER the need is for a single unit or a supply running into thousands . . . if it's a Selenium Rectifier that must fulfil critical requirements and maintain its characteristics over long periods . . . the answer is to be found with Electrix.

- Electrix Rectifiers are characterised by their cool running and consistent long-life conformity to stated specification

- Manufacturers, Traders and Electronic Engineers, send us your specific requirements.

- Your needs may possibly be met from "standard" types, or

- "To specification" models can be quickly prepared.

- Quotations by return . . . and deliveries a matter of days only.

- We welcome export enquiries.

Here are some typical "standard" full-wave types each

Output 12/15 Volts D.C. 1 Ampere.	List Price 9/-
Output 12/15 Volts D.C. 2.5 Ampere.	" 13/6
Output 12/15 Volts D.C. 4 Ampere.	" 22/6
Output 12/15 Volts D.C. 6 Ampere.	" 35/-

Trade Supplied

- Heavy duty rectifiers with say 230/250 volts A.C. input and 220 volts D.C. output a speciality.

- We use only freshly manufactured selenium plates and components, no ex-W.D. materials whatsoever.

HOUSEHOLD ELECTRIX LTD
47-49 HIGH ST., KINGSTON-ON-THAMES

Telephone: KINGston 4585

BK

are now ready with
TAPE!

B.K. CUSTOM BUILT HOME TAPE RECORD/PLAYBACK EQUIPMENT

We can now supply High Fidelity tape recording and reproducing equipment. These incorporate such well-known tape decks as Bradmatic, Wearite and Truvox. Special pre-amplifiers give facilities for Gramophone and Radio Reproduction. Wide range tone controls and low pass filters. Provisions for recording direct from Radio and T.V. Sound, gramophone records and live performances are included. Well-known quality amplifiers are utilised for playback. A wide range of suitable speaker systems available. All systems housed in cabinets of high quality workmanship.

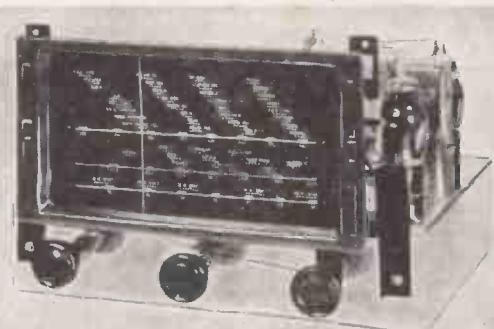
Systems can be built to suit your particular requirements.

FURTHER ENQUIRIES INVITED

Visit our Showrooms for demonstrations. Mon. to Fri. 10.30—5.30. Sat. 10.30—12.30. H.P. TERMS ON ALL EQUIPMENT AVAILABLE

B.K. PARTNERS LTD.

229 Regent St., London, W.I. (Entrance Hanover St.)
Phone : REGent 1051, REGent 7363



LEARN RADIO

by practical experience!

Build this handsome Superhet in our EASY way

THE HOME CONSTRUCTOR

Price 2/6 only

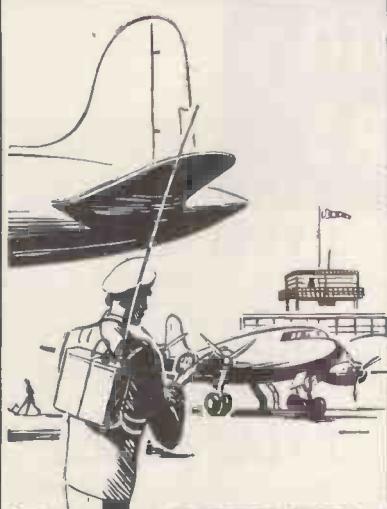
Gives FULL Constructional information, detailed drawings, Charts, Circuit Diagram, etc., for

BUILDING 9 SUPERHETS

All sorts of other information contained in this useful booklet together with hints and tips and circuits of other types of receivers, etc. Fully illustrated catalogue incorporated.

Send for your copy TODAY

SUPACOILS, 21, MARKHOUSE ROAD, LONDON, E.17.



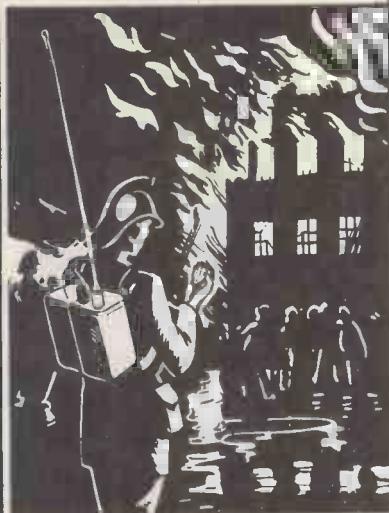
For
CONTROL



unrestricted
MOBILITY

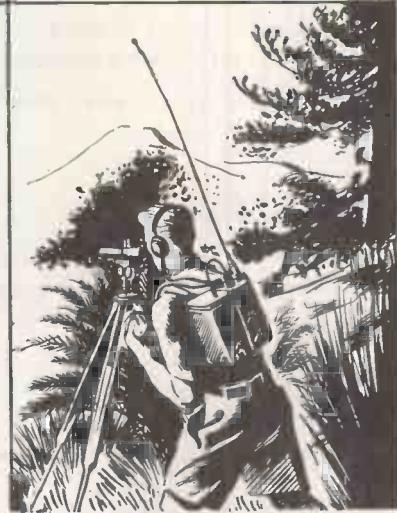


immediate
ACTION



**THE
NEW PACK SET
TYPE 46**

- ★ lightweight
- ★ simple to operate
- ★ easy to maintain
- ★ robust



BRITISH COMMUNICATIONS CORPORATION LIMITED

Second Way, Exhibition Grounds, Wembley, Middlesex. Telephone : Wembley 1212



SHORTAGE OF RADIO and T/V ENGINEERS

There is an assured well-paid future for those trained and willing to train in electronics, radar and radio. Modern industrial techniques demand more and more highly trained personnel and the gap between demand and supply is still widening.

This is your opportunity — write for our free brochures giving full details of courses to :

E.M.I. INSTITUTES

DEPT. 16R, 10 PEMBIDGE SQUARE, LONDON, W.2.

Telephone : Bayswater 5131/2.

The College associated with a world-wide electronics industry.

I YEAR COURSE

We offer full-time day course for one year in the Principles and Practice of Radio and Television.

*Next course commences
1st April, 1954.*

3 YEAR COURSE

This course in Telecommunication Engineering includes one year's Factory attachment.

*Next course commences
30th August, 1954.*

Associated with
'H.M.V.'

MARCONIPHONE
COLUMBIA
etc.

IA9



Introducing The "RD MINOR MK. II"

An improved version of our high performance gramophone amplifier.

NOTE THESE EXCEPTIONAL IMPROVEMENTS:

- ★ Increased Power Output.
- ★ Lower Distortion.
- ★ Exceptionally low hum level.
- ★ Improved Output Transformer.
- ★ All transformers now totally enclosed.

BRIEF SPECIFICATION (Provisional)

Input Sensitivity : LP/78A-70 m/V. for 3.5 watts.
78B-80 m/V.,

Frequency Response : ± .5 DB 30-15,000 cps.

Power Output : 4.5 watts (maximum).

Distortion : Less than .25 per cent, at 1 kc/s. for 3.5 watts.

Hum : — 80 DB below 3.5 watts.

NFB : Main loop, including O.T. 16 DB.

Retail Price £12/17/6.

An illustrated leaflet will gladly be forwarded post free on request. Available from leading dealers in London and the Provinces, or if in any difficulty, please apply direct.

Trade and Export enquiries invited.

ROGERS DEVELOPMENTS Co

"Rodeveo House," 116 Blackheath Road, Greenwich,
London, S.E.10. Telephone: TIDeway 1723

Accepted as the Standard...

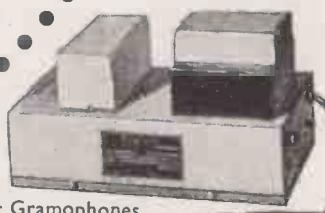
... by leading manufacturers, the trade
and the aircraft industry.

Valradio

Specialists in Converters
since 1937

Please ask for our
descriptive folder
W.W.

**DC/AC
CONVERTERS**
Units Complete and ready
for use

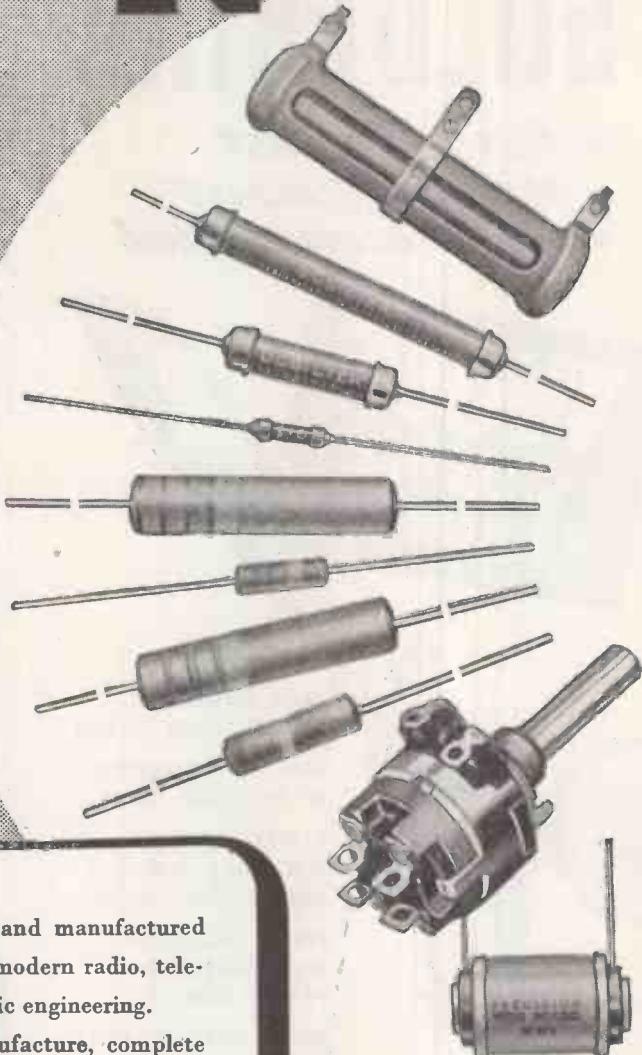


- for Electric Gramophones from £8 16s. Od.
- for Radios, Radiograms, and Autochange Radiograms (Incl. 3-speed motors) from £11 16s. 6d.
- for Television, Tape Recorders, and for operation of TV from Country House lighting plants, price according to instrument.
- Inputs, 6, 12, 24, 32, 50, 110 or 200/250V. D.C.
- Outputs, 110V. or 230V. 50 or 60 c/s.

VALRADIO LTD. NEW CHAPEL ROAD, HIGH STREET
FELTHAM, MIDDX. Tel.: FELtham 4242
Service Dept. : 57 Fortress Road, London, N.W.5. GULiver 5164 and 7202
Scottish Depot : 257 Gorbals Street, Glasgow, C.5. Tel. : South 1326
Overseas enquiries to nearest E.M.I. Organisation Depot

DUBILIER

**RESISTORS
FOR THE
SERVICE
ENGINEER**



Dubilier Resistors are designed and manufactured to meet the exacting requirements of modern radio, television, telecommunication and electronic engineering. Throughout every stage of their manufacture, complete mechanisation and production testing ensures maximum uniformity and quality control, which is your assurance of reliability. Catalogue GR.353 giving details of the full range of DUBILIER Resistors will be sent to you upon request.

DUBILIER CONDENSER CO. (1925) LTD

DUCON WORKS, VICTORIA ROAD, NORTH ACTON, LONDON, W.3, ENGLAND

Phone: ACORN 2241 (5 lines)

Grams: Hivoltcon, Wesphone, London

Cables: Hivoltcon, London

High Speed SOLDERING

- * twice as fast
- * more efficient
- * more economical



Supplied complete with 15 feet reel of acid cored solder, spare 15 feet resin cored solder and fitted with 5 feet tough rubber 3-core cable. Finished in heavy chrome.

★ OBTAINABLE FROM ALL LEADING TOOL MERCHANTS AND FACTORS

WOLF ELECTRIC TOOLS LTD.
PIONEER WORKS, HANGER LANE, LONDON, W.5
Telephone: PERivale 5631-4. BRANCHES: BIRMINGHAM - MANCHESTER - LEEDS - BRISTOL - GLASGOW

SCALAMP ELECTROSTATIC VOLTMETER



Cat. No.
W.W. 11310

DIRECT READING.

**ZERO CURRENT
DRAIN.**

**THREE SECONDS
PERIOD.**

**LAMP OPERATES
FROM MAINS OR
4 VOLT BATTERY.**

**BRIGHT SPOT-
AND-HAIRLINE
INDICATOR.**

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

Cat. No. W.W. 11308

1 - 5 kV A.C. D.C.

Cat. No. W.W. 11309

3 - 10 kV A.C. D.C.

Cat. No. W.W. 11310

5 - 18 kV D.C. and

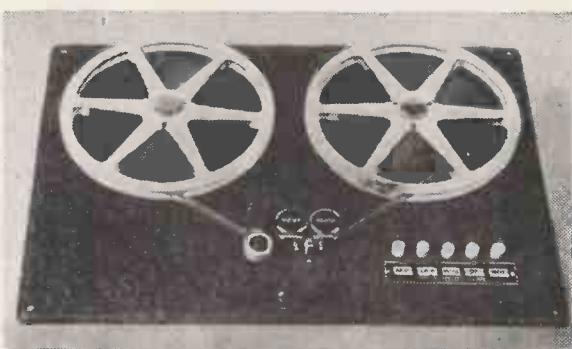
5 - 12 kV A.C. R.M.S.

Please write for illustrated leaflet.

SCIENTIFIC PYE INSTRUMENTS

W. G. PYE & CO. LTD., GRANTA WORKS, CAMBRIDGE

MOTEK



K4 UNIT (shown above).....17 guineas

**Motek—The name
for tape units.**

Illustrated leaflet available on request.

MODERN TECHNIQUES

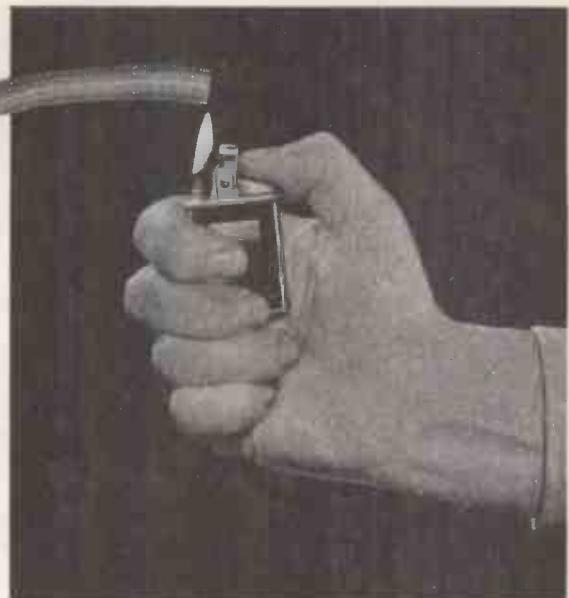
138-144 Petherton Road, London, N.5

Tel.: Canonbury 5896

Wolf Solderguns and
Soldering Irons available for
all work from fine instru-
ment to heavy industrial duty

"PERIBRAID" (Reg'd
Trade Mark)

**SILVERGLASS
SLEEVING
DOESN'T
BURN...**



and now...
IT DOESN'T FRAY!

"PERIBRAID" SILVERGLASS SLEEVING is made from close-braided glass fibre filament specially treated to reduce the fraying of cut ends.

It is available in continuous lengths in sizes from 0.5 to 10mm. and has the following characteristics :—

- Maximum flexibility over whole temperature range from 450°C to minus 50°C.
- Superior tensile strength.
- Smooth bore facilitates easy threading.
- Abrasion resisting.
- Retention of uniformity of roundness on cutting.

35 BAKER STREET, LONDON, W.I.
TEL. WELBECK 0791

SUFLEX
Limited
LONDON



DUROFIX

A clear, free-flowing liquid, Durofix is the perfect adhesive for such work as securing coil windings and terminations, bonding laminations, locking trimmer condensers and cores, fixing diaphragms to moving-coils of speakers, knot fixing on Nylon, and for fixing felt to wood or metal. Durofix more than meets the most exacting requirements of modern radio and T.V. manufacture.

Used by famous manufacturers, because only DUROFIX has all these qualities :—

**INSULATING · HEATPROOF & WATERPROOF
NON-CORROSIVE · 5-Minute Drying · STICKS
almost any material and OUTSTANDING ADHESIVE
STRENGTH.**

**—*the adhesive for radio
manufacture, servicing and
home construction***

Durofix is a Rawlplug product famous for finest quality and utmost dependability.

Extracts from Durofix Specification

Tensile strength - - approx. 10,000 lb./sq. in.

Resistivity (50% Relative Humidity) 10^{10} ohms./cm. cube

Dielectric strength - 600/1200 volts/mil.

Thermal Conductivity $(3.1 \text{ to } 5.1) \times 10^{-4}$ cal./sec./sq. cm./°C/cm.

Temperature Stability Satisfactory from minus 40° C. to plus 120° C.

Water resistance - Very good up to boiling point.

For further Technical Information and Prices write to
THE RAWLPLUG COMPANY LIMITED • CROMWELL ROAD • LONDON • S.W.7
Telephone: FRObisher 8111 (10 lines). Telegrams: Rawlplug, Southkens, London.

B464

RADIO CONTROL OF MODELS

G. Sommerhoff, M.A.

With 44 diagrams and photographs 5/- This book gives circuits (some for the first time) and constructional data of radio control gear for model aircraft, model power boats, sailing yachts and cars. The Author has done several years research on the subject and here he has collected together and fully described the basic principles of the various parts of modern radio control systems. Not only are the simplest and cheapest methods shown, which would be very suitable for the beginner, but also the more complicated methods, so affording the opportunity of improving existing equipment and offering almost unlimited scope for experimenting.

Ready early February.

ELECTRONIC GADGETS FOR THE CONSTRUCTOR

E. N. Bradley

With 53 diagrams 3/6 "Mystery Displays" always attract keen attention at bazaars and exhibitions, and the radio amateur is often called upon at short notice to supply such electronic effects. This book gives constructional details of a large variety of devices: Capacitance Relays: Electronic Musical Instruments: Mystery Displays: and a Photoelectric Novelty. In addition, a number of units designed for extremely practical uses are given. They include various Intercom Systems: Baby Alarms: and Capacitance Testers.

NORMAN PRICE (PUBLISHERS) LTD.

283, CITY ROAD, LONDON, E.C.1.

ALWAYS FIT



CASTORS

Select from our range of over 7,000 types and sizes. Capacities from a few pounds up to

30 TONS EACH

Wheel diameters from 2" to 44".

SPECIFY — Quantity, Load per fitting, type of head fitting, type of wheel and running conditions.

ASK FOR BROCHURE

Leaf equalising castor shown for transport of delicate instruments.

Engineers, Patentees and Sole Manufacturers:

**AUTOSSET (PRODUCTION) LTD., DEPT. "H", STOUR STREET, BIRMINGHAM, 18.
EDG 1143/44.**

Estd. over 30 years.

Please mention "Wireless World."

(AT 16)



...more than you BARGAIN FOR!



The overwhelming reception you get when you fit one of these really powerful units in compact form is more proof that OSMOR "Q" Range Coilpacks provide quality and performance right out of proportion to their midget size and modest cost. They have everything that only the highest degree of long practised technical skill can ensure—extra selectivity, super sensitivity, adaptability. Size only $1\frac{1}{2} \times 3\frac{1}{2} \times 2\frac{1}{2}$, with variable Iron-dust cores and Polystyrene formers. Built-in trimmers. Tropicalised. Pre-aligned, receiver-tested and guaranteed. Only 5 connections to make. All types for Mains and Battery superhet's, and T.R.F.

receivers. Ideal for the reliable construction of new sets, also for conversion of the 21 Receiver, TR.1196, Type 18, Wartime Utility and others. Send today for particulars!

SEPARATE COILS: A full range is available for all popular wavebands and purposes. Fully descriptive leaflet and connection data available. Just note these "plus points":

Only 1in. high. Packed in damp-proof containers. Variable iron-dust cores. Fitted tags for easy connection. Low loss Polystyrene formers.



With **OSMOR**

Lines—you're on the right lines!

A spotlight on another of the "specials" in the OSMOR "Q" Coil Range

45 K/C Tape Recorder
Oscillator Coil

TYPE QT8.

A centre tapped wave-wound coil as illustrated for TRUVOX and similar tape-decks. Singlescrew fixing. Fitted tags.

7/6 each



TWO for the Price of ONE

The NEW **OSMOR**
CHASSIS CUTTER

An inexpensive but invaluable tool of entirely new design. Cuts two hole sizes with any one reversible punch and die; and can be operated with a spanner or tommy-bar. Blanks easily removed. For use on steel up to 18 s.w.g. Brass and Dural up to 16 s.w.g. Aluminium and Copper up to 14 s.w.g.



P.P. 11325/53

Type	Hole Sizes	Illust. price
1	1in. x 1in.	list on request
2	1in. x 1in.	list on request
3	1in. x 1in.	list on request
4	1in. x 2in.	list on request

Tommy-bars available.

The OSMOR "JIFFY PUNCH"

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



P.P. 11324/53

Type	Hole Size	Illust. price
A	1in.	list on request
B	1in.	list on request
C	1in.	list on request

For use on Steel up to 20 s.w.g. Brass and Dural up to 18 s.w.g. Aluminium and Copper up to 16 s.w.g.

(Dept. W.50) 418, BRIGHTON ROAD, SOUTH CROYDON, SURREY.

(Trade Enquiries invited)

DIALS

Type A. Glass DIAL ASSEMBLY (as illus.) measuring 7in. x 7in. (9 $\frac{1}{2}$ in. x 9 $\frac{1}{2}$ in. overall) mounts in any position on or above the chassis and works with any type of drive. Choice of two 3-colour scales—G1 (L.M.S.) or G2 (M.S.S.). Price complete 24/6. P. & P. 1/6. Pulley assembly for right angle drive if required 1/- Escutcheon 4/-



METAL DIALS

Overall size 5 $\frac{1}{2}$ in. sq. Printed area 4in. sq., as illustrated. Cream background, 3-colour. Type M1, L.M.S. waves. M2, L. & M. waves. M3, M. & 2/S. waves. Price 3/6 each. Pointer, 1/6. Drum, Drive, Spring and Cord for use with both types of dial, 3/2.



FREE!

Send 5d. (stamp) for fully descriptive literature including "The really efficient 5-valve Superhet Circuit and practical Drawings," 6-valve ditto, 3-valve (plus rectifier) T.R.F. circuit, Battery portable superhet circuit, Coil and Collpack leaflets, Chassis Cutter leaflet, and full radio and component lists, etc., etc.

We keep stocks of many radio components for use in published circuits, including:—

"WIRELESS WORLD"

"No Compromise" TRF Tuner. "Midget Mains Receiver." Sensitive 2-Valve Receiver. Television Converter (special coils in cans available), etc., etc.

"PRACTICAL WIRELESS"

Coronet Four; Beginners' Superhet; Modern High Power Amplifier 2; Attache Case Portable; RI55 Converter; A.C. Band-Pass 3; Modern I-Valver; 3-speed Autogram.

Dear Reader,

We can't mention all our products here but shall be glad to receive your enquiries for Chassis, Tuning Condensers, Switches, Volume Controls and all other Radio Components. If it's top-quality components and a speedy, courteous service you are looking for—try Osmor. We really shall do our best for you.



Keep those small components—resistors, condensers, etc., neatly stored yet visible by using an

OSMOR "JAR-RACK"

(If you're a generous husband you'll buy one or two for your wife's larder, too—she will appreciate the extra space they make.) Holds any 1 lb. jam jars, with or without lids. Easily removed, cannot fall out. Just the thing for the tidy "HAM" or Radio Dealer. Type 1 for wall-fixing, 6/9 each, holds 8 jars (jars are not supplied but are easily obtained.) Length 24in. enamelled olive green.

Type 2 (as illustrated) for screwing under a shelf, 5/9 each, holds 6 jars. Length 18in., enamelled green.

Post and packing 1/- (either type).

OSMOR STATION SEPARATOR

TYPE METRES

1	141-250
2	218-283
3	267-341
4	319-405
5	395-492
6	455-567
7	1450-1550
8	410-550 k/c

This is a device on the well-known "wave-trap" principle, which will reject an undesired signal when inserted in the aerial lead.

The Separator may easily be tuned to eliminate any one station within the ranges stated and fitting takes only a few seconds. Sharp tuning is effected by adjusting the brass screw provided.

Complete with plug, socket and full instructions—nothing to add.

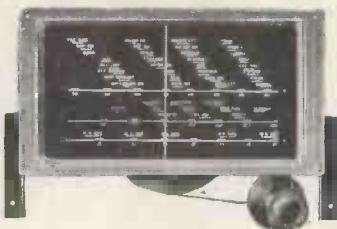
7/6 POST FREE Satisfaction guaranteed.

I.F.s. 465 k/c. Permeability-tuned with flying leads. Standard size 1 $\frac{1}{2}$ in. x 1 $\frac{1}{2}$ in. x 3 $\frac{1}{2}$ in. For use with OSMOR coilpacks and others, 14/6 pair. PREALIGNED, 1/6 extra.

OSMOR radio products ltd.

Telephone : Croydon 5148/9

EXACT EFFORTLESS TUNING



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

Complete with 3-band glass scale 9in. \times 4½in. Printed short, medium and long wavebands with station names. Scale length 7in. Supplied with florentine bronze escutcheon. PRICE 27/6.

S.L.5, similar but fitted with reverse vernier drive, gives ratios of 18-1 search and 50-1 reverse vernier. PRICE 26/6.

Replacement Scales calibrated to Copenhagen Plan now available for :

Airplane Drive 2/3 retail
Squareplane Drive 2/6 retail

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

PRECISION COMPONENTS BY



JACKSON
BROS. (LONDON) LIMITED
KINGSWAY • WADDON • SURREY

Telephone: Croydon 2754
Telephone: Walfilco, Souphone, London

Three-Range PROBE MILLIVOLTMETER

Model VM6451



SELF-CONTAINED

STABILISED
POWER PACK

ACCURACY TO \pm 5% OF
FULL SCALE DEFLECTION

AUTOMATIC OVERLOAD
PROTECTION

Designed to provide direct readings for A.C. voltages from 10 millivolts to 2 volts. Three ranges are provided and readings are accurate within 1db from 50 cycles to 150 megacycles. The double triode measuring valve is detachable from the cabinet. This instrument can also be used for modulation carrier detection with the use of headphones. Write for full specification.

BRITISH PHYSICAL LABORATORIES
Radlett HERTS

Tel: RADLETT 5674-5-6

dm BP 15

Dept. W.W.
12 STORE STREET,
TOTTENHAM
COURT ROAD,
LONDON, W.C.1
Tel : MUSEum 2453/4539
Business Hours:
Monday-Friday 9-5.30,
Saturday 9-1.

Late ALEC DAVIS SUPPLIES LTD.

RELAYS

D.C. COIL RESISTANCE

3,000 TYPES: 1.9Ω to 80,000Ω
600 TYPES: 0.4Ω to 9,200Ω.

ALSO LARGE STOCKS OF
DOUBLE & TRIPLEWOUND
AND SLUGGED COILS.

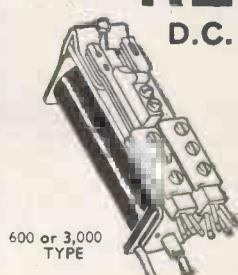
SIEMENS TYPE HIGH SPEED

CONTACTS

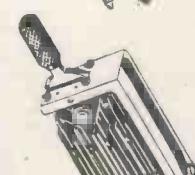
3,000 TYPES: up to 8 sets.
600 TYPES: up to 4 sets.

3,000 TYPES: Make (M), Break (B), in Twin-silver Twin-Platinum, Dome-silver (2 amp.), Tungsten (5 amp.), and Flat-silver (8 amp.). Change-Over (C), in all but Tungsten: Make-Before-Break (K), in Twin-silver and Twin-platinum.

600 TYPES: (M), (B) and (C), in Twin-silver and Twin-platinum.



600 or 3,000
TYPE



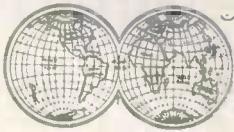
KEY
SWITCHES

KEY SWITCHES.
2 C/O, to 8 C/O. Special types made
up to order.

HOME and**Great Britain's
Valve****Mail-Order House****EXPORT**

RADIO BULLS VALVES

246, HIGH ST., HARLESDEN, N.W.10.



AC/HL	13/3	ECC81	.. 38/2	MP/Pen 5 pin	21/3	TP2620	.. 26/6	X150	.. 21/3	6L1	.. 23/3	20D1	.. 12/-
AC/HLD	21/11	ECH101	.. 23/3	MP/Pen 7 pin	21/3	U10..	.. 13/11	Y81	.. 17/3	6LG6	.. 23/3	20D2	.. 23/11
AC/HLD	19/11	ECH05	.. 20/2	MS4	.. 20/7	U14..	.. 13/11	Y83	.. 17/3	6L7G	.. 21/3	20F2	.. 23/3
AC/T	13/3	ECH42	.. 20/1	MSP4 5 pin	20/7	U16..	.. 28/6	Z21	.. 19/3	6L18	.. 15/11	20P1	.. 23/3
AC/T4	23/3	ECL80	.. 24/7	MSP4 7 pin	20/7	U18..	.. 19/11	Z21	.. 17/3	6LD20	.. 15/11	21A6	.. 23/3
AC/Pen 5 pin	21/3	EF9	.. 19/6	MSP41	.. 19/11	U19..	.. 19/11	Z63	.. 17/3	25A8G	.. 17/3	25L6GT	.. 16/5
AC/Pen 7 pin	21/3	EF22	.. 17/3	MS/Pen 5 pin	20/7	U22..	.. 26/6	Z86	.. 29/10	6M1	.. 17/3	25Z4G	.. 13/11
AC/SIG	23/3	EF38	.. 17/3	MS/Pen 7 pin	20/7	U24..	.. 26/6	Z77	.. 23/3	6N7GT	.. 28/3	25Z6GT	.. 13/11
AC/SVM	23/3	EF27A	.. 22/1	MS/PenB	.. 20/7	U25..	.. 26/8	Z142	.. 23/3	6P25	.. 17/3	25Z8GT	.. 13/11
AC/T/HI	23/11	EF39	.. 16/5	MU14	.. 13/11	U31..	.. 13/11	Z150	.. 23/3	6P28	.. 17/3	25Z9GT	.. 13/11
AC/T	23/11	EF40	.. 22/1	MX40	Clear 23/11	U33..	.. 26/8	ZD17	.. 17/3	6P28	.. 23/3	27SU	.. 19/11
AC/VF1 5 pin	20/7	EF41	.. 16/5	N14	.. 15/3	U35..	.. 26/8	ZD18	.. 19/11	6Q7G	.. 15/11	35AS	.. 17/3
AC/VF1 7 pin	20/7	EF42	.. 23/3	N16	.. 15/3	U37..	.. 26/8	ZD18	.. 19/11	6R7..	.. 15/11	35W4	.. 13/11
AC/VF2	20/7	EF50	.. 22/1	N17	.. 15/3	U50..	.. 13/11	1A5GT	.. 15/3	6R7G	.. 15/11	35Z3	.. 13/11
AC2/HL	13/3	EF54	.. 23/3	N18	.. 15/3	U52..	.. 19/11	1A7G	.. 19/11	6S6T	.. 17/3	35Z4GT	.. 13/11
AC2 Pen	21/3	EF55	.. 23/3	N18	.. 15/3	U70..	.. 13/11	1A7G	.. 17/3	6S6T	.. 16/5	35Z5GT	.. 13/3
AC2 PenDD	23/3	EF80	.. 22/1	N37	.. 17/3	U76..	.. 13/11	1C1	.. 14/6	6S7GT	.. 15/1	40SUA	.. 13/11
AC4 Pen	23/3	EF91	.. 22/1	N77	.. 17/3	U78..	.. 13/11	1C5G	.. 14/6	6S7GT	.. 17/3	41MHL	.. 13/3
AC5 Pen	21/3	EF92	.. 17/3	N78	.. 17/3	U81..	.. 21/11	1D5..	.. 13/11	6S8T	.. 16/5	41MP	.. 23/11
AC5 PenDD	23/3	EF95	.. 33/2	N142	.. 17/3	U84..	.. 19/11	1F9..	.. 15/3	6S8T	.. 23/3	41MPG	.. 23/11
AZ1	13/3	EK2	.. 23/11	N144	.. 17/3	U85..	.. 13/11	1FD9	.. 17/3	6S8T	.. 23/3	41MP	.. 21/3
AZ31	13/3	EK32	.. 21/3	N145	.. 17/3	U87..	.. 13/11	1F9..	.. 15/3	6S8T	.. 23/3	41MP	.. 19/11
B36	.. 23/3	EL31	.. 25/-	N148	.. 17/3	U88..	.. 13/11	1F9..	.. 15/3	6S8T	.. 23/3	41MP	.. 19/11
B65	.. 23/3	EL32	.. 17/3	N150	.. 17/3	U92..	.. 13/11	1F9..	.. 15/3	6S8T	.. 23/3	41MP	.. 19/11
EL33	.. 18/5	N152	.. 23/3	U93..	.. 13/11	U94..	.. 13/11	1L5..	.. 15/3	6S8T	.. 23/3	41MP	.. 19/11
G1	.. 12/6	EL37	.. 22/1	P2 ..	.. 13/3	U95..	.. 13/11	1L5..	.. 15/3	6S8T	.. 23/3	41MP	.. 23/3
GIC	.. 12/6	EL38	.. 26/6	O400	.. 6/8	U96..	.. 13/11	1P10	.. 15/3	6S8/G6S	.. 17/3	41MLT	.. 13/3
CBL1	.. 22/1	EL41	.. 18/5	O401	.. 6/8	U97..	.. 13/11	1P11	.. 15/3	6S8/G6S	.. 17/3	41MLT	.. 13/3
CBL31	.. 21/3	EL42	.. 17/3	O401	.. 13/11	U98..	.. 13/11	1P11	.. 15/3	6S8/G6S	.. 17/3	41MLT	.. 26/6
CCH35	.. 21/3	EL81	.. 23/3	O405	.. 23/3	U99..	.. 13/11	1P11	.. 15/3	6S8/G6S	.. 17/3	41MXP	.. 19/11
CL4	.. 20/2	EL91	.. 17/3	O410	.. 21/3	U100..	.. 20/2	1P12	.. 14/6	6S8/G6S	.. 16/5	41STH	.. 23/11
CL33	.. 17/3	EM4	.. 18/5	O424	.. 16/7	U201..	.. 13/11	1T4..	.. 14/6	6S8/G6S	.. 13/3	42..	.. 21/3
CV1	.. 13/3	EM34	.. 18/5	O425	.. 16/7	U281..	.. 13/11	1U5..	.. 17/3	6X5G	.. 13/3	42MP Pen	.. 21/3
CV1C	.. 13/11	EN31	.. 23/3	P2 ..	.. 13/3	U282..	.. 16/7	2D4A	.. 12/-	6X5GT	.. 13/11	42MP	.. 23/3
CY31	.. 13/11	EX51	.. 26/6	P41 ..	.. 13/3	U403..	.. 13/11	2P ..	.. 19/11	6X5GT	.. 13/11	42MP	.. 23/3
D1	.. 10/-	EZ35	.. 13/11	P51 ..	.. 13/3	U404..	.. 13/11	3A4..	.. 18/11	7A7..	.. 17/3	(Flashed)	.. 23/3
D15	.. 10/6	EZ40	.. 13/3	P52 ..	.. 15/3	U4020..	.. 13/11	3D6..	.. 15/3	7B8	.. 15/11	480T/DD	.. 23/3
D41	.. 12/-	EZ41	.. 13/3	P54 ..	.. 19/11	U4042..	.. 13/11	3D8..	.. 15/3	7B7	.. 17/3	482PT	.. 23/3
D42	.. 13/3	FC2	.. 23/3	Pen 4DD ..	.. 23/3	U4042..	.. 13/11	3D8..	.. 15/3	7C5	.. 17/3	483..	.. 21/3
D43	.. 17/3	FC2A	.. 23/3	Pen 4VA 5 pin	21/3	U4042..	.. 13/11	3D8..	.. 15/3	7C6	.. 16/11	483..	.. 13/11
D63	.. 12/-	FC25	.. 23/11	Pen 4VA 7 pin	21/3	U4042..	.. 13/11	3D8..	.. 15/3	7D5..	.. 21/3	484U	.. 19/11
D77	.. 12/-	FC11	.. 23/11	Pen 4DD ..	.. 23/3	U4042..	.. 13/11	3D8..	.. 15/3	7D6..	.. 21/3	50C5	.. 20/7
D152	.. 12/-	FC13C	.. 23/11	Pen 4DD ..	.. 23/3	U4042..	.. 13/11	3D8..	.. 15/3	7D8..	.. 21/3	50C6	.. 20/7
D30	.. 25/-	FC13	.. 23/11	Pen 4DD ..	.. 23/3	U4042..	.. 13/11	3D8..	.. 15/3	7E7	.. 17/3	50CDG	.. 29/10
DAC32	.. 15/3	FW4/500	.. 19/11	Pen 4DD ..	.. 23/3	U4042..	.. 13/11	3D8..	.. 15/3	7E7	.. 17/3	50LGG	.. 16/5
DAF91	.. 17/3	GD7AB	.. 24/6	Pen453DD ..	.. 24/6	U4042..	.. 13/11	3D8..	.. 15/3	7K7	.. 13/11	52KU	.. 13/11
DCG90	.. 31/6	GT10	.. 25/-	Pen453DD ..	.. 24/6	U4042..	.. 13/11	3D8..	.. 15/3	7R7..	.. 19/11	53KU	.. 19/11
DDA41	.. 12/-	GZ30	.. 13/11	PenA4	.. 23/3	U4042..	.. 13/11	3D8..	.. 15/3	7T4	.. 13/11	61BT	.. 23/3
DD207	.. 15/3	GZ32	.. 18/11	PenD4020	.. 26/6	U405..	.. 13/11	52G3	.. 19/11	8A1..	.. 20/7	61SP	.. 23/3
DDL4	.. 12/-	H30	.. 26/6	PL38	.. 26/6	U6..	.. 13/11	52G4	.. 19/11	8D2..	.. 20/7	62DDT	.. 15/11
DTT	.. 21/11	H63	.. 13/3	PL38M	.. 26/6	U7..	.. 13/11	6A6..	.. 19/11	8D3..	.. 23/3	62TH	.. 21/3
DF33	.. 15/3	HL2	.. 12/-	PL81	.. 22/7	U8..	.. 13/11	6A7..	.. 23/11	8D4..	.. 20/7	62VP	.. 17/3
DF70	.. 15/-	HL2/K	.. 12/-	PL82	.. 16/5	U9..	.. 13/11	6A8..	.. 21/3	8D5..	.. 20/7	63ME	.. 17/3
DF91	.. 15/3	HL13	.. 18/3	PL83	.. 23/3	U9Y..	.. 13/11	6A8..	.. 24/7	8D6..	.. 21/3	63ME	.. 17/3
DF96	.. 15/3	KL13C	.. 13/3	PME2L Clear	.. 12/-	V914..	.. 12/-	6AG6	.. 17/3	8D7..	.. 21/3	63ME	.. 17/3
DH63	.. 15/11	KL21DD	.. 13/3	PME2L met	.. 19/3	V915..	.. 19/3	6AL5	.. 11/4	8D8..	.. 20/7	63SP	.. 13/11
DH76	.. 15/11	KL23	.. 13/3	PME2A	.. 19/3	V916..	.. 19/3	6AP2	.. 20/7	8D9..	.. 21/11	63SP	.. 19/11
DH77	.. 15/11	KL41	.. 13/3	PME2A	.. 19/3	V917..	.. 19/3	6AT3A	.. 20/7	8D9..	.. 21/11	63SP	.. 19/11
DEB81	.. 23/3	KL41DD	.. 13/11	PME4M	.. 21/3	V918..	.. 19/3	6AV3	.. 20/7	8D9..	.. 21/11	63SP	.. 19/11
DEH101	.. 15/11	KL51	.. 15/11	PME205	.. 15/3	V919..	.. 19/3	6AV4	.. 20/7	8D9..	.. 21/11	63SP	.. 19/11
DEH107	.. 15/11	KL13DD	.. 15/11	PTE250	.. 19/11	V919..	.. 19/3	6AV5	.. 20/7	8D9..	.. 21/11	63SP	.. 19/11
DEH142	.. 15/11	KT81	.. 23/3	PTE210	.. 19/11	V919..	.. 19/3	6AV6	.. 20/7	8D9..	.. 21/11	63SP	.. 19/11
DEH147	.. 15/11	KT82	.. 23/3	PTE210	.. 19/11	V919..	.. 19/3	6AV7	.. 20/7	8D9..	.. 21/11	63SP	.. 19/11
DM70	.. 10/-	KT83	.. 17/3	PTE210	.. 19/11	V919..	.. 19/3	6AV8	.. 20/7	8D9..	.. 21/11	63SP	.. 19/11
DN41	.. 23/3	KT83	.. 17/3	PTE210	.. 19/11	V919..	.. 19/3	6AV9	.. 20/7	8D9..	.. 21/11	63SP	.. 19/11
DN143	.. 21/3	KT86	.. 23/3	S130	.. 10/6	V919..	.. 19/3	6F1..	.. 23/3	8D9..	.. 21/11	63SP	.. 19/11
DW2	.. 13/11	KT71	.. 17/3	S130P	.. 16/7	V919..	.. 19/3	6F12..	.. 23/3	8D9..	.. 21/11	63SP	.. 19/11
DW4/350	.. 13/11	KT76	.. 17/3	S130P	.. 16/7	WD142..	.. 18/7	6F13..	.. 23/3	8D9..	.. 21/11	63SP	.. 19/11
DW4/500	.. 13/11	KT81	.. 23/3	S130P	.. 16/7	WD142..	.. 18/7	6F14..	.. 23/3	8D9..	.. 21/11	63SP	.. 19/11
EAS50	.. 10/-	KT101	.. 33/2	SP4 5 pin	.. 20/7	X14..	.. 19/11	6F15..	.. 17/3	12SL70T	.. 23/3	210DDT	.. 15/3
EAC91	.. 33/2	KTW61	.. 17/3	SP4 7 pin	.. 20/7	X17..	.. 17/3	6F16..	.. 20/7	12A6	.. 23/3	210PG	.. 23/3
EAF42	.. 18/7	KTW63	.. 23/3	SP4B	.. 20/7	X18..	.. 17/3	6F17..	.. 20/7	12A7X	.. 22/1	202DDT	.. 21/11
EB34	.. 12/-	KTZ63	.. 17/3	SP13C	.. 20/7	X19..	.. 17/3	6F18..	.. 20/7	12A8	.. 23/3	202STH	.. 23/11
EB41	.. 11/4	L63	.. 13/3	SP42	.. 23/3	X20..	.. 17/3	6F19..	.. 20/7	12A8	.. 23/3	202VTP	.. 19/3
EB91	.. 12/-	L77	.. 13/3	SP42	.. 23/3	X21..	.. 17/3	6F20..	.. 20/7	12A8	.. 23/3	202VTP	.. 19/3
EBC33	.. 13/1	LN152	.. 24/7	SU255	.. 28/6	X21..	.. 17/3	6F21..	.. 20/7	12A8	.. 23/3	202VTP	.. 19/3
EBC41	.. 15/11	LN152	.. 24/7	SU255	.. 28/6	X21..	.. 17/3	6F22..	.. 20/7	12A8	.. 23/3	202VTP	.. 19/3
EBC42	.. 18/11	LP2..	.. 12/-	SU2150	.. 28/6	X21..	.. 17/3	6F23..	.. 20/7	12A8	.. 23/3	202VTP	.. 19/3
EBL1	.. 22/1	LSD3	.. 90/-	SU2150A	.. 28/6	X21..	.. 17/3	6F24..	.. 20/7	12A8	.. 23/3	202VTP	.. 19/3
EBL2	.. 21/3	ML4	.. 13/3	TDD2A	.. 15/3	X28..	.. 21/3	6F25..	.. 20/7	12A8	.. 23/3	202VTP	.. 19/3
EBL3	.. 13/3	ME41	.. 17/3	TDD4A	.. 21/11	X79..	.. 21/3	6F26..	.. 20/7	12A8	.. 23/3	202VTP	.. 19/3
EC31	.. 13/3	ME91	.. 17/3	TDD13C	.. 21/11	X81M	.. 29/9	6F27..	.. 20/7</				



MINIATURE ELECTRONIC COMPONENTS

NEW MIDGET TRANSFORMER, TYPE S

This new series of Fortiphone midget transformers, type S, has been specially designed for use with junction-type transistors when the size of the apparatus must be kept to a minimum. These new transformers are so tiny ($0.375 \times 0.375 \times 0.250$ in.) as to be smaller than the transistor itself!

Most requirements can be met from the range of Fortiphone type S transformers available. On receipt of details we will

be glad to recommend suitable transformers from stock or, if necessary, make a specimen transformer specially for your purpose.

Every transformer is tested before final assembly for short-circuited turns, frequency response, and general efficiency.

Overall dimensions: $0.375 \times 0.375 \times 0.250$ in., or $0.952 \times 0.952 \times 0.635$ cm.
Weight: 0.068 oz. or 1.92 grams.



Actual Size

TRANSFORMER, TYPE T

transformers or, if necessary, make a specimen transformer specially suited to your purpose on receipt of details of your requirements.

Every transformer is tested before final assembly for short-circuited turns, frequency response, and general efficiency.

Overall dimensions: $0.660 \times 0.484 \times 0.460$ in., or $1.675 \times 1.228 \times 1.170$ cms.
Weight: 0.068 oz. or 1.92 grams.



Actual Size

Manufacturers of electronic apparatus are invited to write to

FORTIPHONE LTD

FORTIPHONE HOUSE, 247 REGENT STREET, LONDON, W.I.

Established 1925

Telephone: REGENT 2024-5-6



CONSOLES



For Major Film Mixer Suites to Individual requirements.

"VIEWMASTER" CONSOLES

AS SHOWN



Beautifully designed and finished in Walnut, Oak, Mahogany and Teak, to customers' requirements

Standard "VIEWMASTER" model as shown £13.0.0

With Full Length Doors £14.0.0

Universal Model for all 16" tubes now in preparation.

Carriage and Packing 15/- extra.

Fitted with shelf for easy mounting. These are NOT mass produced and dimensions can be altered to suit personal requirements.

Individual and Trade Enquiries to

H. ASHDOWN
CABINET MAKER

98 HERTFORD ROAD, EDMONTON, N.9
Phone: TOT. 2621

BRADMATIC LTD.

HIGH QUALITY TAPE RECORDING EQUIPMENT

THE MODEL SD TAPE DESK (to take 10½in. NAB Reels)

Programme Time : 62 minutes at 7½ i.p.s.

124 minutes at 3½ i.p.s.

Panel size : 20in. X 14½in.

Two speeds, 3½ and 7½ i.p.s. Double track heads. Push button control. Fast wind and rewind. Three heavy duty motors. Three separately shielded heads. Complete with NAB reel adaptors

PRICE : (fitted with 6RP heads) £50/-.

ALSO AVAILABLE

MODEL SC TAPE DESK (to take 9in. reels)

Programme Time : 55 mins. at 7½ i.p.s.

110 mins. at 3½ i.p.s.

PRICE : (fitted with 6RP heads)

Large Panel (20in. X 14½in.), £47/10/-.

Small Panel (13½in. X 15½in.), £45/10/-.

MODEL SB TAPE DESK (to take 9in. reels)

Programme Time : 31 mins. at 7½ i.p.s.

62 mins. at 3½ i.p.s.

PRICE : (fitted with 6RP heads)

Panel size (13½in. X 15½in.), £42/-.

PORTABLE RECORDERS

In rexine covered case, fitted with model SB tape desk, type D.2. C.J.R. amplifier with monitoring. Provision for external loudspeaker.

PRICE : £117/- (without microphone)

High fidelity sound heads. Type 5RP (Record/play), £3/5/- Type 6RP (super fidelity), £3/15/- Type 5E (Erase), £3/5/- Mumetal Screening cans, 8/6. Amplifiers, microphones. All types and sizes of magnetic tape.

CHANGE OF TELEPHONE NO.
Our 'Phone No. is now EAST 2881-2

Trade supplied.

Send for Lists.

BRADMATIC LIMITED

STATION ROAD . ASTON . BIRMINGHAM 6

Grams : Bradmatic, Birmingham

10,000 off

or

1 off?

Whether you are a professional in the radio industry, or a knowledgeable and enthusiastic amateur, there are at least two things that you have in common—an interest in the pages of the "W.W." and a prejudice towards "buying British". And this is just where we come in.

The 'ENGLISH ELECTRIC' T901 series metal/glass C.R. tubes are and have been

ever since their introduction, entirely British made. In the 16" diameter category we claim that for long life and brilliant performance they are unequalled, whether for new set factory-production—for the home constructor—or as exact equivalents for use in dealer service or maintenance for any receivers equipped with metal C.R. tubes.

Please write to us for details, we shall be very happy to help.

'ENGLISH ELECTRIC'

BRITISH MADE LONG LIFE 16-INCH METAL C. R. TUBE

MAINS TRANSFORMERS

FULLY INTERLEAVED

SCREENED AND IMPREGNATED. ALL GUARANTEED.
ALL PRIMARIES ARE 200/250 v. Half Shrouded.

HSM63 (Midget). Output 250-0-250 v. 60 m/a., 6.3 v. at 3 amps., 5 v. at 2 amps.	16/3
HS63. Output 250-0-250 v. 60 m/a., 6.3 v. at 3 amps., 5 v. at 2 amps.	16/6
HS40. Windings as above. 4 v. at 4 amps., 4 v. at 2 amps. Output	16/6
HS2. 250-0-250 v. 80 m/a.	19/-
HS3. 350-0-350 v. 80 m/a., 19%. HS30. 300-0-300 v. 80 m/a.	19/-
HS2X. 250-0-250 v. 100 m/a., 21/-. HS75. 275-0-275 v. 100 m/a.	21/-
HS30X. 300-0-300 v. 100 m/a., 21/-. HS3X. 350-0-350 v. 100 m/a.	21/-

Fully Shrouded

FSM63 (Midget). Output 250-0-250 v. 60 m/a., 6.3 v. at 3 amps., 5 v. 2 amps.	26/9
Output	
FS2. 250-0-250 v. 80 m/a.	21/-
FS30. 300-0-300 v. 80 m/a., 21/-. FS3. 350-0-350 v. 80 m/a.	21/-
FS2X. 250-0-250 v. 100 m/a., 23/-. FS75. 275-0-275 v. 100 m/a.	23/-
FS30X. 300-0-300 v. 100 m/a., 23/-. FS3X. 350-0-350 v. 100 m/a.	23/-
All the above have 6.3-4.0 v. at 4 amps., 5.4-0 v. at 2 amps.	
FS43. Output 425-0-425 v. 200 m/a., 6.3 v. 4 amps., C.T. 6.3 v. 4 amps., C.T. 5 v. 3 amps. Fully shrouded	47/6
FS50. Output 450-0-450 v. 250 m/a., 6.3 v. 2 amps., C.T. 6.3 v. 4 amps., C.T. 5 v. 3 amps. Fully shrouded	67/6
FS5X. Output 350-0-350 v. 250 m/a., 6.3 v. 6 amps., 4 v. 8 amps., 4 v. 3 amps., 0.2-6.3 v. 2 amps. Fully shrouded	65/-
FS160X. Output 350-0-350 v. 160 m/a., 6.3 v. 6 amps., 6.3 v. 3 amps., 5 v. 3 amps. Fully shrouded	44/-
FS43X. Output 425-0-425 v. 250 m/a., 6.3 v. 6 amps., 6.3 v. 6 amps., 5 v. 3 amps. Fully shrouded	63/6
HS6. Output 250-0-250 v. 100 m/a., 6.3 v. 6 amps., C.T. 5 v. 3 amps. For receiver R1355. Half shrouded	26/6
HS150. Output 350-0-350 v. 150 m/a., 6.3 v. 3 amps., C.T. 5 v. 3 amps. Half shrouded	27/9
F36. Output 250-0-250 v. 100 m/a., 6.3 v. 6 amps., C.T. 5 v. 3 amps. Fully shrouded	29/6
FS120. Output 350-0-350 v. 120 m/a., 6.3 v. 2 amps., C.T. 6.3 v. 2 amps., C.T. 5 v. 3 amps. Fully shrouded	29/9
FS256. Output 250-0-250 v. 80 m/a., 6.3 v. at 6 amps., 5 v. at 3 amps. Fully shrouded	28/6
PRI/1. Output 250-0-250 v. at 30 m/a., 6.3 v. at 1.5/2 amps.	21/-
FS150. 350-0-350 v. 150 m/a., 6.3 v. 4 amps., 5 v. 3 amps....	31/6
FS150X. Output 350-0-350 v. at 150 m/a., 6.3 v. at 2 amps., C.T. 6.3 v. at 2 amps., C.T. 5 v. at 3 amps. Fully shrouded... The above have inputs of 200/250 v.	31/6

OUTPUT TRANSFORMERS

MIDGET OP. 5,000Ω to 3Ω 8,000Ω to 3Ω	3/9
MOP1. Ratios, 26, 46, 56, 66, 90, 120-150 m/a. max. current, C.T. for Q.P.P. Class B, etc. Secondary 2/4 ohms. Top panel, and clamped, each	5/6
OP10. 10/15 watts output. 20 ratios on Full and Half Primary OP30. 30 watts output, 20 ratios on Full and Half Primary... Williamson's O.P. Transformer to Author's specification... Chokes for Williamson's Amplifier, 30 H. at 20 m/a. 10 H. at 150 m/a.	17/9
OP10. 10/15 watts output. 20 ratios on Full and Half Primary OP30. 30 watts output, 20 ratios on Full and Half Primary... Williamson's O.P. Transformer to Author's specification... Chokes for Williamson's Amplifier, 30 H. at 20 m/a. 10 H. at 150 m/a.	25/9
OP10. 10/15 watts output. 20 ratios on Full and Half Primary OP30. 30 watts output, 20 ratios on Full and Half Primary... Williamson's O.P. Transformer to Author's specification... Chokes for Williamson's Amplifier, 30 H. at 20 m/a. 10 H. at 150 m/a.	16/4-
OP10. 10/15 watts output. 20 ratios on Full and Half Primary OP30. 30 watts output, 20 ratios on Full and Half Primary... Williamson's O.P. Transformer to Author's specification... Chokes for Williamson's Amplifier, 30 H. at 20 m/a. 10 H. at 150 m/a.	32/6

FILAMENT TRANSFORMERS

All 200/250 v. Input.	
F3. 6.3 v. @ 3 amps.	9/6
F4. 4 v. @ 2 amps., 7/6. F6. 6.3 v. @ 2 amps.	7/6
F6X. 6.3 v. @ 0.3 amps., 5/6. F12X. 12 v. @ 1 amp.	8/-
FU6. 0.2-4.5-6.3 v. @ 2 amps., 10/-. F12. 12.6 v. tapped 6.3 v. @ 3 amps.	16/6
F24. 24 v. tapped 12 v. @ 3 amps.	23/6
F29. 0.2-4.5-6.3 v. @ 4 amps., 18/9. FU12. 0.4-6.3 v. @ 3 amps.	17/6
FU24. 0.12-24 v. @ 1 amp.	17/6
F5. 6.3 v. @ 10 amps. or 5 v. @ 10 amps., or 12.6 v. @ 5 amps., or 10 v. @ 5 amps.	34/-
F6/4. Four windings in 6.3 v. tapped 5 v. @ 5 amps. each, giving by suitable series and parallel connections up to 6.3 v. @ 20 amps.	51/6

Quotations, etc.—stamped addressed envelope, please

C.W.O. (add 1/6 in £ for carriage).

Export enquiries invited.

**H. ASHWORTH (Dept. WW),
676, Gt. Horton Road, Bradford, Yorks.**

M. R. SUPPLIES Ltd.

offer only first-class material—from stock—at attractive prices. Established 1935—never a single complaint regarding our goods or service.

THERMOSTATS for heat control. Ex. A.M. small model, switching on at 22 deg. F. and off at 49 deg. F. (with adjustments), capacity 3 amps., new 4/6, (despatch 6d.). Also Capillary type, adjustable range 55/90 deg. F. Cap. 15 amps., for air or immersion. Tube 3ft. long with thin phial, 17/6 (des. 1/4). Also new room or greenhouse model by British Thermostat Co., range 10/80 deg. F. to accuracy of 2 deg. F., capacity 10 amps. Current controlled, switch 100 m/a., with on-off switch. In metal housing size 2 1/2 in. dia. for all mains 54/- (des. 1/4).

LONDEX MINIATURE MAINS RELAYS, 230 v. A.C. coil, 2-pole "make," 5 amps Size—2 1/2 in. x 1 1/2 in. x 1 in. Silent in operation. New, 12/6 (des. 9d.). Also same make, Model L.Q.A. 230 v. A.C. coil two-pole change-over mercury switch, cap. 15 amps. 75/- (des. 1/6).

MINIATURE AIR BLOWERS (smallest model obtainable). Max. length 4in. Operating from 12 v. D.C. or 24 v. D.C./A.C. Highly efficient and ideal for lamp and electronic cooling, car heaters, etc., 12/6 (des. 1/4). We have sold over 3,000 of these for domestic and industrial use—very fine value.

MAIN VOLTOMETERS (grade m/m/r.m.s.) 55/- (des. 2/4). Self-starting IMMERSION ELECTRIC PUMPS. New—ex. A.M. Fitted 24 v. D.C. Motor operating well on 12 v. D.C. or 24/30 v. A.C.). Handy short model, 12 1/2 in. overall length—immersion 9 1/2 in. Delivery 200/300 g.p.t., ideal for use in laboratories, caravans, boats, etc., 25/8 (des. 2/4).

SYNCHRONOUS CLOCK MOVEMENTS, 200/250 v. 50 c. With spindles for hours, minutes and seconds hands, in plastic dust cover 3 1/2 in. dia., 2in. deep, with flex. ready for use, 27/6 (des. 1/4). Set of three hands for 5 1/2 in. dial, 9/-.. Remarkable offer of suitable mantel mounts for these movements, in translucent plastic, green, cream, wine, blue, pink, yellow, with figured zone. Height 8in. Only 5/8 (des. 1/4). Please give second choice.

SYNCHRONOUS TIME SWITCHES (Sangamo—brand new) 200/250 v. 50 c. Up to three "on-off" operations each 24-hours, cap. 20 amps. Fitted day-nighting device (use optional). Size 4in. dia. by 3 1/2 in. deep. Easily installed and utterly reliable, £5/8 (des. 2/4).

ELECTROMAGNETIC COUNTERS, operating from 20/24 v. D.C. or 40/50 v. A.C. Each unit contains two separately energised counters, each counting up to 9999 and one or both can be used at the same time. Manual re-set. Can be used for high-speed counting. In cylindrical housing 5in. high with 3in. window (for panel mount 3 1/2 in. hole required). Each in moisture-proof pack and in brand new condition. 37/6 (des. 1/6).

SHADOW POLE MOTORS, 200/250 v. A.C., torque 400 grm/cmns. 3in. dia. 3in. long, silent 1in. proj. 1in. 1,200 r.p.m. silent running, 22/6 (des. 1/4).

SIDING DIMMERS for control of lighting from full-bright to blackout at 220/240 v. Fully enclosed and safe. 100 watts, 36/-, 200-watts, 42/6, 300 watts, 47/6 (des. any one 2/4). 500 watts 55/- (des. 3/4).

STUD SWITCHES, with 20 stud-taps, panel 5in. square, by 2in., with laminated switch arm, new boxed, 9/8 (des. 1/4).

M. R. SUPPLIES, Ltd., 68 New Oxford St. London, W.C.1
Telephone: MUSEum 2958

THE BRITISH NATIONAL RADIO SCHOOL

ESTD. 1940

NOW IN OUR FOURTEENTH YEAR
AND STILL

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

to pass his examination(s) after completing
our appropriate study course.

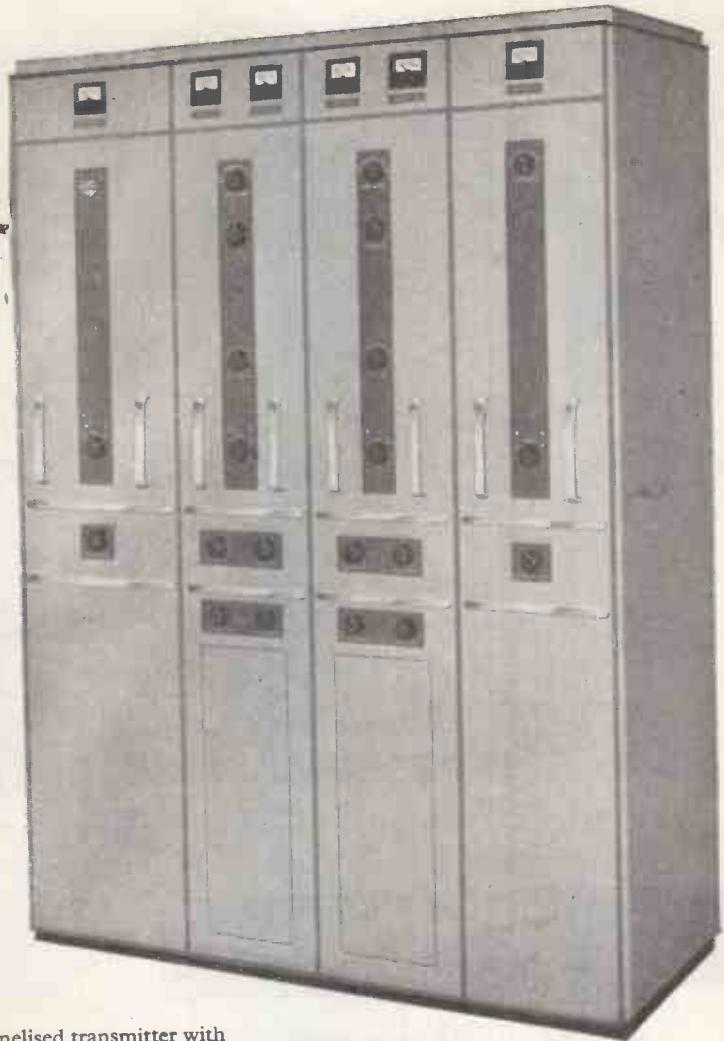
And we don't propose to
permit **YOU** to spoil
our record!

**A.M.Brit.I.R.E. and CITY and GUILDS Radio and
Telecommunications Exams., etc., etc.**

NOTE NEW ADDRESS:

PRINCIPAL
BRITISH NATIONAL RADIO SCHOOL
2, CANYNGE ROAD, CLIFTON, BRISTOL, 8
Tel. BRISTOL 34755

1 kW Channelised Transmitter



THE GFT.560 is a 1kW channelised transmitter with a frequency range of 1.5—30 Mc/s. It consists of three basic cabinets—r.f. unit, modulator unit, and power supply unit—combinations of which can be used to provide multi-frequency working as well as a number of different types of emission. The wave change facilities of the transmitter are both rapid and reliable—a valuable asset when the operating frequency is changed many times each day.

The GFT.560 is fully tropicalised, and its unit construction facilitates future expansion of the initial installation, should the need arise.

For use in conjunction with the GFT.560 there are ancillary units that enable the transmitter to be remotely controlled over a two wire telephone circuit: operational adjustments are dialled to the transmitter.

The versatility and reliability of this new Mullard transmitter make it particularly suitable for h.f. en-route, ground-to-air services and point-to-point communication networks. A team of Mullard communication engineers is available to advise on the use of the GFT.560 in such applications. They will also assist in planning complete communication systems, if required.

ABRIDGED DATA

Frequency Range 1.5—
30 Mc/s
Frequency Stability To At-
lantic City, 1947, standards
Power Output 1 kW
Types of Emission c.w.,
m.c.w., telephony, fre-
quency shift, single and
independent sideband. (A1,
A2, A3, F1, A3a and A3b)
Output Impedance 600
ohms balanced twin feeder
Power Supply 400V, 50-
60 c/s, 3-phase

Mullard



SPECIALISED ELECTRONIC EQUIPMENT

**MODEL
1950**

AUDIO FREQUENCY PANORAMIC WAVE ANALYSER

FOR VISUAL INTERPRETATION OF THE FREQUENCY COMPONENTS PRESENT IN NOISE,
VIBRATION AND WAVEFORMS

INDUSTRIAL ELECTRONICS

DERBY ROAD · EAST SHEEN · LONDON · S.W.14.

PHONE: PRO 8211/2

S.G. Brown

"F" TYPE HEADPHONES

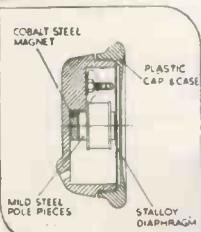
for LONG LIFE and
TROUBLE-FREE SERVICE

This is a featherweight model of exceptionally strong construction and high sensitivity. It appeals equally to both amateur and professional radio-engineers. It incorporates powerful cobalt steel magnets with flat Stalloy diaphragms.

D.C. Resistance: 4,000 ohms.

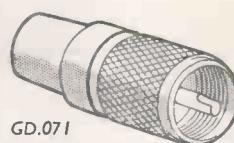
Impedance: 14,000 ohms at 1,000 c/s.

For full details of other models in the wide S.G. Brown range please write for Illustrated Brochure "W."

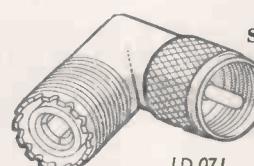


S.G. Brown Ltd.
SHAKESPEARE ST., WATFORD, HERTS.
Telephone: Watford 7241.

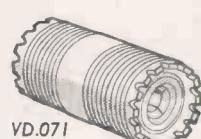
(13)



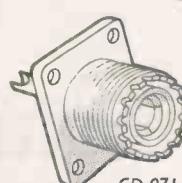
GD.071



LD.071



VD.071



CD.071



RD.07/05

SCREENED CONNECTORS

for cables of 0.2" to 1.03" O.D.

Single and multi-way types.

Special types fitted with coupling rings.

Cable joining connectors.

U.S. Type Connectors
as illustrated.

CABLE O.D.	TYPE	CODE NO.
0.41"	Straight plug	GD.071
0.45"	Reducing adaptor	RD.07/05
0.25"	Reducing adaptor	RD.07/03
0.2"		
fits on GD.071 CD.071 VD.071	Elbow plug adaptor	LD.071
fits on GD.071 LD.071	Bulkhead (Junction) adaptor	VD.071
fits on GD.071 LD.071	Chassis receptacle	CD.071

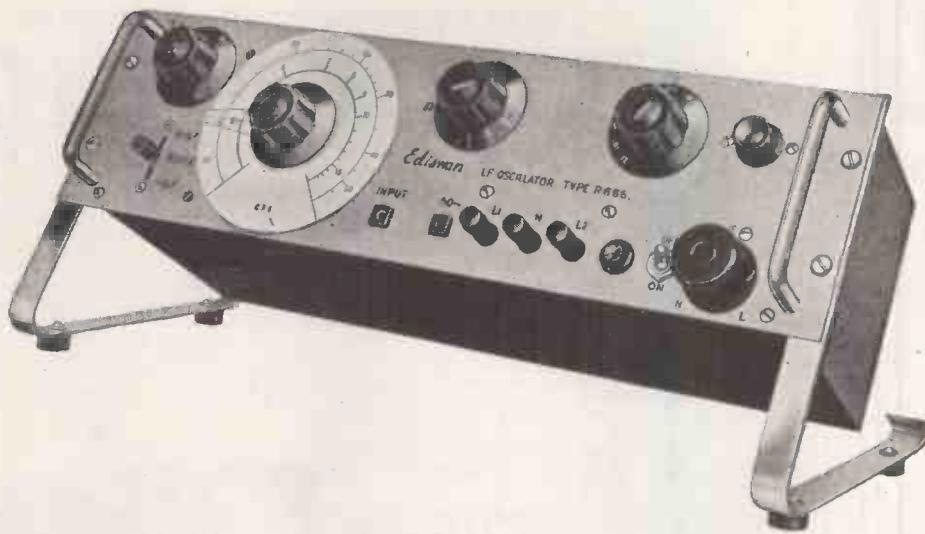
Other Transradio specialised products:
CO-AX air-spaced articulated
Very Low Loss Cables,
Microdual Two-speed Precision Drives.

TRANSRADIO

LTD

138A CROMWELL ROAD, LONDON, SW7,
ENGLAND Telephone: FREmantle 4421 (P.B.X.)

A dependable low-frequency standard



The Ediswan Low Frequency Oscillator type R.666 provides a dependable low frequency standard for testing, calibration and set up of biological amplifiers and recorders, strain and vibration recorders, and low frequency wave analysers.

Production of this Oscillator has been stepped-up to meet the great demand for it and delivery can now be made with little or no delay. Complete the attached coupon or write for further details.

Brief Specification of Ediswan Low Frequency Oscillator type R.666

TYPE. Resistance capacity, with automatic amplitude control effective over the whole frequency range.

FREQUENCY RANGE. 1.15 c.p.s. to 5,500 c.p.s. **INPUT.** 200—250 volts, 40—60 c.p.s.

OUTPUT. Sine wave 50 volts peak to peak, push-pull, with built-in attenuator.

CONSTRUCTION. Standard 19" rack mounting, but also suitable for bench use. Bench stands available.

NOTES. An incremental switch is fitted. Provision is made for modulation of output.

PRICE £75 nett **STANDS £1. 1s. nett**



THE EDISON SWAN ELECTRIC CO. LTD.
155 Charing Cross Road, London, W.C.2.
*Please send me full details of the Ediswan
Low Frequency Oscillator Type R.666.*

NAME.....

ADDRESS.....

EDISWAN

RADIO DIVISION

THE EDISON SWAN ELECTRIC CO. LTD.,
155 CHARING CROSS ROAD, LONDON, W.C.2

Member of the A.E.I. Group of Companies

14

**reasons why those concerned
with recorded sound choose**

FERROVOICE MAGNETIC RECORDING TAPE

★ 1 Does not curl—lies flat on the transducer head, giving better frequency response, and smooth tracking.

The pigment is dispersed and milled, with the highest degree of control, thus ensuring a uniform dispersion of the oxide particles within the binder.

★ 2 Has the lowest possible surface friction—reducing wear on transducer heads, and guide pillars.

The spools were designed to incorporate the "universal" hub, perfect balance, and negligible rotation noise.

★ 3 Has the best possible dispersion of oxide particles, free from coagulation, and flocculation ensuring low noise level.

"FERROVOICE" products are subject to continuous development by our technical staff.

★ 4 Is correctly heat-dried to preclude "blocking" and sticking, layer-to-layer, under storage conditions.

"FERROVOICE" has a Coercivity of 270 oersteds (BHC) remanence = 730 gauss, when subjected initially to a magnetising force of H = 2,000 oersteds.

★ 5 The Lacquer is formulated to attain the maximum adhesion to the base material.

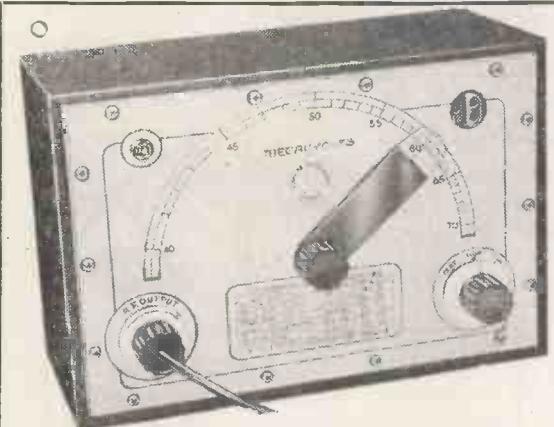
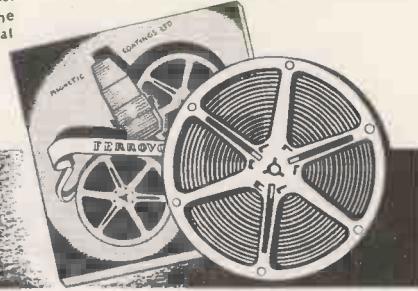
- ★ 1 Does not curl—lies flat on the transducer head, giving better frequency response, and smooth tracking.
- ★ 2 Has the lowest possible surface friction—reducing wear on transducer heads, and guide pillars.
- ★ 3 Has the best possible dispersion of oxide particles, free from coagulation, and flocculation ensuring low noise level.
- ★ 4 Is correctly heat-dried to preclude "blocking" and sticking, layer-to-layer, under storage conditions.
- ★ 5 The Lacquer is formulated to attain the maximum adhesion to the base material.

Suitable for Single or Double Track Recording. Length 1,200 ft. on 7 in. Diameter Spool—Frequency response 50 C.P.S. to 10 kc.s. at 7.5 in. per sec. Breaking strain exceeds 4lb.

Length 1,200 ft.
50 C.P.S. to 10
kc.s. at 7.5 in. per sec. Breaking strain exceeds 4lb.
22/6 PRICE RETAIL

MAGNETIC COATINGS LIMITED

38 GROSVENOR GARDENS LONDON SW1 Telephone: SLOANE 9129
WORKS & LABORATORY: 25 DASHWOOD TRADING ESTATE
LARCH ROAD · LONDON · SW12 BALHAM 5579



PATTERN GENERATOR TYPE 4

Price £8.0.0 (Postage and packing 3/6 extra.)

● 40-70 Mc/s ● A.C. mains operation ● Direct calibration. CHECKS : Frame and line time base frequency and linearity ● Vision channel alignment ● Sound channel and sound rejection circuits ● Vision channel bandwidth, etc.

SIGNAL GENERATOR TYPE 10. 100 Kc/s-100 Mc/s

Price £7.10.0 (Postage and packing 3/6 extra.)

● 100 Kc/s to 100 Mc/s ● Modulated or unmodulated carrier ● Direct calibration ● Adjustable 400 c.p.s. AF signal ● Stable RF oscillator ● Large, easily read scale ● A.C. mains operation.

Obtainable only direct from the manufacturers. Send for full technical details or call at address below.

HOMELAB INSTRUMENTS LTD.,
615-617, HIGH ROAD, LEYTON, LONDON, E.10
Telephone : LEY 5651

A SELECTION from our GENERAL LIST

MIKES. Acos Mic. 22-2, 84/-; Mic. 30, 50/- Rothermei 2.AD/56, 63/- Lustraphone C.51/Z, 25/15/- base extra 10/6.

LOUDSPEAKERS. Goodmans Audiom 60, £8/12/6; Axiom 150 Mk. II, £10/5/6; W.B. HIGH FIDELITY, 3 ohm coil, HF. 610, 6 inch, 50/6; HF. 810, 8in., 60/6; HF. 912, 9in., 67/-; HF. 1012, 10in., 73/-; 15Ω available at 73/6.

COILS. (Stand range required). Osmor Q, 4/-; Weymouth H, 3/9; Wearite P, 3/-; Denco CTRF, 8/- pr.; Denco Maxi-Q std. or miniature, 3/11, with reaction 4/9. R.E.P. dual range high gain 4/-; OSMOR Q Coilpacks, Type HO 48/-; LO 40/-; Bell 50/-; TR 40/-; ETA 4 Series Tuning pack, 49/8.

LEAD SPLANS. (455 K/cm) Denco 11, 12, 13, 14/-; H.T. 8, 18/- Wearite M.800, 21/- pr. Weymouth P.4, 15/- pr.; P.5, 8/6 each; P.5A, 10/- each.

OUTPUT TRANSFORMERS. 50 Watt POTTED or COTTON type to suit single or push-pull EX4, 5V6, 6L6 & KT66 valves. Optimum loads 4,000 to 10,000 ohms.

Eleven ratios 15:1 to 78:1 4/7/3; Elstone M.R/T 4 w. multi-ratio, 8/6; Elstone M.R/7, 7-10 w. multi-ratio, 18/8; MR.15, 15 w. multi, 41/6; MR.30, 30 w. multi, 49/6; Weden Williamson, Potted, WOT.25, 1.70 secs., £6/10/- WOT.26, 3.6 ohm. secs., £6/18/8.

RECTIFIERS. Brimar S.T. & C. RM.I, 5/3; RM.2, 5/9; RM.3, 7/-; RM.4, 21/-; DRIM.IR, 11/6; DRIM.B, 12/6; DRIM.B, 15/-; KS/45, 8/3; KS/50, 8/9; KS/100, 14/8; Westinghouse 14A86, 20/4; 14A100, 26/-; 36EHT45, 23/8; 36EHT50, 26/1; 36EHT100, 29/5; 14D36, 11/7; WX.3 & WX.6, 4/- each.

TAPE DECKS. Truxor Mark III, 223/2/-; Motek type K.4 with super sensitive heads, £17/17/- TAPE. Bimtape and Scotch Boy 1.200ft., 35/-; 600ft., 21/-; Polytron 1.200ft., 22/6; 600ft., 15/-; 300ft., 8/6. Spare REELS, 1.200ft., 4/8; 600ft., 2/6; 200ft., 2/3.

WIDE ANGLE COMPONENTS. ALLEN, Telekino Chassis, 50/-; Collecta, (TK & Super-Vision), 44/6; LO.308, 40/-; FO.303, 21/-; DC.300c, 39/6; FC.302, 31/-; GL.18 & 18, 7/6 each; SC.312, 21/-; AT.210, 30/-; OP.117, 9/-; BT.114, 15/-; DENCO Chassis Magnaview, 37/6; Chassis, Super-Vision, 51/6; Collecta, Magnaview, 41/2; WA/DCAL, 43/-; WA/FCAL, 31/-; WA/LCI & WCI, 7/6 each; WA/FMAL, 21/-; WA/LOTI, 42/-; WA/FBT1, 16/-.

ELAC Duo-mag Focalisers, Low Flux, 37/6; Medium, 39/6; High, 42/- Ion traps, all types, 5/- each.

SUNDRIES. Denco MTO.1 test oscillator, 75/-; AVO Universal AC-DO Minor, £10/10/-; DECALS, standard, 4/9, post free. Amateur, 3/9, post free; J.B. Dial assemblies, SL.5, 26/6; SL.8, 27/6; TXANA Std. Irons, 16/9; ERIE RESISTORS, type 9, 1/2, 8d.; Type 8, 1 w. 8d.; Type 2, 2 w. 10d., all listed values 10Ω to 10 meg. ERIE Silertex 10 watt w/w resistors, 25Ω to 10k., 2/- each

Send 6d. stamp for our General List of components for Viewmaster, Soundmaster, Williamson Amplifier, Telekino, Magnaview (Brimar & English Electric large screen TV), Super-vision; Close tolerance Silver Micas etc., etc. Please add 1/- postage to orders under £1.

L. F. HANNEY
77, LOWER BRISTOL ROAD, BATH
Tel.: 3811



OPEN TUE & SATURDAYS

TELEPHONES: AMBASSADOR 4813 & PADDINGTON 31718

PREMIER RADIO Company

(Dept. W.W.) 207 · EDGWARE ROAD · LONDON · W2

BUILD A PROFESSIONAL LOOKING RADIO AT LESS THAN HALF TODAY'S PRICE

We can supply all the parts to help you.
 Drum (2in. dia.) ... 1/6
 Driving head ... 1/6
 Double pointer ... 4d.
 Spring ... 3d.
 Nylon Cord (yard) ... 6d.
 Dial Front Plate ... 2/6
 Engraved Glass Dial 180-360 and 800-
 2,200 m. With station names, new wavebands ... 1/6
 T.R.F. Coll. 180-350, 800-2,200 metres pair ... 5/6
 Double chassis, 3-valve plus rectifier T.R.F. ... 3/9
 Cabinet, Bakelite, in Walnut or Ivory or Wooden in Walnut Finish ... 17/6
 Packing and Insurance ... 2/6
 SEND 1/6 FOR EASY TO FOLLOW POINT-TO-POINT DIAGRAMS AND CIRCUIT DIAGRAM which shows how YOU can build the Receiver illustrated above.



MANUFACTURER'S SURPLUS STOCK

5-VALVE SUPERHET RADIO RECEIVER CHASSIS, built to high standards ensuring quality reception. SPECIFICATION: VALUABLE TUNING UP - 787, 7B7, 7C6, 7C5, 7V4, 3 WAVEBANDS Long, medium and short. CONTROLS: Tuning, wave change, volume tone control on/off Gram Position on Switch. Pick-up and Extension Speaker Sockets incorporated. For use on 200/250 v. A.C. mains. DIMENSIONS: Length 14in., height 11in., width 6½in. Distance between controls, left to right from edge of chassis: 1in., 3in., 6½in., 3in. Plus 5/- pkg./carr./ms.

The above Receivers less Speaker and Output Transformer. A suitable 10in. Moving Coil Speaker and Output Transformer can be supplied at 23/- extra.

LIMITED QUANTITY

1132A RECEIVER UNITS
COMPLETE WITH CIRCUIT

11-valve Superhet covering 100 to 124 Mhz., using four VR53, two VR56, VR65, VR66, VR67, VS4 and VR57 valves. Fitted with Tuning Meter, slow motion drive, R.F. and L.F. Gain Control, etc. Circuit: R.F. amp, frequency changer, oscillator and stab., 3-I.F. amps., B.F.O. Det., first audio and output. Brand new, with circuit diagram.

Price 59/6 plus 7/- carriage.

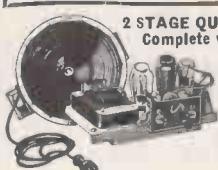
POWER PACK for above completely wired and tested, will fit on Receiver chassis. Price 50/- plus 2/6 pkg. and carr.

2 STAGE QUALITY AMPLIFIER
Complete with 10 in. Energised LOUDSPEAKER

4 watts output. A.C. 110/230 mains.

£6.19.6

plus 5/- carriage.



DECCA MODEL 33A

DUAL SPEED RECORD PLAYER

Includes crystal pick-up with sapphire stylus and a light weight plastic spring balanced arm. Heavy gauge pressed steel case with brown enamel finish in good quality for operation on A.C. mains 200/250 v. 50 c.p.s. Supplied complete with single head (either standard or long playing). £4.19.6 Extra Head can be supplied for 19/6. Plus pkg. and carr. 5/-.

EX-U.S.A. U.H.F. AERIAL
with un tuned detector stage, consisting of V.R.92 valve, etc. Brand new, in carton, 5/-.

MAINS NOISE ELIMINATOR KIT
Two specially designed chokes with three smoothing condensers with circuit diagrams. Cut out all mains noise. Can be assembled inside existing receiver. 5/6 complete.

Terms of Business:-
Cash with order or
C.O.D. over £1. Please add 1/- for Post Orders under 10/-, 1/6 under 40/-, unless otherwise stated.

THE COMPLETE KIT to construct a 3-valve plus rectifier T.R.F. Receiver for use on 200/250 v. A.C. mains can be supplied at 28/15/0 plus 2/6 packing and carriage. Each Kit is complete in every detail, nothing has to be made or improvised. Easy to follow, point-to-point diagrams are supplied, making construction very simple. The Dial is illuminated, and the Receiver housed in its Cabinet, size 12in. x 5in. x 6in., presents an attractive appearance. The valve line-up is: 717A—H.F. Pentode

VR116 — Detector.
ATP4 — Output, and Metal Rectifier.

Waveband coverage for the medium and long bands. Choice of 3 Cabinets: Bakelite in Walnut or Ivory, or Wooden (Walnut finish).


**ONLY A FEW LEFT—BUY NOW!
THE FAMOUS 'SOBELL' 4-VALVE SUPERHET TABLE RECEIVER**
M. & L. WAVEBANDS

Valve line-up: 12J7, 35L6, 1487, 35Z4.

Entirely transportable and unusually sensitive owing to special feed-back circuit employed. Housed in attractive plastic cabinet.

Choice of 2 colours—Brown and Cream.

Carrying handle incorporated in design. For use on 200/250 A.C./D.C. mains.

Plus 5/- Pkg./carr./ms.

**£8.8.0****Fully covered by Manufacturer's Guarantee****5-VALVE SUPERHET RADIO CHASSIS****1124 RECEIVER UNITS**

Range 30 to 40 Mc/s. Contains six new Valves 3-9D2, 1-8D2, 1-15D2 (frequency changer), 1-4D1, 24 ceramic trimmers, 6 ceramic waveholder cans, 30 resistors, 1-W/W Pot. Meter Mica Tubular and Block Condensers. Ceramic coil former, 2 Westecor WX6 and 1 Westecor WX4, 5-way 4-bulk switch with long spindle, I.F. transformers, etc.

17/6 plus 3/6 postage and packing.

1155 RECEIVER UNIT**SLIGHTLY SOILED**

In original cases complete with 10 valves. Frequency range 18.5 Mc/s.-75 Kc/s. in 5 wavebands. £7/19/6. Plus 10/6 packing and carriage.

**POWER SUPPLY UNIT**

for above, incorporating output stage. Supplies an output of 250 volts at 80 mA, which is ample for the R1155 with the output stage. Jones plugs for connecting the Power Pack to the Receiver are included. The 6V6 output stage complete with Output Transformer and 6½in. speaker is built into the unit. Price £5/5/-, plus 5/- packing and carriage.



We have a few Brand new R1155 Receivers in original cases, complete with 10 valves. Frequency range 18.5 Mc/s.-75 Kc/s. in 5 wavebands. PRICE £11/19/6. Plus 10/6 pkg. and carr.

As a special offer, power supply unit including speaker together with R1155 receiver.
PRICE £16.19.6. Plus 15/- pkg. & carr.

R1355 RECEIVER AMPLIFIER
with 5 I.F. Stages for T.V. conversion. Contains 7 VR65's, 1-5U4, 1-VU120, 1-EA50. £1/19/6. Plus pkg. and carriage 10/-.

RF 24 UNITS

Frequencies covered 30-30 Mc/s (10-15 metres). Switched tuning, 5 pre-set positions complete with 3 VR65's. 17/6.

RF 25 UNITS

Frequencies covered 40-50 Mc/s (6.75 metres), switched tuning. 5 Pre-set positions complete with 3 VR65's. 17/6.

RF 26 UNITS

The ideal short-wave converter for T.V., variable tuning, contains 2-EF54. 1-VR137. 37/6.

RF 27 UNITS

Frequencies covered 85-85 Mc/s (3.5-3 metres). Otherwise as RF 26. 37/6.

**CORRECT ASPECT WHITE
Rubber Mask—Round or Flat**

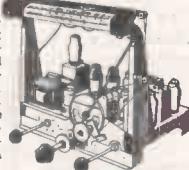
6in. 8/6 9in. 9/6
12in. 16/11 15in. 27/6

T.V. PRE-AMPLIFIER

Amplifier Unit Type 208A, using 2 VR69 valves suitable for operation on London frequency. Brand 19/6 new. Plus 1/6 pkg. and carr.

Drilled and cut out for all necessary control mounting

and Mains Transformer, fitted with 6 Amphion Octal Valveholders, Aerial, Earth and Ground Terminals, 500 pf Tuning Gang Condenser, full vision dial, Tuning Assembly consisting of unbreakable Perspex 3-coloured scale for long, medium and short wavebands. Calibrated in metres, kilocycles and station names, price 39/6.

A WORLD-FAMOUS Manufacturer's Surplus of RADIO RECEIVER CHASSIS 7-valve RECEIVER

Built to exacting specifications and incorporating features ensuring superlative tonal qualities and world-wide reception. Specification: 8 watts pull-push output using 2 Mazda Pen. 45 valves. Ample negative feedback is applied over all the audio-amplifier. Amplifier Mazda Type HL414D gives signal Detection A.V.C. and Phase Splitting. Two stages of I.F. amplification 465 Kc/s., using Mazda VP41. FOUR WAVEBANDS—14 M.-24 M.-24 M.-55 M., 180 M.-600 M., 900 M.-2,000 M.

DIRECT AND VERNIER TUNING. Gram. position on Switch. Provision for external Loudspeaker. For use on 200/250 A.C. Mains. £13/10/- p/us 21/- pkg. and carr.

Famous Manufacturer's Surplus of ANTI-INTERFERENCE AERIALS offered at a fraction of original cost

The aerial is designed for reception of long, medium and short waves, with any ordinary or communications receiver, having an input impedance greater than 1,000 ohms long/medium waves and 150 ohms short waves. The installation discriminates against locally generated electrical interference, especially on the short wave bands. The equipment enables the installation of an 8.3 Mc/s fatly-tuned dipole which operates as a "T" aerial on medium and long waves. The aerial and receiver transformers are intended to be interconnected with a 70 ohms co-axial cable.

COMPONENT PARTS

Aluminium Aerial Transformer Assembly. Comprising one each Aluminium transformer, Transformer clip, Rubber sucker, ½in. x ½in. brass screw, 4AB x 1in. brass bolt, 4BA nut.

Receiver Transformer. Complete with Insulators, clips, etc.; Porcelain Insulators, 2 each, 60ft. Insulated Aerial Wire, 60ft. Screened Co-Axial Down Lead.

Installation instruction leaflet included.

LESS CO-AXIAL CABLE & AERIAL WIRE. 15/- plus 1/6 pkg. and carr.

COMPLETE 35/-: plus 1/6 pkg. and carr.

PREMIER RADIO COMPANY

MAY BE BUILT FOR

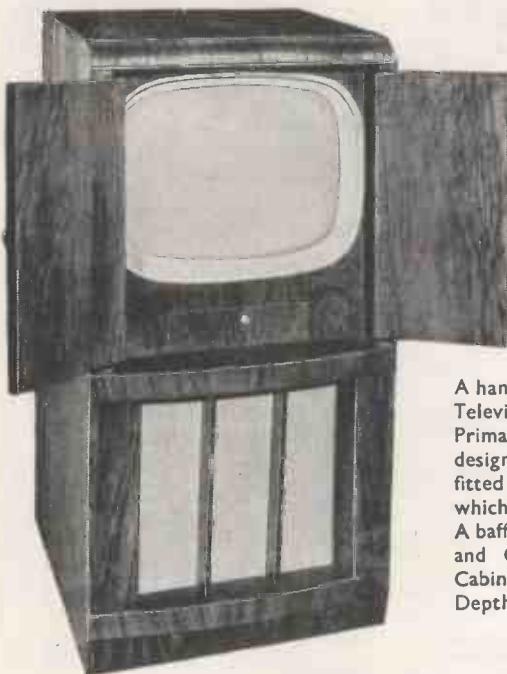
£31 · 19 · 7

including all valves.
(plus cost of CRT)



THE COMPLETE TELEVISOR IS SAFE TO HANDLE, BEING COMPLETELY ISOLATED FROM THE MAINS BY A DOUBLE WOUND MAINS TRANSFORMER. ALL PRESET CONTROLS CAN BE ADJUSTED FROM THE FRONT, MAKING SETTING UP VERY SIMPLE.

The Televisor may be constructed in 5 easy stages : (1) Vision, (2) Time Base, (3) Sound, (4) Power Pack, (5) Final Assembly. Each stage is fully covered in the Instruction Book, which includes layout, circuit diagrams and point-to-point wiring instructions.



PRICE £13 · 10 · 0

plus 2/- packing & carriage.

The NEW **PREMIER TELEVISOR**

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

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

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

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

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

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

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

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

The Instruction Book also includes full details for converting existing Premier Magnetic Televisors for use with modern wide angle tubes. All components are individually priced.

Instruction book 3/6, Post Free.

PREMIER TELEVISOR CONSOLE CABINETS For 14" and 17" Televisors

A handsome Walnut Cabinet that will be a fitting housing for a first-class Televisor.

Primarily designed for our own Televisor, they are quite suitable for most designs published in the various Radio Periodicals. Folding doors are fitted to cover the Cathode Ray Tube when not in use. A flap is provided which gives access to any preset controls on the front edge of the Chassis. A baffle board suitable for a 10in. Loudspeaker and all the necessary Tube and Chassis bearers are included. The overall dimensions of both Cabinets are the same : Height 38½in. Width 19in. Depth Top 19in. Depth Bottom 21in.

TUBE ESCUTCHEONS

17in. White Moulded	21/-	(packing and postage 1/6)
17in. Bronze Moulded, Complete with Protective Glass.....	48/-	(packing and postage 2/6)
14in. Black Moulded	7/6	(packing and postage 1/-)
Dark Screen Filter suitable for 14in. or 17in. Tubes.....	19/-	
		(plus 1/6 packing and postage).

PREMIER RADIO COMPANY

WHY PAY MORE?

WILLIAMSON AMPLIFIER KIT 15gns.

plus 7/8 post, pkg. & ins.
This kit is absolutely complete and all components are guaranteed exactly to author's specification.

WILLIAMSON OUTPUT TRANSFORMER

(author's spec.), 3.6 ohms. sec. \$4.40

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

\$3.76

PREMIER MAINS TRANSFORMERS

All primaries are tapped for 200-230-250 v. mains 40-100 cycles. All primaries are screened. All LT's are centre tapped.

SP175B, 175-0-175, 50 mA., 4 v. @ 1 a., 4 v. @ 2-3 a.

25/-

SP350A, 250-0-250, 100 mA., 5 v. @ 2-3 a. 6.3 v. @ 2-3 a.

29/-

SP350B, 350-0-350, 150 mA., 4 v. @ 1-2 a. 4 v. @ 2-3 a. 4 v. @ 3-6 a.

36/-

SP352, 350-0-350, 150 mA., 5 v. 2-3 a. 6.3 v. @ 2-3 a.

36/-

SP375A, 375-0-375, 350 mA., 6.3 v. @ 2-3 a. 6.3 v. @ 3-6 a. 5 v. @ 2-3 a.

55/-

SP501, 500-0-500, 150 mA., 4 v. @ 2-3 a. 4 v. @ 2-3 a. 4 v. @ 2-2 a. 4 v. @ 3-5 a.

47/-

SP501A, 500-0-500, 150 mA., 5 v. @ 2-3 a. 6.3 v. @ 2-3 a. 6.3 v. @ 2-3 a.

50/-

SP425A, 425-0-425, 200 mA., 6.3 v. @ 2-3 a. 6.3 v. @ 3-5 a. 5 v. @ 2-5 a.

67/6

250-0-250, 80 mA., 6.3 v. @ 4 a. 5 v. @ 2 a.

19/6

350-0-350, 80 mA., 6.3 v. @ 4 a. 5 v. @ 2 a.

19/6

200-230-250, output 3 v.-30 v. @ 2 a.

17/6

SELECTOR SWITCHES

For many uses, including station selection on a Pre-tuned Radio Receiver.

16 way, 53 Position.
24 v. motor driven.

Price **69/6**

Plus 2/6 Pkg. & Carr.

PREMIER VARIABLE IMPEDANCE "MATCHMAKER" M.O.I.S. OUTPUT TRANSFORMER

Designed to meet the demand for an efficient variable ratio Output Transformer. 11 ratios from 13:1 to 80:1 all centre tapped and can be used to match any output valves either single- or push-pull. Class "A" "AB1" "AB2" or "B" to any low impedance speech coil or combination thereof. Primary Inductance 60 henries 15 watts audio 100 mA. Price 45/-.

WEYMOUTH MINIATURE I.F. TRANSFORMERS

465 Kc/s., iron cored, permeability tuned, 10/8 pair.

WEYMOUTH MINIATURE COIL PACK

Covering Med./Long/Short wave bands. Iron cored coils, gram position on switch. Dimensions: Height, 1 1/8 in. Length, 3 1/4 in. Width, 2 1/2 in. Spindle length 2 in. Price 19/6.

MINIATURE TUNING CONDENSERS

2 gang .0005 mfd. with trimmers .6/8

CHARGER TRANSFORMERS

Input 230 v. A.C. Output 12 v. at 1 amp. Completely shrouded.

BATTERY CHARGERS

200-250 v. A.C. Will charge 2 v., 6 v. and 12 v. Car Battery at 1 amp. Housed in strong metal casing. Finished in Green hammered enamel. Size: 6 in. long, 3 1/4 wide, 3 1/2 high.

Guaranteed 12 mths. The above unit is manufactured by PREMIER and does not contain ex-Govt. components. Plus 2/6 post and pkg. **39/6**

BATTERY CHARGER KITS

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

Cat. No. 2002 Charges 6 volt accumulator at 1 amp. Resistance supplied to charge 2 v. accumulator 21/-

2004 Charges 2.6 and 12v. accumulators at 1 amp. 24/6

7-VALVE SUPERMET CHASSIS

All control mountings cut out, fitted with completely assembled full vision drive scale, long, medium and short wavelength and band spread. Heavy flywheel tuning, 19/6, plus 2/6 pkg. and carr.

H.T. ELIMINATOR AND TRICKLE CHARGER KIT

All parts to construct an eliminator to give an output of 120 volts at 20 mA., and 2 volts to charge an accumulator. Uses metal rectifier, 37/6.

C.R. TUBES

VCR516

9in. Blue picture. Heater volts 4 Anode 4 Kv. In manufacturer's original carton. £23/19/6. Plus 5/- pkg., cart., ins.

VCR517C

6in. picture. This tube is a replacement for the VCR97 and Price 35/- VCR517. Guaranteed full size picture. Plus 2/6 pkg. cart. ins.

AUTO TRANSFORMERS 50 WATTS

Input/Output 0-110-210-220-230-240-250

voltas. Plus 1/- P. & P. 7/6

SPECIAL OFFER

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

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

QUALITY CRYSTAL PICK-UP ROTHERMEL TYPE U48 26/-

plus 1/6 Pkg. and Carr.

PORTABLE GRAMOPHONE UNIT

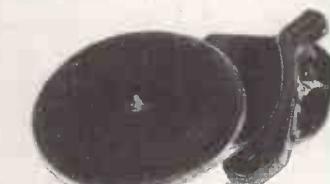
Ready to plug into Radio or Amplifier. Fitted with B.B.S. 2-speed motor 33 1/2 and 78 r.p.m. and Chancery high fidelity microcell pick-up type G.P.X. with L.P. and Standard Cartridge. Assembled in reprise covered cabinet. Height 5 1/2"; Length 15"; Depth 13".

Price **£7.7.0**

plus 5/- Pkg. & Carr.

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

SPECIAL OFFER—AT ALMOST HALF PRICE PLESSEY GRAMOPHONE UNITS



The Motor, Tone arm, and Magnetic Pick-up is in one Unit, with Automatic stop and start.

For use on 200/250 v. A.C. mains 50 cycles. Limited quantity only. £3/19/6. plus 2/6 packing and carriage.

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

Packing and carriage on the above units 2/6

THE COLLARO RC3/521 3-SPEED AUTOMATIC RECORD CHANGER



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

Price **£9.19.6**

Plus 5/- Pkg. & Carr.

"MASTERADIO" VIBRATOR PACK

6 v. input. 180 v. 35 mA. output, complete with valve rectifier and leads. 39/6. Plus 5/- pkg., carr.

ACCUMULATORS

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

2 volt 10 amp (by famous maker) 4/11

RECTIFIERS

E.H.T. Pencil Type S.T.O.

Type K3/25	650 v.	1 mA.	4/7
= K3/40	3.2 kV.	1 mA.	6/-
= K3/45	3.6 kV.	1 mA.	8/2
= K3/50	4 kV.	1 mA.	8/8
= N3/160	12 kV.	1 mA.	21/6

H.T. Type S.T.C.

Type RM1	125 v.	60 mA.	4/-
= RM2	125 v.	100 mA.	4/6
= RM3	125 v.	125 mA.	5/6
= RM4	250 v.	250 mA.	18/-
L.T. Type Full Wave			
6 v. 1 amp.			4/-
12 v. 1 amp.			8/-
12 v. 2 amp.			10/9
12 v. 4 amp.			15/-

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

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

SUPER QUALITY TELEVISION MAGNIFYING LENS

5in. lens suitable for 6in.	18/6
6in. lens	25/-
10in. lens	22/10/-
12in. lens	23/10/-

ALUMINIUM CHASSIS 18 s.w.g.

Substantially made from Bright Aluminium, with four sides

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

ALUMINIUM PANELS 18 s.w.g.

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

LOUDSPEAKERS

ELAC—2 1/2 in. dia. Moving Coil, 15 ohms imp.	15/-
PLESSEY—3in. dia. Moving Coil, 3 ohms imp.	9/1
ELAC—3in. dia. Moving Coil, 3 ohms imp.	15/-
ELAC—5in. dia. Moving Coil, 3 ohms imp.	15/6
PLESSEY—5in. dia. Main Energised, 3 ohms imp. (600 ohms field)	19/6
PLESSEY—10in. dia. Moving Coil, 3 ohms imp.	23/6
GOODMANS—12in. dia. Moving Coil, 15 ohms	28/8
Plus 5/- packing and carriage.	

VITAVOX—K12/20 12in. dia. Moving Coil, 15 ohms imp.	£11/11
Plus 5/- packing and carriage.	

SPECIAL OFFER

A 12in. TRUVOX P.M. SPEAKER

For only

47/6

These are brand new in Maker's Cartons
Plus 2/6 Pkg. and Carr.

METERS

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

Full Scale Deflection in.	Scale Length in.	External Dimensions in.	Movement
2.5	1 1/2	2 1/2 round	R.F. Thermo ..
3.5 A	1 1/2	2 1/2 x 2 1/2	R.F. Thermo ..
4 A	1 1/2	2 1/2 x 2 1/2	R.F. Thermo ..
20 A	1 1/2	2 1/2 round	M/C ..
40 A	1 1/2	2 1/2 round	M/C ..
1.5 mA.	1 1/2	2 1/2 round	12/6
5 mA.	2	3 1/2 round	6/-
10 mA.	2	3 1/2 x 2 1/2	18/9
50 mA.	1	2 1/2 x 2 1/2	7/8
20 V.A.	2	2 1/2 x 2 1/2	M/C ..
40 V.	1	2 1/2 x 2 1/2	M/C ..

MOVING COIL METER

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

Price 4/9

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

PREMIER RADIO COMPANY

The PREMIER De Luxe

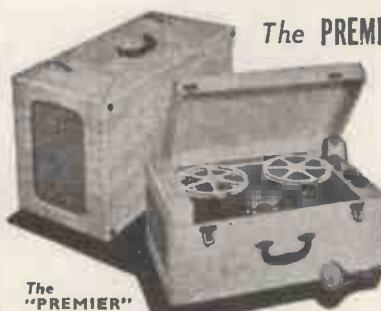
PORTABLE

PRICE

£37·4·0

MAGNETIC TAPE RECORDING KIT

(Plus 15/- Pkg., Carr. & Ins.)



The "PREMIER"® Recorder

This Recording Outfit has been designed for use with M.C.-2-III "SCOTCH BOY" Magnetic Tape. With this new and improved high-quality tape a frequency of 50 c.p.s. to 9,000 c.p.s. at tape speed of $\frac{1}{2}$ in./sec. can be readily achieved. Additional reels of 1,200ft. can be supplied at 35/-.

INSTRUCTIONAL BOOKLET . . . 2/6

This is credited if a complete kit of the Tape Recorder is ordered.

As is usual in all PREMIER KITS every single item down to the last nut and bolt is supplied. The Chassis is punched and layout diagrams and theoretical circuits are included.

When completed the PREMIER PORTABLE TAPE RECORDER compares MORE than favourably with any other make at double the price.

CRYSTAL MICROPHONE

An entirely insulated crystal microphone which can be safely used on A.C./D.C. amplifiers. High impedance. No background noise, really natural tone. The ideal Mike for tape, wire and sound projectors. Price 22/-

MICROPHONE STAND BASE

Heavy moulded black base fitted with standard thread adaptor. Dimensions: 7in. across, 2in. deep. Weight: 1½lb. Post paid 3/11.

SEPARATE UNITS CAN BE SUPPLIED AS LISTED BELOW

AMPLIFIER KIT (including 8in. Speaker) £11 0 0 plus 5/- pkg./carr.

AMPLIFIER (already built, wired and tested) £14 15 0 plus 7/6 pkg./carr.

LANE TAPE TABLE & REWIND SPOOLE £17 10 0 plus 7/6 pkg./carr.

PORTABLE CABINET (rexine covered) £4 19 6 plus 5/- pkg./carr.

MICROPHONE £2 19 6 plus 1/- pkg./carr.

REEL OF NEW M.C.-2-III "SCOTCH BOY" TAPE £1 15 0 plus 1/- pkg./carr.

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

MICROPHONES

LUSTRAPHONE: Moving Coil; High Impedance. Stand Type: £5/15/- Hand Mike £6/6/-.

RONETTE—Crystal Mike; Incorp. the Filter Cell Insert; High Imped. Ball Type: £3/19/6.

CRYSTAL MICROPHONE—Rothermal 2AD56. Especially recommended. £2/19/6. Table stands for all the above 10/6 and 17/6.

THE GOLDRING MAGNA CARTRIDGE



- A magnetic Turnover Cartridge with high output and cantilever styli.
- Entirely new principle. (Pat. applied for.)
- Output comparable to crystal pick-ups.
- Cantilever styli give minimum record wear and eliminate needle-talk.
- Styli easily replaceable.
- Smooth extended frequency response on both standard and L.P. records.
- The ideal replacement Cartridge for 3-speed record changers and units.

Of special interest to the designer of new equipment.

Write for full technical information to:—

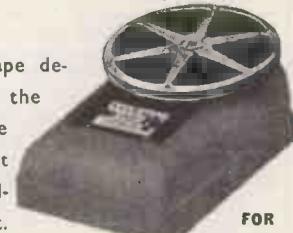
ERWIN SCHAFER

49-51a, DE BEAUVOIR ROAD, N.1

Telephone: CLissold 3434-5-6

LeeRaser

The original ultra rapid tape demagnetiser as supplied to the leading recording studios, the B.B.C., and many Government departments including the Admiralty, R.A.F. and War Dépt.



FOR

A.C. MAINS

MODEL B (up to 7" spool capacity) £9. 10. 0.

MODEL C (up to 12" spool capacity) £15. 0. 0.

Tropical Specification

LEEVERS-RICH EQUIPMENT LTD.,
Manufacturers of high quality magnetic recorders

37, WARDOUR STREET, LONDON, W.I. GER. 4502

RELAYS

AND

KEY SWITCHES

LARGEST EX-GOV'T. STOCK
IN GT. BRITAIN

Types 600-3000 Relays—Siemens High Speed
Also A.C. 400 volts 50 cycles

Uniselector Switches, Telephone Switch-Boards, Telephone Components
Plugs, Jacks, Handsets—Government Contractors.

JACK DAVIS (RELAYS) LTD. (Dept. W.)
36 PERCY STREET, LONDON, W.I.

Phones: MUSeum 7960, LANGham 4821

WE PAY TOP PRICES

FOR

AMERICAN SURPLUS ELECTRONIC EQUIPMENT

Any Quantity or Condition

LOOK AT THESE EXAMPLES

for equipment in good condition

SCR291, complete	£350
R54/APR4 Receiver with all tuning units	£135
ET4336 Transmitter	£110
BC348R Receiver	£25
TS175/U Frequency Meter	£80
TS67 Test Set	£25
RC94 Scanner	£100
TS13 Test Set	£100
723A/B Valve	£3

We pay similar remarkable prices for:-

SCANNERS. Any U.S.A. type.**RECEIVERS.** R111/APR5, R89/ARN5, R5/ARN7, R65/APN9, R15/APN3, R15/CPN2, BC1147A, BC348.**TRANSMITTERS.** CPN2, APN3, ART13, BC1149, TDQ, TDE.**TRANSCEIVERS.** ARCI, ARC3, SCR-522, TCS, BC800 RTI/APN2.**INDICATORS.** ID16B/APN4, ID17/APN3, ID18/CPN2, BC1151, BC1152, BC1159, MC412, I-81A, I-82A.**TEST SETS.** Any unit with prefix "TS." IE19, BC638, I-208.**MODULATORS.** BC1091, BC1142, CM3.**SYNCHRONISER.** BC1148.**POWER UNITS.** RA34, RA42, RA59, TA2, RA88, RA90, MG149, PE98, PE158, DM28.**TUNING UNITS.** TN17, TN18, TN19, TN54, TU57, TU58, TU59.**CONTROL GEAR.** BC1150, BC1145, JB91, JB95, JB98, JB102, PN31, PN32.**ANTENNA GEAR.** BC223A, RC94, AS27, AT4, AN104.**MOUNTINGS.** FT237, FT247A.

And almost every American made unit even if not mentioned above.

Phone us immediately, transfer charge.

Deal with the firm that has been established for twenty-five years and which is by far the largest buyer of Ham Equipment.

ALTHAM RADIO CO.

JERSEY HOUSE, JERSEY ST.

MANCHESTER 4

Telephone : Central 7834/5/6

SUB-MINIATURISATION

HIVAC

THE FIRST TO
GET DOWN
TO IT!



XFY 41

Beam Tetrode

Sub-Miniature Output Valve
with still lower filament current

TYPICAL OPERATION

Filament Voltage	1.25	1.25 V.
Filament Current	10	10 mA.
H.T. Voltage	22.5	30 V.
Control Grid Voltage	0	-1.2 V.
Power Output	1.8	3.3 mW.

The maximum cross-section is only 8 mm. x 6 mm. with a maximum glass length of 35 mm.

A small flat sub-miniature output tetrode with still lower filament current and improved performance at reduced battery voltages.

HIVAC
THE SCIENTIFIC
VALVE

Hivac Ltd.

Telephone: HARrow 2855

GREENHILL CRESCENT, HARROW-ON-THE-HILL, MIDDLESEX

EDDYSTONE

MODEL '840'

AC/DC COMMUNICATIONS RECEIVER



The New Model "840", illustrated above, possesses full Communication facilities and operates from either A.C. or D.C. mains 100/110 and 220/250 volts.

- Seven valve superheterodyne with R.F. stage.
- Frequency coverage 30 Mc/s. to 480 kc/s.
- Gear driven tuning with 140/1 reduction.
- Mechanical bandspread. Accurate re-setting.
- B.F.O. and noise limiter.
- Internal loud-speaker. Headphones jack.
- Robust diecast construction. Rustproofed steel case.
- Suitable for tropical service.
- Weight 30 lbs. Size 16 $\frac{1}{4}$ " x 10 $\frac{1}{2}$ " x 8 $\frac{3}{4}$ " high.

List Price (in U.K.) £45

Exempt from Purchase Tax

PLEASE WRITE FOR FULL SPECIFICATION TO THE MANUFACTURERS:

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

IF YOUR PROBLEM IS COIL IMPREGNATION

The BLICKVAC HIGH VACUUM IMPREGNATOR meets the rapidly growing demand for high-vacuum impregnation.



- Full range of models available to meet the needs of
- ★ The large-scale Producer.
 - ★ The Research Laboratory.
 - ★ The small Rewind Shop.

BLICKVAC UNITS MEET THE MOST STRINGENT SPECIFICATIONS.

Outstanding features:

- ★ Ease in Control.
- ★ Simple attachment of auxiliary autoclaves.
- ★ Best quality fittings.
- ★ Fully demountable to facilitate cleaning.

UNEQUALLED FLEXIBILITY AND PERFORMANCE.

Units available for:

VARNISH
WAX

BITUMEN
POTTING RESINS

If your problem is Coil Impregnation

CONSULT BLICKVAC

Write today to

HAMILTON ROAD WORKS, HAMILTON ROAD, S.E.27
Associated with Blick Time Recorders Ltd., Blick Engineering Ltd.

PARKER'S SHEET METAL FOLDING MACHINE

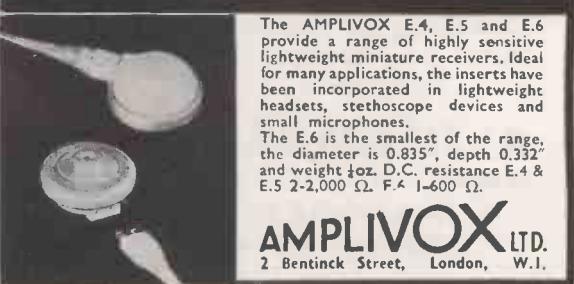


Heavy Vice Model. Capacity 18 gauge M.S.or .016 in. wide. Loose Attachments for Radio Chassis making Weight 22 lb. Price 50/- Attachments 1/2 ft. square 4/-, with attachments 5/8. Also Parker's Square Type Drill Vice. Made from 18 gauge M.S. x 1 in. Jaws of Bright Steel. Admits stock of 4 in. Complete with stand. Heavily constructed. Wt. 134 lb. Price 37/6. Carriage 2/6.

Machines guaranteed.
Send for details.

A. B. PARKER WHEATCROFT WORKS, WELLINGTON STREET, BATLEY, YORKSHIRE. Tel.: Batley 426

MINIATURE MAGNETIC LIGHTWEIGHT EARPHONES

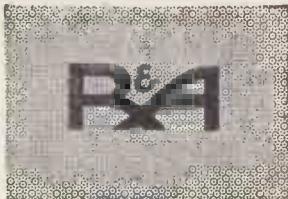


The AMPLIVOX E.4, E.5 and E.6 provide a range of highly sensitive lightweight miniature receivers. Ideal for many applications, the inserts have been incorporated in lightweight headsets, stethoscope devices and small microphones.

The E.6 is the smallest of the range, the diameter is 0.835", depth 0.332" and weight 1/2 oz. D.C. resistance E.4 & E.5 2-2,000 Ω. F.A. 1-600 Ω.

AMPLIVOX LTD.
2 Bentinck Street, London, W.I.

Loud-speaker Manufacturers to the radio industry since 1930



We don't presume

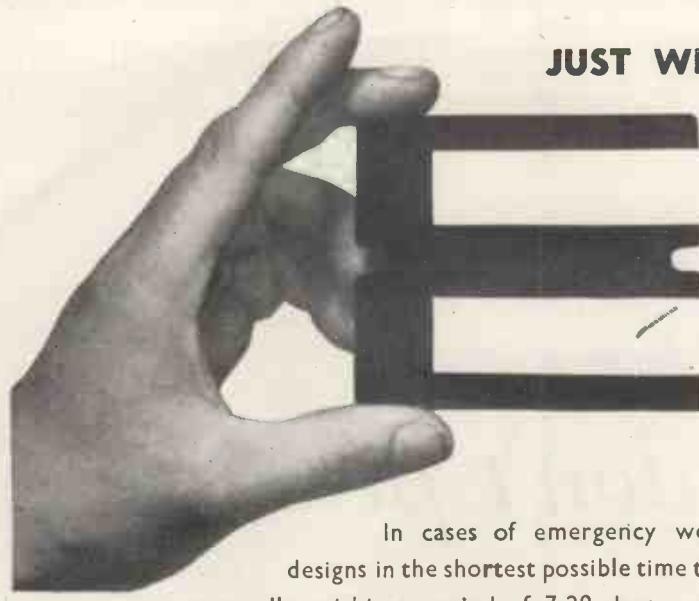
... to know all the set-manufacturer's problems, and still less how they should be solved. Our job is looking after that final, critical link in the chain of reproduction—the loud-speaker. And there we do know what we are talking about.

We do, for instance, supply hundreds of thousands of loud-speakers every year to many of the best-known radio and television manufacturers in the world. Among them are firms with "household names" in North America, where competition is as keen and vigorous as it can be. What we can do for some, we can pretty certainly do for others.

**REPRODUCERS AND AMPLIFIERS LIMITED
WOLVERHAMPTON ENGLAND**

Telephone : Wolverhampton 22241 (5 lines)

Telegrams : Audio, Wolverhampton



**JUST WHAT YOU HAVE BEEN
WAITING FOR . . .**

**PROTOTYPE
LAMINATIONS PRODUCED
WITHIN 7-28 DAYS
ACCORDING TO DESIGN**

In cases of emergency we can supply prototypes for all new designs in the shortest possible time that size, type and circumstances permit, generally within a period of 7-28 days. All Nickel Iron Alloy Lamination heat treatment is guaranteed by certificate. Send us a sample or sketch of your requirements, together with a specification and you will receive a reply by return of post.

ELECTRONIC LAMINATIONS LTD.
OXFORD AVENUE, SLOUGH, BUCKINGHAMSHIRE. TELEPHONE: SLOUGH 25171



Heat, shock and moisture proof.
Diameters from 0.5 mm. to 30 mm.
in 36" lengths. It is manufactured
in all colours and bi-colours.

SPICERS LIMITED

19 New Bridge St., London, E.C.4. Tel.: CENTRAL 4211

TELEVISION

for "Fringe" and "Long distance" Viewers is vastly improved with the SPENCER-WEST type AC/3 Pre-Amplifier. The specification includes a first stage neutralised triode cathode coupled to a grounded grid triode. The optimum arrangement for best "noise factor." Self-contained power supply unit complete with correctly adjusted interference filter. Price complete, 10 gns. from your dealer or direct. Leaflets, etc., on request.

RECEIVER CONVERSION TO NEW CHANNELS
The type AC/4 Converter units for perfect simple conversion. Price complete with 5 valves and self-contained power unit, etc. 15 gns. Available for Brighton booster or London receivers (type AC/4KL) and all other conversions. Leaflets on request.

**SPENCER-WEST
QUAY WORKS, GT. YARMOUTH**

Phone : Gt. Yarmouth 3009

SOLE IMPORTERS

of

RONETTE MICROPHONES

Trianon-Electric Limited
95 Cobbold Road, London, N.W.10

Telephone: WILlesden 2116

Enquiries from Industry invited

CLASSIC EXAMPLES of

HIGH-FIDELITY EQUIPMENT and COMPONENTS

TAPE RECORDERS ETC



COMPLETE INSTRUMENTS	PRICE	DEPOSIT
580/1 Ferograph Model 2a (as available)	79 10 0	27 0 0
580/2 G.B. Standard	99 10 0	33 5 0
580/A Vortexion with Wearite Deck	84 0 0	28 0 0
581/2 Grundig 2-speed	84 0 0	28 0 0
581/8 R.M.C. with new Lane Tape Desk	47 10 0	16 0 0

TAPE DESKS

585 Lane Mark IV	17 10 0	6 0 0
586 Truvox, Mark III*	23 2 0	8 2 0
587/1 Wearite, Type 2A*	35 0 0	12 0 0
587/2 Wearite, Type 2B*	40 0 0	14 0 0
588/1 Bradmatic, Type 5 and 5RP*	41 0 0	14 0 0
588/2 Bradmatic, Type 5C*	45 10 0	15 10 0
588/3 Bradmatic, Type 5/6RP*	42 0 0	14 0 0
588/4 Bradmatic, Type 5CL*	47 10 0	18 10 0
588/5 Bradmatic, Type 5D*	50 0 0	17 0 0

*Equipped for half-tape recording.

MICROPHONES

553 Reale VMC (Moving-coil)	8 0 0
554 Reale R.V. Ribbon	9 0 0
557 Granpian Moving-coil	5 17 6
560 Cosmocord Mic/30 Desk Model Crystal	2 10 0
561 Cosmocord Mic/22-1 Acos Crystal	4 4 0
563 Cosmocord Mic/16-2 Acos Crystal	12 12 0
565 Lustraphone C.H.51 Hand Model, Moving-coil	5 15 6
566 Lustraphone L.X.55 Crystal Model	2 10 0

Stands of all types available.

T.R. AMPLIFIERS

592/1 Lane Amplifier Kit, K.A.-1/R.P.	13 10 0	4 10 0
592/2 Lane Amplifier Assembled	15 10 0	5 5 0
593/1 Elpico Junior Amplifier	16 18 0	6 0 0
593/2 Elpico Senior Amplifier	24 0 0	8 0 0
594 Bradmatic C.I. with Push/Pull O/P	62 0 0	21 0 0
595 G.J.C.B.P./1 with P/P O/P	24 12 0	8 5 0
595/1 O.J.R. Professional Type P.A.I.	94 0 0	32 0 0

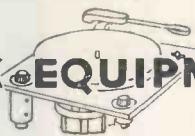
MOTORS

520 Collaro Clock and Anti-clockwise	1 18 6
521 B.S.E. Model S.R.2	1 5 0
522 B.S.E. Model S.R.1	1 12 0
523 B.S.E. Model P.F.10	1 18 0
T.R. TAPES	
569 Emittape H60/6, 600ft.	1 1 0
570 Emittape H60/12, 1,200ft.	1 15 0
570 Emittape H65/12, 1,200ft.	1 15 0
572 G.E.C. Plastic, 1,200ft.	1 10 0
573 Gevaert, 1,200ft.	2 0 0
574 Agfa 1,200ft.	1 17 6
576 Magnetophor, 1,200ft.	2 0 0
576 Ferrotape (Wearite), 1,200ft.	2 5 0
577 Ferrotape (Wearite), 1,750ft., 8in.	3 3 0

And our vast and varied range of apparatus and equipment, possibly the largest in the country, is backed by the famous Classic pre-sales test scheme, whereby every piece of apparatus is thoroughly tested before despatch and guaranteed by our own highly skilled technicians, thus enabling us to give a firm guarantee.

The outright purchase of equipment can be a heavy item, but that is no reason why you should not straight away have the best of gear available by Classic H.P. Here are a few examples showing deposits in relation to the full cash purchase price.

DISK EQUIPMENT



MOTORS AND PICK-UPS	PRICE	DEPOSIT
CONNOISSEUR	£ s. d.	£ s. d.
400 3-speed motor	21 17 3	7 10 0
400/1 3-speed motor with pick-up and one head	27 18 6	9 5 0
GARRARD		
401 Autochanger RC 80 less pick-up heads	15 1 6	5 0 0
401/1H Autochanger RC.75A with 2 Decca XMS heads	18 17 8	6 5 0
COLLARO		
402 Autochanger Model 3RC.531, 3-speed less pick-up head	12 3 1	4 5 0
402/6 A.C. Motor 5/534, 3-speed	6 5 4	2 5 0
DECCA		
403 GU.4C 3-speed motor with crystal turnover pick-up	9 10 0	3 5 0
403/3 Decca transcription motor, 3-speed, Decca XMS pick-up and 2 heads	23 18 2	8 0 0
B.S.E.		
405 M.U.10 3-speed motor	3 18 7	1 5 0
405/2 GU.4 3-speed motor with turnover crystal pick-up	9 9 0	3 5 0
PLESSEY		
406 Plessey 3-speed Autochanger unit, with pick-up. Special price, limited number	10 10 0	3 10 0
E.M.I.		
407 E.M.I. 3-speed, type 2125	17 2 6	5 15 0

AMPLIFIERS, TONE-CONTROLS ETC.

100 Leak, T.12 Standard	28 7 0	9 10 0
101 Quad, with control unit	35 0 0	11 15 0
103 Goodell M.A.15	19 10 0	6 10 0
104 Rogers Baby de Luxe	14 0 0	4 15 0
150 Leaf "Vari-slope"	12 12 0	4 5 0
151 Goodell Type U/T/C	8 15 0	3 0 0
151/1 Goodsell Type F/U/T/C	14 14 0	5 0 0
151/2 Goodsell Type P/U/T/C	18 0 0	6 0 0
192 Rogers Junior de Luxe, Mk. II	9 0 0	3 0 0
153 Lowther Master Control Unit	20 0 0	6 15 0

LOUDSPEAKERS

WHARFEDALE		
601/2 W.12	9 5 0	3 5 0
601/3 W.12/C8	9 15 0	3 5 0
601/4 Super 12in./CS/AL	16 0 0	5 10 0

GOODMANS

603/1 Axiom 150/2	10 5 9	3 10 0
603/2 Audiom 80 15in.	22 10 0	7 10 0
603 Audiom 60	8 12 6	3 0 0

TANNOY

606 Tannoy 12in. Dual Concentric, with built-in crossover network	27 10 0	9 5 0
LOWTHER		

LOWTHER VOIGT		
607 Lowther Voigt FM/2 Drive unit	35 0 0	12 0 0

VOIGT

608 Voigt P.M. Pressure Unit	42 0 0	14 0 0
------------------------------	--------	--------

The items shown here represent but a small proportion of our regular stock, which includes radio-feeder units, complete radio units etc.

CLASSIC ELECTRICAL CO LTD

352-364 LOWER ADDISCOMBE ROAD · CROYDON · SURREY TEL · ADDISCOMBE 6061-2



'IMPRESARIO'

COMPLETE ENTERTAINER

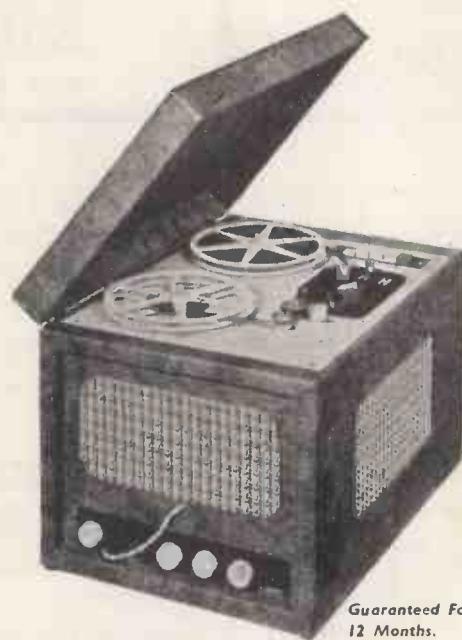
TAPE RECORDER

The "Impresario" is a combination instrument that will make high quality tape recordings of live speech or music, gramophone or radio and telephone conversations, etc.

- DUAL SPEED: 3½ in./7½ in. per sec.
- TWIN TRACK: Up to 2 hrs. recording.
- SEPARATE BASS AND TREBLE CONTROLS.
- 4 WATTS OUTPUT: Neg. F.B.
- INTERNAL MIKE RECORDING SYSTEM.

The "Impresario" can also be used as a high quality radio, gramophone or microphone amplifier.

PRICE 49½ GNS.
(EXCLUDING TAPE)



Guaranteed For
12 Months.

May be fitted in a few minutes.

PRICE 14 GNS.
(TAX PAID)

PIEZOELECTRIC MICROPHONES

Hand unit in rubber grip..... 3 gns.
Studio Floor-stand Pattern..... 6 gns.

Telephone Pick-up Stand..... 3 gns.

Send for "Impresario" Illustrated Brochure which also contains details of Radio Tuner Unit, Telephone Pick-up, Suitable Microphones and Recording Tape.

LEE PRODUCTS (GREAT BRITAIN) LTD., ELPICO HOUSE, GT. EASTERN ST., LONDON, E.C.2.



Actual Size

NEW!

The Manning-Carr Miniature Polarised Relay

DATA—A Sensitivity of 25 milli-watts and capable of handling mains voltage on the contacts with alternating currents up to 0.25 amps. Being polarised it has the advantage that the Armature contact can be biased to lock in either direction by suitable adjustment of the contact screws, which provides a useful facility where pulse operation is required. Speed of operation is also high and the Relay will follow A.C. frequency of 50 c.p.s. Resistance 7,000 ohms, which is acceptable for Anode circuits. Alternatives to specification if required. Sole Concessionaires.

POST OFFICE TYPES 3,000 AND 600 RELAYS

to specification. Tropicalising, impregnating and Services jungle finish if required. Delivery 3-4 weeks.

Manufacturers to H.M. Govt. Depts. and leading contractors.

L. E. SIMMONDS LTD.
5, BYRON ROAD, HARROW, MIDDX.
Telephone: Harrow 2524-0315.

POLYTHENE
H. F. EQUIPMENT
(AMBYTHENE BRAND)
COIL FORMERS
CHOKES
STAND-OFFS
FEED-THROUGHS

Send for particulars and Samples

AMPLEX APPLIANCES (KENT) LTD.
19, DARTMOUTH ROAD, HAYES, BROMLEY, KENT.
(RAVensbourne 5531)

All export enquiries to
ANTEX LTD., 3, TOWER HILL, LONDON, E.C.3

PLASTICABLE LIMITED

A.I.D
approved

**P.V.C. SLEEVINGS
INSULATED WIRE
& FLEX**

HAWLEY LANE · FARNBOROUGH · HANTS
Phone Farnborough Hants 85



Pointers for Designers

AND CONSTRUCTORS
NUMBER ELEVEN

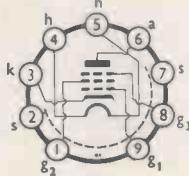
VALVES FOR TAPE RECORDERS

Service in tape recorder amplifiers makes stringent demands on the valves used, particularly in the early stages.

Operation in high gain circuits with a considerable degree of bass boost, and in a confined space in close proximity to a loudspeaker, places a premium on freedom from microphony and hum.

The typical Osram valve line-up shown has proved entirely satisfactory in practice for tape recorder applications. The use of the Z729 low noise pentode, allied with a suitable circuit layout, ensures the virtual elimination of induced hum.

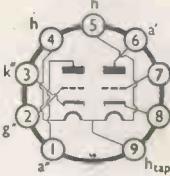
INPUT STAGE
Z729
low noise pentode



V_h 6.3V
 I_h 0.2A
 V_a 250V
 V_{g2} 140V
 g_m 1.85mA/V
 V_{hum} 1.5 μ V
 $R_{g_1-k} = 470\text{k}\Omega$

Base B9A

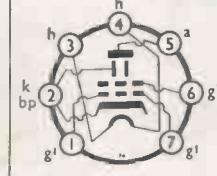
Tone correction
and intermediate
stages
B309
double triode



V_h 6.3V
 I_h 0.6A
 V_a 250V
 g_m 5.5 mA/V
 r_a 10 k Ω

Base B9A

Output and bias oscillator
N727/6AQ5 or N78

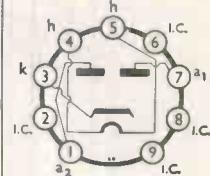


V_h 6.3V
 I_h 0.45A
 V_a 250V
 V_{g2} 250V
 I_k 50mA
 V_{g1} -12.5V
 P_{out} 4.5W

Base B7G

Rectifier
U709

full-wave rectifier

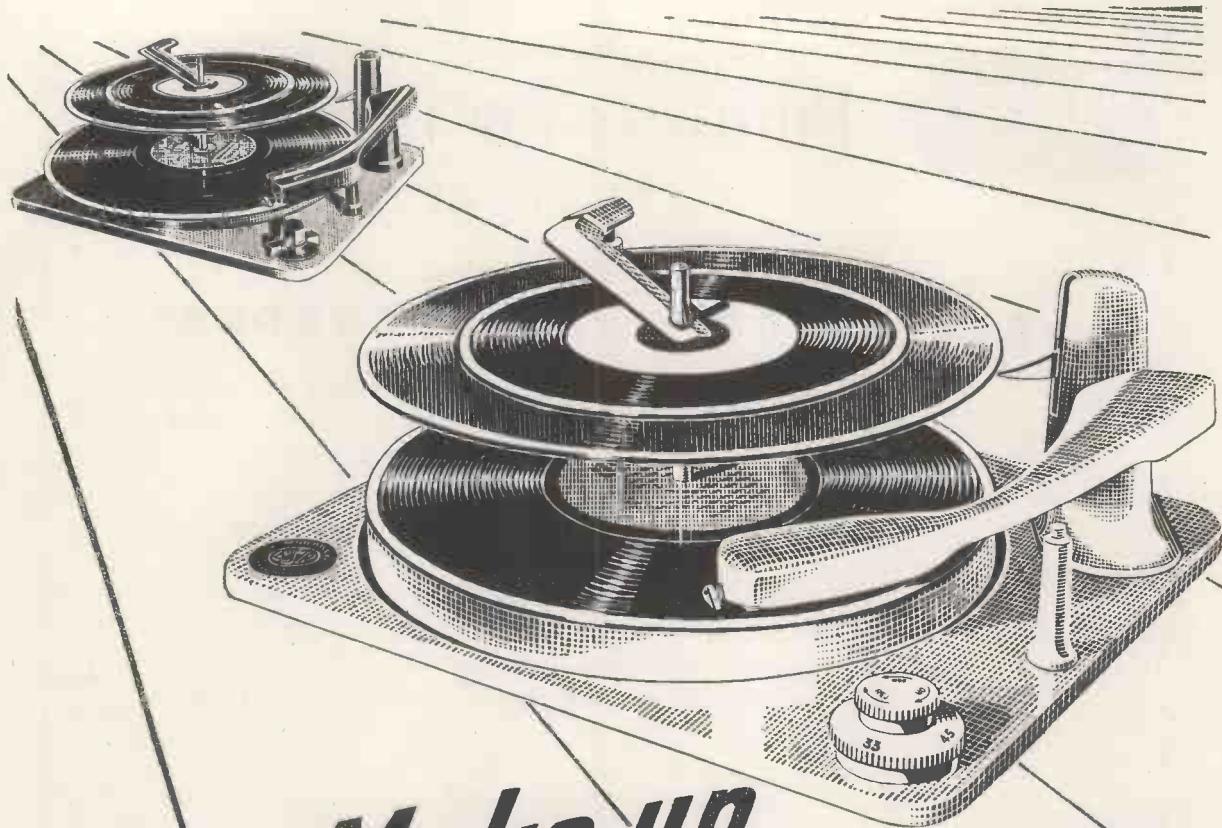


V_h 6.3V
 I_h 0.95A
 V_{h-k} 450V (max.)
 V_{in} 350 rms (max.)
 I_{out} 150 mA
 Base B9A
 The heater-cathode rating of the U709 permits operation from a common 6.3V heater winding

For further information and full technical data write to :

The Osram Valve and Electronics Dept.

THE GENERAL ELECTRIC CO. LTD., MAGNET HOUSE, KINGSWAY, LONDON, W.C.2



New Make-up for famous features

Everyone knows the Monarch couldn't be better, but the universally acclaimed features have been given a new-look. It's fresher—smoother looking—superfinely finished. In fact it's a new conception that still stars—

★The 'Magidisk'—that exclusive feature of the Monarch that selects any record, any size, in any order.

★The quickest changeover that gives uninterrupted pleasure.

★The hidden music discovered by the BSR dual stylus cartridge.

★The control—so simple—so handy. That is why it is agreed that the Monarch is the World's Finest and most wanted Auto-changer.

WORLD'S FINEST AND MOST WANTED AUTOCHANGER

BIRMINGHAM SOUND REPRODUCERS LTD. OLD HILL, STAFFS. ENGLAND

Wireless World

RADIO, TELEVISION
AND ELECTRONICS

43rd YEAR OF PUBLICATION

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

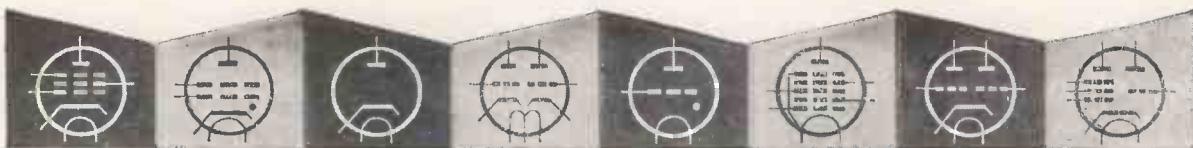
Editor: H. F. SMITH

FEBRUARY 1954

In This Issue

EDITORIAL COMMENT	51
"CHAMELEON" OSCILLATOR. By <i>Thomas Roddam</i> .. .	52
THE TRANSISTOR IN HEARING AIDS. By <i>S. Kelly</i> .. .	56
MEASURING NON-LINEARITY. By <i>D. C. Pressey</i> .. .	60
THE D.C. COMPONENT IN TELEVISION. By <i>W. T. Cocking</i>	63
IONOSPHERE REVIEW: 1953 By <i>T. W. Bennington</i> .. .	66
LETTERS TO THE EDITOR	69
RUSSIAN TELEVISION	71
TELEVISION SOCIETY'S EXHIBITION	72
RADAR ON AIRLINERS	74
WORLD OF WIRELESS	75
ELECTRON OPTICS. By "Cathode Ray"	79
MAGNETIC TAPE RECORDING	84
MEGAWATT TRANSMITTER	85
WIDE-BAND I.F. AMPLIFIERS. By <i>H. S. Jewitt</i> .. .	86
ELIMINATING C.W. INTERFERENCE. By <i>B. L. Morley</i> ..	91
"PLUG AND SOCKETRY." By <i>C. Lister</i>	92
SHORT-WAVE CONDITIONS	94
RESISTANCES IN PARALLEL. By <i>Francis Oakes</i> .. .	95
MANUFACTURERS' PRODUCTS	96
RANDOM RADIATIONS. By "Diallist"	98
UNBIASED. By "Free Grid"	100

PUBLISHED MONTHLY (last Monday of preceding month) by ILIFFE & SONS LTD., Dorset House, Stamford Street, London, S.E.1. Telephone: Waterloo 3833 (60 lines). Telegrams: "Ethaworld, Sedist, London." Annual Subscription: Home and Overseas, £1 7s. 0d. U.S.A. \$4.50. Canada \$4.00. BRANCH OFFICES: Birmingham: King Edward House, New Street, 2. Coventry: 8-10 Corporation Street. Glasgow: 268 Renfield Street, C.2. Manchester: 260, Deansgate, 3.



VALVES, TUBES & CIRCUITS

14. FULL-WAVE RECTIFIER TYPE EZ80

The new Mullard full-wave rectifier, type EZ80, having a maximum output current of 90 mA, is suitable for the power supplies of most small and medium power amplifiers designed for operation from a.c. mains. It is a miniature all-glass valve having a single-ended construction and a B9A (noval) base. With a heater rating of 6.3V, 0.6A, the maximum peak heater-to-cathode voltage of 500 volts is sufficient to permit the heater of the EZ80 to be supplied from the same 6.3-volt winding on the transformer as the other valves in the amplifier.

CHOICE OF RESERVOIR AND SMOOTHING CAPACITORS. When designing an amplifier it is desirable to know the amount of a.c. ripple which may be superimposed on the direct voltage supplied to the valves. For a particular input voltage and output current the values of ripple and direct voltages depend upon the reservoir capacitance and upon the type of smoothing network. Generally the power supply includes a reservoir capacitor (C1), either an inductance (L) having a resistance (R) or a resistance (R) alone, and a smoothing capacitor (C2). The following table shows typical values of ripple and direct voltages across C1 and across C2 for several standard values of components. The input voltage is 2×250 V.r.m.s. and total output currents of 90 and 60 mA are considered.

In general, the value of the ripple voltage across C2 is inversely proportional to the values of both C2 and C1 whereas the ripple across C1 is only inversely proportional to the value of C1 and not dependant upon L, R or C2. To ensure a low ripple voltage at C2 it is necessary to make both C1 and C2 as large as possible. If further smoothing is desired, as with the supplies to a pre-amplifier stage, it is usual to incorporate this in a form of decoupling in order to isolate this stage.

If large values of capacitance are used it is possible to economise in the design of the amplifier by replacing the smoothing choke by a resistor with little change in ripple voltage. The output voltage from C2 will then be reduced by an amount depending upon the load current and the value of the resistor. In this case the voltages required for the anodes of the output valves may be taken from C1. With a single valve output stage, the ripple across C1 must then be as low as possible. In push-pull stages, if the two output valves are reasonably similar, quite large amounts of ripple can be tolerated as they will be balanced out.

From the table it is seen that the conventional network of C1 = 8 μF, L = 10H, C2 = 16 μF may be replaced by C1 = 50 μF, R = 500 Ω, C2 = 50 μF with only a slight increase in ripple across C2 from 210 mV to 225 mV and a reduction in the ripple across C1 from 21V to 3.5V. The output voltage across C2 is reduced from 251V to 220V but the anodes of the output stage may be connected to C1, across which is a voltage of 265V.

VALVE DATA

HEATER

V _h	....	6.3	V
I _h	....	0.6	A

LIMITING VALUES

V _a (r.m.s.) max.	....	2 × 350	V
I _{out} max.	....	90	mA
C max.	....	50	μF
V _{h-k(pk)} max.	....	500	V

BASE

B9A

DIMENSIONS

Max. seated height	61	mm.
Max. overall length	67	mm.
Max. bulb diameter	22.2	mm.

$$V_a (\text{r.m.s.}) = 2 \times 250 \text{V}, I_{\text{out}} = 90 \text{mA}.$$

C1 (μF)	C2 (μF)	L (H)	R (Ω)	Ripple Voltage		Direct Voltage across C1 (V)	Direct Voltage across C2 (V)
				across C1 (V _{r.m.s.})	across C2 (mV _{r.m.s.})		
8	8	10	100	21	450	260	251
8	16	10	100	21	210	260	251
16	16	10	100	10.5	110	263	254
50	50	0	500	3.5	225	265	220
50	50	0	1000	3.5	110	265	175

$$V_a (\text{r.m.s.}) = 2 \times 250 \text{V}, I_{\text{out}} = 60 \text{mA}.$$

C1 (μF)	C2 (μF)	L (H)	R (Ω)	Ripple Voltage		Direct Voltage across C1 (V)	Direct Voltage across C2 (V)
				across C1 (V _{r.m.s.})	across C2 (mV _{r.m.s.})		
8	8	10	100	15	315	283	277
8	16	10	100	15	145	283	277
16	16	10	100	7.5	75	285	279
50	50	0	500	2.5	160	287	257
50	50	0	1000	2.5	80	287	227

TYPICAL OPERATING CONDITIONS							
V _a (r.m.s.)	....	2 × 250	2 × 275	2 × 300	2 × 350	V	
C	....	50	50	50	50	μF	
*R _{lim} min.	....	125	175	215	300	Ω	
I _{out}	....	90	90	90	90	mA	
V _{out}	....	265	285	310	360	V	

*Per anode.

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

MULLARD LTD., Technical Publications Department, Century House, Shaftesbury Avenue, W.C.2.
MVM 260



BRITISH MADE
BRIMAR
 VALVES
More reliable



than EVER!

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

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

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

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

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

BRIMAR	FERRANTI	MAZDA	MARCONI OSRAM	MULLARD
6AL5	DD6	6D2	D77 DI52	EB91

now is the time to BRIMARIZE!

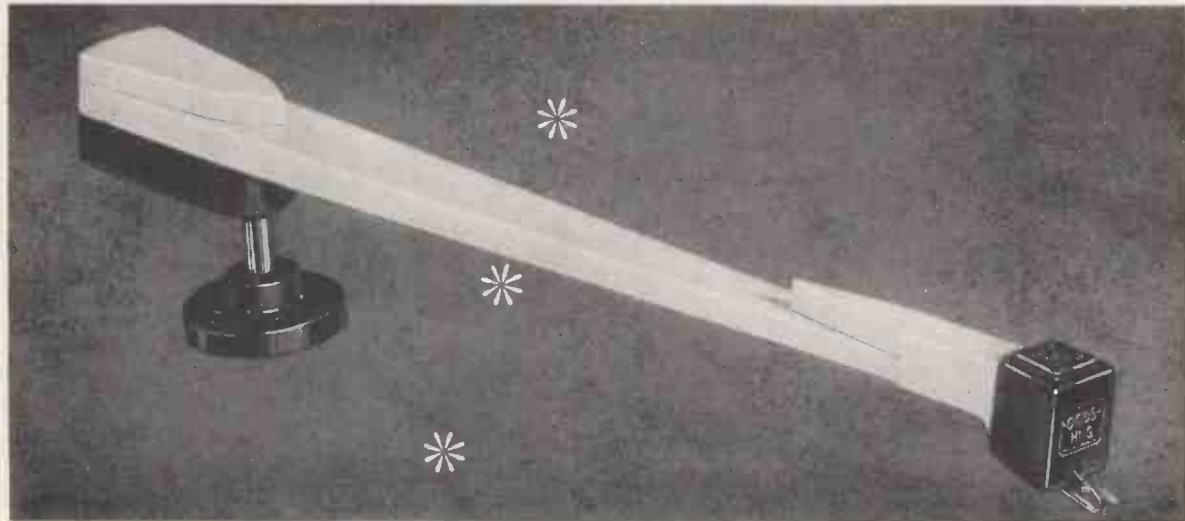
Standard Telephones and Cables Limited

FOOTSCRAY · SIDCUP · KENT



FOOTSCRAY 3333

Important Announcement



ABOUT • *acos* • HGP 40 AND GP 20 PICK-UPS

* We will be frank with you. When we evolved the now famous Hi-g pick-up tracking principle, we felt that it called for the introduction of an entirely new pick-up, complete with arm and new style heads. We called this pick-up the HGP 40.

* The interest in the HGP 40 has been tremendous, but it is already clear that there are thousands of owners of that most popular of all crystal pick-ups—the GP 20—who wish to bring it up to date by changing the existing head (GP 19 or GP 19LP) for an HGP 40 head (standard or LP). It cannot be done.

* However, we bow to public demand. We are discontinuing the HGP 40 as such. Instead, we are now producing the HGP 39-1 (STD. or LP) pick-up head to fit the GP 20 arm. Its response will be substantially the same as the HGP 40 and the sapphire stylus is easily replaceable. Its price is £1 12 0, plus 10/3 Purchase Tax.



always well ahead

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

TO SUM UP :—

*HGP 40 Pick-up is discontinued.
HGP 39-1 (STD or LP) Heads are available to modernise the GP 20.
GP 20 fitted with HGP 39-1 head will in future be known as the GP 20/Hi-G.*

COSMOCORD LIMITED · ENFIELD · MIDDLESEX

THE "BELLING-LEE" PAGE

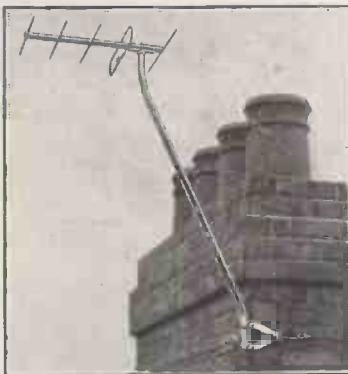
Providing technical information, service and advice in relation to our products and the suppression of electrical interference

Television Developments

Television may or may not develop along the lines with which you agree, but nobody can say that it stands still.

The first alternative programme will be the transmission of "Stills" by the Television Society's experimental transmitter. The aerial was designed by D. N. Corfield, manufactured by "Belling-Lee" and presented to the Society by the company. The range of the transmitter is semi-visual and about 15 miles, covering Central, South and West London. The necessary receiving aerials are available to those who prefer to buy a factory made job rather than make their own.

The Isle of Man Douglas transmitter has brought Christmas cheer to thousands, and one is tempted to enquire as to whether suppressors will be considered a "must" in



next year's Tourist Trophy races on the Island as they are at Goodwood.

A small island is an ideal place on which to launch a suppression campaign, as it is reasonably practical for the organisers to keep a grip on the situation.

We would like to make it very clear that so far as aerials for the official alternative transmissions are concerned, it is our policy to develop these so that they may be added to an existing aerial in such a way that its good features are retained. Where the normal B.B.C. Television programme is obtainable on an indoor aerial and an outdoor aerial is necessary for the alternative programme, complete installations will be made available. Dimensionally, these new aerials are much smaller, consequently offering less windage, and it will be our aim to design fixings and attachments in such a way as to keep prices at a minimum.

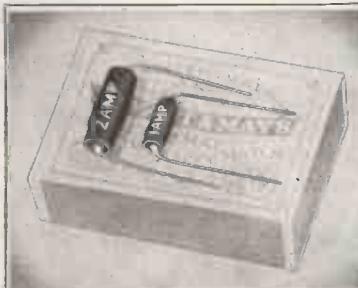
One very important point must be made here. It will be obvious

that in designing these additional arrays to be attached to or incorporated in existing aerials, care has been taken to ensure that the addition does not in any way adversely affect the performance or mechanical strength of the aerial to which it is intended to be attached.

It is possible that some viewers will build their own supplementary arrays or attach arrays not manufactured by Belling and Lee Ltd., but such additions if attached to an existing aerial manufactured by Belling and Lee Ltd., will invalidate any guarantee or insurance by Belling and Lee Ltd., which may be in force at the time.

In addition, Belling and Lee Ltd., can accept no responsibility whatever if a supplementary array manufactured by them is attached to an aerial not of their manufacture. Supplementary arrays complete with masts and lashings will be available where a viewer wishes to use one manufactured by Belling and Lee Ltd., although his original aerial may be of another make.

The method of connecting such aerials to receivers or converters has not yet been decided but we are at present discussing this point at Industry level as a very urgent question.



Except for the fact that the alternative stations will probably transmit on band 3, at the time of going to press, no official information is available regarding siting of stations relative to existing B.B.C. transmitters, nor polarisation nor contemplated radiated power.

Suppression of Household Appliances

The ever increasing number of television receivers coming into use emphasises the need for the suppression of household appliances employing fractional horse power motors. It is a fact that the eye is less tolerant than the ear and has a very strong dislike to flashes and distorted pictures.

Suppression of some of the larger pieces of domestic apparatus should be approached with care, as sewing machines, washing machines, refrigerators, etc., may be subject to Hire Purchase agreements which may prohibit their being opened up. The same kind of thing may have to be considered when dealing with appliances where the guarantee might be affected.

Fortunately much may be achieved in many cases without opening up, even in locations famed for bad reception conditions. For example, during a conversation with Mr. Coupland, a service engineer working with Messrs. J. E. Dawson, Bridge Street, Boston, Lincs., he confirmed that sewing machines, etc., are satisfactorily suppressed without tampering with the "innards" by the use of 2 "Belling-Lee" type L.1310 inductors (see illustration) inserted in the mains lead at the motor. These were, in fact, within 2/3 inches of the brushes.

In general, fairly large capacitors are required to suppress interferences on medium and long waves. In the case of a hairdryer or a similar class of appliance, it is often impractical to have these large suppressors either within the appliance housing, or hanging in the lead close to it. In such cases a plug suppressor "Belling-Lee" type L.1308 will probably solve the difficulty. Where both television and medium and long waves have to be considered, and particularly in the case of a "portable" appliance, the flex lead suppressor "Belling-Lee" type L.799 close to the appliance will take care of T.V. suppression, and the plug suppressor L.1308 will protect you on the medium and long waves.

P.S.

All efficient new cars have a suppressor fitted as standard.

Bring your car up to date for 2/6d.

Fit a "Sparkmaster" for controlled spark, easier cold starting, reduced pinking and longer plug life.

Cars so fitted do not interfere with T.V. reception.

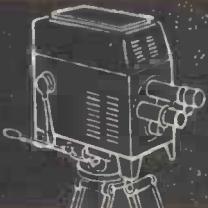
Fit a "Belling-Lee" "Sparkmaster" today.

Written 24th December, 1953

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

BROADCASTING

Marconi made radio broadcasting possible. Today 75% of the countries in the world rely on Marconi broadcasting transmitters.

**TELEVISION**

Marconi Television Equipment is installed in every one of the B.B.C.'s Television Stations and has been ordered by countries in North and South America, Europe and Asia.

**MOBILE RADIO**

Marconi Mobile Radio is used by Public Utilities and Armed Forces, including Police and local Defence Forces all over the world.

MARCONI

Electronic Engineers, Designers,

System Planners and

Manufacturers of Aeronautical,

Broadcasting, Communications

and Maritime Radio

Equipment, Television, Radar

and Navigational Aids

on land, sea and in the air.

AERONAUTICAL

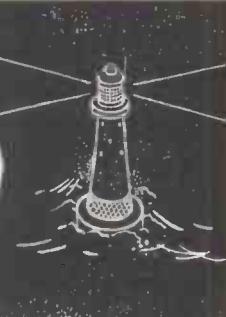
Forty-four Airlines and twenty-two Air Forces fit Marconi air radio equipment. Marconi airport installations are in use in many parts of the world.

**COMMUNICATIONS**

More than 80 countries now have Marconi-equipped telegraph and communications services, many of which, completed twenty years ago, still give trouble-free operation.

**MARITIME**

All radio approach and marker Beacons around the British coasts have been designed and manufactured by Marconi's. Marconi's experience of seagoing radio and radar is unrivalled.



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

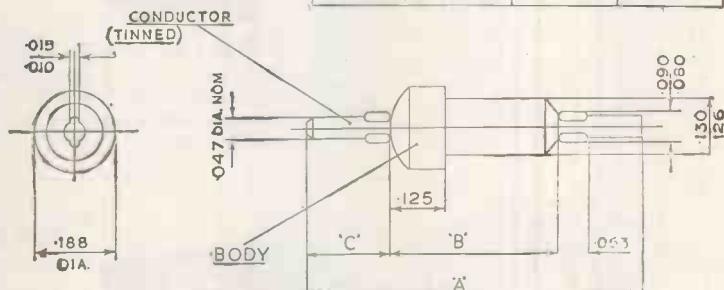
Polytetrafluoroethylene (P.T.F.E.) is an outstanding insulator. It is tough, durable and will not crack or arc. Its dielectric properties are substantially constant over a frequency range of 60 c.p.s. to at least 300 Mc.p.s. and are unaffected by temperature changes between minus 100°C. and plus 288°C.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

PT 1 & 2. Lead-through

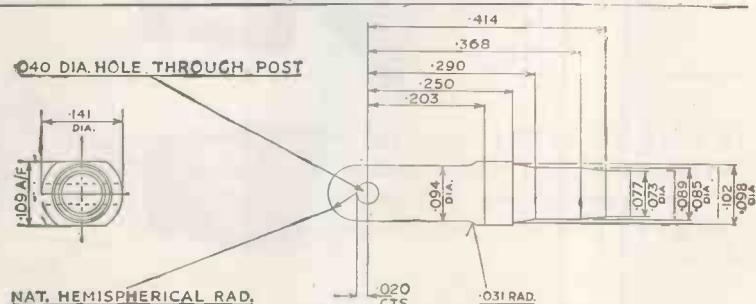


	A	B	C
PT 1	.750	.375	.188
PT 2	.875	.500	.188
PT 3	.563	.375	—
PT 4	.688	.500	—

PT 3 & 4. Stand-off



PT 5. Component mounting



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

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

EDISWAN

CLIX

THE EDISON SWAN ELECTRIC CO., LTD.,

Sales Department P.T.F.E. 6, 21 Bruton Street, London, W.1. Telephone: Mayfair 5543
Head Office: 155 Charing Cross Road, London, W.C.2. Member of the A.E.I. Group of Companies

NEW!

EXPERIMENTAL OUTFITS

LEARN THE PRACTICAL WAY

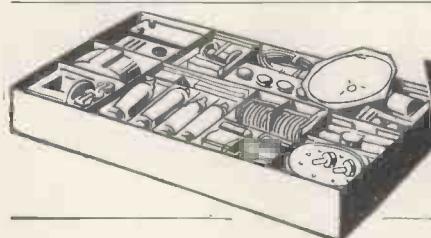
Specially prepared sets of radio parts with which we teach you, in your own home, the working of fundamental electronic circuits and bring you easily to the point when you can construct and service radio sets. Whether you are a student for an examination; starting a new hobby; intent upon a career in industry; or running your own business—these Practical Courses are intended for YOU—and may be yours at very moderate cost.

EASY TERMS FROM £1 A MONTH

With these outfits, which you receive upon enrolment, you are instructed how to build basic Electronic Circuits (Amplifiers, Oscillators, Power Units, etc.) leading to complete Radio and Television Receiver Testing and Servicing.

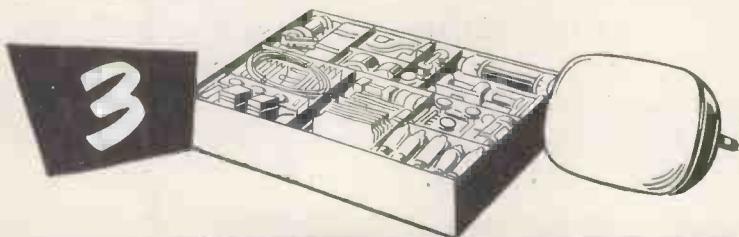


RADIO Outfit No. 1.—For carrying out basic practical work in Radio and Electronics, from first principles and leading to the design and building of simple Receivers.



2

RADIO Outfit No. 2.—With this equipment, you are instructed in the design construction, testing and servicing of a complete modern Superhet Radio Receiver.



3

TELEVISION Outfit No. 3.
—With this equipment you are instructed in the design, construction, servicing and testing of a modern high-quality Television Receiver.

OTHER COURSES WITH EQUIPMENT INCLUDE:

MECHANICS • ELECTRICITY
CHEMISTRY • PHOTOGRAPHY
CARPENTRY

ALSO DRAUGHTSMANSHIP • COMMERCIAL ART
AMATEUR S.W. RADIO • LANGUAGES • ETC.

POST THIS COUPON TODAY

Please send me your FREE book on Practical Courses:
I am interested in Radio 1 , Radio 2 , Television .

Other subjects.....

To : E.M.I. INSTITUTES, Dept. 127x, 43, Grove Park Road,
Chiswick, London, W.4.

NAME

ADDRESS

.....

E.M.I. INSTITUTES The only Postal College which is part of a world-wide Industrial Organisation

COSSOR presents...



The new Cossor Double Beam Oscilloscope

MODEL 1052

Two similar amplifier channels with an approximate gain of 2000 and an upper frequency response of 3 megacycles are features of this new Cossor Double Beam general purpose oscilloscope. The repetitive or triggered time base has a sweep duration from 200 milliseconds to 5 microseconds.

The instrument will operate from power supplies of any of the various frequencies and voltages encountered in the Armed Services or from standard civil supply mains. The top and side panels are quickly detachable to allow inspection and a removable plate at the rear of the instrument allows access to tube plates, anode and modulator.

and Voltage Calibrator

MODEL 1433



Primarily designed to be used with the new Cossor oscilloscope the Cossor Voltage Calibrator model 1433 provides an accurate means of calibration of input voltages to the plates or amplifiers of any oscilloscope. Calibrating voltages are read directly from a wide scale meter without any computation being necessary. Measurements can be made to an accuracy of $\pm 5\%$ and the instrument can be used in any application where a source of accurately-known voltage is required.

COSSOR ELECTRONIC INSTRUMENTS

Write for illustrated leaflets about both of these instruments
A. C. COSSOR LTD., INSTRUMENT DIVISION, DEPT. 1,
HIGHBURY GROVE, LONDON, N.5
Telephone : CANonbury 1234 (33 lines)

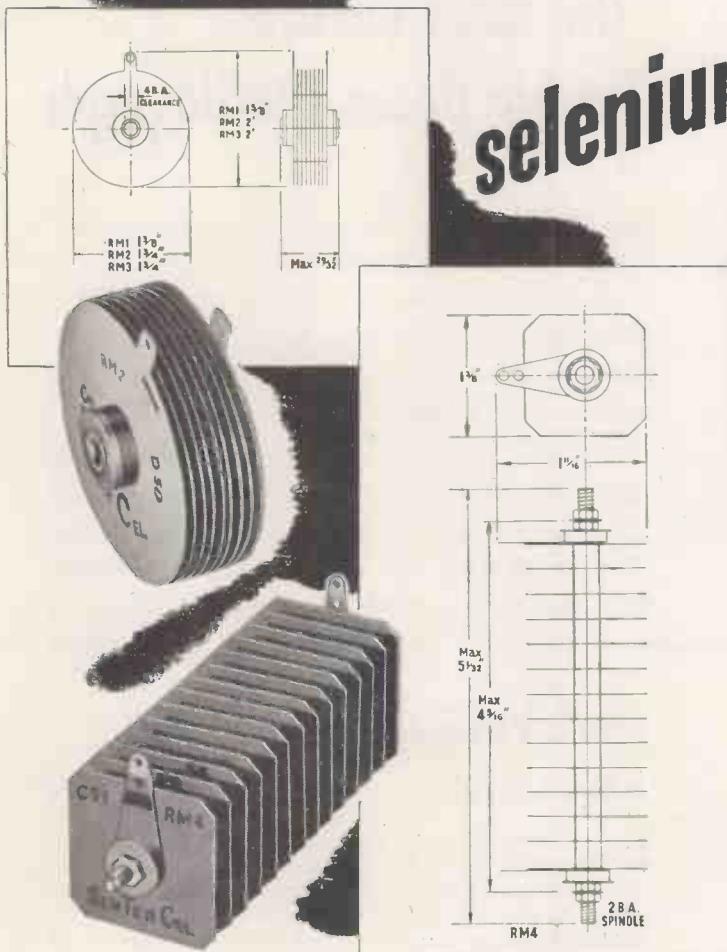
ALWAYS USE
COSSOR
TUBES &
VALVES

10 advantages of



miniature

selenium rectifiers



Compare these outstanding features with those of the rectifiers which at present you are using :—

- Less wiring
- Unlimited instantaneous overload such as the charging current of de-formed electrolytic capacitors.
- Far lower heat dissipation.
- No "warming-up" period.
- No valve-holder.
- Practically indestructible in normal service.
- No limit to size of electrolytic capacitor.
- Saves weight.
- Saves space.
- Low in cost.

Study these RATINGS

TYPE	RM0	RM1	RM2	RM3	RM4
Maximum ambient temperature	35°C 55°C	35°C 55°C	35°C 55°C	35°C 55°C	35°C 40°C 55°C
Maximum output current (mean)	30mA 15mA	60mA 30 mA	100mA 60mA	120mA 90mA	275mA 250mA 125mA
Maximum input voltage (r.m.s.)	125V	125V	125V	125V	250V
Maximum peak inverse voltage	350V	350V	350V	350V	700V
Max. instantaneous peak current	Unlimited	Unlimited	Unlimited	Unlimited	Unlimited
Weight	0.82 oz.	1 oz.	1.4 oz.	2 oz.	4.5 oz.



Standard Telephones and Cables Limited

(Registered Office : Connaught House, Aldwych, W.C.2)

RECTIFIER DIVISION : Warwick Road, Boreham Wood, Hertfordshire.

Telephone : Elstree 2401 Telegrams: Sentercel, Borehamwood

VORTEXION TAPE RECORDER



The amplifier, speaker and case, with detachable lid, measures 8½ in. x 22½ in. x 15¾ in. and weighs 30 lb.

PRICE, complete with WEARITE TAPE DECK £84 0 0

★ The noise level is extremely low and audibly the hum level and Johnson noise of the amplifier and deck are approximately equal. Only 25% of this small amount of hum is given by the amplifier alone.

★ Extremely low distortion and background noise, with a frequency response of 50 c/s.—10 Kc/s., plus or minus 1.5 db. A meter is fitted for the measurement of signal level and bias level.

★ Sufficient power is available for recording on disc, either direct or from the tape, without additional amplifiers.

★ A heavy mu-metal shielded microphone transformer is built in for 15-30 ohms balanced and screened line, and requires only 7 micro-volts approximately to fully load.

★ The .5 megohm input is fully loaded by 18 millivolts and is suitable for crystal P.U.s, microphone or radio inputs.

★ A power plug is provided for a radio feeder unit, etc. Variable bass and treble controls are fitted for control of the play back signal.

★ The power output is 3.5 watts heavily damped by negative feedback and an oval internal speaker is built in for monitoring purposes.

★ Facilities are provided for using the amplifier alone and using power output or headphones while recording or to drive additional amplifiers.

★ The unit may be left running on record or play back even with 1,750 ft. reels with the lid closed.

POWER SUPPLY UNIT to work from 12 volt Battery with an output of 230 v., 120 watts, 50 cycles within 1%. Suppressed for use with Tape Recorder. **PRICE £18 0 0.**

3-WAY MIXER AND PEAK PROGRAMME METER

FOR RECORDING AND LARGE SOUND INSTALLATIONS. ETC.

One milliwatt output on 600 ohm line (.775V) for an input of 30 micro-volts on 7.5-30 ohm balanced input.

Output balanced or unbalanced by internal switch. The meter reading is obtained by a valve voltmeter with 1 second time constant, which reads programme level, and responds to transient peaks.

Calibration in 2 db steps, to plus 12 db and minus 20 db referred to zero level. Special low field internal power pack supplies 8 valves including stabilising and selenium rectifier, consumption 23 watts.



Manufactured by

VORTEXION LIMITED, 257-263, The Broadway, Wimbledon, London, S.W.19

Telephones: LIBerty 2814 and 6242-3

Telegrams: "Vortexion, Wimble, London."

Crystal Palace Transmitters

**Britain to have most powerful transmissions with
Marconi-equipped station**

By 1956 BBC television transmissions will be the most powerful in the world.

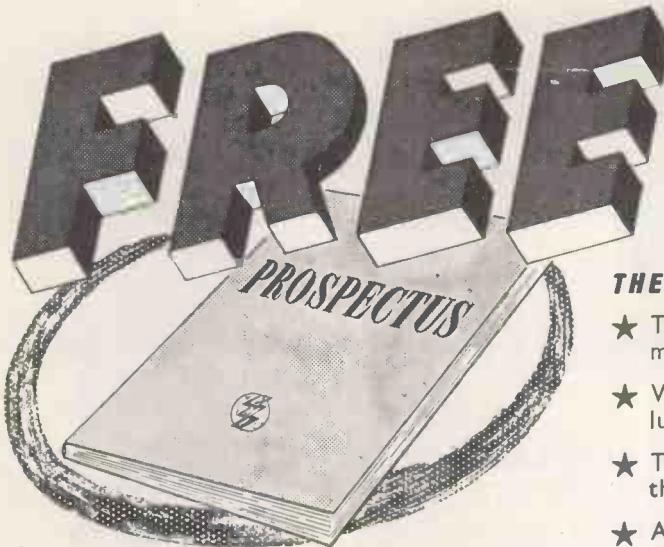
For the new Crystal Palace station which will replace Alexandra Palace, the Corporation has ordered Marconi sound and vision transmitters. They will be used with a high gain aerial system which will radiate 200/250kW—twice the power of existing Regional transmitters.

Two 15kW vision transmitters, the first two in the world to work in parallel, will ensure the highest reliability of service. They will use a new type of tetrode valve of small size, a Marconi development permitting valuable space savings in transmitter design. Two 4½kW sound transmitters will also operate in parallel.

Marconi high or medium power transmitters and high power aerials are installed in every one of the BBC's television transmitter stations, while Marconi television equipment has been ordered by countries in North and South America, Europe and Asia.

MARCONI

complete television transmitting equipment



**POST THE COUPON TODAY
FOR OUR BROCHURE ON THE
LATEST METHODS OF HOME
TRAINING FOR OVER
150 CAREERS AND HOBBIES**

THE ADVANTAGES OF E.M.I. TRAINING

- ★ Your training is provided by the only Postal College which is part of a world-wide Industrial Organisation.
- ★ The teaching methods are planned to meet modern industrial requirements.
- ★ We offer training in all subjects which provide lucrative jobs or interesting hobbies.
- ★ The student is taken carefully and thoroughly through his chosen subject.
- ★ A tutor is personally allotted by name to ensure private and individual tuition.
- ★ Free advice covering all aspects of training is given to students before and after enrolment with us.

NEW

LEARN THE PRACTICAL WAY

With many courses we supply actual equipment thus combining theory and practice in the correct educational sequence. The equipment, specially prepared and designed, remains your property. Courses include: Radio, Television, Electronics, Draughtsmanship, Carpentry, Photography and Commercial Art, Amateur S.W. Radio, Electricity, Languages, Mechanics, etc.



PRIVATE AND INDIVIDUAL TUITION IN YOUR OWN HOME

Accountancy	Customs & Excise Officer	M.C.A. Licences	Secretaryship
Advertising	Mechanical Engineering	Mechanical Engineering	Sheet Metal Work
Aeronautical Engineering	Draughtsmanship	Motor Engineering	Shorthand &
Automobile Engineering	Economics	Photography	Typing
Banking	Electrical Engineering	P.M.G. Licences	Sound Recording
Book-keeping	Electronics	Police Production	Structural Engineering
Building	Fashion Drawing	Engineering	Tele-communications
Business Management	Heating & Ventilating	Public Speaking	Television
Carpentry	Engineering	Radar	Time & Motion Study
Chemistry	Industrial Administration	Radio & Television Servicing	Tracing
Civil Service	Journalism	Radio Engineering	Welding
Civil Engineering	Languages	Refrigeration	Writing
Commercial Subjects	Marine	Retail Shop	Workshop Practice
Commercial Art & Drawing	Engineering Mathematics	Management	Works Management
		Salesmanship	and many others.
		Sanitation	

Also courses for University Degrees, General Certificate of Education, B.Sc.Eng., A.M.I.Mech.E., L.I.O.B., A.C.C.A., A.C.I.S., A.M.Brit.I.R.E., A.M.I.I.A., City & Guilds. Examinations, R.S.A. Certificates, etc.

Courses from £1 per month

POST THIS COUPON TODAY

Please send without obligation your FREE book.

E.M.I. INSTITUTES Dept. 127k,

43 Grove Park Road, London, W.4. Phone: Chiswick 4417/8.

NAME.....

ADDRESS.....

SUBJECT(S) OF INTEREST.....

**EMI
INSTITUTES**

**THE ONLY POSTAL COLLEGE WHICH
IS PART OF A WORLD-WIDE
INDUSTRIAL ORGANISATION**

TRUVOX

It Pays As You Earn!

EQUIPMENT

Profitable P.A. business is built upon a reputation for reliability which can only be based on the dependability of your equipment. That is why it pays to use only TRUVOX, the reproducers that have had reliability built into them for a quarter of a century.

TRUVOX PRESSURE' TYPE DRIVING UNITS

Senior and Junior models have a power handling capacity of 15 and 10 watts respectively and provide a substantially linear response from 175 to 10,000 c.p.s. The Senior model is available with built-in tropicalised multi-radio transformer a noteworthy feature much appreciated by sound engineers.

For Full Details Write to:

ROLA CELESTION LTD., FERRY WORKS, SUMMER ROAD, THAMES DITTON, SURREY

*Phone: Emberbrook 3402-6.



TRUVOX REFLEX SPEAKERS

Senior models give a substantially linear response from 250 to 8,000 c.p.s. with a peak handling capacity of 8 to 10 watts whilst Junior models range from 350 to 8,000 c.p.s. with 6 to 8 watts peak handling capacity. Either can be supplied with built-in transformer. Completely weather-proofed and designed to withstand prolonged exposure and vibration.

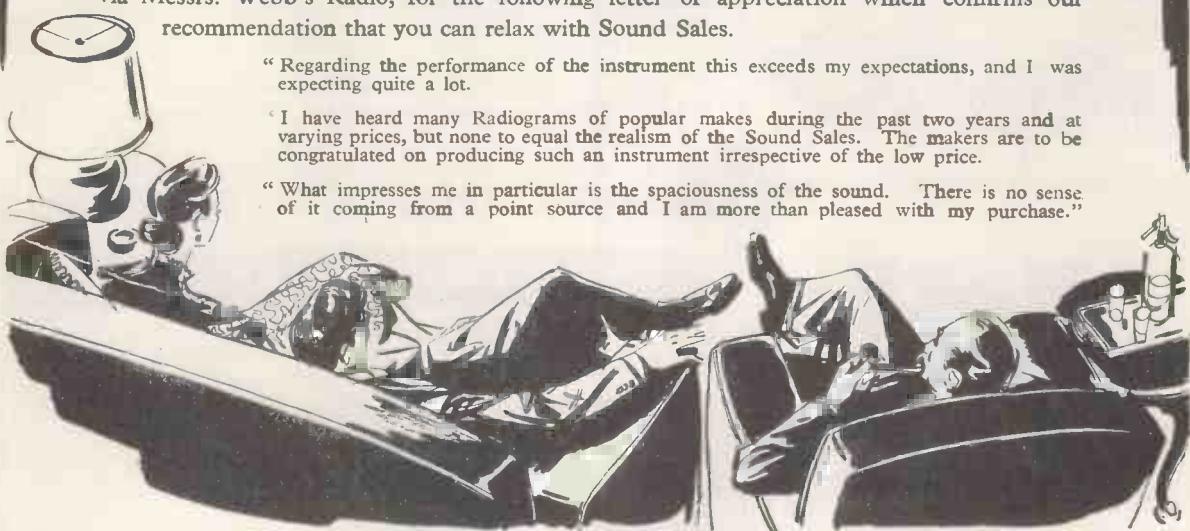
ENDORSING 3-D RADIO

We are indebted to A. F. Bushell, Esq., who obtained one of our D.X. Plus Four Radiograms via Messrs. Webb's Radio, for the following letter of appreciation which confirms our recommendation that you can relax with Sound Sales.

"Regarding the performance of the instrument this exceeds my expectations, and I was expecting quite a lot."

"I have heard many Radiograms of popular makes during the past two years and at varying prices, but none to equal the realism of the Sound Sales. The makers are to be congratulated on producing such an instrument irrespective of the low price."

"What impresses me in particular is the spaciousness of the sound. There is no sense of it coming from a point source and I am more than pleased with my purchase."



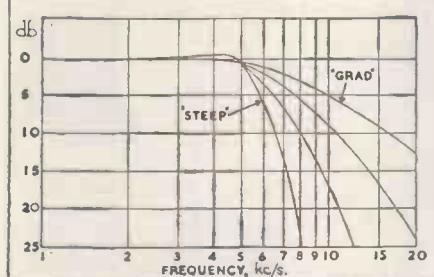
SOUND SALES LTD., WEST STREET, FARNHAM, SURREY Farnham 6461-2-3
LONDON AGENTS: WEBB'S RADIO—HOLLEY'S RADIO

LEAK equipment is unique—

It is acceptable to professional communications engineers for recording and broadcasting. The B.B.C. use several hundreds of the TL/12 Amplifier, and 1,000 are used by other Broadcasting Corporations.



The Vari-Slope



Frequency amplitude curves for the "TREBLE-3" position (5 kc/s turn-over). Curves of the same slopes are obtained on the other two positions turning over at 7Kc/s and 9Kc/s ("-2" and "-1" positions).

Point-One TL/12 Triple Loop Feedback Amplifier

Used with the "Vari-Slope" pre-amplifier and the best available complementary equipment, the TL/12 power amplifier gives to the music-lover a quality of reproduction unsurpassed by any equipment at any price.

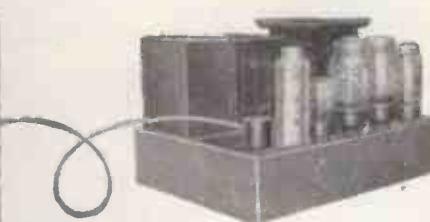
For laboratory use as a stabilised-gain audio frequency power amplifier. For the highest possible standard of disc recording. For the highest possible quality of reproduction from Pickup, Radio, Microphone, Film and Magnetic Tape. For use as a driver amplifier in the speech modulator chain of broadcast transmitters.

27 Gns.

The "Point-One" TL/12 Amplifier is built to a tropical specification and used throughout the world, including:

The British Broadcasting Corporation.
The South African Broadcasting Corporation.
The Swedish Broadcasting Corporation.
The Swiss Broadcasting Corporation.
The Italian Broadcasting Corporation.

LIST PRICE IN BRITAIN 12 Gns.



£5. 10s.

Write for fully descriptive literature.

H. J. LEAK & CO., LTD., BRUNEL ROAD, WESTWAY FACTORY ESTATE, ACTON, W.3

Phone : SHEpherds Bush 1173/4.

Telegrams : Sinusoidal, Ealux, London.

Cables : Sinusoidal, London.

Steep-Cutting Filter

For use with the TL/12 power amplifier and pre-amplifiers preceding the Vari-Slope. This filter unit is of particular interest to the record enthusiast.

**BE PREPARED**

For a cold winter by making our low-cost Electric Blanket. 27 yards of special heater wire and blueprint 20/- Blueprint only, 1/6. Alternatively make a Bed-Warmer. Constructional data 1/6.

**CONNECTING WIRE SNIP**

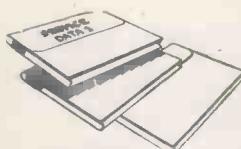
P.V.C. insulated 23 s.w.g. copper wire in 100ft. coils, 2/9 each. Colours available : Black, Brown, Red, Orange, Pink, Yellow, White, Transparent. 4 coils for 10/-.

SOMWEAVE

This really lovely loud-speaker fabric we offer at approximately a third of today's cost. It is 42in. wide and our price is 2/- per yard or panels 12in. x 12in., 1/9 each. This is also very suitable for covering plain wooden cases, for portable radio amplifiers, etc.

**PLUGS FOR MODERN VALVE HOLDERS**

Each is fitted with a rubber shroud. For B7G button base and type 2 for B9A. Price 1/4 each, discounts for quantities.

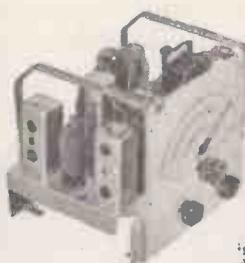
**SERVICE DATA**

100 service sheets, covering British receivers which have been sold in big quantities, and which every service engineer is ultimately bound to meet. The following makes are included : Aerodyne, Alba, Bush, Cossor, Ekco, Ever-Ready, Ferguson, Ferranti, G.E.C., H.M.V., Kolster-Branded, Lissen, McMichael, Marconi, Mullard, Murphy, Philco, Philips, Pye, Ultra. Undoubtedly a mine of information invaluable to all who earn their living from radio servicing. Price £1 for the complete folder.

Our folder No. 2 consists of 100 data sheets covering most of the popular American T.R.F. and superhet receivers "all dry" etc., which have been imported into this country. Names include Sparton, Emerson Admiral, Crosley, R.C.A., Victor, etc. Each sheet gives circuit diagrams and component values, alignment procedure, etc., etc. Price for the folder of 100 sheets is £1. Post free.

ELECTRONIC PRECISION EQUIPMENT LTD.**SUPERHET RADIO BY BEETHOVEN**

NOW AVAILABLE FOR LONG, MEDIUM and SHORT WAVES



Cabinets for this chassis available next month.

MULTI-METER KIT

The Multi-meter illustrated measures D.C. volts, D.C. m/amps and ohms. It has a sensitivity of 200 ohms per volt and is equally suitable for the keen experimenter, service engineer or student. All the essential parts including 2in. moving coil meter, selected resistors, wire for shunts, 8-point range selector, calibrated scale, stick-on range indicator and full instructions for making are available as a kit, price 15/- plus 9d. post and packing.

Extremely well built on chassis size approx. 9 $\frac{1}{2}$ x 7 $\frac{1}{2}$ x 8 $\frac{1}{2}$ using only first-class components, fully aligned and tested, 110-240 volt A.C. mains operation. Large clear edge-lit dial. Three wave bands covering Long, Medium and Short waves. Complete with five Mullard valves, frequency changer, double diode triode, pentode output and full wave rectifier. Complete with Rola loudspeaker ready to operate. Special cash-with-order price this month, £8/17/6, carriage and insurance 7/6. Hire purchase terms £3 deposit, balance over 12 months.

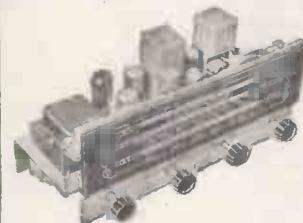
Special cash-with-order price this month, £8/17/6, carriage and insurance 7/6. Hire purchase terms £3 deposit, balance over 12 months.

**HUGE NEW PURCHASE**

We have purchased another large quantity of the Collaro Auto Record Changer, type R.C. 3/521, three speed suitable for all types of records and with the latest type crystal pick-ups.

Buy one this month as you will not be able to again at this special price of 11 gns. plus 7/6 carriage and insurance. H.P. Terms 4/-

deposit and balance over 12 months.

THE "WINDSOR" 5-VALVE SUPERHET

This is a 5-valve A.C. superhet covering the usual long, medium and short wave bands. It has a particularly fine clear dial with an extra long pointer travel. The latest type octal valves are used and the chassis is complete and ready to operate. Chassis size 15in. x 6in. x 6in. Price £9/19/6 complete with 8in. or 6in. speaker. Carriage and insurance 10/- H.P. terms £3/7/- deposit.

TABLE RADIO CABINET

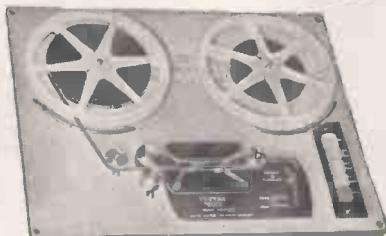
Due to a special purchase, we are able to offer this very fine cabinet, size approx. 15 $\frac{1}{2}$ x 14 x 6in.—walnut veneered and satin finished. 37/6, carriage and packing 3/6.

Note. This cabinet is the correct one for the chassis above with 6in. speaker.

**TRUVOX TAPE DECK**

Yours for £7/14/- Now available ex-stock, this fine tape deck has many superior features some of which are as follows :

1. Powered by 3 shaded-pole A.C. motors.
2. "Drop-in" Tape loading.
3. Push-button control, electrically and mechanically interlocked.
4. Separate push-button brake. Patented electric type.
5. "Fast-forward" and "fast-rewind" without tape wear, one minute for a full reel.
6. Silent drive eliminating "wow" and flutter.
7. Half-track working, and two Tape speeds giving 60 minutes each track at 3 $\frac{1}{2}$ in. per second or 30 minutes each track at 7 $\frac{1}{2}$ in. per second.

**ELECTRICAL BARGAINS**

In addition to our large range of radio accessories we also carry a good stock of electrical wiring accessories ; details of a few of these can be found below :—

T.R.S. CABLES, 250 v. CLASS	9d.
1/0.04 Twin flat	1/-
3/0.29 Twin flat	1/3
3/0.29 Twin with earth	1/3
3/0.20 3 Core flat	1/6
3/0.36 Twin flat	1/4
3/0.36 Twin with earth	1/7
3/0.36 3 Core flat	2/-
7/0.29 Twin flat	1/6
7/0.29 Twin with earth	1/11
7/0.36 Twin flat	2/9
7/0.36 Twin with earth	3/3
7/0.64 Twin flat	4/9

LEAD-COVERED CABLES 250 v. CLASS

3/0.29 3 Core	yard 2/3
3/0.36 3 Core	2/8
7/0.44 Twin	3/3
3/0.36 Twin	2/-
7/0.29 Twin	2/9
7/0.64 Twin	5/-

CLIX 15 AMP. FOOT PLUG

Made to B.S.S. specification, shuttered in moulded Bakelite case, 8/6 each.

IRON-CLAD SWITCH FUSES

Best makers, M.E.M., etc., 15 amp., 10/6, plus 1/6 post.	16/6
15 amp., used but in good condition, 8/6.	10 amp. porcelain (Memix), 6/-.
Oblong Brown Plastic 1-way 1/3 each.	Oblong White Plastic 1-way 1/3 each.
Oblong Brown 2-way.. 1/6 each	Oblong White 2-way.. 1/6 "
Round Brown 1-way.. 1/3 "	Round White 1-way.. 1/3 "
Round Brown 2-way.. 1/6 "	Round White 2-way.. 1/6 "

5 AMP. SURFACE SWITCHES—HICRAFT

Oblong Brown Plastic 1-way 1/3 each.	Oblong White Plastic 1-way 1/3 each.
Oblong Brown 2-way.. 1/6 each	Oblong White 2-way.. 1/6 "
Round Brown 1-way.. 1/3 "	Round White 1-way.. 1/3 "
Round Brown 2-way.. 1/6 "	Round White 2-way.. 1/6 "
15 per cent. discount if bought in dozens.	

10 AMP. SWITCH

Rotary pattern with chrome cover and on/off indicator.

**SOCKETS—HICRAFT**

Flush type for skirtings, 5 amp. 3-pin shuttered, 1/3 each ; ditto with switch, 2/3 each.

**CEILING SWITCHES—HICRAFT**

With cord and acorn. Brown or White, 1-way, 3/9 each; 2-way, 4/3 each.

**LAMP HOLDERS**

Bakelite, 1/- each or 10/6 dozen. Bakelite skirted Batten holder. 1/6 or 15/- dozen. Bakelite type threaded, for 1/2in. with HO skirt, 1/6.

ELECTRONIC PRECISION EQUIPMENT LTD.

ENAMELLED WIRE
(On wooden reels)

S.W.G.	2 oz. Reel	4 oz. Reel
16	1/4	2/-
18	1/4	2/2
20	1/5	2/4
22	1/6	2/6
24	1/7	2/8
26	1/8	2/10
27	1/9	3/-
28	1/8	2/10
30	1/9	3/-
31	1/10	3/1
32	1/10	3/2
33	1/11	3/3
34	1/11	3/4
36	2/-	3/6
38	2/2	3/10
40	2/4	4/2

TINNED COPPER WIRE

16	1/4	2/-
18	1/4	2/2
20	1/5	2/4
22	1/6	2/6

DOUBLE SILK COVERED WIRE

16	1/3	1/10
18	1/3	1/11
19	1/5	2/3
20	1/6	2/6
22	1/8	2/10
23	1/9	3/-
24	1/9	3/-
26	1/11	3/4
27	2/-	3/6
28	2/1	3/8
29	2/2	3/10
30	2/3	4/-
31	2/4	4/2
32	2/6	4/6
33	2/9	5/-
34	2/10	5/2
35	3/-	5/6
36	3/2	5/10
38	3/6	6/6
39	3/9	—
40	4/-	7/6
41	2/3	—
42	2/6	—



SHEET PAXOLIN

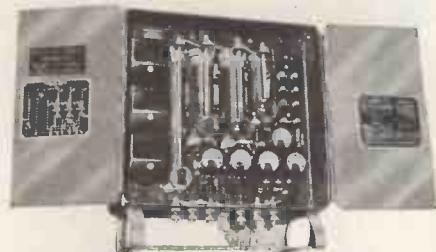
Invaluable for when you are experimenting. Size 6in. x 6in., 1/-. Size 12in. x 8in., 2/-. Size 12in. x 12in., 3/6. Size 24in. x 12in., 6/-.

CLIX 15-AMP. FOOT SWITCH PLUG

Made to B.S.S. specification, shuttered in moulded bakelite, case, 8/6 each.



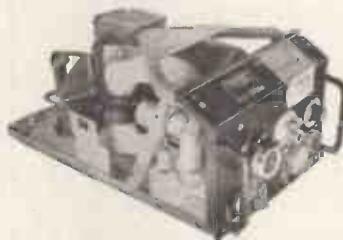
This other one is our portable Tape Recorder Cabinet. A Superior cabinet covered with best quality rexine and complete with carrying handle and fasteners. Price is £3, carriage and packing 10/- extra.



CHARGING SWITCHBOARD

Feed this Switchboard through a Mains Transformer and Rectifier giving 24 volt D.C. up to 50 amps, and you have an excellent multi-circuit charger for simultaneously charging several batteries at different currents. This is an ex. Government switchboard rated at 550 watts 18 volts fitted into steel cases with doors. It contains three reversed current relays, one voltmeter, one main ammeter, two secondary ammeters and three variable resistors for controlling circuits. These are brand new, in original cases. Price £4/10/-, carriage 10/-.

We can supply a 12 volt, 50 amp. Mains Transformer at £4/5/-, plus 5/- carriage.

COMPLETE 10 C.M.
TRANSMITTER RECEIVERS

Type numbers available include T.R. 3548, T.R. 3191, T.R. 3151. All are priced at £15 each, and contain blower motor, I.F. Unit, suppressor unit etc.



MAGNETRONS
Precision made for RADAR type Nos. CV. 186 and CV. 64. Unused, guaranteed. Any not functioning correctly will be replaced. Price £7/10/- Post and insurance 10/-.



MAGNETRON MAGNET

The correct one for using with the above magnetrons can be used for many other purposes, one such purpose being the making of a magnetic chuck. Price 30/- each, carriage 7/6.

THIS MONTH'S SNIP

This month our special snip is quite a small item but undoubtedly of use to every radio electrical experimenter. It is a wire-wound variable slider resistance which can be locked at any point along its length. The Type Number is CLR.810. Its value is 1,000 ohms but other gauges of wire can be wound on it to make a variable resistor to your special requirements. Price only 1/6, or 6 for 8/-.

GREATLY REDUCED
CATHODE RAY TUBES

VCR97. Brand new and unused, ideal for 'scope, etc. Price 12/6. Carriage and insurance 5/- extra.

VCR517. 6½ in. guaranteed full picture. 29/6 plus 5/- carriage and insurance.

VCR139A. 2½ in., 32/6 plus 2/6 carriage, etc.

VCR138. 3½ in. electrostatic short persistence, suitable for T.V. and ideal for 'scope work, 37/6 plus 3/6 carriage, etc.

VCR112. 5 in. electrostatic, persistence not known, 15/- each plus 5/- carriage, etc.

CV996. 6 in. electrostatic, persistence not known, 15/- each plus 5/- carriage, etc.

CV1140, CV1590, CV1546. All 12 in. magnetic long persistence £4/10/- plus 10/- carriage.

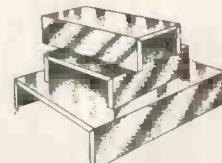


CHASSIS ASSEMBLY

3 colour, 3 waveband scale covering standard Long, Medium, and short wavebands, scale pan, chassis punched for standard 5 valve superhet, pulley driving head, springs, etc., to suit. Scale size 14½ in. x 3½ in. Chassis size, 15 in. x 5 in. x 2 in. deep. Price 15/-, plus 1/6 post. Note: This is the one that fits our £7/10/- Radiogram cabinet and our 37/6 table cabinet.



Complete kit comprises Hi-craft 40 watt control unit starter lamp lamp holders, clips and wiring diagram. Price, less tube, 22/6, plus 1/6 post. With tube, 30/-, plus 3/6 P.P. Tubes 7/6 each, cart. free, minimum quantity 6.



BLANK CHASSIS

18 S.W.G. Aluminium

7 x 3½ x 2	3/9
9½ x 4½ x 2½	5/-
10 x 8 x 2½	5/6
10 x 5½ x 2½	5/-
10 x 9 x 3	7/1
12 x 9 x 2½	7/-
14 x 9 x 2½	7/6
14 x 10 x 3	7/9
16 x 10 x 3	8/3
16 x 8 x 3	7/9
11½ x 10 x 3	7/6
16 x 12 x 3	8/8
19½ x 9 x 2½	8/3
20 x 10 x 3	10/-
21½ x 9½ x 2½	10/6

NEW ITEMS THIS MONTH

WELDING CABLE

This Cable is adequately insulated, and so is quite suitable for any job where high current is required, e.g. motor-starter wiring, plating, welding, etc.

250 amp.	5/- per yd.
75 amp.	3/- "
25 amp.	1/6 "

NON-STRETCHABLE CABLES

These Cables are extra heavily rubber covered and have string plaited with the conductors, which makes them tremendously strong and ideal for portable appliances where normal cables would stretch and break. These are twin cables.

70/0076 (10 amp.)	2/- per yd.
110/0076 (15 amp.)	2/6 "

LACQUERED AUTO CABLE

20 amp. twin flat	44/012, 1/- per yd.
-------------------	---------------------

SCREENED CABLES

4-core 23/0076 V.I.R. taped	plated metal overall, 3/- per yd.
Single-core 9/102 V.I.R. taped	plated metal overall, 1/6 per yd.

EARTH WIRE

7/029 enamelled copper	50ft. coils, 3/-.
------------------------	-------------------

CONNECTING WIRE

Push back, assorted colours, 10ft. coils, 6d. per coil, 5/- per doz.	P.V.C. insulated, single, 23 gauge, tinned copper, 50ft. coils, 1/9 per coil; assorted colours, 4 coils, 6/6.
--	---

GROUP BOARDS

9-way on PAX Panel, size 3 1/2 x 2 in. approximately, 9d. each, 8/- a doz.	13-way on PAX Panel, size 5 1/2 x 2 1/2 in. approximately, with two mounting brackets, 1/3 each, 12/- a doz.
--	--

TAG STRIPS

7-way plus 2 combined mounting brackets and earthing tags. 6d. each, 5/6 a doz.	9-way plus 2 combined mounting brackets and earthing tags. 9d. each, 8/6 a doz.
13-way plus 2 combined mounting brackets and earthing tags. 1/- each, 11/- a doz.	Voltage Selection Panels with Shorting Plug, 1/- each.
PLUGS AND SOCKETS	
7-way plus 2 combined mounting brackets and earthing tags. 6d. each, 5/6 a doz.	9-way plus 2 combined mounting brackets and earthing tags. 9d. each, 8/6 a doz.
13-way plus 2 combined mounting brackets and earthing tags. 1/- each, 11/- a doz.	Voltage Selection Panels with Shorting Plug, 1/- each.
PLUGS AND SOCKETS	

12-way, 1/6 the pair Octal Plug, fits standard Octal valve-holder, 1/-.	12-way, 1/6 the pair Octal Plug, fits standard Octal valve-holder, 1/-.
---	---

METAL-CASED CONDENSERS

64 mfd. 450 volt working 600 mA. ripple, can size 4 1/2 x 1 1/2, 4/9 a doz.	350 volt, size 1 1/2 x 1 1/2 tubular, 8d. each, 7/- a doz.
---	--

MINIATURE WIRE-WOUND POT

Colvern 200 ohms, 1/3 each, 12/- a doz.	Colvern 200 ohms, 1/3 each, 12/- a doz.
---	---

CONDENSER FIXING CLIPS

1 1/2 in., 4d. each, 3/9 a doz.	1 1/2 in., 4d. each, 3/9 a doz.
---------------------------------	---------------------------------

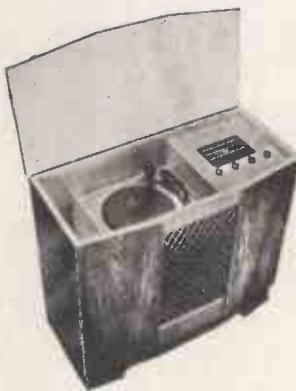
12in. P.M. SPEAKER, TRUVOX

£3. Post and packing 3/6.	£3. Post and packing 3/6.
---------------------------	---------------------------

ELECTRONIC PRECISION EQUIPMENT LTD.

A 70 Gn. RADIOPHONIC FOR ONLY 40 Gns.

OR £14. 0. 0. DEPOSIT



This Cabinet has all the properties which combine to make it a beautiful piece of furniture and yet a most up-to-date radiogram. Externally, it is beautifully figured walnut; internally, it is white sycamore. The radio section is raised to a comfortable operating level and beyond the auto changer is a compartment for storing your most popular records. We are most proud to offer this cabinet, and feel sure that every purchaser will be equally proud to own one. It can be supplied complete as a working radiogram, the price being £42, carriage and insurance £1. Alternatively, the cabinet may be purchased separately, price £18/18/-. Or with record changer, but uncut radio board, price £30. The radio chassis incorporated in the complete model is our popular 5-valve A.C. mains Superhet, covering 3-way bands (long, medium and short) and with volume and tone controls, multi-colour edge-lit dial, etc. The record changer incorporated in all models is the latest Collaro 3-speed model (type No. RC531) with the famous Collaro "Studio" pick-up.

A FEW MORE AVAILABLE



The Cabinet illustrated alongside has proved one of our best bargains, and all of the original batch we purchased was sold during November and December. Nevertheless, we have been able to obtain a further quantity, but regret that the price is just a little higher, though still well below cost. The Cabinet is suitable for television using tube sizes varying from 12in. to 17in., its overall dimensions being 3ft. 5in. high, 1ft. 4in. deep, 1ft. 10in. wide. It is complete with plywood back and "Bowler Hat." Originally made for a very expensive television and really good quality. Unrepeatable. Offered at £7/5/-, carriage, packing, etc., 12/6. Note: These are cut for 12in. tubes, but the holes for the controls are not drilled.

THE 17 RANGE ELECTRONIC TEST METER

10 megohms input impedance on voltage ranges.

This is the first instrument of the new "Elpreq" range of test equipment. It is undoubtedly an essential piece of equipment for professional and amateur alike. It has all the qualities of a modern 20,000 ohms per voltmeter, with none of its fragility. It is quite as easy to handle as an ordinary instrument, yet it is a valve voltmeter which will enable you to measure directly, grid, A.V.C. and resonant voltages and to perform checking operations which extend its usefulness far above that of any ordinary multimeter.

By an ingenious piece of circuitry, exceptional accuracy is obtainable. The ranges include:-

D.C. Voltage	4 Ranges	A.C. Voltage	4 Ranges
D.C. Current	4 Ranges	A.C. Current	4 Ranges
	Resistance Ranges.		

For those interested in television, an optional E.H.T. probe extending the meter's range to 10KV is also available.

The instrument is completely self-contained and can be totally enclosed in an attractive metal case with carrying handle. Price of completely self-contained instrument, less case, 57/6. E.H.T. Probe 10/6. Case as illustration will be available shortly.



MISCELLANEOUS ITEMS

PROJECTION T.V. SCREEN

Made from plastic and precision-milled on both sides to give a reflectionless surface. The cost of these from the manufacturers was 30/- each, but through a company going into liquidation we are able to offer these at 17/6 each. Size is 17 x 14in. but easily cut to suit cabinet opening. A limited quantity only, of course, is available.

PLASTIC TELEVISION MASK

This is a Mask and Implosion Guard combined, made for 12in. tube from moulded Perspex and internally sprayed bronze. It is the type of mask which fixes on the inside of the cabinet and is thus suitable for the amateur-cut hole. It is the latest type of mask as fitted to most modern televisions. Brand new and perfect at less than manufacturer's price, viz., 15/-, plus 1/6 carriage and insurance.

BALL BEARING TURNTABLE

As fitted to portable radios. The diameter approximately 4 1/2 in. Price 2/6 each.

NEEDLE CUPS

For gramophones made from Bakelite. Diameter approximately 1 1/2 in. Price 6d. each, or 4/6 a dozen.

BLACK SEALING WAX

For filling grubb screw holes in Bakelite, knobs, sealing instruments, etc.: 1 lb. sticks, 1/6 each, or 15/- a dozen.

BLOCK CONDENSERS

.5 mfd., 1,000 volts, 2/6. .5 mfd., 750 volts, 2/-. 2 mfd., 400 volts, 2/6. 2 mfd., 350 volts, 2/-.

CLEAR PLASTIC PANELS

Suitable as windows in radio sets and instruments, size 4, 2 1/2 in. each; 5, 6d. each; 5/- a dozen.

CROCODILE CLIPS

Large size for battery charges. 9d. each, 7/6 a dozen.

SCREENED SYSTOFLEX

5 mm., 1/- per yard length; 10/- a dozen yards.

DOMED FEET

Nickel plated, knock-in type for wooden cabinets. 6d. each, 5/- a dozen.

NIPHAM PLUG

2-pin type, No. XB.10260, 2/3.

MAZAK PLUGS AND SOCKETS

2-pin plug type, No. 10H/1411, and socket to match, type No. 10H/397, 3/6 the pair. 19-pn plug, type No. 10H/418, 2/6.

BAKELITE PLUG AND SOCKET

3-pin heavy duty type, No. ZA/6557, with a socket to match. Type No. ZA/5585, 3/- a pair.

SYSTOFLEX, ETC.

Insulated sleeving for all purposes. 24 1-yard lengths, mixed sizes 2-10 mm. Some varnished cotton (Systoflex), some P.V.C. for E.H.T. work. Approximate cost value 15/- offered as a parcel 7/6, or half the quantity, 4/-.

"Superior 15"

SOME QUESTIONS ANSWERED

QUESTION



Can I expect sound and pictures equal to factory made sets?

Is it robust and likely to go for long periods without trouble?

Why is it so much cheaper than any other big picture televison?

Does it look like a home-made set?

How about soldering? Is it difficult like repairing a kettle or saucepan?

Is aligning the set difficult?

Will the Elpreq "Superior 15" receive all B.B.C. stations?

What happens if I cannot get my televison to work once I have it finished?

ANSWER

The picture compared favourably with any set at the Radio Show.

Yes, because all parts are standard size and proved types.

The reason is because you assemble it yourself and thus save labour and other costs.

No, because it isn't really home made, it is simply assembled from factory made parts, just as are all so-called "factory made" T.V. models.

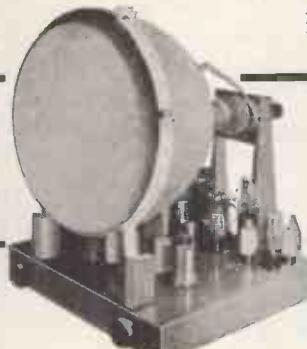
Soldering radio parts is simplicity itself.

No, the coils are all specially designed which "pre-aligns" them and you have only to follow the simple directions to ensure receiving the perfect picture. No instruments are necessary.

Yes, and all constructors will be notified of the modifications that will be necessary when Commercial T.V. starts.

You send for a service form which you complete and then our engineer will indicate your trouble. Alternatively, for a nominal charge, we will take your chassis and make it perfect.

UP TO THE MINUTE BIG PICTURE T.V.



**ONLY £37.10
OR £12.10 deposit**

MORE QUESTIONS ANSWERED

QUESTION

What is the cost?

Are Hire Purchase terms available?

Are there any guarantees?

Are cabinets available?

How much is the data and can I have it on approval?

How can I order?

ANSWER

All components, valves and Cossor 15in. cathode ray tube cost £37-10-0.

Yes, the deposit is £12-10-0, the balance is spread over 12 months.

You are covered by two guarantees, one covers the components and the other ensures that you will get perfect results.

The illustrations show the cabinets which are available. The Console costs £11-10-0 and the Super corner model £18-0-0. H.P. terms again are available.

The data costs 7/6, but providing you keep it clean and in good condition you can return it within 7 days if you think you cannot make the televison (7/- will be refunded to you).

An order form is enclosed with the 7/6 data, which you can complete and post to us.



-As Demonstrated at the National Radio Show

ELECTRONIC PRECISION EQUIPMENT LTD.

Post orders should be addressed to :—

**ELPREQ HOUSE (Ref 2.), HIGH STREET,
WEALDSTONE, MIDDX.**

Personal shoppers however must continue to call at :—

**42-46, WINDMILL HILL, RUISLIP, MIDDX.
Phone : RUISLIP 5780. Half-day, Wednesday.**

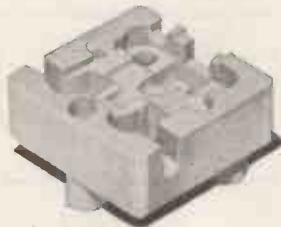
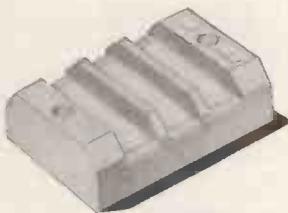
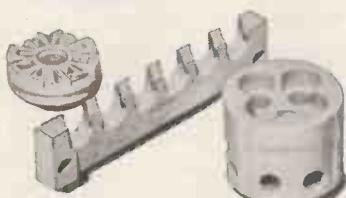
**152-153, FLEET STREET, E.C.4.
Phone : CENTRAL 2833. Half-day Saturday.**

**29, STROUD GREEN RD., FINSBURY PARK.
Half-day, Thursday.**



Bullers CERAMICS FOR INDUSTRY

High quality material and dimensional precision are attributes of Bullers die-pressed products. Prompt delivery at competitive prices.



PL108

We specialise in the manufacture of
PORCELAIN
 for general insulation
REFRACTORIES
 for high temperature insulation

FREQUELEX
 for high-frequency insulation
PERMALEX & TEMPLEX
 for capacitors

BULLERS LIMITED

Porcelain Works :
 MILTON,
 STOKE-ON-TRENT
 Stoke-on-Trent 5164

Sales Office :
 6, LAURENCE POUNTNEY HILL,
 LONDON, E.C.4
 MANSION HOUSE 9971

Iron Works :
 TIPTON,
 STAFFORDSHIRE
 Tipton 1691

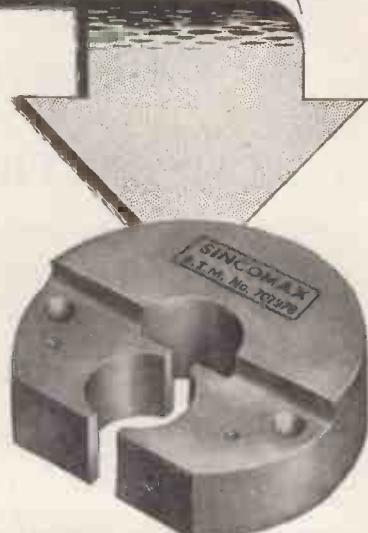
MUREX 'SINCOMAX' MAGNETS

ARE USED IN
E.I.C. INSTRUMENTS



Photograph by courtesy of E.I.C. (Hillington) Ltd., Glasgow

The high magnetic stability and strength of 'Sincomax' magnets makes a robust job even of a sensitive Microammeter. In this application as in many others Murex Sintered Magnets continue to give accurate and reliable service.



MUREX LIMITED (Powder Metallurgy Division)

RAINHAM • ESSEX • Rainham, Essex 3322

London Sales Office: Central House, Upper Woburn Place, W.C.1. Euston 8265



C.R.T. Display Units

With the basic essentials for visual presentation and designed to provide in simple and convenient form the best means of demonstrating signals from your existing equipment, they will also form display units for the Unitel System of instruments.

Model 1001 incorporates a 5in. diameter cathode ray tube with the following features : ● Post Deflection Acceleration at 4000 v. ● Fine Focus, High Intensity and Sensitivity. ● Self contained operating potentials from 200 to 250 v. A.C. Mains. ● Graticule with variable illumination. ● Full screening against external fields.

Ideal for monitoring production tests.

NAGARD
LTD

18, Avenue Road, Belmont, Surrey. VIGilant 0345.

Specialists in Oscilloscopes and D.C. Amplifiers

Your problems are our interest—Write for details.



Estd.

1925

LEAK

POINT-ONE TL/12 12-WATT
Triple Loop Feedback Amplifier



For the highest possible quality of reproduction from Pick-up, Radio, Microphone, Film and Magnetic Tape this amplifier has won worldwide recognition. As used by the B.B.C. and many overseas Broadcasting Corporations.

Cash Price £28 7 3.

THE NEW VARI-SLOPE PRE-AMPLIFIER

Gives audibly better reproduction. No chokes to cause magnetic hum pick-up. Extremely low harmonic and intermodulation distortion. Cash Price £12 12/0



For fuller details see maker's advertisement on p. 85

TERMS for these TWO UNITS

£9 deposit with order and 18 monthly instalments of 40/-.

Passenger carriage 10/- extra, payable with deposit.
LEAK V.S. TUNER AND DYNAMIC P.U. also supplied on similar terms

All the above available separately

Armstrong Chassis

Two new models incorporating many new features including Bass and Treble lift controls and improved tuning scales with flywheel action.
MODEL FC38. 3-wavebands 16-50m., 190-500m., 1 000-2 000 m. 8-watt P.P. Output. Cash Price £23 13/0 (incl. P.T.)
MODEL RF41. 10 valves, 4-wavebands, 12-35, 35-90, 190-550, 800-2 000 m 10-watt P.P. output. Cash Price £31 19/8 (incl. P.T.).

See maker's advertisement on p. 133.

Connoisseur 3-speed GRAM UNITS and LIGHTWEIGHT PICK-UPS to match, can be supplied from stock.

Wharfedale & Goodmans LOUDSPEAKERS. Complete range available.

Illustrated lists of any item and details of our EASY TERMS will be sent upon request by return.

HAVE YOU TRIED?

the amazing ALL-NEW

REMINGTON '60'
ELECTRIC DRY SHAVER



OUR 14 DAYS FREE TRIAL OFFER

WILL CONVINCE YOU

that it really does shave every type of beard quicker and closer than any other method.

SEND ONLY 20/- DEPOSIT for 14 DAYS FREE TRIAL

DEPOSIT RETURNED IN FULL IF NOT SATISFIED. Balance by 3 monthly payments of 24/-. Cash Price £9 19/0 A.C./D.C. 200/250v Brand new, dispatched by return in silk-lined case post paid. 12 months maker's guarantee.



THE L.R. SUPPLY COMPANY LTD.
(LONDON RADIO SUPPLY COMPANY)
BALCOMBE Telephone: Balcombe 254 **SUSSEX**

MODERN ELECTRICS LTD.,

164, Charing Cross Road, London, W.C.2.

Export enquiries welcomed.

Immediate delivery from stock.

Tel.: TEMple Bar 7587.

Cables: Modcharex, London.

Prompt attention to post orders.

TAPE RECORDERS

GRUNDIG 700L £84 0 0

SIMPHONIC 8 watts £83 0 0

BAIRD Soundmaster £68 5 0

Baird Mk. II £61 19 0

Soundmirror Twin Track

Table £69 10 0

Portable £74 10 0

WEARITE TAPE DECK

£35 0 0

TRUVOX TAPE DECK

£23 2 0

RECORDING TAPES

GRUNDIG

L.G.S. 1,200ft. £2 0 0

SOUNDMIRROR

Paper Tape 1,200ft.... £1 5 0

FERROVOICE

Spare Spools..... 4 6

E.M.I. H60, 1,200ft.... £1 15 0

E.M.I. H60, 600ft.... £1 1 0

E.M.I. H65, 1,200ft.... £1 15 0

E.M.I. H50, 1,200ft.... £2 8 0

SCOTCH BOY

1,200ft. £1 15 0

600ft. £1 1 0

Spare Spools 1,200ft. 4 3

Spare Spools 600ft.... 3 3

FERROGRAPH

1,200ft. £2 5 0

1,750ft. £3 3 0

8½ in. Spools 9 6

AGFA

1,200ft. £1 17 6

600ft. £1 2 6

RECORD REPRODUCING EQUIPMENT

COLLARO

3-spd. Unit complete with studio P/U..... £10 6 1

GARRARD

R.C.80 £17 1 3

R.C.90 £17 16 6

R.C.80 A.C./D.C. £24 14 4

T/A.C. £9 10 10

TA/B Decca £13 7 1

SPEAKERS

TRUVOX

12 in. 3Ω £2 5 0

WB STENTORIAN

HF. 610 £2 10 6

HF. 912 £3 7 0

HF. 1012 £3 13 6

GOODMAN'S

Axiom 150 Mk. 2 ... £10 5 6

Axiom 102 £9 18 2

Axiom 101 £6 12 1

Audiom 60 £8 12 6

WHARFEDALE

W15 CS £16 0 0

Super 12 CS/AL £16 0 0

W12 CS £9 15 0

Golden 10 CSB £8 6 7

Super 5 and 8 CS/AL £6 13 3

Bronze 10in £4 12 9

Bronze 8in £3 4 0

W.B. Crossover Unit... £1 6 6

W.B. Tweeter Unit ... £3 15 6

TEST GEAR

AVO

Model 8 £23 10 0

Model 7 (latest) £19 10 0

Unimor Mk. II £10 10 0

Electronic Meter £40 0 0

Wide Band Sig/Gen.. £30 0 0

Valve Characteristic

Meter £60 0 0

D.C. Minor £5 5 0

10kV Multiplier for

Model 8 £3 5 0

Carrying Cases for

Models 7, 8 and 40 ... £3 0 0

ADVANCE

H.1 (Sig/Gen) £25 0 0

E.2 (Sig/Gen) £28 0 0

J.1 New Model..... £35 12 0

COSSOR

Oscilloscope 1049 ... £150 0 0

Oscilloscope 1052 ... £104 0 0

TAYLOR

All new Taylor Test Gear in

stock.

PICK-UPS

ACOS

GP.20 (Std. or L.P.)... £3 6 1

Spare heads for above £2 0 0

DECCA

X.M.S. Magnetic £6 9 5

CONNOISSEUR

Super 2 Hds. £9 5 6

Spare Heads..... £3 6 3

COLLARO STUDIO

Type O or P..... £3 14 4

VALVES

We are one of London's largest stockists—Please write for requirements.

MICROPHONES

ACOS

Mic 22 (Crystal) £4 4 0

Mic inserts for above £1 0 0

Mic 16 (Crystal) £12 12 0

Mic 35-1 (Crystal)..... £1 5 0

LUSTRAPHONE

M/C with T/F/C 51... £5 15 6

Heavy Table Base for above £1 1 0

RESLO M/C (Low Imp.)

Ribbon High Fidelity £7 5 0

Mumetal Transformer £1 15 0

MICROPHONE STANDS

Floor, 3 extensions £3 12 6

Table Stand £1 1 0

LEAK AMPLIFIERS

Point 1, TL 12 £28 7 0

Point 2, TL 25 £34 7 0

Vari-slope pre-amp..... £12 12 0

Type VS R.F. Tuner Unit £35 1 3

SOLON. New Instrument Iron 200-250 v

25 w. 19 8

ALL GARRARD, CONNOISSEUR, DECCA and COLLARO HEADS AND STYLUS IN STOCK.

H.P. Terms available on all items over £10 . 0 . 0 . 0 .

FERGUSON RADIO CORPORATION LTD., requires ENGINEERS:-

ENFIELD FACTORY

Senior Engineers with initiative and sound technical background for work on a wide range of projects covering the Television, Radio and Communications field. Permanent posts for men able to carry responsibility in rapidly expanding departments offering exceptional promotion and long-term prospects.

Junior Engineers of ability for work on Development Projects offering a wide experience in Communications and Test Equipment Development with excellent prospects for advancement.

SPENNYMOOR FACTORY (County Durham)

Engineers with Initiative and sound technical background to work on the development of Radio Receivers. Permanent posts for men able to carry responsibility in a rapidly expanding department offering good prospects.

Laboratories are well equipped and working conditions excellent. Successful applicants eligible for Company's Pension Scheme. Housing assistance considered in appropriate cases.

Applications specifying the post for which application is made and giving full particulars as to age, qualifications and experience, etc., to:-

**Employment Manager, FERGUSON RADIO CORPORATION LTD.
GREAT CAMBRIDGE ROAD, ENFIELD, MIDDLESEX**

In the "right set"

... you'll meet 'Delanco'

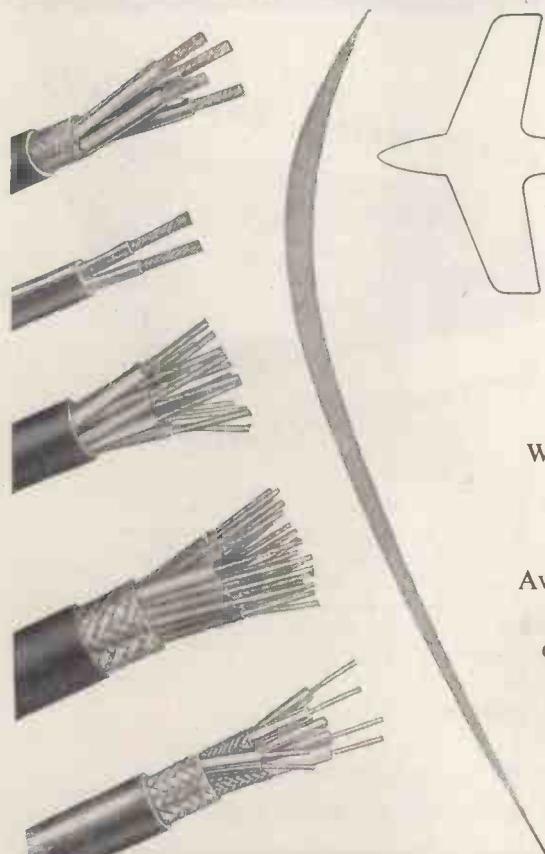
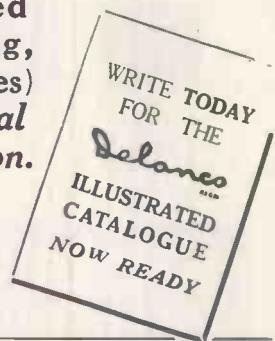
Delanco

REGD. Electrical insulating materials are widely used in the radio and electronics industry. In many of the most famous sets you will find 'Delanco' coil formers and component panels.

The wide 'Delanco' range includes:—

- Terylene, Leatheroid, Ebonite,
 - Bakelite (sheet, strip, roll and tube),
 - Coil formers (all types), varnished
 - cambric, varnished cotton sleeving,
 - Presspahn (rectangular and round tubes)
- in fact there is a 'Delanco' material for every form of electrical insulation.*

ANGLO-AMERICAN VULCANIZED FIBRE
CAYTON WORKS, BATH STREET, LONDON, E.C.1
CO. LTD.
CLE 3271 (10 LINES)



TELCON MULTICORE AIRCRAFT CABLES

for electronic and radio engineering

Whilst Telcon Multicore Cables are designed primarily for aircraft wiring, they are also eminently suitable for the varying needs of the electronic and radio engineer.

Available in a range of from 2 to 25 cores, with alternative finishes, Telcon Multicore Cables are colour-coded for easy reference. Fully illustrated and detailed publication, ref MC/1, is available free on request.



THE TELEGRAPH CONSTRUCTION & MAINTENANCE CO. LTD
Works: Telcon Works, Greenwich, S.E.10. Tel: GReenwich 3291
Branch Office: 43 Fountain St., Manchester, 2. Tel: Central 0758

for all Good Instruments

COPPER OXIDE RECTIFIERS

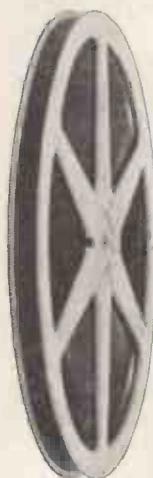


A range of rectifiers designed to suit all types of instrument movements.

The performance data and details of the types available are given in our publication No. C.O.R. 5305/2.

Please apply to the following address:—

SALFORD ELECTRICAL INSTRUMENTS LTD
PEEL WORKS • SILK STREET • SALFORD 3 • LANCS
 A Subsidiary of THE GENERAL ELECTRIC CO. LTD. OF ENGLAND



*the truest sound recording tape yet—
 NEW SCOTCH BOY
 MAGNETIC RECORDING TAPE
 TYPE MC2-11
 —with 6db extra output!*

You've not heard true sound reproduction until you've tried the new 'Scotch Boy' Magnetic Recording Tape—the nearest approach yet to perfection in tape recording! Already noted for crystal clear recordings at economical running speeds, 'Scotch Boy' now offers you new and improved features—higher sensitivity,

6 db extra output, higher signal/noise ratio, even less distortion, and perfected dry lubrication. As before, you have the choice of six reel sizes from 300ft. to 3280ft. Put this new magnetic tape on your recorder and you will realise why 'Scotch Boy' is used by recording companies and the B.B.C.

ANOTHER  PRODUCT

Ask your dealer to show you the new 'Scotch Boy' or write for full details to:

MINNESOTA MINING & MANUFACTURING COMPANY LTD, 167 Strand, London, W.C.2 Tel: TEMple Bar 6363

RADIO EXPORT

TUBES ONLY

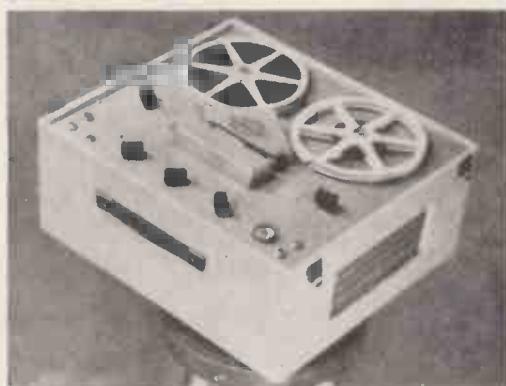


900 types
of Receiving and
Transmitting Radio
Tubes available ex stock.

HALL ELECTRIC LTD
Haltron House, 49-55 Lisson Grove,
London, N.W.1.

Tel.: Ambassador 1041 (5 lines) Cables: Hlectric, London

The Musicmaster SENIOR Tape Recorders



£45

DESIGNED FOR CRITICS

Trusound Ltd.

BY CRITICAL DESIGNERS

Showroom Open for Demonstrations Monday—Saturday 9 a.m.—1 p.m., 2 p.m.—6 p.m.
(Wednesday 9 a.m.—1 p.m.)

OFFICES & SHOWROOM: 196 KINGSLEY ROAD, HOUNSLOW, MIDDX. (HOUNslow 7947) WORKS: TWICKENHAM, MIDDX

- ★ Twin speeds. ★ Twin tracks. ★ Four watts output.
- ★ Low distortion. ★ Mic., Gram. and Radio inputs.
- ★ Fidelity amplifier. ★ Simple operation.

Further details of these two excellent recorders, together with complete technical specifications are available on receipt of a stamped addressed label.

£52

Model 2250

Hire purchase
facilities
now
available



SEE HEAR ADMIRE at WEBB'S

The NEW ACOUSTICAL "QUAD. II" Amplifier
and unique "QC.II" control unit with push-button selection of record compensation, also any pick-up can be accurately matched by using ingeniously contrived plug-in units. Such conveniences plus reproduction of the highest order makes the "QUAD.II" quite outstanding—an amplifier which is bound to influence future design. Price of amplifier and control unit together is £42.0.0. (The control unit "QC.II" costs £19.10.0 and is applicable for use with the "QUAD".)

The NEW "REFLECTOGRAPH" Recorder
Here is a high fidelity tape recorder of clever electronic design made with engineering precision. It has all the usual facilities like twin-track, recording meter, internal speaker, ALSO CONTINUOUSLY VARIABLE SPEED AGAINST CALIBRATED DIAL—HIGH AND MEDIUM GAIN MICROPHONE INPUTS—OUTPUT FOR EXTERNAL AMPLIFIER—PLUS TRUE "HI-FI" REPRODUCTION.

Before buying a tape recorder we earnestly advise you to hear the Reflectograph at Webb's. The "Standard" model costs £87.0.0 and special models are available for scientific and schools use.

The NEW COLLARO "STUDIO" Turnover Crystal Pick-up
Gives about the best reproduction we have heard from any pick-up with a reasonably large output. Plays L.P. and 78 records with the convenient turnover device. Price including Purchase Tax £3.14.8.

The NEW EDDYSTONE "770R" VHF Receiver
Covers 19 to 165 megacycles by rotating turret in six wave-bands. This quite unique receiver is designed primarily for the professional user and fulfils the long-felt want of the communications engineer for a VHF set of wide frequency coverage. Commercial and official requirements take almost the entire output, but an occasional receiver can be allocated for private sale at £195.0.0. A receiver is on demonstration at 14 Soho Street, W.1.

The NEW QUALITY of Reproduction
given by the B.B.C. experimental FM transmissions from Wrotham. Solves the problem of radio reception free of background noises and heterodynes—here is the "hi-fi" radio system of the future. We demonstrate most days, we shall be happy to let you hear the clarity of these transmissions.

THE NEW 1954 RANGE OF EDDYSTONE COMPONENTS ARE NOW AVAILABLE, fully detailed in the new Eddystone illustrated component catalogue 1/- post free. (Webb's registered catalogue holders are receiving details by post.)

SEE, HEAR AND ADMIRE THE LATEST AT

WEBB'S Radio

14 SOHO STREET, OXFORD STREET, LONDON, W.1
Tel : GERrard 2089 Shop Hours : 9 a.m.—5.30 p.m. Sat. 9 a.m.—1 p.m.
ALL ITEMS ARE AVAILABLE FROM STOCK

**URGENT "PER RETURN" ATTENTION,
IS A NORMAL PART OF OUR SERVICE TO ALL
RADIO DEALERS AND TRADE SERVICE
ENGINEERS**

AT TO-DAY'S KEENEST TRADE PRICES
we are comprehensive stockists of quality condensers, resistors, potentiometers, transformers, valves and engineers' sundries of all kinds.

STOCKISTS OF "HOME CONSTRUCTOR" KITS

"Sound Master" Tape deck and amplifier. "Truvox Mark III Tape Deck" and amplifier components. "View Master" and Tele-King Televisor Kits, etc.

FAST TRADE SERVICE GIVEN ON REPAIRS
to loudspeakers and transformers. Special Transformers to own specs.

A.W.F. CONE ASSEMBLIES
for L/S repairs in your own workshops at economical rates

**BUYERS OF SURPLUS STOCKS OF BRAND NEW
COMPONENTS & VALVES. SEND US YOUR OFFERS.**

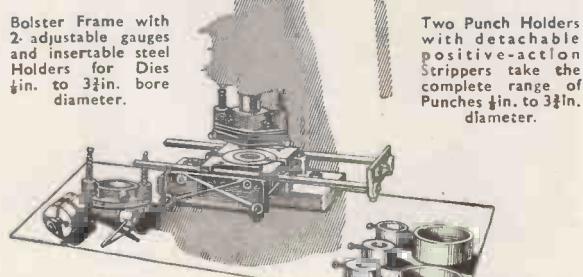
TRADE LISTS for 3d. stamp (2/- overseas air mail)
"We know the export business".

A.W.F. RADIO PRODUCTS
TATLER CHAMBERS, BRADFORD 1.

Phone 24008. Cables "Testube"

REDUCE YOUR PRESS TOOL COSTS

**THE HUNTON UNIVERSAL BOLSTER OUTFIT
FOR SHEET METAL PIERCING AND
BLANKING ON FLY PRESSES**



Equip your Press with the Hunton Outfit and use inexpensive standardised Punches and Dies 1/16in. to 3/16in. diameter, obtainable from stock—in 1/16in. sizes when required.

Standardised Tools also available at short notice for Square, Oblong and other shapes, Louvre Forming (up to 8in. long), Corner Notching, Corner Radiusing, Angle Iron Notching and Piercing, etc.

Get the Outfit now—Buy Punches, Dies and Tools as you need them.

Descriptive brochure and prices on request.

HUNTON LIMITED

Phoenix Works, 114-116, Euston Road, London, N.W.1
Telephone : EUSton 1477-8-9 Telegrams : Untonexh, London

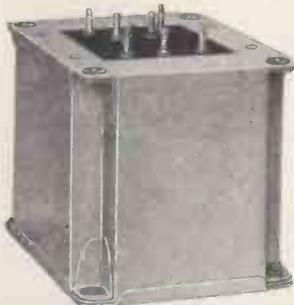


The mark of RELIABILITY

HERMETICALLY SEALED "C" CORE UNITS

The Woden range of Hermetically Sealed transformers and chokes embody the very latest developments in both mechanical and electrical design and are made to conform to the relevant Inter-Service Specifications RCS.214 and RCL.215.

A complete range is available comprising 32 sizes covering transformers from 1 VA to 2kVA and also the usual range of chokes.
Manufactured to customers specification.



POTTED COMPOUND FILLED TRANSFORMERS

Of proved performance these units have been first choice by many leading manufacturers over a number of years. Highly suitable for use in equipment which is subject to exacting industrial and climatic conditions.

We also manufacture Power and Industrial Transformers up to 750 KVA.

Further particulars and our latest Catalogue will be sent on request.

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

FOR WIDE RANGE FREQUENCY AND VOLTAGE

AUDIO FREQUENCY SIGNAL GENERATOR

Model LO63

Accuracy to $\pm 1\frac{1}{2}\%$ or 0.5 cycle



- Completely Self-contained
- Operates from A.C. Mains—Stabilised Voltages

FREQUENCY RANGE: 50 cycles to 55,000 cycles.

BASIC RANGE: 50-550 cycles direct reading on a 6" diameter scale over an arc of 300°.

MULTIPLIER: 1, x 10, x 100.

TOTAL SCALE LENGTH: 48".

Alternatively 30-33,000 cycles or 10-11,000 cycles.

Here is a standard calibrated audio frequency voltage generator designed to cover a wide range. The use of high value capacity components in the bridge circuit allied to the two valve phase-shift oscillator which is equipped with fully automatic electronic feed-back control, results in a circuit of exceptionally high stability.

Please write for full specification.

BRITISH PHYSICAL LABORATORIES

Tel.: RADLETT 5674-5-6



Radlett HERTS

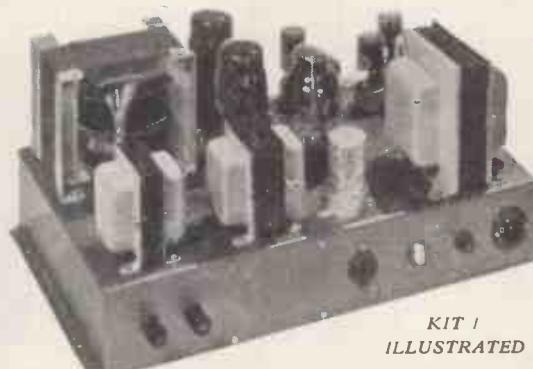
WILLIAMSON AMPLIFIER KITS

KIT 1

WITH ELLISON
MAINS
TRANSFORMER
AND CHOKES

19 GNS.

READY BUILT
and tested
23½ Gns.



KIT 2

WITH
PARTRIDGE
TRANSFORMER
AND CHOKES

21 GNS.

READY BUILT
and tested
25½ Gns.

KIT 1
ILLUSTRATED

BOTH Kits have PARTRIDGE OUTPUT TRANSFORMERS

Fully drilled and enamelled chassis, T.C.C. and G.E.C. Condensers, Marconi-Osram-Cossor valves, sundries by Colverne, Belling-Lee, Erie, Bulgin, Welwyn, etc., complete to the last nut and bolt, with wiring instructions and layout drawings. Packing and Carriage £1 extra, 10/- refunded on return of case carriage paid. C.W.O.

PA1 PRE-AMPLIFIER

In response to numerous requests for a simple, inexpensive pre-amplifier for use with Tele-Radio Williamson Kits we have introduced our PA1. Specification includes full control of Bass and Treble, radio input and switched compensation for standard and long playing records. Recommended for use with ACOS GP20 and GP30, Decca C. & D. heads and Connoisseur Pick-ups. With wiring instructions and lay-out drawings.

KIT OF PARTS 6½ gns. READY BUILT 8½ gns. Postage and Packing 2/- extra. C.W.O. or C.O.D.

TELE-RADIO (1943) LTD.

189 EDGWARE ROAD, LONDON, W.2.
SHOP HOURS : MON.-SAT. 9 a.m. to 6 p.m.

Phone : PAD 4455/6
THURSDAY 9 a.m. to 1 p.m.

TWO AND SIX!

This small sum will bring you on 50 glossy art pages* full information enabling you to build ALL of the following high-class equipment.

- ★ 3-VALVE 3-BAND SUPERHET. FEEDER UNIT.
- ★ 4-VALVE 3-BAND SUPERHET. "NORM./HI-FI/GRAM." FEEDER UNIT.
- ★ 4-VALVE 3-BAND A.C. SUPERHET. ("CORONET.")
- ★ 5-VALVE 3-BAND A.C. SUPERHET.
- ★ 5-VALVE 3-BAND A.C./D.C. SUPERHET.
- ★ 6-VALVE 3-BAND A.C. SUPERHET.
- ★ 6-VALVE 3-BAND A.C./D.C. SUPERHET.
- ★ 3-VALVE 2-BAND "LOCAL STATION" T.R.F. SUPER QUALITY FEEDER UNIT, ETC.
- ★ FEEDER AMPLIFIER AND POWER PACK.
- ★ MAGIC EYE TUNING INDICATOR UNIT.
- ★ SIGNAL TRACER A.C.
- ★ 5-WATT QUALITY AMPLIFIER A.C.
- ★ 10-WATT PUSH-PULL QUALITY AMPLIFIER, A.C.
- ★ SIGNAL GENERATOR, A.C.
- ETC., ETC.

Our completely NEW 1954 HOME CONSTRUCTORS HANDBOOK contains constructional details, LARGE blueprint circuits, COMPLETE parts lists, and technical descriptions of these famous outfits, as well as Set Building Hints, Servicing Hints, Facts and Formulae, Resistance Colour Code, Symbols, etc., etc., AND our current Catalogue. WHAT MORE COULD YOU WANT FOR ONLY HALF-A-CROWN ! SO DON'T DELAY, SEND FOR YOUR COPY TO-DAY !!

* Printed on glossy art paper, and now enlarged to 50 9in. x 5½in. pages, this latest issue of our famous book is packed solid from cover to cover with information YOU want !

OVER 60,000 COPIES NOW SOLD !

RODING LABORATORIES

(Dept. WW2), BOURNEMOUTH AIRPORT, CHRISTCHURCH.



CELSIONIC

(REGD. TRADE MARK)

MAGNETIC TAPE RECORDERS

Used as a first class recorder for high fidelity work; also employed with 'CELSIONIC' Synchroniser Unit for high quality synchronised sound with sub-standard film projectors. Standard full track; also half track to order.

- WIDE FREQUENCY RESPONSE
- FREEDOM FROM "WOW" AND FLUTTER
- 10½in. DIAMETER FLYWHEEL
- SUPERIMPOSING
- NOISE SUPPRESSION.
- TAPE CAPACITY: Standard 3250 ft. single sided spools and NAB 2400 ft. double sided spools.
- PORTABLE. WIDTH 14½ in. DEPTH 17½ in. HEIGHT 8½ in.

For full details and nearest Agent please write to

EXCEL SOUND SERVICES LTD.

"CELSIONIC" WORKS, GARFIELD AVE., BRADFORD, 8 (Yorks)
Telephone: BRADFORD 45027



HUDSON

RADIO - TELEPHONES

MODELS

AM/250/M 5 watt Mobile 60 to 100 Mc/s
 AM/250/M MK2 as above but with P.A.
 AM/150/M 5 watt Mobile 100 to 185 Mc/s
 AM/250/F 6 watt Fixed Station 60 to 100 Mc/s
 AM/150/M 5 watt Fixed Station 100 to 185 Mc/s.
 HED 102 Walkie-Talkie 60 to 132 Mc/s
 FM 101 10 watt FM Fixed Station 60 to 185 Mc/s
 FM 102 10 watt FM Mobile Station 60 to 185 Mc/s

Supplied to the G.P.O. and the Home Office

HUDSON ELECTRONIC DEVICES LTD.

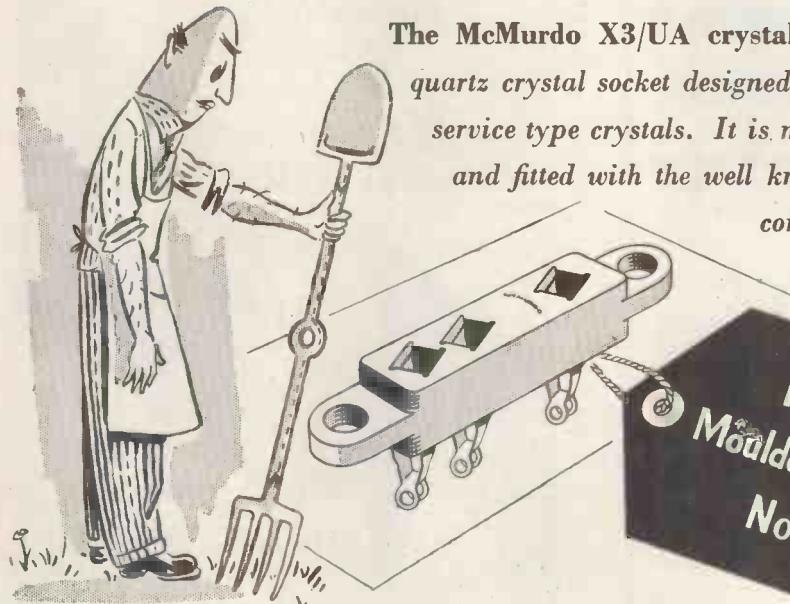
APPACH ROAD, LONDON, S.W.2

Tel.: TULSE HILL 4861



TWO JOBS IN ONE . . .

The McMurdo X3/UA crystal holder is a dual purpose quartz crystal socket designed to take either 10X or 10XJ service type crystals. It is made of nylon loaded bakelite and fitted with the well known McMurdo Valveholder contacts ensuring a remarkably low and stable contact resistance.

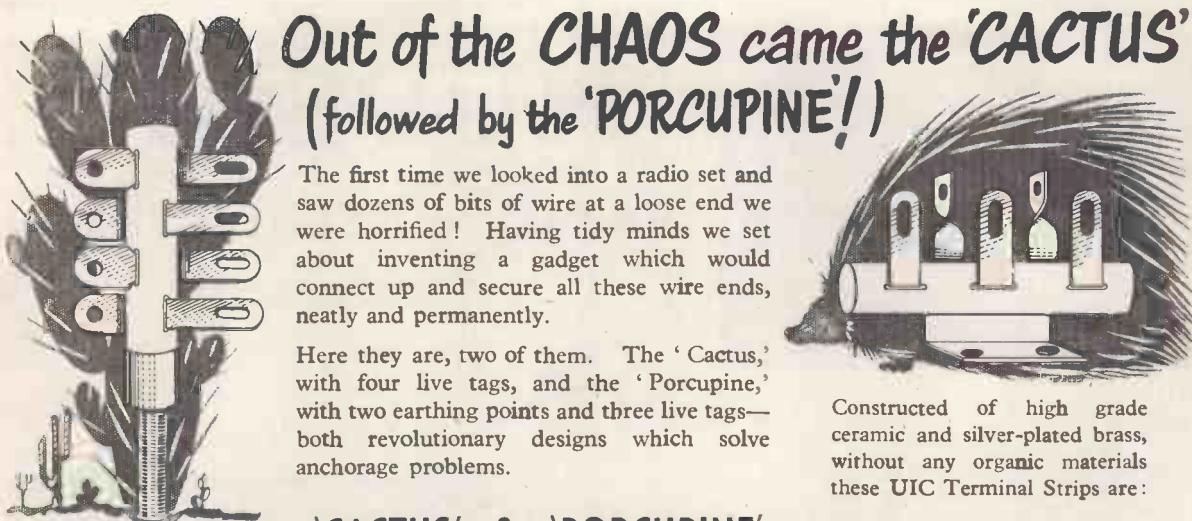


Mc MURDO
 Moulded Crystal Holder
 No. X3/UA

Wholesale Enquiries :—

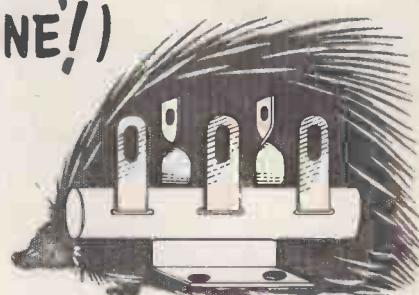
CYRIL FRENCH HOLDINGS LTD., Hampton Wick, Middlesex. KIN. 2240

Manufacturers' Enquiries: THE McMURDO INSTRUMENT CO. LTD., VICTORIA WORKS, ASHTead, SURREY. ASHTead 3401



The first time we looked into a radio set and saw dozens of bits of wire at a loose end we were horrified! Having tidy minds we set about inventing a gadget which would connect up and secure all these wire ends, neatly and permanently.

Here they are, two of them. The 'Cactus,' with four live tags, and the 'Porcupine,' with two earthing points and three live tags—both revolutionary designs which solve anchorage problems.



Constructed of high grade ceramic and silver-plated brass, without any organic materials these UIC Terminal Strips are:

- TOUGH!
- FIREPROOF!
- SPACE-SAVING!
- FREE FROM SOLDER!

'CACTUS' & 'PORCUPINE' TERMINAL STRIPS FOR RADIO & ELECTRONIC ASSEMBLY

Let's tell you more about the 'Cactus' and the 'Porcupine'—write for catalogue (pages 2028-2029/A)

United Insulator Co., Ltd., Oakcroft Road, Tolworth, Surbiton, Surrey. Tel: Elmbridge 5241/2/3/4

SPECIALISTS IN ELECTRO TECHNICAL CERAMICS & COMPONENTS • SPECIALISTS IN ELECTRO TECHNICAL CERAMICS & COMPONENTS



Still Available—

R. C. A. TRANSMITTERS ET. 4336 and ET. 4332.

Complete with Speech Amplifiers MI 11220. Wilcox Gay V.F.O. and Crystal Multiplier and all tubes.

Normal frequency coverage of the ET.4336 is 2-20 Mc/s. A special modified version covering 900 Kc/s—2,000 Kc/s is available.

Hallicrafter BC.610 complete with Speech Amplifier, BC.614E, Aerial Tuning Unit BC.939A, all Tuning Units, Tubes and Coils. Large stocks of spares available for RCA, BC.610 Transmitters.

Army I2 Transmitter 25 watts. Frequency coverage 1.2-17.5 Mc/s. Phone or C.W. built in Modulator complete with all Tubes.

Receivers available. RCA AR88 LF and AR88 D, Hallicrafter SX.28, National H.R.O.

McELROY-ADAMS MFG. GROUP LTD.
(8th) Importers U.K. for Hallicrafter Communication Equipment.
46, GREYHOUND ROAD, LONDON, W.6
Cables: Hallicraft, London

Phone: Fulham 1136/9

HIVAC
INDICATOR
LAMPS

Neon
INDICATOR LAMPS

A collection of various neon indicator lamps of different sizes and shapes, some with internal filaments and others with external leads. They are arranged against a dark background.

for
ELECTRICAL EQUIPMENT

ACTUAL SIZE

Hivac Ltd

GREENHILL CRESCENT, HARROW-ON-THE-HILL
MIDDLESEX

Telephone HARrow 2655

PHILIPS

present...

GM 2889 A.M. F.M. Signal Generator

Features :—

- 1 Frequency range 5-225 Mc/s in one band.
- 2 Marker oscillator 15-30 Mc/s.
- 3 A.M. Modulation int. 400 c/s ext. 0-10 Mc/s.
- 4 F.M. Modulation sweep 0-15 Mc/s.
- 5 Output impedance 75 and 300 ohms.

INDUSTRIAL X-RAY EQUIPMENT · ELECTRONIC APPARATUS
LAMPS AND LIGHTING EQUIPMENT · ARC AND RESISTANCE
WELDING PLANT AND ELECTRODES · MAGNETIC FILTERS
BATTERY CHARGERS AND RECTIFIERS · H.F. HEATING
GENERATORS · RADIO AND TELEVISION RECEIVERS



PHILIPS ELECTRICAL LTD.
INDUSTRIAL DEPARTMENT

CENTURY HOUSE · SHAFTESBURY AVENUE · LONDON · W.C.2

(PT.410)

VIEWMASTER, SOUNDMASTER FROM STOCK

SMOOTHING CHOKES, 10 H. 50 mA., 6/-; 15 H. 60 mA., 5/11 ; 10 H. 100 mA., 8/3 ; 20 H. 30 mA., 6/-; 40 H. 50 mA., 6/-; 20 H. 120 mA., 15/6 ; 50 H. 30 mA., 10/9 ; 10 H. 150 mA., 16/6 ; 15 H. 150 mA., 18/-; PANEL Black Crackle Paint, 3/6. WIRE-WOUND RESISTORS, 5 w. 1/3, 10 w. 1/6. SILVER MICA CONDENSERS up to 100 pf., 9d., 100-1,000 pf. 1/-; CARBON RESISTORS, 1/2 and 1 w., 4d. PENTODE OUTPUT TRANSFORMERS, 5/11. METAL RECTIFIERS RMO, 5/-; RMI 5/3 ; RM2 5/9 ; RM3 7/- ; RM4 21/- ; DRM1B 11/6 ; DRM2B 12/6 ; DRM3B 15/- ; K3/45 8/2 ; K3/50 8/8 ; K3/100 14/8.

MINIATURE MAINS TRANSFORMERS

for PRE-AMPLIFIERS, TESTGEAR, etc. PRIMARY 230/240 v., SECONDARIES 0-250 v. 30 mA. (for 250 v. from a half-wave rectifier), and 6.3 v. 1 a. New and guaranteed. Price 14/9.

ELECTROLYTICS. 450 v. wkg. (Gtd. New Stock), 4 mfd., 1/6 ; 8 mfd., 2/- ; 16 mfd., 3/- ; 8-8 mfd., 3/6 ; 8-16 mfd., 4/- ; 16-16 mfd. 4/6. PM LOUDSPEAKERS (3 ohms), 3in., 13/6 ; 5in., 14/6 ; 6in., 15/6 ; 8in., 18/6 ; 10in., 22/6. GERMANIUM CRYSTAL DIODES, 2/-, B.I.C., 0.1 mfd. 3 kv. TV Condensers, 10/6. ROTARY SWITCHES, 3-bank, total of 5 p. 6 w., 3/9. H.R. HEADPHONES, 18/6. SOLON Miniature SOLDERING IRONS, 19/6, 6in. ENLARGERS (for VCR97), 17/6. WEARITE "P" COILS, 3/-, ALI. CHASSIS, 2½in. deep, 6in. x 4in., 4/6 ; 8in. x 6in., 6/- ; 10in. x 7in., 7/- ; 12in. x 8in., 9/- ; 14in. x 8½in., 13/- ; 16in. x 9in., 14/-, TRANSFORMERS (Mains input Standard Primaries), 250-0-250 v. 80 mA., 0-4-6.3 v. 4 a., 0-4-5 v. 2 a., 19/6 ; Ditto, but 350-0-350 v., 19/6 ; 250-0-250 v. 100 mA. 6.3 v. 2.5 a., 5 v. 2 a., 26/6 ; Ditto, but 350-0-350 v., 26/6. ORDERS UNDER £1 please add 1/- p. and p. ORDERS £1 and over add 1/9.

FOR INSTANT SERVICE—WRITE :

CITY & RURAL RADIO,
101 HIGH STREET, SWANSEA, GLAM.

Telephone : Swansea 4677



REPLACEMENTS

134-136 LEWISHAM WAY, NEW CROSS, S.E.14

Tel: TIDewey 3696-2330

IF YOU REQUIRE A COMPONENT FOR A T/V SET, WE ARE ALMOST CERTAIN TO STOCK IT. IF OUT OF STOCK OUR REWIND DEPARTMENT IS AT YOUR SERVICE, SPECIALIZING IN LINE, OUTPUT AND E.H.T. FLYBACK TRANSFORMERS, MURPHY, PHILIPS, FERRANTI, ROMAC, R.G.D., BUSH, ETC.

SILICONE M.S.4. WE ARE DISTRIBUTORS TO THE RADIO TRADE OF 2oz. TUBES. . . . 10/6 Every T/V engineer should have a tube. Prevents corona around line outputs, final anode and deflection coils.

Recommended by leading manufacturers and trade journals

NEW ARCOLECTRIC SIGNAL LAMPS

For Low Voltage or Mains

Illustrated are a few of our wide range of new signal or indicator lamps.

A new mains voltage lamp holder, Cat. No. S.L.88/N, has been developed for use with the Arcolectric MES neon tube. Among the features of this design are easy lamp replacement, from front or rear of panel, and a built-in resistor.

The low voltage lampholders are designed for use with standard MES bulbs. Features are, easy single-hole fixing and pleasing appearance. Bulbs are accessible from front or back of panel. Insulation of all types will withstand a flash test in excess of 1,500 volts A.C.

Write for Catalogue No. 128



ARCOLECTRIC
SWITCHES LTD

CENTRAL AVENUE, WEST MOLESEY, SURREY · TELEPHONE: MOLESEY 4336 (3 LINES)

The advertisement features a large, rectangular core transformer with multiple windings and a central magnetic core. To its right is a vintage-style speaker cabinet with a dark wood finish and a prominent grille. The words "GARDNERS RADIO Ltd" are printed in a stylized, serif font across the top of the speaker cabinet. The background is a light-colored surface with fine horizontal lines, creating a grid-like effect.

"C"—Core transformers and chokes (open and hermetically sealed) are now included in the comprehensive range of standard "Somerford" types available for 'off the shelf' delivery. A fully descriptive catalogue is available from GARDNERS RADIO Ltd., Christchurch, Hants.

BUILD YOUR OWN TAPE RECORDER

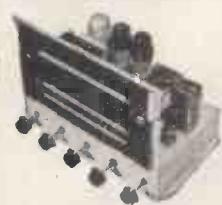
ALL PARTS PRECISION ENGINEERED

Main plate (Drilled—16½ in. x 14¼ in.)	52/6
Capstan assembly 3¾/sec.	65/-
Switch unit	37/6
Tape Holder assembly	22/6
Pinch Roller assembly	15/-
Brake assembly	16/6
Capstans—7½ in., 7/-; 15 in.	7/6
Motors, each	38/6

(Send S.A.E. for detailed list)

Decks : Wearite	£35
Truvox	22 gns.
Lane	£17/10 Motek

Also Complete "Soundmaster" Kit.

8-VALVE ARMSTRONG SUPERHET

8 watts push-pull output, Negative feedback, Bass and Treble controls, Short, medium and long wavebands.

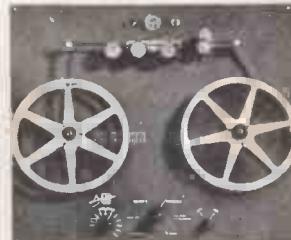
£23/13/-

Also 10 valve Superhet Chassis (Model RF41) £31 19 8
EXP. 119 10 v. 6 bandspread, plus M and 2 S £55 19 4

H.P. TERMS
AVAILABLE ON
PURCHASES
OVER £10.

Illustrated Catalogue 6d. post free.

N.B. If you already have catalogue, send S.A.E. for latest additions and amendments.

**LATEST GRAM. UNITS**

TA/AC—3-speed unit (less heads)	£7 11 1
RC90—3-speed changer (less heads)	£17 16 6
RC75A—3-sp. auto (less heads)	£13 8 4
RC80—3-sp. auto (less heads)	£15 1 6
BSR GU4A—3-sp. Xtal T/o head	£9 4 11
GU4M—3-sp. Decca XMS heads	£12 17 7
COLLARO—3-sp. Studio transcription (less P.U.)	£13 9 6
(with Studio pick-up)	£18 4 9
3/534—3-sp. with Studio pick-up	£10 6 11
CONNOISSEUR 3-speed	£21 17 3

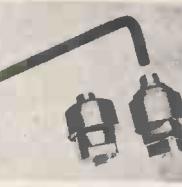
"Q-MAX" CHASSIS CUTTERS

STILL the easiest and quickest way of cutting holes in SHEET METAL.

each

1" or 2"	11/6
2"	12/6
1½" or 1¾"	14/9
1¾" or 1½"	16/6
1½"	18/6
2½"	30/-
2½"	35/-
1" square	23/-

Keys, small, 10d.; medium, 1/3; large, 1/9.



Patent No. 619178

SPECIAL PRICE FOR COMPLETE SET £10.

SPEAKERS

Complete range, including Axiom 101, £6/12/1 ; Axiom 102, £9/18/2 ; Axiom 150 Mk. II, £10/5/6 ; Super 5, £6/13/3 ; Super 8 CS/AL, £6/13/3 ; W10CSB, £12/6/6 ; W12CS, £9/15/- ; W15CS, £16 ; WB.HF.610, £2/10/6 ; HF. 810, £3/0/6 ; HF. 912, £3/7/- ; HF. 1012, £3/13/6.

WILLIAMSON AMPLIFIER. All specified parts, transformers, etc., in stock.

BERRY'S

(SHORT WAVE) LTD.

25 HIGH HOLBORN, LONDON, W.C.1
TEL: HOLBORN 6231

HEADS

ACOS	
HGP35 (head)	42/11
GP20/HIG ...	68/8
HGP39 (head)	42/3
CONNOISSEUR	
Head and arm	119/3
Head only	66/3
DECCA XMS	
Head and arm	75/-
Head only	54/8

COIL WINDING MACHINERY

We invite your enquiries for the Type A1/1 automatic machine, as illustrated. Also for the Type H/1 hand coil winder and Type AW/1 Armature Winding Head.

KOLECTRIC LTD

73 UXBRIDGE ROAD, EALING, LONDON, W.5

Ealing 9096

ASK ARTHURS FIRST

Send your enquiries for all Radio and Electrical goods, especially those in short supply.

★ NEW VALVES

We have probably the largest variety of valves in the country. Let us know your requirements.

AVO METERS IN STOCK

Avo Model 7..... £19 10 0

Avo Model 8..... £23 10 0

Signal Generator, Mains and Battery Models

£30 0 0

Models

£40 0 0

Electronic Test Meter..... £60 0 0

Valve Characteristics Meter.....

Also full range TAYLOR METERS. List on request.

Leak Point 1 Amplifiers £28 7 0

Leak Pre-Amplifiers ... £9 9 0

Leak Tuning Unit £35 6 3

Wearite Tape Deck ... £35 0 0

Grundig Tape Recorder

two-speed

Recording Tapes: E.M.I., G.E.C. and Scotch Boy, 35/- each.

Ferrovoice Tape, 1,200ft. on 7in. spool 22/6 (plus 9d. postage).

Terms C.O.D. or Cash with order. Goods offered subject to being unsold and to price alteration.

Arthur's
EST.
1919

DOORS: ARTHUR GRAY, LTD.

GRAY HOUSE, 150-152 CHARING CROSS ROAD, LONDON, W.C.2
TEMple Bar 5833/4 and 4765. Cables: TELEGRAY, LONDON

First Single Unit 4' x 3' Forward Projection Receiver

Nera of England Limited announce the first 4' x 3' forward projection receiver completely housed in a single cabinet. Only 24" deep when closed and, mounted on castors, the cabinet moves easily through narrow doorways. Both optical focus and screen position are fixed, making no mechanical adjustment necessary, and the folded beam design has the additional advantage of reducing the space required to about half of that of a normal projector. This new instrument, Model C 48, is constructed to the same high standard as other Nera models.



The Standard Nera Remote Control Panel fitted gives complete control at any distance up to 20' from the receiver. This distance may be extended to order, as required. The special activated screen enables the equipment to give a brilliant picture under normal room lighting—an important factor when used in hospitals and public rooms. Dimensions are: 24" deep, 45" high, 51" wide (closed), 56" deep, 77" high, 51" wide (open). Complete details on application.



The above photograph shows the receiver closed, in this position it may be securely locked. On the right the receiver is shown opened for viewing. Note the remote control panel on the right hand side of cabinet.

Prices, £187 in stained and polished cabinet or £198 in attractively veneered cabinet. (Both Prices tax free.)

NERA

FIRST AND FOREMOST IN FORWARD PROJECTION

HIGH STREET, GUILDFORD, SURREY

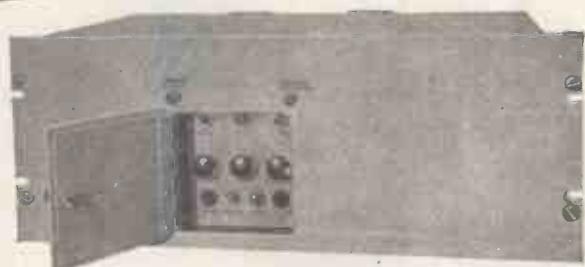
of England Ltd.,
FORMERLY AREN (RADIO & TELEVISION) LTD.,

Telephones: GUILDFORD 67222/3

The Ideal Receiver for Point-to-Point
and Ground-to-Air Channels

A Fixed Frequency, Single Channel Receiver
covering 2 to 20 Mc/s.

The crystal-controlled R.93 is an important receiver which has been designed to operate over long periods under either temperate, arctic or tropical conditions at unattended sites. A number of R.93's may be stacked in standard 19" racks for multi-channel working on R.T. or W.T. Double or triple diversity racks can also be supplied with suitable terminal equipment for direct teleprinter operation from frequency shift transmission. Enquiries will receive immediate attention.



REDFON LIMITED
RADIO COMMUNICATIONS DIVISION

BROOMHILL ROAD
LONDON, S.W.18

Phone: VANDYKE 7281

Redifon

CITY SALE & EXCHANGE

LIMITED

THE HI-FI SPECIALISTS

90-94 Fleet Street, London, E.C.4

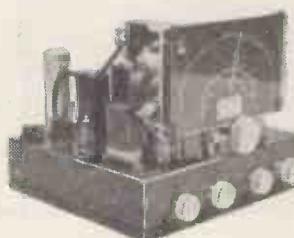
Phone: Central 9391/2

Offer the following from stock :—

LEAK. TL/12 Point one amplifier with Varislope pre-amplifier £40/19/-. Console cabinet 32 x 16 x 14 in walnut veneer to house above, cut out for any motor £10/10/-. V/S tuner with magic eye, variable selectivity 6-24 KC/S £37/6/3. Ruby pick-up £11/11/-. Pick-up with diamond stylus £17/11/8. Transformer £2/15/-.

ACOUSTICAL. QUAD II amplifier complete with pre-amp. £42/-/. QUAD amplifier with tunable TRF radio unit £35.

H.P. TERMS
1/3rd deposit and balance
over 6, 12 or 18 months.



ROGERS.

Baby Mark II amplifier with new pre-amplifier £23. Tuner unit for above £24/16/1. Table cabinets for either of above units £3/7/6. Minor amplifier £12. Cabinet 39/6. Junior corner horn £18/17/6. Speaker for above £3/-/. Also Goodmans Axiom 102 £9/18/2 or Axiom 101 £6/12/1. Wharfedale Super 8 £5/13/3.



CONNOISSEUR. Three-speed transcription quality motor £21/17/3. Super lightweight pickup £5/19/3. Extra heads £3/6/3, matching transformer 13/-.

SPEAKERS. Lowther Voigt PW1 corner horn with P.M.2 pressure unit £60. Wharfedale 3 speaker corner assembly £72. Two speaker assembly £58. Decca corner horn £28/10/-. Sandfilled corner reflex baffles 12in. £10/10/-. 10in. and 8in. £9/-/. 12in. reflex cabinets £9/15/-; both types finished in handsome walnut veneer.

Why not part exchange your present equipment for the latest type? Write giving details.

OUR SERVICE AFTER SALES IS SUPERB.

For your OWN-STYLED Cabinet! 'TELEMAX' (4ft. x 3ft.) PROJECTION TELEVISION CHASSIS



STOP PRESS!
Price Reduced

- ★ 23-valve s/h circuit.
- ★ Sensitivity better than 50 microvolts.
- ★ Full bandwidth.
- ★ 5 channel facility.
- ★ Complete with valves, c.r.t. and optical unit.
- ★ Ready for fitting.
- ★ Chassis size approx. 19" x 17" x 15".

A.C. only.

★ Detailed Specification from the Manufacturers:

TELEMECHANICS LTD

3 NEWMAN YARD, NEWMAN ST., LONDON, W.I. LANgham 7965

I KW TELEGRAPH TRANSMITTERS. Two HF 300's output. Operation 3.5 mc. to 16 mc.

BC610 TRANSMITTERS with speech amplifier, aerial tuning unit, etc. Brand new.

RCA TRANSMITTERS. Type ET-4336. Complete with original speech amplifier, crystal multiplier and VFO units. Unused and reconditioned. Can be supplied with very large quantity of spares.

RCA TRANSMITTERS. Type ET-4332 modified by R.A.F. for use on crystal or master oscillator. Complete with speech amplifier.

MAGNETO 10 LINE U.C. TELEPHONE SWITCH-BOARDS (complete).

NO. 33 TRANSMITTERS.

A.R.88D's, A.R.88LF's, A.R.77's, S27's, HRO, R.109 and others.

SCR510's complete with Power Pack and telescopic aerial.

All above items in excellent working condition.
Working demonstration upon request.

SPARES A large selection available for SCR399 (BC610), ET4336, SCR610, EE8 Telephones, and Teleprinters type 7B.

TX VALVES 805, 807, 813, 861, 866A, DET-16, 100TH and many others.

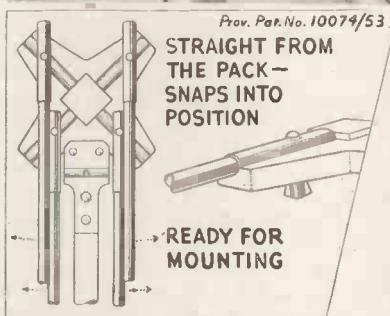
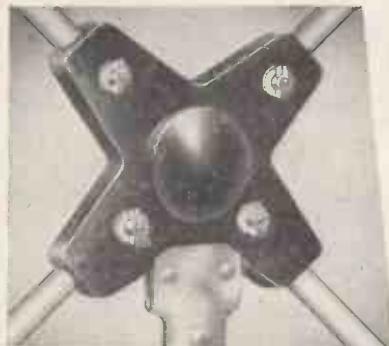
Large stock of Tx condensers, crystals and other components. Alignment and repair of communication receivers and all other short-wave equipment undertaken.

P.C.A. RADIO

New Address, Offices and Works :

BEAVOR LANE, HAMMERSMITH, LONDON, W.6

Telephone : RIV 8006



A major development of the ORIGINAL 'X' Aerial designed and produced by Antiference Ltd., who hold the master patents.

ANTIFERENCE
LIMITED

it's easier to erect!
it's lighter in weight!
it's more efficient!
it costs less!

it's the **NEW 'ANTEX'** with the **Snapacitor** action

The revolutionary "SNAPACITOR" principle incorporated in this range brings long lasting efficiency. There is no direct electrical contact between rods and aerial terminals. A patented coupling plate provides ample capacity (min. 500pF) to permit free transfer of the programme signal but offers high resistance to time-base interference.

As there is always an insulated gap between each coupling, no amount of corrosion can affect performance.

FOR VERTICAL MOUNTING

Model X4L/* Chimney Lashing, 6ft. mast	75/-
" X4W/* Wall Mounting, 6ft. mast	66/-
" X4M/* Chimney Lashing, 10ft. mast	115/-
" X4P/* Pole Top Mounting	40/-

*State channel required

FOR HORIZONTAL MOUNTING

Model X4L/HOR/* Chimney Lashing	70/-
" X4W/HOR/* Wall Mounting...	61/6

Both the horizontal mounting models are provided with 3ft. Swan-neck arm.

/1 London ; /2 Holme Moss ; /3 Kirk O'Shott and Brighton ; /4 Midlands ; /5 Wenvoe ;
/1 HOR Glencairn ; /5 HOR Pontop Pike.

BICESTER ROAD, AYLESBURY, BUCKS.

Telephone: Aylesbury 1467/8



Several more good reasons
why our circle of friends keeps enlarging

Air Cooled, Compound Filled and Oil Immersed Transformers for every requirement

A.I.D. Authority Ref. No.: 6489/53

WILLESDEN TRANSFORMER CO., LTD.,

2a FRITHVILLE GARDENS, SHEPHERDS BUSH, LONDON, W.12.

Telephone : SHEpherds Bush 5819

GARLAND BROS., Ltd.



The "Unitelex Prima" Tape Recorder

57
GNS.

OR ON HIRE PURCHASE

(£19/19/- Deposit. Balance by 6 monthly instalments of £7/3/- or 12 monthly instalments of £3/13/2.)

TAPE DECK : Truvox Mk. III. 3-motor Twin Track Two Speed (3½in. per second and 7½in. per second). **AMPLIFIER** : Unitelex PR3A. Valves EF40, 12AX7, EL41, EL41, EM34. Separate power pack with full-wave metal rectifier system for robustness and instantaneous brake operation. **CONTROLS** : Bass control (boost) operative on both record and playback; treble control (boost and cut) operative on playback; volume control. **INPUTS** : Low Gain 20mV. across 1 megohm, used for recording from Radio, Television and Gramophone. High Gain 100µV across 2 megohm, used for recording from microphone. **FREQUENCY RESPONSE** : 50 Cycles—10 Kc/s ± 3 db on recording. 30 Cycles—14 Kc/s ± 1 db on direct playback. **OUTPUT** : 4 watts. **L/SPEAKER** : High—Flux 10in. elliptical speaker—provision for feeding up to 2 extension speakers; switch for muting internal speaker if desired. **RECORD LEVEL INDICATION** : Magic eye. Direct Playback available for playing records from Gramophone unit or as direct microphone amplifier. A.C. Mains only, 200/250, 50 cycles. Supplied complete with microphone and tape. Weight 35 lbs. Dimensions : Height 18½in., Width 17½in., Maximum Depth 10in. Send 2½d. stamp for illustrated brochure.

EXAMPLES OF OUR "EASY PAYMENTS" TERMS

ARTICLE	Cash Price	Deposit	6 monthly payments	12 monthly payments
T.V. Enlargers. 9in.	£2 10 0	16 8	6 2	—
T.V. Enlargers. 12in.	£3 10 0	£1 3 4	8 8	—
De Luxe T.V. Enlargers. 12in.	£3 15 0	£1 5 0	9 2	—
Bremi Microphone 7D.	£3 15 0	£1 5 0	9 2	—
Tamsa R/P & Erase Head.	£4 10 0	£1 10 0	10 9	—
Amplion Testmeter. 10 ranges A.C.-D.C.	£5 0 0	£1 13 4	12 3	—
Bremi Microphones II.A.	£5 5 0	£1 15 0	12 10	—
Three 1,200ft. reels Scotch Boy Tape.	£5 5 0	£1 15 0	12 10	—
Black & Decker ½in. Universal Drill.	£6 5 0	£2 1 8	14 11	7 8
Collaro AC514.	£6 5 11	£2 2 0	15 1	7 10
Bremi Microphone 13U.	£6 6 0	£2 2 0	15 1	7 10
Goodmans Axions 10I. 8in. L/Spk.	£6 12 1	£2 4 1	15 9	8 1
Garland Amplifier ACIIA.	£6 12 6	£2 4 2	15 9	8 1
Collaro AC47.	£6 13 4	£2 4 6	15 11	8 2
Wharfedale Golden CBS. 10in. Speaker.	£8 6 7	£2 15 7	19 11	10 12
Goodmans Audiom 60 Speaker.	£8 12 6	£2 17 6	£1 0 8	10 7
B.S.R. 3-speed single player. GU4.	£9 5 0	£3 1 8	£1 2 2	11 4
Connoisseur Pick Up, 2 heads.	£9 5 6	£3 1 10	£1 2 2	11 4
Leak Pre-amplifier.	£9 9 0	£3 3 0	£1 2 7	11 7
Wharfedale W12/cs. 12in.	£9 15 0	£3 5 0	£1 3 4	11 11
Goodmans Axions 150, Mk. II.	£10 5 6	£3 8 6	£1 4 7	12 7
Leak "Varislope" Pre-amplifier.	£12 12 0	£4 4 0	£1 10 2	15 6
Garrard 3-speed Auto-changer. R.C.75A.	£15 8 1	£5 2 8	£1 16 10	18 10
Garland Amplifier AC IV.	£15 15 0	£5 5 0	£1 17 8	19 3
B.S.R. "Monarch" 3-speed Auto-change.	£16 10 3	£5 10 1	£1 19 6	£1 0 3
Garrard 3-speed Auto-change. R.C.80.	£17 1 1	£5 13 9	£2 0 10	£1 0 11
Lane Tape Desk, Mk. IV.	£17 10 0	£5 16 8	£2 1 10	£1 1 5
"Unitelex" Record/Playback Amplifier. PR3A.	£20 0 0	£6 13 4	£2 7 10	£1 4 6
Connoisseur 3-speed unit.	£21 17 3	£7 5 9	£2 12 3	£1 6 9
Truvox Tape Deck, Mk. III.	£23 2 0	£7 14 0	£2 15 3	£1 8 3
Leak "Point One" Amplifier.	£28 7 0	£9 9 0	£3 7 9	£1 14 8
Q.U.A.D. Amplifier with pre-amplifier.	£35 0 0	£11 13 4	£4 3 8	£2 2 9
Herald Tape Recorder.	£50 8 0	£16 16 0	£5 17 8	£3 1 8
Unitelex "Prima" Tape Recorder. (Described above)	£59 17 0	£19 19 0	£7 3 0	£3 13 2

This list is not exhaustive—if your requirements are not here, ask us for H.P. quotation.

ALL GOODS NEW AND UNUSED (except where otherwise stated).

PLEASE ADD POST OR CARRIAGE ON ALL ITEMS. KINDLY PRINT NAME AND ADDRESS. POST ORDERS TO OUR DEPTFORD ADDRESS, EARLY CLOSING THURSDAY. OPEN ALL DAY SATURDAY.

SHOP HOURS: Mon: Tues: Wed: and Sat: 9 a.m.—6 p.m. Thurs: 9 a.m.—1 p.m. Fri: 9 a.m.—7 p.m.

GARLAND BROS. LTD.

CHESHAM HOUSE, DEPTFORD BROADWAY, S.E.8.
5 OBEGLIS PARADE, LEWISHAM, S.E.13.

TEL: TIDEWAY 4412/3
TEL: LEE GREEN 4038



GARRARD RECORD PLAYERS
For 6 and 12 v. operation, complete with magnetic pick-up and volume control. In metal cabinet size: 17in. x 14in. x 11in. Very limited quantity.
LASKY'S PRICE £5.19.6
Carriage 10/- extra.

1/2 H.P. ELECTRIC MOTORS

By Famous British Manufacturer, 230/250v. 50 c.p.s. Single phase, 1425 r.p.m. Self starting, standard spindle. Dims: 8 x 6 x 6in. **LASKY'S PRICE** 99/6

Brand New and Unused. Carr. 7/6.

HEARING AIDS

By well-known Manufacturer. In metal case, size: 2½in. x 4½in. x 1in. Complete with batteries and 3 sub-miniature valves, earpiece and cord. Only two controls; volume and on/off. Fitted with internal crystal microphone.

MADE TO SELL FOR 22 GNS.

LASKY'S PRICE 99/6

Postage 3/6 extra.

Ready for use. Perfect working order. Slightly soiled but new and unused.

TANNOY PRESSURE UNITS

10 watts. 7.5 ohms impedance. Last few only. **PRICE** 59/6
Carriage 4/6 extra.

R.F. OSC. E.H.T. KIT
Consisting of R.F. oscillator E.H.T. coil with EY51 heater winding, EY51 rectifier, 6V6 valve and base. All necessary condensers and resistances, including .0005mfd. 12.5kV. smoothing condensers. **LASKY'S PRICE** 53/6

GRAM MOTORS

Shaded Pole



Rim drive, synchronous. For 200-250v. 50 c.p.s. Many uses. 9/6.

METAL RECTIFIERS

6 and 12 volt F.W. Bridge.

0.6a.	4/6
2a.	9/-
3a.	9/11
4a.	12/-
6a.	17/6
6 volt Centre Tapped Bridge.	
0.75a.	3/9
1a.	3/11

R.1155 RECEIVERS

BRAND NEW AERIAL TESTED BEFORE DESPATCH

These well-known ex-Air Ministry Receivers need no further introduction. Supplied complete with 10 valves, and full circuit data.

LASKY'S PRICE £11.19.6

USED MODELS £7.19.6

A Few Only. Model R1155N. Covering the shipping band of 1.5-3.0 Mc/s. Price £17.

Carriage 12/6 per unit extra, including 10/- returnable on packing case. 10s. Od. rebate will be given on power packs for the R.1155 when purchased with the receiver.

£11.19.6

£7.19.6

1.5-3.0 Mc/s. Price £17.

Carriage 12/6 per unit extra, including 10/- returnable on packing case. 10s. Od. rebate will be given on power packs for the R.1155 when purchased with the receiver.

TOGGLE SWITCHES. BULGIN

S.P.S.T.	1/6
D.P.S.T.	2/6
D.P. Change over	3/6

TRIPLEX DARK SCREEN FILTERS

14 x 12½ x 1½ in.	7/6
15½ x 13½ x 1½ in.	9/6

Postage and packing 5/- per piece extra. (This charge is necessary owing to extra packing required.)

BRANDENBERG R.F. E.H.T. UNITS

Complete with valves.

6-9 Kv.	£6 6 0
13-16 Kv.	£9 9 0

Fully Assembled Power Pack and Output Stage, for R1155 Receiver. For use on 200-250 volts A.C. mains.

LASKY'S PRICE 79/6

Carriage 5/- extra.

MUIRHEAD SLOW MOTION DRIVES

8/6

CRYSTAL DIODES

Germanium 1/6 each, post free.

12 VOLT D.C. MOTOR GENERATORS

Output 300 volts at 150 m.A. D.C. 7,500 r.p.m. Size: 2½in. diam. 6in. long.

LASKY'S PRICE 17/6

I.F. TRANSFORMERS

465 Kc/s. Iron dust cores in cans, midget type. Size 1½in. x 1in. x 2½in.

By Plessey. Price 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair.

WEARITE TYPE 550. 445-520

Kc/s. 8/6 per pair.

WEARITE TYPE 500. 450-470

Kc/s. 8/6 per pair


LINE TRANSFORMERS FOR "ETRONIC" T.V. RECEIVERS

No. 1. For models 1536 and 1637. Complete with EY51 rectifier, 39/-.
No. 2. 7Kv. type, 35/-.

POT/METERS. All values. Wire wound from 3/6. Depending on wattage and length of spindle. Carbon. Less switch 2/11 each. With s.p. switch ... 4/3 each. With d.p. switch ... 5/6 each

VCR97 C.R. TUBES, new unused. 35/-. Carriage 5/-.

Screen Enlarger for VCR97. Filter or clear, 17/6. Postage 2/6.

C.R.T. Neck Protectors, 2/6.

10 K.V. METROSIL E.H.T. REGULATORS. By Metravick. Pencil type, 5/- each.

TELEVISION SELENIUM RECTIFIERS

The very latest "Sentercell" S.T.C. range:
K3/40, 3.2 kV. 7/6
K3/45, 3.6 kV. 8/2
K3/50, 4.0 kV. 8/8
K3/100, 8.0 kV. 14/4
K3/160, 12.8 kV. 21/6

DARK SCREEN PERSPEX FILTERS

18in. x 14½in. 25/-
14½in. x 12in. 19/6
13½in. x 11in. 14/11

PERSPEX. 13½in. x 10½in. x ½in. Neutral shade. slightly marked, 4/11 per piece.

TEST PRODS
Fully fused, with retractable points, 4/11 per pair (1 red, 1 black).

9in. TABLE T.V. CABINETS



Medium shade mahogany finish. Complete with back, safety glass, speaker-fret. Internal dimensions: 19½in. high, 16in. wide, 14in. deep.

LASKY'S PRICE
Spoiled 25/-

Carriage 7/6 each extra

Adaptor frame available for 6in. C.R. tubes. The aperture can easily be enlarged to take 12in. or 14in. tubes.

SPECIAL C.R.T. OFFER

Brand new and unused 12in. ion trap cathode ray tubes. 6.3 volt heater, 7.9 Kv. E.H.T. 35 mm. neck. Black and white picture. By famous manufacturer.

PERFECT £12/19/6
Carriage and insurance 15/- per tube extra.

MANUFACTURERS' SURPLUS T.V. COMPONENTS

Wide Angle Scanning Coils. Low imp. line and frame pair	19/6
Scanning Coils. 35 mm. Low imp. line and frame	12/6
Frame multi ratio output trans.	12/6
Focus Coil. 35 mm. electro magnetic	12/6
Line or Frame B.O. transformer. Auto.	4/6
Wide Angle Frame B.O. trans.	10/6
P.M. Focus Magnets. With vernier. 35 mm.	15/-
Tetrode	17/6
Less vernier	12/6
Wide Angle P.M. Focus Unit. For all 38 mm. tubes. With vernier and picture shift. Ferroducture	25/-

PLESSEY

Scan coils per pair 25/-
Width Control 6/6

CO-AXIAL CABLE. 70-80 ohms impedance.
Single core, 8/- doz. yards.
Twin core, 12/- doz. yards.
Twin feeder, 6/- doz. yards.
CO-AXIAL CONNECTORS. For standard ¼in. cable, 1/6.

C.R.T. MASKS
Brand New
LATEST ASPECT RATIO

9in.	7/-
10in.	7/6
12in.	15/-
12in. Flat Face	15/-
12in. Old ratio	9/6
14in. Rectangular	21/-
15in. Cream rubber	17/6
15in. With fitted safety glass	22/6
16in. Plastic, white	17/6
16in. Double D	31/6
17in. Rectangular	21/-

PLASTIC ESCUTCHEON SAFETY MASKS
Incorporating dark screen filter.
12in. Round Face .. 15/-
12in. Double D. 17/6
Round Face 17/6
16in. for metal tubes 32/6

SOILED. NEW ASPECT RATIO

9in.	5/-
12in.	7/6
12in. with fitted armour plate glass, cream	11/6
12in. do. Black	8/6

ARMOUR PLATE GLASS

16in. Actual size 17½ x 15½ x ½ inch	7/11
15in. Actual size 15½ x 13in. x ½in.	6/11
12in. Actual size 13in. x 10½in. x ½in.	4/-
9in. Actual size 9in. x 8in. x ½in.	3/-

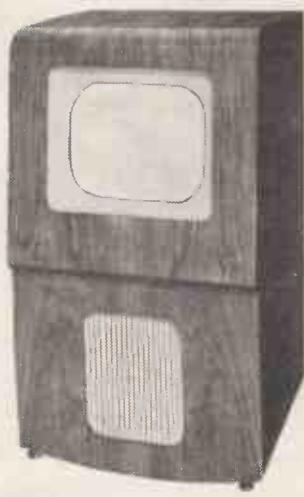
DE LUXE T.V. CABINETS

NEW 1954

12 INCH MODEL

(Mark II)

This cabinet is now supplied complete with mask, glass, castors, shelf, bearers, c.r.t. neck end protector, back, speaker fret and baffle board. Finished in beautiful figured medium, light or dark walnut veneer, with high polish. Suitable for most home constructor T.V. receivers, including the "Viewmaster," "Practical Television," "Tele King," "Magniview," "Wireless World," etc. Can be supplied with cut-out for 16in. c.r. tube at no extra cost.



WHY NOT CONVERT YOUR TABLE RECEIVER TO A CONSOLE MODEL

Adaptor frames for fitting 9in. or 10in. c.r. tubes can be supplied if required.

LASKY'S PRICE
Carriage 12/6 extra.

£8.10.0

An allowance of 4s. 6d. will be made if the mask is not required. Mask and glass extra when cabinet is ordered with cut out for 14, 16, or 17in. C.R.T.'s.

Inside Dimensions : Depth 16½in.; width 17½in.; height 28in. Overall height 32in. and width 18½in.

THE VIEWMASTER

Construction envelope 7/6. **POST FREE.**

Wide angle conversion 3/6 **POST FREE.**

All components in stock. Write for price list.

COLLAR 3-SPEED AUTOMATIC RECORD CHANGERS

MODEL 3RC/521.

Brand new and unused in maker's original carton. Pleasing cream or fawn finish. Complete with hi-fidelity studio crystal turnover head. Type GP. 29.



LASKY'S PRICE

£9.19.6

Carriage Free

NOW IN STOCK. 3-Speed Mixer Changer model 3RC/522.
Price on request.

TYPE AT/9 T.V. MAINS AUTO TRANSFORMER

200, 220, 250 and 375 volt tappings. 250 mA. Also 5 v. 3 a.; 6.3 v. 7 a., and 6.3 v. 3 a. secondaries. Price 25/-

ION TRAPS

All types. Price 3/- State tube type number when ordering.

INTERCOM UNITS

4-station operation. For use on A.C./D.C. mains 200-250 volts. Supplied complete, with 3 new valves, ready for immediate installation. Fitted in attractive plastic cabinet.

Suitable for use as baby alarm.

MASTER UNIT £5/19/6.

Carr. 5/- extra.

Extension Units. Price 21/- each complete. Carrage 2/- each extra.

LASKY'S LINE TRANSFORMER

R.F.EHT for line fly-back. 6-8Kv. with EY51 heater winding. Suitable for home construction T/V 19/6 each.

POSTAGE STAMP TRIMMERS

Paxolin. Up to 100pf. 6d. each. 5/- per doz. Ceramic. Up to 100pf. 9d. each. 7/6 per doz.

Dodecal (B12A) bases. VCR139 c.r.t. bases. 1/- each. 10/6 dozen.

ELAC DUOMAG FOCALISERS. For wide angle c.r. tubes. Low, medium and high flux. 37/6 each.

THE TELE-KING

A practical 5-channel
SUPERHET TELEVISION RECEIVER

Using the new 16 and 17 inch cathode ray tubes and wide angle components for the home constructor.

Complete instructions, wiring diagrams and 32-page descriptive booklet.

6/- POST FREE

**ALL COMPONENTS IN STOCK
WRITE FOR LIST**

16"

17"

Alexandra Palace,
Sutton Coldfield,
Holme Moss,
Wenvoe,
Pontop Pike,
Belfast,
Kirk o' Shotts.

ALLEN WIDE ANGLE COMPONENTS

	CHASSIS	RESISTANCES.
D.C. 300 latest type Ferroxcube Coils	Power pack Sound-vision and Scan chassis.	72 Resistances, all exactly as specified, 18/-.
GL. 16 Coil	PRICE 11/- each.	CABINET
GL. 18 Coil	7/6	Walnut veneer, £8/10/-, plus carriage 12/6 extra. As illustrated here.
Focus Coil	7/6	WIDE ANGLE CATHODE RAY TUBES
FO.305 trans.	31/-	14in. MW36-22 £19 9 3
Frame B.O. transformer	21/-	14in. C14B £20 10 1
Line EHT. transformer	15/-	16in. MW41-1 £22 4 10
	40/-	16in. T901 £22 4 10
		17in. MW43-64 £23 12 8
		17in. C17BM £24 13 0
		Carriage and insurance extra.

OUTPUT TRANSFORMERS

40 mA Multi ratio	4/11
80 mA Multi ratio	14/11
80 mA Pentode	12/6
60 mA Plessey, 6,000 ohms	5/11
Standard Pentode	4/11
Pentode	3/6
Midget Pentode	3/6
Miniature Pentode, 354, 1S4	3/6
5X4 Intervalve	8/6
5:1 Intervalve	5/11

R.F. E.H.T. OSCILLATOR COILS. 6-18 Kv. output. Heater winding for EY51. Circuit and full data supplied.

LASKY'S PRICE 25/-.

LASKY'S T.V. CONSTRUCTORS' PARCELS

No. 1. All brand new components by Igranic. Comprises B.H.T. flyback line transformer, 7-10Kv. with Ferroxcube core and rectifier heater winding; scanning coils; frame output transformer; Elac focus unit with vernier adjuster, U37 E.H.T. rectifier and brand new 12-inch cathode ray tube with ion trap, mask and glass. LASKY'S PRICE FOR THE COMPLETE PARCEL, £15/19/6. Carriage and insurance 15/- extra.

No. 2. The Constructors' Parcel as above, but less the cathode ray tube and ion trap. LASKY'S PRICE 79/6. Carr. 3/6 extra.

No. 3. Condenser Parcel. 1 of each: -0.04mf. 12.5Kv.; 32 +32mfd. 350 v.w.; 32 +100mfd. 450 v.w. AND 24 1,000pf. ceramic tubes; 6 .Imfd. 500 v.w.; .01mfd. 500 v.w. ALSO 12 assorted "pf" condensers of your own choice. PRICE 45/- POST FREE.

RESISTANCES. 72 Resistances, all exactly as specified, 18/-.

CABINET

Walnut veneer, £8/10/-, plus carriage 12/6 extra. As illustrated here.

WIDE ANGLE CATHODE RAY TUBES

14in. MW36-22	£19 9 3
14in. C14B	£20 10 1
16in. MW41-1	£22 4 10
16in. T901	£22 4 10
17in. MW43-64	£23 12 8
17in. C17BM	£24 13 0

Carriage and insurance extra.

P.M. LOUDSPEAKERS

All with 3 ohm speech coil 24in. 15/- 4in. 9/6 6in. 15/- 3in. 14/6 5in. 14/6 8in. 15/- 10in. 17/6

NEW AVAILABLE 12-inch Goodmans heavy duty speaker. Capacity 15 watts, 15 ohms speech coil impedance.

LASKY'S PRICE £5/19/6. Car 3/6 ex. All loudspeakers offered are first grade and of highest quality construction. Many other types in stock. Send us your reqts. Special offer. 12in. Truxox, 3 ohms. LASKY'S PRICE 49/6.

SMOOTHING CHOKES

20 mA. 40 H	3/6
40 mA. 8 H	3/6
40 mA. 10 H	4/3
100 mA. 10-20 H	7/3
250 mA. 10 H	18/6

Car 3/6 ex. All loudspeakers offered are first grade and of highest quality construction. Many other types in stock. Send us your reqts. Special offer. 12in. Truxox, 3 ohms. LASKY'S PRICE 49/6.

N. 4. Complete set of metal-work, as illustrated here. Unassembled. Comprising main chassis, tube supports and valve-holders. (Less sound-vision chassis.) PRICE 25/-.

N. 5. RESISTANCES. 1 Watt, 85 resistances your choice. PRICE 18/- POST FREE.

N. 6. One of each of the following: - Ion tap IT6; Duodenal tube holder; low impedance line and frame scanning coils. PRICE 15/-. Postage 1/6 extra.

N. 7. One of each T.V. Mains auto-transformers (type AT/9), 60 +100mfd. 350 v.w. condenser; 5H 250 mA. choke; 1A100 rectifier. PRICE 60/-. Carriage 2/6 extra.

N. 8. FILAMENT TRANSFORMERS. 6.3 v. 1.5 a., 5/9. 6.3 v. 3 a., 9/6. 6.3 v. tapped at 4 v. 2 amps, 7/9. Special Transformer. 2 amps. with the following tappings: 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24 and 30 volts. Price 17/6.

N. 9. COIL PACKS. Medium and 2 short Long, medium and short wave bands. Price 16/- wave bands. 29/6.

N. 10. RF25 UNITS. New, with valves. 19/11. Carriage 2/6.

N. 11. LASKY'S PRICE £9.19.6 COMPLETE

Carriage 15/- extra.

N. 12. High quality components used throughout. In black rexine covered wood case, size 15 1/2 x 13 1/2 x 9 1/2 ins. giving plenty of room for speaker, etc.

Circuit diagram available.

Complete with 6 valves, fully assembled and wired.

N. 13. LASKY'S PRICE £9.19.6 COMPLETE

Carriage 15/- extra.

N. 14. FILAMENT TRANSFORMERS.

6.3 v. 1.5 a., 5/9. 6.3 v. 3 a., 9/6.

6.3 v. tapped at 4 v. 2 amps, 7/9.

Special Transformer. 2 amps.

with the following tappings:

3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20,

24 and 30 volts. Price 17/6.

N. 15. COIL PACKS. Medium and 2 short Long, medium and short

wave bands. Price 16/- wave bands. 29/6.

N. 16. RF25 UNITS. New, with valves. 19/11.

Carriage 2/6.

N. 17. LASKY'S PRICE £9.19.6 COMPLETE

Carriage 15/- extra.

N. 18. FILAMENT TRANSFORMERS.

6.3 v. 1.5 a., 5/9. 6.3 v. 3 a., 9/6.

6.3 v. tapped at 4 v. 2 amps, 7/9.

Special Transformer. 2 amps.

with the following tappings:

3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20,

24 and 30 volts. Price 17/6.

N. 19. COIL PACKS. Medium and 2 short Long, medium and short

wave bands. Price 16/- wave bands. 29/6.

N. 20. RF25 UNITS. New, with valves. 19/11.

Carriage 2/6.

N. 21. LASKY'S PRICE £9.19.6 COMPLETE

Carriage 15/- extra.

N. 22. FILAMENT TRANSFORMERS.

6.3 v. 1.5 a., 5/9. 6.3 v. 3 a., 9/6.

6.3 v. tapped at 4 v. 2 amps, 7/9.

Special Transformer. 2 amps.

with the following tappings:

3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20,

24 and 30 volts. Price 17/6.

N. 23. COIL PACKS. Medium and 2 short Long, medium and short

wave bands. Price 16/- wave bands. 29/6.

N. 24. RF25 UNITS. New, with valves. 19/11.

Carriage 2/6.

N. 25. LASKY'S PRICE £9.19.6 COMPLETE

Carriage 15/- extra.

N. 26. FILAMENT TRANSFORMERS.

6.3 v. 1.5 a., 5/9. 6.3 v. 3 a., 9/6.

6.3 v. tapped at 4 v. 2 amps, 7/9.

Special Transformer. 2 amps.

with the following tappings:

3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20,

24 and 30 volts. Price 17/6.

N. 27. COIL PACKS. Medium and 2 short Long, medium and short

wave bands. Price 16/- wave bands. 29/6.

N. 28. RF25 UNITS. New, with valves. 19/11.

Carriage 2/6.

N. 29. LASKY'S PRICE £9.19.6 COMPLETE

Carriage 15/- extra.

N. 30. FILAMENT TRANSFORMERS.

6.3 v. 1.5 a., 5/9. 6.3 v. 3 a., 9/6.

6.3 v. tapped at 4 v. 2 amps, 7/9.

Special Transformer. 2 amps.

with the following tappings:

3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20,

24 and 30 volts. Price 17/6.

N. 31. COIL PACKS. Medium and 2 short Long, medium and short

wave bands. Price 16/- wave bands. 29/6.

N. 32. RF25 UNITS. New, with valves. 19/11.

Carriage 2/6.

N. 33. LASKY'S PRICE £9.19.6 COMPLETE

Carriage 15/- extra.

N. 34. FILAMENT TRANSFORMERS.

6.3 v. 1.5 a., 5/9. 6.3 v. 3 a., 9/6.

6.3 v. tapped at 4 v. 2 amps, 7/9.

Special Transformer. 2 amps.

with the following tappings:

3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20,

24 and 30 volts. Price 17/6.

N. 35. COIL PACKS. Medium and 2 short Long, medium and short

wave bands. Price 16/- wave bands. 29/6.

N. 36. RF25 UNITS. New, with valves. 19/11.

Carriage 2/6.

N. 37. LASKY'S PRICE £9.19.6 COMPLETE

Carriage 15/- extra.

N. 38. FILAMENT TRANSFORMERS.

6.3 v. 1.5 a., 5/9. 6.3 v. 3 a., 9/6.

6.3 v. tapped at 4 v. 2 amps, 7/9.

Special Transformer. 2 amps.

with the following tappings:

3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20,

24 and 30 volts. Price 17/6.

N. 39. COIL PACKS. Medium and 2 short Long, medium and short

wave bands. Price 16/- wave bands. 29/6.

N. 40. RF25 UNITS. New, with valves. 19/11.

Carriage 2/6.

N. 41. LASKY'S PRICE £9.19.6 COMPLETE

Carriage 15/- extra.

N. 42. FILAMENT TRANSFORMERS.

6.3 v. 1.5 a., 5/9. 6.3 v. 3 a., 9/6.

6.3 v. tapped at 4 v. 2 amps, 7/9.

Special Transformer. 2 amps.

with the following tappings:

3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20,

24 and 30 volts. Price 17/6.

N. 43. COIL PACKS. Medium and 2 short Long, medium and short

wave bands. Price 16/- wave bands. 29/6.

N. 44. RF25 UNITS. New, with valves. 19/11.

Carriage 2/6.

N. 45. LASKY'S PRICE £9.19.6 COMPLETE

Carriage 15/- extra.

N. 46. FILAMENT TRANSFORMERS.

6.3 v. 1.5 a., 5/9. 6.3 v. 3 a., 9/6.

6.3 v. tapped at 4 v. 2 amps, 7/9.

Special Transformer. 2 amps.

with the following tappings:

3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20,

24 and 30 volts. Price 17/6.

N. 47. COIL PACKS. Medium and 2 short Long, medium and short

wave bands. Price 16/- wave bands. 29/6.

N. 48. RF25 UNITS. New, with valves. 19/11.

Carriage 2/6.

N. 49. LASKY'S PRICE £9.19.6 COMPLETE

Carriage 15/- extra.

N. 50. FILAMENT TRANSFORMERS.

6.3 v. 1.5 a., 5/9. 6.3 v. 3 a., 9/6.

6.3 v. tapped at 4 v. 2 amps, 7/9.

Special Transformer. 2 amps.

with the following tappings:

3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20,

24 and 30 volts. Price 17/6.

N. 51. COIL PACKS. Medium and 2 short Long, medium and short

wave bands. Price 16/- wave bands. 29/6.

N. 52. RF25 UNITS. New, with valves. 19/11.

Carriage 2/6.

N. 53. LASKY'S PRICE £9.19.6 COMPLETE

Carriage 15/- extra.

N. 54. FILAMENT TRANSFORMERS.

6.3 v. 1.5 a., 5/9. 6.3 v. 3 a., 9/6.

6.3 v. tapped at 4 v. 2 amps, 7/9.

Special Transformer. 2 amps.

with the following tappings:

3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20,

24 and 30 volts. Price 17/6.

N. 55. COIL PACKS. Medium and 2 short Long, medium and short

wave bands. Price 16/- wave bands. 29/6.

N. 56. RF25 UNITS. New, with valves. 19/11.

Carriage 2/6.

N. 57. LASKY'S PRICE £9.19.6 COMPLETE

Carriage 15/- extra.

N. 58. FILAMENT TRANSFORMERS.

6.3 v. 1.5 a., 5/9. 6.3 v. 3 a., 9/6.

6.3 v. tapped at 4 v. 2 amps, 7/9.

STAND-OFF INSULATOR

3-hole fixing porcelain, with solder tag and wing unit by Bulgin, 1/- each.

SOLDERING IRONS

964 Solon oval bit type, 19/- each.
968 Solon pencil bit type, 21/- each.

TORCHES, ETC.

2 cell torch complete with bulb and 2 U2 type batteries, 1/8 each.
Cycle rear lamp complete with bulb and battery, 1/8 each.

HAND MICROPHONE

Crystal insert. Mic chrome plated. Black handle. Usual price 2 gns. Our price 24/-.

FUSES

Standard cartridge fuses, 4 amp., 1 amp., 1/4 amp., 2 amp. and 3 amp., 4d. each.

OUTPUT TRANSFORMERS

Multi ratio type, 6/6 each.
AWF Power/Pentode, 4/- each.

Midget for 384 valves, etc., 3/6 each.

CONDENSERS

Chassis mounting 1 mfd. 350 v. can, 6d. each. Electrolytic, dual section (plain foil) 12-4 mfd. 450 v., 2/- each.

Electrolytic (plain foil). 50 mfd. 12 v., 1/9 each.

Tubeular paper (in std. units), .05 mfd. 500 v., 1/- each.

1 mfd. 230VAC 50 to 100 cycles with leads, 1/3 v.

100 mfd. 25 v., 1/8 ea.; 8 mfd. 500 v., 2/8; 25 mfd. 25 v. CR32C, 1/9 ea.

50 mfd. 50 v., 2/- ea.; 16 x 16 mfd. 450 v., 3/- ea.; .02 mfd. 1,000 v., 7d. ea.

YAXLEY SWITCHES

1 pole 8 way, 1/6 ea.; 2 pole 3 way, 1/- ea.; 4 pole 3 way 2 bank, 1/6 ea.; 4 pole 3 way spindle 4in. long, slotted end, 1/6 ea.; 4 pole 3 way, 2/8 ea.; 4 pole 2 way, 1/8 ea.; 3 pole 3 bank 2 way, 1/6 ea.

LOUDSPEAKER CABINETS

Available for 6in. and 8in. Speaker Units. Polished walnut finish. A very attractive cabinet at quarter of today's prices. Price: 61in. Type Cabinet, 15/6 each.

Price: 8in. Type Cabinet, 19/6 each.

See under loudspeakers for suitable speaker units.

RECEIVER 1132A

Complete with all valves, VR53, VR65 and VR57, etc., tuning meter and full scale dial. In good condition. 50/- each. Carriage and packing 7/6. Single hole fixing fuse holders, Billing type, 1/- each.

WIRE WOUND VARIABLE RESISTORS

Covern CLR902 1KΩ, 1/8 ea. Polar 500Ω, 1/9 ea. Covern 200Ω, 10KΩ, 20KΩ, 25KΩ, 30KΩ, 50KΩ, 2/- each. Covern CLR101, 10KΩ, 20KΩ, 25KΩ, 20Ω, 1/3 each.

EX-GOVERNMENT VOL. CONTROLS

500Ω, 600Ω, Double 1,500Ω 10KΩ, 20KΩ, 25KΩ, 50KΩ, 100KΩ, 150KΩ, 200KΩ, 1/2 megΩ, 1/2 megΩ, 1 megΩ, 2 megΩ. All 1/- each.

COLLARO AC49

Or Gram. Motors. Tape Recording Motors. Available Clockwise or Anticlockwise Retail price, 38/6 ea. Our price: 28/6 ea.

Standard cartridge fuses, 4 amp., 1 amp., 1/4 amp., 2 amp. and 3 amp., 4d. ea. Bulgin Toggle Switch DPDT, 2/- ea. Bulgin Toggle Switch DPST, 2/3 ea. Extension Speaker Vol. Control, 1/3 each. 44 Variable Resistors suitable for train sets, etc., 5/- each.

Welwyn 50K Pre-Set Carbon Controls, 1/9 each. Throat Microphones, 2 in a box, 1/8 box. GPO Jack Plugs, 1/3 each.



OFFER THESE SPECIAL PURPOSE VALVES

EF8	6/6	807	8/-
6G6G	6/6	5Z3	8/6
9004	6/3	6Y6G	8/-
VR136	7/-	955	4/-
VR66	3/9	TT11	6/6
VU120A	3/6	VR116	4/-
9002	6/3	VR56	7/-
VR53	7/6	954	2/-
VR91	6/-	CV71	1/-

Block Condenser 4 mfd. 500 v. Flying Leads, 1/8 each.

T.V. Coll Formers, 1in., 9d. each; 1in., 7d. each.

Microphone Transformer, 60 to 1 Ratio, 1/6 each.

Intervalle Transformer, 1/- each.

WHANDA wirs and cable stripper.

Radial price 15/- each. Our price 5/- each.

T.R.F. Switch, 1/- each.

Crystal Diodes, wire ends, 1/8 each.

16 x 16 mfd. 350 v. Can type, 2/9 each.

16 x 16 mfd. 450 v. Can type, 3/- each.

Bridge Rectifiers 12 v. 3 A., 13/9 ea.

Octal and British screened valve caps, 3d. each.

Standard Iron Elements, 450 watts, 1/8 each.

Morphy Richards and H.M.V. Elements, 3/- each.

Hydrometers, brand new in wooden case, 8/- each.

Plessey 8in. Round type, 2 to 3 ohms.

Plessey 61in. Round type, 2 to 3 ohms.

Plessey 6in. Lightweight, 2 to 3 ohms.

Plessey 8in. Mains Energised 1,500 ohms field.

Plessey 10in. Lightweight, 2 to 3 ohms.

Rola 10in. Type Z10DB, 2 to 3 ohms.

Leetona 10in. 2 to 3 ohms.

Truvox 12in. Heavy duty model.

889 with 15 ohm. Speech coil.

Goodmans 10in. Loudspeaker.

Packing and Post 3/-.

**HALF WAVE 1 M/A PENCIL
RECTIFIERS**

K3/26 655V..... 5/8

K3/40 1KV..... 7/6

K3/45 1.140KV..... 8/2

K3/50 1.260KV..... 8/8

K3/60 1.5KV..... 9/8

K3/100 2.500KV..... 14/8

VCR97 Cathode ray tubes complete with base and screw.

Packing and Post 29/- ea.

Packing and Post 3/-.

GOLDRING PICKUP HEADS

Pick-up head type No. 112 (2,000 ohms.),

complete with lead. Price 20/- each.

TRUVOX MODEL BX11

Loudspeaker, 12in. Lightweight type.

Packing and Post 48/- each.

MOULDED MICA CONDENSERS

All wire ends, .0001, .0003, .0004, .0005,

.001, .001, .005, .0027, .0008, .00005,

.003, 4/6 doz.

MAINS TRANSFORMERS

3-Way Mounting Type.

MTI. Primary 0-210-230-250 v. Secondary

250-0-250 v. 80 mA. 6.3 v. 4 amps. 5 v.

2 amps., with taps at 4 v. on Filament

Winding. Price 17/6 each.

MT2. Primary 0-210-230-250. Secondary

350-0-350 v. 80 mA. 6.3 v. 4 amps. 5 v.

2 amps. Both filament windings tapped

4 v.

FILAMENT TRANSFORMERS

All 220 to 240 v. Input, 2 volts 1/4 amp.

4/6; 2 volts 3 amps., 7/9; 4 volts

1/2 amps., 5/-; 4 volts 3 amps., 10/-;

5 volts 2 amps., 10/-; 6.3 volts 1/2 amps.,

6/-; 6.3 volts 1 amp., 5/-; 6.3 volts

3 amps., 9/-.

BULLDOG CHARGE CLIPS

3in. long, 8d. each.

MOULDED BAKELITE CASE CON-

DENSERS.

.001 mfd. 4 Kv., 1/- ea.; .01 mfd. 4 Kv.,

1/8 ea.; .25 mfd. 800 v., 1/3 ea.; .1 mfd.

1,000 v., 1/- ea.

A modern Radio Cabinet

with drilled chassis; dial drive and drum;

back plate; dial; spring;

pointer; size 15in. x 11 1/2 in. x 5in.

Price £1.16.8. Post and Packing 2/-.

We can supply a circuit diagram with instructions

for constructing a 3 valve plus metal rectifier T.R.F. receiver for

Long and Medium wave bands for 1/6. The com-

plete kit supplied for £6.0. Plus Packing

and Post 2/-.

TERMS : Cash with order or C.O.D. Postage and Packing charges extra, as follows:

Orders value 10/- add 9d.; 20/- add 1/-; 40/- add 1/6; £5 add 2/- unless otherwise stated.

Minimum C.O.D. fee and postage, 2/3. MAIL ORDER ONLY.

SCREENED MICROPHONE CABLE with outer P.V.C., 7/0078, 1/- yd.

'00035 MFD. 2-GANG CONDENSER
complete with trimmers and dust cover.
8/3 ea.

DIAL BULBS

M.E.S. Types. 6.3 v. 15 a., 6d. ea.; M.B.C.T. Types.
6 v. 3 a., 5d. ea.; 6.5 v. 3 a., 5d. ea.

30 AMP ROTARY SWITCH

4 position, complete with knob, 4/- ea.

HEADPHONES

Type CLR Low Resistance Headphones,
120 ohms, 7/6 pair. Type CHR High
Resistance Headphones, 4,000 ohms, 11/8
pair. Type DHR A. Super Quality
Headphones, 13/8 pair. Headbands,
Metal type, 1/9 ea.

MISCELLANEOUS CONDENSERS

8 mid. 20 v. 1,000 v. D.C., 13/- ea.;
.001 mfd. 6 kV. D.C., 3/6 ea.; .001 mfd.
12.5 v. D.C., 6/9 ea.

**ENAMELLED COPPER WIRE ON
LB. REELS**

14 S.W.G., 1/4; 16 S.W.G., 1/4;
18 S.W.G., 1/8; 24 S.W.G., 1/10;
26 S.W.G., 1/10; 28 S.W.G., 2/3;
30 S.W.G., 2/2; 32 S.W.G., 2/3;
34 S.W.G., 1/6; 36 S.W.G., 2/6;
38 S.W.G., 2/8; 40 S.W.G., 2/11;
44 S.W.G., 3/3.

J.B. DRIVES, ETC.

SLS Spin Wheel Drive, 27/6; Airplane-
Drive, 13/-; Full Vision Drive, 13/-;
Square Plane Drive, 12/8; SLS EV
Drive, 26/6. Send for catalogue of drives, condensers,
etc.

WALNUT CABINET

Complete with drilled chassis, dial, back plate, pointer, dial drive and drum, etc.
Price 27/6, post 2/-.

* SPECIAL OFFER OF CO-AXIAL CABLE

Best quality Grade "A" cable, solid, 1/02/70 ohms, 7d. yd.

Best quality Grade "A" cable, stranded 7/0078, 8d. yd.

Best quality Grade "A" cable, air-spaced 1/036, 1/- yd.

"SWAN"**RADIO CABINET**

Address your requirements to Dept. W.W.

ALPHA RADIO SUPPLY CO.
5/6 VINCES CHAMBERS, VICTORIA SQUARE, LEEDS 1.

SEND 6d.
IN STAMPS
FOR
ILLUSTRATED
CATALOGUE

**CONSTRUCTORS
say "IT'S STILL THE
BEST MAINS OR BATTERY
PORTABLE SET"**

STERN'S

ESTABLISHED 25 YEARS



A Midget 4-valve Superhet Portable covering medium and long wavebands. Designed to operate on A.C. mains or 20 volt battery by "Aldry" battery. The set is designed so that the mains section can be supplied as a separate unit, and can be added at any time. The Set supplied as an "Aldry" battery Superhet can be accommodated in the attaché case illustrated (size 9in. x 4in. x 7in.). This is attractively finished in lizard, maroon, dark green or blue rexine. As a combined Mains/Battery Superhet Portable a polished cabinet is available to accommodate both Mains Unit and Batteries. Circuit incorporates delayed A.V.C. and pre-selective Audio Feedback. The Set is complete in every detail and includes ready-wound frame aerials, fully aligned I.F. transist, and drilled chassis, etc. Overall size of assembled chassis 8in. x 4in. x 2in.. The receiver, as illustrated, can be completely built for approx. £10 (plus mains Unit if required). Send 1/9 for the fully descriptive Assembly Book which includes Practical Layouts and complete Pricelist of Components. Attaché case available separately 37/6.

SELENIUM RECTIFIERS

6 or 12 Volt 1 amp. rating	7/6
6 or 12 Volt 2½	12/6
6 or 12 Volt 4	17/6
6 or 12 Volt 6	£1/7/9

TWO BATTERY PORTABLES

(a) THE "MINI TWO-THREE"

An "Aldry" Battery Portable of midget size, 6in. x 4in. x 3½in., designed to cover medium waveband 190-559 metres, with the aid of short trailer aerial. The simple design of this Receiver is so arranged that either a 3-valve set or a 2-valve (afterwards easily converted to the 3-valve) can be made. Consists of a T.R.F. circuit using a regenerative detector with H.F. stage and a high gain output pentode. Valve line up IT4—IT4—DL94. The 2-valve set can be completely built for £4 3/6 (less case), and the 3-valve for £5 5/3/- (less case). Each price includes valves, speaker and drilled chassis. Send 2/- for the assembly instructions: they include simple and complete practical component layouts and diagrams, which enable the most inexperienced constructor to successfully build either set. All components are available for separate sale, a price list being supplied with assembly instructions.



(b) THE "MINI-FOUR"

A 4-valve Battery Superhet Receiver designed to receive 4 pre-set stations, three on medium waveband and one on long wave to suit local conditions. Each station is obtained on demand by the turn of a rotary switch. No tuning is necessary. It is of midget size, being only 4½in. x 6in. x 4½in. when completely built and is very easily assembled from diagram supplied. Cost of all components to build this set in accordance with the design, including a drilled and cut chassis and panel and new valves, is £9 10/- (or less valves for £6 7/6). Attractive carrying case finished in blue leatherette, 16/9. Comprehensive constructional data with a blue print, which shows the practical component layout and wiring diagram, together with an individual component price list are available separately, 1/8. Our battery eliminators (illustrated above) available in kit form are suitable for use with this set.

WE HAVE THE NEW W. B. "STENTORIAN" HIGH FIDELITY SPEAKERS IN STOCK

Model H.F. 6-inch	£2 10 6
Model H.F. 9-inch	£3 7 0
Model H.F. 8-inch	£3 0 6
Model H.F. 10-inch	£3 13 6

These speakers are of the very latest design and provide quality reproduction for the lower-price range. 3 or 15 ohm models are available.

THE VIEWMASTER TELEVISOR

We have had very considerable experience in assisting customers to build this T.V. and can supply SPECIFIED COMPONENTS EX-STOCK. The assembly instructions showing practical layouts and price list are available for 7/6 for London, Sutton Coldfield, Holme Moss, Kirk-o-Shotts and Wenvoe.

You're SURE to get it at

"PERSONAL SET" BATTERY ELIMINATOR

A complete Kit of parts to build Midjet "Aldry" Battery Eliminator, giving approx. 69 volts and 1.4 volts. This eliminator is for use on A.C. mains and is suitable for any 4-valve Superhet Receiver requiring H.T. and L.T. voltage as above, or approx. to 69 volts.

The Kit is quite easily and quickly assembled and is housed in a light aluminium case, size 4in. x 1in. x 3½in. Price of complete Kit with easy-to-follow assembly instructions, 35/6 (plus 1/- carriage and insurance). In addition we can offer a similar COMPLETE KIT to provide approx. 80 volts and 1.4 volts. Size of assembled unit 7in. x 2½in. x 1in. Price 42/6 (plus 1/- carriage and insurance).



The "Wireless World" 3-Valve Set

A Midget 3-valve T.R.F. Receiver for operation on A.C. mains, covering long and medium wavebands. We are able to supply all of the components to build this set, as designed and specified in the Feb. 1950 issue, including the drilled chassis. Valves and moving coil speaker, etc., at the following prices:—

To construct complete chassis, less dial and drive assembly, £5/5-. Dials including dial and drive assembly £6. To construct the complete set, including dial and drive assembly and cabinet, £7 7/3. Overall size of cabinet is 7in. x 3½in. x 1½in. A reprint of the designer's article, giving circuit and assembly instructions (this is available separately for 9d), together with a practical component layout is included with each of above assemblies.



THE WILLIAMSON AMPLIFIER

We have the complete range of specified Components in stock for this famous quality Amplifier. Enquiries are welcomed and immediately dealt with. The complete assembly instructions and diagrams are available for 3/6.



1-VALVE BATTERY SET



A design of a simple 1-valve 2-stage Battery Receiver, giving excellent results on medium and long wave-bands and having exceptionally low battery consumption. Drilled chassis and practical diagrams make it the ideal set for the beginner to build.

The complete chassis, including valve, can be built for 37/6 plus 8/1 P.Tax, the attractive plastic case is 9/6, and suitable headphones, 14/9.

The complete assembly instructions, layouts and a component price list are available for 1/6.

This Receiver also performs excellently, without modification, as a tuning unit, and, in addition, with simple modifications for which a complete diagram is provided, makes first-class pre-amplifier for pick-up or microphone.

A DUAL CHANNEL PRE-AMPLIFIER and TONE CONTROL UNIT

This comprehensive PRE-AMPLIFIER and TONE CONTROL UNIT provides a full control of bass and treble in conjunction with a main Volume/Mixer Control.



A COMPLETE "CAR RADIO" FOR THE HOME CONSTRUCTOR



11½" x 4½" x 3½"

A design of a complete 5-VALVE SUPERHET RECEIVER employing an R.F. Stage and incorporating a separate VIBRATOR PACK size 4½ x 2½ x 6½in. for use on 6 or 12 volt D.C. supplies. We can supply all components to build this complete Receiver and Vibrator Pack including a Metal Case.

Valves, Drilled Chassis and 5in. P.M. Speaker for £12 19/6. (Carr. and Ins. 5/6 extra).

Or the receiver Components for £9 19/6, and the Vibrator Components for £3.

This is NOT an EX-GOV'T. Receiver, it is a new design employing new Components.

Send 2/8 for the complete set of ASSEMBLY INSTRUCTIONS, CIRCUITS and PRACTICAL LAYOUTS, including a complete individual Component Price List.

THE DENCO ULTRA MIDGET SUPERHET COIL TURRETS WITH A ROTARY TURRET ACTION

Type CTB consists of a four-station "pre-set" unit from which any three stations on medium waveband and one on long wave can be received by a turn of the turret switch. Price 32/3.

Type CT10, is a 3 waveband coil pack incorporating a fourth switch position for Gram. Complete coverage is, long waveband 700-2,000 metres, medium waveband 190-570 and shortwave 15-50 metres. Price £2 8/-.

A complete receiver circuit and all necessary data are included with each turret. These can be supplied separately for 6d.

SPECIAL OFFER

A 12in. P.M. SPEAKER (2-3 ohm Voice Coil) by a very famous manufacturer for only 49' 6 (plus 1/- carriage and insurance).

THESE ARE BRAND NEW IN MAKER'S CARTONS

"HOME CONSTRUCTORS" THE NEW "SOUNDMASTER"

Send 6/6 for the complete set of building and operating Instructions. These provide for an easily assembled complete PORTABLE TAPE RECORDER including a component price list enabling all components to be bought separately.

When submitting please include cost and packing charge
STERN RADIO LTD.
109 & 115 FLEET STREET, E.C.4
Tel: CENTRAL 5812-3-4

A Famous Manufacturer's

**SHADED POLE
GRAM MOTORS** (Plus 1/- Carr. and Ins.)
Clockwise rotation and incorporates a Main Adjustment Panel. Could also be used as Recording Take Up or Rewind Motor.

10'6

THIS IS A STERN'S ADVERTISEMENT

 Constructors everywhere are amazed!

AT THE EXCELLENCE OF

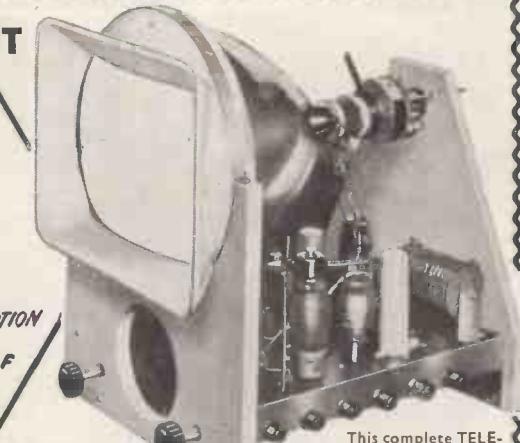
The "TELE-VIEWER"

5 CHANNEL TELEVISOR
DESIGN OF A COMPLETE 12" SUPERHET T.V. RECEIVER



Here are some of the features which combine to make this such a fine receiver.

- The Superhet circuit easily tuned to any of the five channels, i.e., LONDON, SUTTON, COLDFIELD, HOLME MOSS, WENVOE and KIRK-O-SHOOTTS. (The extreme ease of tuning is accomplished by the provision of pre-aligned I.F.T.'s.)
- A lifelike, almost stereoscopic, picture quality made possible by the following factors :
 - a. Excellent band width of I.F. circuits.
 - b. A really efficient video amplifier.
 - c. C.R.T. Grid modulated from low impedance source.
 - d. High E.H.T. voltage (approx. 10 kV).
 The picture brilliance is also much above the average and enables comfortable viewing with normal room lighting or daylight.
- FIRM picture "HOLD" circuits (Frame-Line) ensures a steady picture, free from bounce or flicker even under the most adverse conditions met with in "fringe" areas and excellent "interlace" ensures the absence of "liney effect."
- Negative feedback is used in the audio frequency circuits which provide 2/3 watts of High Quality Sound.
- Entire receiver built on two chassis units each measuring 14½" x 6½" x 3½".



This complete TELEVISOR including all Valves, can be built for only £28·16·4
(Plus cost of C.R.T.)

£12 - 19 - 6

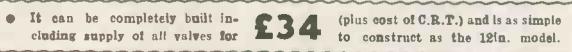
We can supply
New 12in. C.R.T.
at specially re-
duced price of

- Rigid C.R.T. mounting enables entire receiver to be safely handled with tube in position.
- All pre-set controls are mounted on side of chassis enabling all adjustments to be carried out whilst facing the C.R. Tube.
- As no hire purchase terms are available the receiver can be bought in five separate stages (practical diagrams and circuits are provided for each stage) thus enabling hire purchase interest rates to be avoided. The complete set of ASSEMBLY INSTRUCTIONS is now available, price 5/-.
- The instructions include really detailed PRACTICAL LAYOUTS, WIRING DATA AND COMPONENT PRICE LIST. ALL COMPONENTS ARE AVAILABLE FOR INDIVIDUAL PURCHASE. A CABINET WILL ALSO BE AVAILABLE.

NOW available at Stern's

The "WIDE ANGLE" TELE-VIEWER

- A design that retains all the distinctive features of the 12in. Televisor but with increased Time Base efficiency, producing 15 to 16 K.V. E.H.T., with ample scanning power for C.R. Tubes up to 17in.


It can be completely built in-
cluding supply of all valves for £34 (plus cost of C.R.T.) and is as simple
to construct as the 12in. model.

- This is the most efficient "WIDE ANGLE" large screen design yet offered to constructors, and yet it can be built for almost half the cost of similar designs.
- Complete assembly instructions, diagram, etc., available for 5/-.

SMITHS
"PRESET"
SELF-STARTING
SYNCHRONOUS
CLOCK

incorporating auto-
matic "on-off"
switching.



SPECIAL OFFER 57/6 (Normal Price £4·7-6).
(Postage and Packing 1/3)

- NEW !! and carries maker's guarantee.
- WILL SWITCH ON (AND OFF) YOUR RECEIVER AT ANY PRESELECTED TIME.
 - WILL ALSO OPERATE ANY APPARATUS (i.e. LIGHTING, etc.) UP TO 300 WATTS.
 - EASILY INSTALLED — SIMPLY CONNECTED IN THE MAINS LEAD.
 - THE IDEAL "ALARM CLOCK".
 - FOR USE ON A.C. MAINS 200-250 VOLTS.

HIGH FIDELITY PICK UP

Incorporating the famous CONNOISSEUR Light Weight Moving Iron Head and including the Connoisseur matching Transformer (plus 1/- carriage and Ins.) 39/6

!! The TRUVOX TAPE UNIT !!

We can now offer this very successful Unit.
ex stock. Price £23/2/0
(Plus 5/- carriage and ins.)

A really good class TAPE AMPLIFIER
is also available. Price £16/16/0
(Plus 5/- carriage and ins.)

The combination of these two Units provides a really first-class complete TAPE RECORDER. Send S.A.E. for complete details.

FOR HOME CONSTRUCTORS
A 5 VALVE 3 WAVEBAND
SUPERHET RECEIVER
FOR £10.10.0



- For use on
A.C. Mains 200 to 250 volts.
The following are outstanding features:
- A superhet circuit designed for high efficiency on all three wavebands.
 - A 3in. P.M. Speaker accurately matched for good quality reproduction.
 - The latest range of new 6-volt B.V.A. miniature valves.
 - Built-in frame aerial with provision for external aerial for distant stations.
 - A white plastic cabinet of very attractive appearance, overall size 7½in. x 5½in. x 5½in.
 - Send 2/6 for the fully descriptive stage by stage assembly and wiring diagrams, with which complete price details are given.

Ex W.D. TESTMETER

Complete with case and carrying strap.

23/6 Post and 1/3

Provides direct readings of
(a) 1.5 volts and 3 volts D.C.
(b) 6 mA. and 60 mA.
D.C. current.
(c) 500 ohm and 5,000 ohm
resistance ranges.

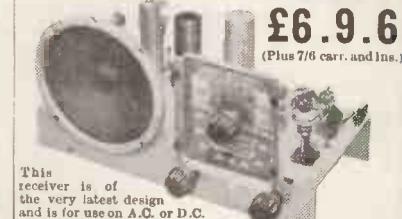
Voltages can be increased to 150, 300 and 600 volts D.C. at 6 mA. F.S.D. by an external series resistor arrangement for 6/-.

**AN AMAZING OFFER!
A COMPLETELY ASSEMBLED
4 VALVE
T.R.F. CHASSIS**

Including a 5in. P.M. SPEAKER and VALVES FOR ONLY

£6.9.6

(Plus 7/6 carriage and ins.)



This receiver is of the very latest design and is for use on A.C. Mains 200-250 Volts. It covers both Long and Medium Wavebands, and includes the modern BVA miniature valves. The line up being 12 BA6-12AT6-12A6-35W4. It incorporates Permalloy Tuned Coils thus ensuring excellent selectivity and sensitivity. The overall size of the complete chassis including speaker is 10½in. x 4½in. x 6½in. An attractive Bakelite Ivory finished Cabinet size 11½in. x 5½in. x 6½in. is available for 16/6 (plus 2/6 carriage and insurance).

The GARRARD Model RC75A

A 3 SPEED AUTOCHANGE UNIT

COMPLETE WITH THE TWIN £13/15/0 (Plus 7/6
STYLUS CRYSTAL PICK-UP, 1/3 in. car. and ins.)

- These Units will autochange on all three speeds, an adaptor, price £1/0/7, being required for the 45 r.p.m. records.
- They have separate sapphires for L.P. and 78 r.p.m. which are moved into position by a switch on the pick-up head. These Units are one of the best made today, they are brand new, complete with mounting instructions, etc.

R.S.C. MAINS AND OUTPUT TRANSFORMERS

Fully Guaranteed, Interleaved and Impregnated

FILAMENT TRANSFORMERS

Primaries 200-250 v.	50 c/cs.
6.3 v. 1.5 a.	5/9
6.3 v. 2 a.	7/6
6.3 v. 3 a.	9/6
0.4-6.3 v. 2 a.	7/9
12 v. 1 a.	7/11
6.3 v. 6 a.	17/6
0.2-4.5-6.3 v. 4 a.	16/9
12 v. 3 a. or 24 v. 1.5 a.	17/6

CHARGER TRANSFORMERS

All with 200-250-250 v. 50 c/s. Primaries: 0-9-15 v. 1.5 a., 14/9; 0-0.15 v. 3 a., 16/9; 0-9-15 v. 6 a., 22/9; 0-4-0-15-24 v. 3 a., 22/9; 0-9-15-30 v. 3 a., 23/9; 0-22-23-24 v. 5 a., 19/6.

TOP SHROUDED DROP THROUGH TYPE

Primaries 200-230-250 v.	50 c/s.
250-0-250 v. 70 mA., 6.3 v. 2.5 a.	12/11
280-0-260 v. 70 mA., 6.3 v. 3 a., 5 v. 2 a.	14/11
350-0-350 v. 80 mA., 6.3 v. 2 a., 5 v. 2 a.	16/9
350-0-350 v. 80 mA., 6.3 v. 3 a., 4 v. 2.5 a.	14/11
250-0-250 v. 100 mA., 6.3 v. 4 a., 5 v. 3 a.	23/9
300-0-300 v. 100 mA., 6.3 v. 4 v., 4 a. c.t., 0-4.5 v. 3 a.	23/9
350-0-350 v. 100 mA., 6.3 v. 4 v. 4 a. c.t., 0-4.5 v. 3 a.	23/9
350-0-350 v. 150 mA., 6.3 v. 4 a., 5 v. 3 a.	29/11
350-0-350 v. 150 mA., 6.3 v. 2 a., 6.3 v. 2 a., 5 v. 3 a.	29/11

E.H.T. TRANSFORMERS. 2,500 v. 5 mA., 3-0-2 v. 1.1 a., 2-0-2v. 1.1 a., for VCR97, VCR517 or ACR2X 35/-

5,000 v. 5 mA. 2 v. 2 a. 39/6

SILVER MICA CAPACITORS. 5, 10, 15, 20, 25, 30, 35, 50, 100, 120, 150, 180, 200, 230, 300, 330, 400, 470, 500, 1,000 pfd. (.001 μF), 002 mfd. (2,000 pfd.). All at 5d. each; 3/9 dozen one type.

DIAL BULBS, M.E.S., 8 v. 0.15 a., 6/9 doz. 6.5 v., 0.15 a., 6/9 doz.

VOLUME CONTROLS with long spindles, all values less switch, 2/9; with S.P. switch, 3/9.

WIRE WOUND POTS: 20 ohms, 30 ohms, 1,000 ohms, 5K, 50K (medium length spindles), 2/9. 220 ohms, 2K, 10K, 20K, 50K Preset type, 1/9 ea.

AMMETERS. Moving coil. G.E.C. 0-5 amps., 2in. scale, 11/9.

ELECTROLYTICS (Current production. ex-Govt.).

Tubular Types	Can Types	NOT
8μF 450 v.	1/11	16μF 450 v.
8μF 500 v.	2/9	24μF 350 v.
16μF 350 v.	2/3	32μF 350 v.
16μF 450 v.	2/9	32 mfd. 450 v.
16μF 500 v.	3/9	40μF 450 v.
24μF 350 v.	3/3	64 mfd. 450 v.
32μF 350 v.	3/9	8-8μF 350 v.
32 mfd. 500 v.	5/9	8-8μF 450 v.
8-16μF 500 v.	4/11	8-16μF 450 v.
25μF 25 v.	1/3	16-16μF 450 v.
50μF 12 v.	1/3	16-16 mfd. 500 v.
50μF 50 v.	2/3	16-32μF 350 v.
Can Types	2/3	32-32μF 350 v.
8 mfd. 450 v.	2/3	32-32μF 450 v.
8 mfd. 500 v.	2/11	64-120 mfd. 350 v.
16 mfd. 350 v.	1/11	7/6

MISCELLANEOUS EX-GOV'T. ITEMS

Slydelock Fuses, 15 amp., 1/9. Bulgin panel mounting Fuseholders (ex-equip't.), 11d. Bulgin octal type moulded Bakelite, 5-pin or 7-pin Plugs and Sockets, 1/1 pr. Earphones (Single), low resistance, 1/3.

EX-GOV'T. ACCUMULATORS with non-spill vents. Unused and guaranteed. 2 v. 16 A.H. Size in wood carrying case 9-7-5in., 14/9, plus 2/6 Carr.

P.M. SPEAKERS. All 2-3 ohms. 3½in. Goodmans (Ex New Units) 10/9, 6½in. Elac., 14/11, 6½in. Plessey with Pentode Trans., 14/11, 8in. Plessey, 15/9, 8in. R.A. Heavy duty, 18/9, 10in. Goodmans, 31/7, 10in. Plessey, 18/6, 10in. Rola with Trans., 29/6, 12in. Truvox, 49/9.

M.E. SPEAKERS. All 2-3 ohms, 6½in. Rola field 700 ohms, 11/9, 10in. R.A. field 600 ohms, 23/9, 10in. R.A. field 1,500 ohms, 23/9, 10in. R.A. Field 1,000 ohms, 23/9.

Primaries 200-230-250 v. 50 c/cs.

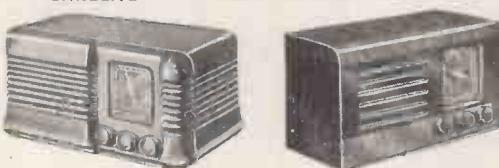
FULLY SHROUDED UPRIGHT MOUNTING

250-0-250 v. 60 mA., 6.3 v. 2 a., 5 v. 2 a., Midget type 24-3-3in.	16/9
350-0-350 v. 70 mA., 6.3 v. 3 a., 5 v. 2 a.	18/9
300-0-300 v. 60 mA., 12 v. 1.5 a., c.t., 0-4.5 v. 3 a.	18/11
250-0-250 v. 100 mA., 6.3 v. 4 v. 4 a. c.t., 0-4.5 v. 3 a., for R1355 conversion	25/9
250-0-250 v. 100 mA., 6.3 v. 6 a., 5 v. 3 a., 0-4.5 v. 3 a.	29/9
300-0-300 v. 100 mA., 6.3 v. 4 v. 4 a. c.t., 0-4.5 v. 3 a.	25/9
350-0-350 v. 100 mA., 6.3 v. 6 a., 5 v. 3 a., 0-4.5 v. 3 a.	33/9
350-0-350 v. 150 mA., 6.3 v. 2 a., 6.3 v. 2 a., 5 v. 3 a.	45/9
350-0-350 v. 250 mA., 6.3 v. 8 a., 4 v. 8 a., 0-2.6 v. 2 a., 4 v. 3 a., for Electronic Eng. Televisor	67/6
425-0-425 v. 200 mA., 6.3 v. 4 v. 4 a. c.t., 6.3 v. 4 v. 3 a., suitable Williamson Amplifier, etc.	49/9
425-0-425 v. 250 mA., 6.3 v. 6 a., 6.3 v. 6 a., 5 v. 3 a.	65/6

EX-GOV'T. E.H.T. SMOOTHING CAPACITORS

0.02 mfd. 5,000 v. Bakelite Tubulars.	1/6
0.02 mfd. 8,000 v. Cans	1/11
1 mfd. 2,500 v. Cans	3/6
1 mfd. plus 1 mfd. 8,000 v., large blocks (common negative isolated)	9/6

BAKELITE AND WALNUT VENEERED CABINETS



Size approximately 12in. x 6½in. x 5in. Bakelite type available in Brown or Cream. Price of

Cabinets, 17/6 ea., carr. 2/6.

Suitable fully punched T.R.F. 3-valve and rectifier chassis

3/9

Suitable fully punched superhet chassis (4 valves and rect.)

4/9

Dial Scales, 2 colour, 2 waveband, station named, glass

1/6

Dial Scales, 3 colour, 3 waveband, station named, glass

1/9

Suitable coloured Metal Backplates

1/3

Pointers, Double ended

4d.

T.R.F. Coils, 2 waveband with circuit

6/9

Drum Drives, complete

2/6

THE SKY CHIEF T.R.F. RECEIVER

A design of a 4 stage, 3 valve 200-250 v. A.C. Mains receiver with selenium rectifier. For inclusion in any of cabinets illustrated above. It consists of a variable Mu high gain H.F. stage followed by a low distortion grid detector triode. The next stage is a further triode amplifier with tone correction by negative feedback. Finally comes the output stage consisting of a parallel connected double triode giving ample output at an extraordinary low level of distortion. Point to point wiring diagrams, instructions, and parts list, 2/6. This receiver can be built for a maximum of £4.16/- including cabinet.

SELENIUM RECTIFIERS



L.T. Types	H.T. Types H.W.
2/6 v. ½ a.h.w.	1/9
F.W. Bridge Types	70 v. 20 mA. ... 2/11
6/12 v. 1 a.	90 v. 20 mA. ... 3/6
6/12 v. 2 a.	120 v. 40 mA. ... 3/11
6/12 v. 6 a.	250 v. 50 mA. ... 5/9
6/12 v. 12 a.	350 v. 50 mA. ... 7/9
6/12 v. 6 a.	250/350 v. 80 mA. ... 8/9

SMOOTHING CHOKES

250 mA., 7-10 H. 200 ohms Shrouded	16/9
250 mA., 3 H. 50 ohms	11/9
100 mA., 15 H. 350 ohms	7/6
80 mA., 10 H. 350 ohms	5/6
60 mA., 10 H. 400 ohms	4/11
50 mA., 40 H. 1,000 ohms Potted	10/9

ELIMINATOR TRANSFORMERS

Primaries 200-250 v. 50 c/s. 120 v. 40 mA.	7/11
90 v. 10 mA., 8-0-8 v. 250 mA.	9/11

OUTPUT TRANSFORMERS

Midget Battery Pentode 66 : 1 for 3S4, etc.	3/6
Small Pentode, 5,000Ω to 3Ω	3/9
Standard Pentode, 8,000Ω to 3Ω	4/9
Standard Pentode, 10,000 ohms to 3 ohms	4/9
Multi-ratio 40 mA. 30:1, 45:1, 60:1, 90:1, Class B Push-Pull	4/9
Push-Pull 10-12 Watts 6V6 to 3Ω or 15Ω	15/9
Push-Pull 10-12 Watts to match 6V6 to 3-5 or 15Ω	15/9
Push-Pull 15-18 Watts to match 6L6, etc. to 3Ω or 15Ω Speaker	22/9
Push-Pull 20 Watts high-quality sectionally wound, 6L6, KT66, etc., to 3 or 15Ω	47/9
Williamson type, exact to author's specification	85/-

MICROPHONE TRANSFORMERS

100:1	5/9
-------	-----

EX-GOV'T. AUTO TRANSFORMERS

15-10-5-0-215-235 v. 200 watts	25/8
Double wound 10-0-200-220-240 v. input, 10-0-270-290-310 v. output	27/9
200 watts	27/9

EX-GOV'T. MAINS TRANSFORMERS

All 230 v. 50 c/s input	4/6
1 a. output	9/6
Outputs 250-0-250 v. 40 mA., 6.3 v.	10/9
2 a., 5 v. 2 a.	17/6

VALVE SCREENING CANS.

International Octal 3 piece, 10/6 doz., 1/3 each.

EX-GOV'T. SMOOTHING CHOKES

250 mA., 10 H. 50 ohms	14/9
250 mA. 20. 250 ohms. Tropicalised	13/9
250 mA. 10. 100 ohms	14/9
250 mA. 3 H. 50 ohms Potted	7/6
150 mA. 10. 50 ohms	10/11
100 mA. 10. 100 ohms. Tropicalised	6/9
90/100 mA. 5 H. 100 ohms. Tropicalised	4/6
50 mA. 50 H. 1,250 ohms. Potted type	8/11
70 mA. 5-10 H.	3/9
50 mA. 5-10 H.	2/9

EX-GOV'T. T.V. TYPE TRANSFORMERS.

All 230 v. 50 c/s input	25/8
6.3 v. 6 a., 0.3 v. 6 a., 5 v. 3 a., 5 v. 3 a.	22/6
7-8-2-78 v. 80 mA.	7/9
400 v. C.T. 150 mA. 4 v. 6 a., 6.3 v. 6 a., 6.3 v. 0-6 a., 4 v. 6 a., 4 v. 3 a., 4 v. 3 a.	22/9
4 v. 3 a., 5 v. 2 a.	22/9

EX-GOV'T. BLOCK PAPER CAPENDORS

4 mfd. 500 v. ... 2/9	4 mfd. 1500 v. ... 4/9
4 mfd. 750 v. ... 3/3	10 mfd. 1500 v. ... 7/9
10 mfd. 500 v. ... 6/9	

EX-GOV'T. CATHODE RAY TUBES

VCR517 (guaranteed full picture) (carr. 5/)-29/6 ea.	29/6 ea.
ACR2X (guaranteed full picture) (carr. 5/)-12/6 ea.	12/6 ea.

SPECIAL OFFERS.

Germanium Crystal Diodes 1/11. Midget Mains Transformers (size approx. 2½ x 3 x 2½in.). Screened Primary 220/240 v. 50 c/s Output, 250-0-250 v. 60 mA., 6.3 v. 2.5 a. Only 11/9.

CO-AXIAL CABLE.

.75 ohms ¼in., 8d. yard.

EX-GOV'T. CATHODE ISOLATING FILAMENT TRANSFORMERS.

6.3 v. to 6.3 v. c.t., 3/9 ea.

SPECIAL PURPOSE EX-GOV'T. VALVES (GUARANTEED)

VR91, 5/9, SP61 (VR65) 2/9, VR56 3/11, 807 6/11, 707 6/11, 6J6 10/6, OSHTMet 6/11, 12SC7GT 6/11, VU120A 2/9, VS110 1/9.	2/9, 10/6, 6/11, 7/9, 8/9, 9/9, 10/6, 11/6, 12/6, 13/6, 14/6, 15/6, 16/6, 17/6, 18/6, 19/6, 20/6, 21/6, 22/6, 23/6

R.S.C. 25 WATT "PUSH PULL" AMPLIFIER

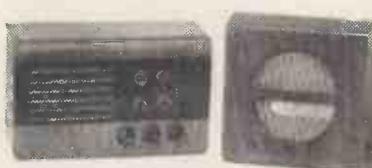
Now firmly established and proving extremely popular, our All Quality Amplifier we consider to be the best value in amplifiers offered to-day. The volume of its high fidelity reproduction is completely controllable, from the sound of a quiet intimate conversation to the full glorious volume of a great orchestra. Its sensitivity is so high that in areas of fair signal strength it can be operated straight from a crystal receiver. Entirely suitable for standard or long playing records in small homes or in large auditoriums. For electronic organ or guitar or for garden parties or dance bands.

The kit is complete to the last detail, and includes easy to follow point-to-point wiring diagrams.

Twin volume controls with twin input sockets allow SIMULTANEOUS INPUTS for BOTH MICROPHONE and GRAM, or TAPE and RADIO. SEPARATE BASS and TREBLE CONTROLS giving both LIFT and CUT. FOUR NEGATIVE FEEDBACK LOOPS with 15 db in the main loop from output transformer to voltage amplifier. Frequency response ± 3 db. 50-20,000 c.p.s. Hum and distortion LESS THAN 0.5 per cent. measured at 10 watts. This is comparable with some of the highest priced amplifiers. Six B.V.A. valves, Marconi/Osram KT series output valves. A.C. only, 200-230-250 v. 50 c.c.s. input. 420 v. H.T. LINE. Paper reservoir condenser. Compact chassis. Matched components. OVERALL SIZE 14-10-9in. approx. Output impedances for 3 and 15 ohms speakers.



Available in kit form at **9 gns.** Plus the amazingly low price of **9 gns.** carriage 5/- Or ready for use 50/- extra.



R.S.C. MASTER INTERCOMM. UNIT, with provision for up to 4 "Listen—Talk Back Units" individually switched. A high gain amplifier enables speech and other sounds emanating from the rooms containing remote control units to be heard at the master control. The unit is in kit form and point-to-point wiring diagrams are supplied. A walnut veneered wood or Brown Bakelite cabinet is included. Mains input is 200-250 v. 50 c.s. H.T. line 300 v. CHASSIS IS NOT "ALIVE." Ideal also for use as "Baby Alarm." Sound amplification 4 watts. Price only £5/19/6. "Listen—Talk Back Unit" as illustration can be supplied at 30/- each. Full descriptive leaflet 10d. The Master Unit can be supplied assembled and tested for 30/- extra.

R.S.C. BATTERY CHARGER KITS. For mains input 200-250 v. 50 c.s. To charge 6 v. accumulator at 2 amps., 25/9.



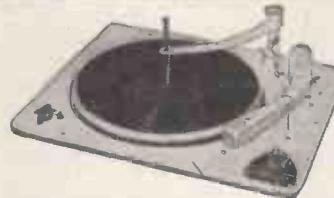
To charge 6 v. or 12 v. accumulator at 2 amps., 31/8.

To charge 6 v. or 12 v. accumulator at 4 amps., 49/9.

ABOVE KITS CONSIST OF BLACK CRACKLE STEEL CASE, MAINS TRANSFORMER FULL

WAVE METAL RECTIFIER, FUSES, FUSE-HOLDERS AND CIRCUIT. Due to careful design the use of resistors for regulation of charge has been obviated. The mean charging rates are as indicated above, and complete safety is ensured by fusing of both input and output. Chargers supplied assembled and tested for 6/9 extra.

A PUSH-PULL 3-4 WATT HIGH-GAIN AMPLIFIER FOR £3/12/6, plus carr. 2/6. For mains input 200-250 v. 50 c.s. Complete kit of parts including point-to-point wiring diagrams and instructions. Amplifier can be used with any type of feeder unit or pick-up. Output is for 2-3 ohm speaker. (We can supply a very suitable 10in. unit by Goodmans at 31/-). The amplifier can be supplied ready for use for 25/- extra. Full descriptive leaflet 7d.



COLLARO 3-SPEED AUTOMATIC RECORD CHANGER (brand new), type RC8/521, complete with 2 plug-in Crystal P.U. heads for long playing or standard records 7, 10 or 12in. Not intermixed. Mains input 200-250 v. Limited number available at only £9/15/-, plus carr. 5/-.

COLLARO 3-SPEED RECORD PLAYER UNIT. Type RC8/514, complete with Orthodynamic Pick-up, and matching transformer. Separate Stilts for long playing or standard records are moved into position by a switch which also makes necessary weight adjustment. Mains input 200-250 v. A.C. Brand new in Makers cartons, £6/19/6, plus 5/- carr.

COLLARO RECORD PLAYER UNIT. Type AC/514. Standard 10in. turntable. Speed normal 78 r.p.m. Crystal pick-up. Mains input 200-250 v. A.C. Brand new cartoned £3/19/6, plus 5/- carr.

COLLARO GRAM MOTORS, TYPE AC37. Governor controlled at 78 r.p.m. Mains input 110-200-230-250 v. Shaded pole type, 35/-.

COLLARO TAPE DESK MOTORS. Shaded pole type. Clockwise or anti-clockwise. Mains input 110-200-250 v., 31/6.

RADIO SUPPLY CO.

32 THE CALLS, LEEDS 2

Terms C.W.O. or C.O.D. No C.O.D. under £1. Postage 1/1 extra under £1, 1/9 extra under £3. Full Price List 6d. Trade List 5d.

Open to Callers : 9 a.m. to 5.30 p.m. Saturdays until 1 p.m.

(LEEDS)
LTD.

BATTERY SET CONVERTER KITS. All parts for converting any type of battery receiver to all mains. A.C. 200-250 v. 50 c.s. Kit will supply fully smoothed H.T. of 120 v. 60 v. or 60 v. at up to 40 mA., and fully smoothed L.T. of 2 v. at 0.4 a. to 1 a. Price complete with circuit and instructions only 48/9. Supplied ready for use for 7/9 extra.

H.T. ELIMINATOR AND TRICKLE CHARGER KIT. Consists of h.t. and l.t. transformer, h.t. and l.t. rectifiers, smoothing electrolytic choke, and steel case. For mains input of 200-250 v. Output 120 v. 40 mA. and 2 v. $\frac{1}{2}$ a. Price with circuit 29/6.

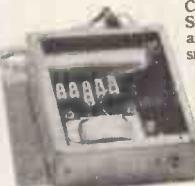
Or in working order, 37/6.

R.S.C. TONE CONTROL-PRE-AMP. UNIT. A complete set of parts for the construction of a very efficient but simple pre-amplifier and tone control unit. Suitable for use with any amplifier and pick-up. Fil. supply is self-contained. Overall size is 7 $\frac{1}{2}$ -5 $\frac{1}{2}$ in. approx. Full descriptive leaflet 9d. Price including wiring diagrams 37/6. Or ready for use 15/- extra.

CHASSIS

18 s.w.g. undrilled aluminium amplifier type (4 sided)	6/11
12in. \times 9in. \times 2 $\frac{1}{2}$ in.	6/11
14in. \times 9in. \times 2 $\frac{1}{2}$ in.	7/11
14in. \times 10in. \times 3in.	8/3
16in. \times 10in. \times 3in.	8/3
18 s.w.g. aluminium, receiver type. 6in. \times 3in \times 1in.	1/11
7 $\frac{1}{2}$ in. \times 4 $\frac{1}{2}$ in. \times 2in.	2/9
10in. \times 5 $\frac{1}{2}$ in. \times 2in.	3/3
11in. \times 6in. \times 2 $\frac{1}{2}$ in.	3/11
16 s.w.g. aluminium, receiver type, 12in. \times 2 $\frac{1}{2}$ in.	5/3
16in. \times 6in. \times 2 $\frac{1}{2}$ in.	7/6
20in. \times 8in. \times 2 $\frac{1}{2}$ in.	8/11
16 s.w.g. aluminium, amplifier type, 4 sided.	7/11
12in. \times 8in. \times 2in.	10/11
16in. \times 8in. \times 2in.	13/6
20in. \times 8in. \times 2 $\frac{1}{2}$ in.	13/6
14in. \times 10in. \times 3in.	13/6

PERSONAL SET BATTERY SUPERSEDER KIT. All parts for an "All Dry" Battery Eliminator. Complete with case. Supplies 90 v. 10 mA. and 1.4 v. 250 mA. fully smoothed, from normal. 200-250 v. 50 c.s. mains. For 4-valve superhet receivers. Price with circuit 35/9. Or ready for use 42/6. Size of unit 5 $\frac{1}{2}$ -4 $\frac{1}{2}$ in.



RADIO

OUR MOTTO IS—

GOODS OF QUALITY
SERVED WITH CIVILITY"

BARTON'S (Radio) LIMITED

42 · TOTTENHAM COURT ROAD,
LONDON · W.1.

Telephones : LANGHAM 1151/2

TELEVISION

THE FAMOUS RANGE OF

• DULCI •

RADIO/RADIOPHONIC CHASSIS

All chassis 11in. x 7in. x 8in. high. Latest type valves 6BE6, 6BA6, 6AT6, 6BV6, 6X4. Flywheel tuning. Negative feedback over entire audio section. Engraved knobs. 3 tone positions for radio and gram. Model B3.—Long, Medium Short.

Model B3.—5 Valves. Output 3½ watt. £12 12 0

Model B3.—Plus Push Pull Stage. £15 15 0

Model B3.—Double Feature with P/Pull & E.F. Stage. 7 Valves. Output 6 watt. £18 18 0

Model B6.—Six Wavebands. Med., Long, 4 Short. (3 Bandspread). 5 valves. Output 3½ w. £15 15 0

Model B6.—Plus Push Pull Stage 6 Valves. Output 6 watt. £18 18 0

Model B6.—Double Feature with P/Pull & E.F. Stage. 7 Valve. Output 6 watt. £23 2 0

FULLY GUARANTEED. TAX PAID.

For A.C. Mains 100/120 and 200/250 volts.

The Double Feature chassis are supplied with separate Power Packs.

5 VALVE SUPERHET CHASSIS

Fitted with Valve Holders, Aerial, Earth and Gram Sockets; Full Vision 3 Waveband Dial and Drive Assembly; 2 gang Tuning Condenser. Chassis dimensions:—13½in. long, 5½in. wide, 2½in. deep.

Price 42/6

Plus 1/6 pkg., carr., ins.

LARGE STOCKS OF B.V.A. VALVES

and Ex-Govt. Special purpose valves.

Your enquiries invited.

★ SPECIAL OFFER ★
**TANNOY HEAVY DUTY
SPEAKER UNITS—BRAND NEW—**

These units consist of a solid wooden cabinet (ream finish) 11in. long; 11in. high; 4in. deep. Fitted with heavy duty 8in. speaker, 3 ohms impedance. Will handily fit 5 watts. Normal price £5.

Plus 5/- packing, carriage and insurance. 79/6

FILAMENT TRANSFORMERS

6.3 v. 1½ amp., 5/11; 6.3 v. 3 amp., 8/11; 6.3 v. (with 4 v. and 2 v. tappings), 1½ amp., 7/5. All plus 1/- p.p.

CONDENSERS

Silver Mica; Moulded Mica; Wax Tubular; Paper Block Types.

Huge Stocks carried—please state your requirements.

ELECTROLYTIC CAPACITORS—NEW!

8 mfd., 150 v.	1/8	25 mfd., 50 v.	1/8
8 mfd., 450 v.	2/8	24-20 mfd., 275 v.	2/8
8-8 mfd., 450 v.	3/8	23 mfd., 25 v.	1/8
8-16 mfd., 450 v.	3/11	50 mfd., 50 v.	2/8
16 mfd., 450 v.	3/8	8-14 mfd., 350 v.	3/11
32 mfd., 500 v.	4/11	4 mfd., 450 v.	1/8
50 mfd., 12 v.	1/8	32-32 mfd., 350 v.	3/11

RESISTORS (CARBON)

½ and ¼ watt, 3d. each. 1 watt 5d. each. All preferred values from 10 ohms to 10 mega.

EXCEPTIONAL OFFER!
1.5 AMP. HOT WIRE METER

3½in. dia. Suitable for use with Battery Charger. Plus 1/- post., carr., ins. 3/6

METAL RECTIFIERS

S.T.C.			
R.M.1.	125 v. 60 mA.		4/6
R.M.2.	125 v. 100 mA.		5/-
R.M.3.	125 v. 125 mA.		6/-
R.M.4.	250 v. 250 mA.		18/-
E.H.T. PENCIL RECTIFIERS—			
K350.	6 Kv.		8/8
K3/100.	8.5 Kv.		14/8

METAL RECTIFIERS (FULL WAVE)

12 v. 1 amp. (Bridge Type). 7/6; 12 v. 2 amp., 11/3;

12 v. 3 amp., 12/6; 12 v. 4 amp., 16/-.

METAL RECTIFIERS—BRAND NEW!

300 v. 75 mA., may be used in series or voltage doubling to give any required voltage. 7/11, plus 6d. post/pkg.

VIBRATORS

WEARITE, Type QFA/12, 12 v. 7-pin Sync. (Self Rectifying). BRAND NEW, in orig. cartons, 15/-.

MALLORY, Type G46, 12 v. 5-pin (Non-Sync.), 7/6.

Pkg., carr. on either of above 1/-.

LOUDSPEAKERS (2-3 ohms impeded.)

ELAC, 2½in. dia. ... 15/-	TRUVOX (MERCO), 6in. dia. ... 12/6
PLESSEY, 3in. dia. ... 9/11	ELAC, 6in. dia. ... 16/6
ELAC, 3½in. dia. ... 15/-	PLESSEY, 6½in. dia. ... 12/6
PLESSEY, 10in. dia. 18/9	ELAC, 8in. dia. ... 17/8

All the above plus 1/6 pkg., carr., ins.

GOODMAN'S 8in. H.F. 15 ohms 5 w. peak A.C. Axion 101	£6 12 0
GOODMAN'S 8in. H.F. 15 ohms 5 w. peak A.C. Axion 102	£9 18 2
R.A. 10in. with transformer, 2-3 ohms	£1 8 6
R.A. 10in. 2-3 ohms	£1 3 6
LECTRONA 10in., 2-3 ohms	£1 7 6
ELAC 10in., 2-3 ohm	£1 2 6

TRUVOX 12in. 2-3 ohms. SPECIAL OFFER, 47/6.

THE LATEST RANGE OF W.B. H.F. SPEAKERS

Incorporating the NEW Composite Cone

W.B. 8in. H.F., 10,000 lines, 3 ohms	£2 10 6
W.B. 8in. H.F., 12,000 lines, 3 ohms	£3 0 6
W.B. 10in. H.F., 12,000 lines, 3 ohms	£3 7 0

(Also available 15 ohms impeded.)

WHARFEDALE BRONZE 10in. Flux Density, 10,000 lines 6 w. 15 ohms	£4 12 8
WHARFEDALE GOLDEN 10in. Flux Density 13,000 lines, 8 w. 15 ohms	£7 13 3
WHARFEDALE GOLDEN/C/SB 10in. Flux Density 13,000 lines, 5 w. 15 ohms	£8 6 7
WHARFEDALE SUPER 8/CS/AL 8in. Cloth Suspension, Flux Density 13,000 lines, 40 w. 10 ohms	£6 13 3
WHARFEDALE SUPER 5/CS/AL 5in. Cloth Suspension, Flux Density 13,000 lines, 10 ohms	£6 13 3
WHARFEDALE W12/CS 12in. Cloth Suspension, Flux density 13,000 lines, 10 w. 15 ohms	£9 15 0
WHARFEDALE W12 12in. Flux Density 13,000 lines, 15 w. 15 ohms	£9 5 0
GOODMAN'S 12in. Axion 150 twin cone H.F. 15 ohms 15 w. peak A.C.	£10 5 6
GOODMAN'S 12in. Audioro 60 H.F. 15 ohms 15 w. Peak A.C.	£8 12 6

MAINS TRANSFORMERS

Type LP1. 80-250, 60 mA. 6.3 v. 3 amp., 5 v. 2 amp. Fully shrouded

22/9

LP4. 275-675 v. at 80 mA., 0/4/6.3v. at 4 amps., 0/4/5 v. at 2 amps.

22/6

LP6. 350-6-350 80 mA. 6.3 v. 5 amp., 5 v. 3 amp. Half-shrouded

28/1

LP7. 350-6-350 120 mA. 6.3 v. 5 amp., 5 v. 3 amp. Fully shrouded

29/6

LP9. 425-6-425 150 mA. 3 v. 4 amp. O/T.

52/6

LP10. 430-6-430 200 mA. 6.3 v. 4 amp., 6.3 v. 4 amp., 5 v. 3 amp. F/B.

55/-

LP11. 350-6-350 150 mA. 6.3 v. 5 amp., 5 v. 3 amp. Fully shrouded

44/6

B12. 350-6-350 150 mA. 6 v. 3 amp., 4 v. 3 amps. 20-30 v. 0.5 amp., incorporates voltage adjustment panel tapped

200/210 v., 220/230 v. 240/250 v.

Semi-shrouded drop through type

21/-

B13. 250-6-250 80 mA., 6.3 v. 4 amp., 5 v. 2 amp. Universal upright mounting

23/6

B14. 350-6-350 80 mA., 6.3 v. 4 amp., 5 v. 2 amp. Universal upright mounting

23/6

B15. General Purpose Step-down Transformer. Tapped 3 v., 4 v., 5 v., 6 v., 8 v., 9 v., 10 v., 12 v., 15 v., 18 v., 20 v., 24 v., 30 v. Total output 30 v. at 2amps.

22/-

AUTO TRANSFORMERS

Tapped 100 v., 120 v., 200 v., 230 v., 250 v., 100 w., 22/-.

All the above plus 1/6 post. & pkg.

MICROPHONE TRANSFORMERS

Ratio 100:1, Mu metal. Has innumerable uses. 1/11 plus 6d. post/packing.

MICROPHONES

ACOS Mic. 22 (Crystal) £4 4 0

Mic. 16 (Crystal) £12 12 0

LUSTRAPHONE M.C. with T/F, C/S1 £5 15 6

Heavy Table Base for above £1 1 0

RESLO (M/C Low Imped.) £7 5 0

Ribbon High Fidelity Mumetal Transformer £1 15 0

THE NEW ACOS 35-I.

Crystal Mic. Output level—55 db. Ref. 1 v./dyne/cm., 25/- plus 6d. post/pkg.

RECENT HAND MICROPHONES

A high impedance crystal microphone complete with screened lead and Jack-plug (Normal list price £2/2/-).

Plus 1/6 post/packing. 22/6

TERMS OF BUSINESS : Cash with order (or C.O.D. Post items only); all orders for small items totalling over £2 post free unless otherwise stated.

**BUILD YOUR OWN
HIGH FIDELITY
TAPE RECORDER**

THE SENSATIONAL

'SOUND MASTER'

BY THE CREATORS OF THE FAMOUS

'VIEWMASTER'

Precision machined parts and standard radio components. Easily wired and assembled without previous experience. KITS can be purchased separately as follows:

Tape Deck Kit £13 13 0

3 Collage Motors £15 15 0

Bulgin Component Kit £23 10 0

Lab. Resistor Kit £8 8 6

T.C.C. Condenser Kit £24 3 0

N.S.F. Switches £21 15 8

Wearite Components £27 0 0

Whiteley Components £21 13 2

Cabinet £24 19 6

EASY STEP BY STEP INSTRUCTION ENVELOPE,

Working model may be heard at our shop.

7/6

TRUVOX TAPE DECK MARK III

Incorporating high impedance my-metal twin-track heads. Two-speed capstan, for tape speeds of 7½ and 3½ inches per second. Three heavy-duty motors allowing for fast forward and rewind facilities without tape handling. All controls operated by electrically and mechanically interlocked push buttons.

Price £23/2/- carriage free.

LANE TAPE DECK MARK IV

Made to high standards and incorporating features ensuring low level of "Wow" and "Flutter" throughout the length of tape. Provision for fast rewind and forward run in less than 1 min. in either direction. WIND AND REWIND WITHOUT UNLACING OF TAPE. INSTANTANEOUS BRAKING. THREE MOTORS obviating friction drive. Table is fitted with a built-in lid which plays back head of new design wound to high impedance and a separate A.C. Erase Head. The Heads are half-track size allowing approx. 1 hr playing from standard 1,000ft. Reel of Tape.

TAPE SPEED: 7½in. sec. FOR USE ON A.C. 200/250, 50 CYCLES MAINS ONLY Price £17/10/- carriage free.

TAPE DECKS AND TABLES

WEARITE 2A TAPE DECK £35 0 0

NOTEK K4 TAPE TABLE. Push Button operation £17 17 0

TAPE RECORDER

The Famous "GRUNDIG" 2 Speed £84 0 0

RECORDING TAPE

FERROGRAPH, 1,200ft. £2 5 0

GRUNDIG, 1,200ft. £2 2 0

SCOTCH BOY, 1,200ft. £1 15 0

EMITAPE, 1,200ft. £1 15 0

FERRODOICE, 600ft. £1 2 6

SCOTCH BOY, 600ft. £1 4 0

EMITAPE, 600ft. £1 1 0

FERRODOICE, 600ft. £1 1 0

FERRODOICE, 300ft. £1 0 8

SCOTCH BOY, 300ft. £1 0 8

THE NEW COLLARO STUDIO PICK-UP

Type "O" or "P" £3 14 8

THE FAMOUS 4-VALVE

"SOBELL"

SUPERHET TABLE RECEIVER

MEDIUM/LONG WAVES

Valve line up: 12J7, 3SL6, 1487, 352A. This very sensitive receiver, incorporates a carrying handle making it entirely transportable. Housed in an attractive plastic cabinet of modern design, it can be used on either A.C. or D.C. 200/250v.

mainains.

CHOICE OF THREE COLOURS: WALNUT BROWN

GREEN, CREAM.

GUARANTEED FOR TWELVE MONTHS

"TYANA" SOLDERING IRON

Weight 4 ozs.; Adjustable Bit; heating time 3 mins. Length 10in., 16/8 plus 1/4 post.

"TYANA" ELECTRIC SOLDER GUN

Instant heating, low voltage, bit which can be bent to reach corners, balanced grip. A.C. 220/250 v. Guaranteed 12 months.

Complete with 6 Bits, £6.50



RADIO

OUR MOTTO IS—
“GOODS OF QUALITY
SERVED WITH CIVILITY”

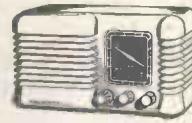
BARTON'S (Radio) LIMITED
42 · TOTTENHAM COURT ROAD,
LONDON · W.1.
Telephones: LANGHAM 1151/2

TELEVISION

TERMS OF BUSINESS : Cash with order (or C.O.D. Post items only); all orders for small items totalling over 2/- post free unless otherwise stated.

BUILD YOUR OWN RADIO!

We can supply all the parts (including valves, 5in. moving-coil speaker, cabinet, chassis, and every thing down to the last nut and bolt) to enable YOU to build a professional looking radio. The chassis is punched and drilled ready to mount the components. There is a choice of any of three attractive cabinets 12in. long, 5in. wide by 6in. high as follows: either ivory or brown bakelite, or wooden, finished in walnut. Complete and easy-to-follow point-to-point and circuit wiring diagrams supplied.

**Model 1 T.R.F RECEIVER**

This is a 3 valve plus metal rectifier T.R.F. receiver with a valve line-up as follows: 6K7 (HF), 6J7 (Det) and 6V6 (Output). The dial is illuminated and when assembled the receiver presents a very attractive appearance. Coverage is for the Medium and Long Wave bands. Operates on 200/250 volts A.C. mains.

PLUS 2/6 PACKING,
CARRIAGE & INSUR.

£5 · 15 · 0

T.R.F RECEIVER

To those who require this Receiver ready-built we can supply it at £6 · 19 · 6 plus 3/6 packing, carr. and insurance.

ALL COMPONENTS SUPPLIED GUARANTEED FOR ONE YEAR

NOTE: We would respectfully suggest to those interested in building these receivers that they send for OUR Instruction Booklets. Intending constructors can then judge for THEMSELVES how comprehensive these Booklets are.

Instruction Booklets and Priced Parts List available separately at 1/- This money will be refunded if the Booklet is returned as NEW within 7 days.

THE
IDEAL
GRAMOPHONE
AMPLIFIER

THE
IDEAL
MICROPHONE
AMPLIFIER

**Announcing a NEW
4 watt AMPLIFIER KIT**

This is a 3 valve-3-stage Amplifier for use with Gramophone, Microphone or Radio. Valve line-up is as follows—6SL7 ; 6V6; 5V3. Negative feed-back. Tone control and voltage adjustment panel incorporated. 4 watts output. For operation on A.C. Mains 200/250 volts.

The complete Kit, which includes every item down to the last nut and bolt, drilled and punched chassis, and comprehensive point-to-point wiring circuit diagram can be supplied at

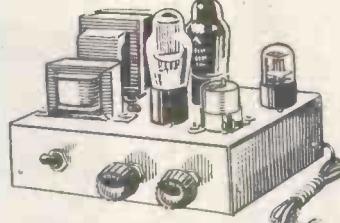
PLUS 2/6 PACKING,
CARRIAGE & INSUR.

£4 · 19 · 6

The Output Transformer supplied is for use with a loudspeaker of 3 ohms impedance and we would suggest that the output of the completed amplifier justifies the use of one of the latest W.B. H.F. Speakers which can be supplied as follows:—5in., 60/6; 9in., 67/-; 10in., 73/6. All plus 2/6 pkg., carr., insur.

Circuit Diagram only, available separately at 1/-.

To those who require this Amplifier ready-built we can supply it at 25.19.6 plus 3/6 pkg., carr., ins.



ALL COMPONENTS
SUPPLIED GUARANTEED
FOR ONE YEAR

BATTERY CHARGER KIT
Incorporates metal rectifier. Transformer is suitable for A.C. mains 200/250 volts. Charges either 12, 6 or 2 volt accumulator at 1 amp. Complete with circuit diagram. Price 22/6, plus 1/6 post and packing.

CHARGER TRANSFORMER
For charging 6 v. at 1 amp., 8/3 plus 1/- p.p.

ELIMINATOR AND 2V TRICKLE CHARGER UNIT—BRAND NEW MANUFACTURERS' STOCK
For use on A.C. mains 200/250 v. Smoothed output of 12 or 18 mA. at 150 v. Voltage panels tapped at 50, 60, 75, 80, 90 and 150 volts. Housed in strong metal case, meas. 6in. long, 8½in. wide, 3½in. deep. Normal price £5/15/-
Complete with instructions and in manufacturers' orig. carton plus 2/6 post, carr., ins.

77/6

MAINS NOISE SUPPRESSOR KIT
Consisting of 2 specially designed chokes and 3 condensers. Extremely effective, cuts out all mains noise. Can be assembled in existing receiver or separately as desired. Complete with circuit diagram, 4/11, plus 1/- p.c.

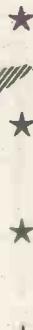
QUALITY GOODS · MONEY BACK GUARANTEE · PROMPT DESPATCH

CONSTRUCTOR'S PARCEL

We can supply the basic parts to help you construct the radio illustrated above. Most radio enthusiasts have stocks of small components such as condensers, resistors, valves, etc., around their workshop. For those people we supply a special constructor's parcel of the main components to enable them to build a set of their own circuit. This parcel consists of: Cabinet (Bakelite) in Ivory or Brown. Or wooden (as above), 17/6, plus p. & c. 2/6. Punched chassis, 3 valves T.R.F., 3/0. Dial front plate, 2/6. Dial M. and L. with station names, 1/6. Drum 1/6. Driving head, 1/6. Double pointer, 4d. Spring, 3d. Chassisfixing bracket, 9d. pr. T.R.F. coils, 180-550, and 800-2,000 metres, 5/6 pr. The above items may be purchased separately or as a complete parcel at 31/-, plus p. & c. 2/6.

Comprehensive stocks available of such small items as:—bolts; nuts; washers; solder tags; resistance wire; tinned and enamelled copper wire; blank aluminium chassis (reinforced corners); croc. clips; wander plug and sockets; and other items too numerous to mention, all of which are useful to constructors. We invite your inquiries.

NOW BEING
DEMONSTRATED
AT OUR SHOP!
TIMES OF BUSINESS:
MON. to FRI. 9-6 p.m.
SAT. 9-1 p.m.



MAINS TRANSFORMERS

Primary, 200-250 v. P. & F. 2/-.
300-400, 100 mA., 6 volt 3 amp.,
5 volt 2 amp., 22/6.

Drop thro' 350-0-350 v. 70 mA., 6 v.
2.5 amp., 5 v. 2 amp., 14/6.

Drop thro' 250-0-250 v. 80 mA., 6 v.
3 amp., 5 v. 2 amp., 14/6.

Drop thro' 110-110 60 mA., 6 v. 0.5
amp., 8/6.

280-0-280, drop through, 80 mA.,
6 v. 3 amp., 5 v. 2 amp., 14/6.

250-0-250 80 mA., 6 v. 4 amp., 14/-.
Pri. 230 v. Sec. 200-0-200 35 mA.,
6 v. 1 amp., 8/6.

Pri. 200/250 v., secondary 3, 4, 5, 6,
8, 9, 10, 12, 15, 18, 20, 24 and 30 volt
at 2 amps., 13/-.

Drop thro' 280-0-280, 200 mA., 6 v.
5 amp., 5 v. 3 amp., 27/6.

Drop thro' 270-0-270 80 mA., 6 v.
3 amp., 4 v. 1.5 amp., 13/6.

Drop thro' 270-0-270 60 mA., 6 v.
3 amp., 11/6.

Heater Transformer. Pri. 230-250 v.
6 v. 1½ amp., 6/-; 2 v. 2½ amp., 5½/-;
2.4 v. 6 v. at 2 amps., 7/6; 2 v. 2½ amp.;
and 6 v. 0.6 amp. E.H.T. insulated,
8/6. P. & P. each 1/-.

Input 200/250 sec., v. 6.3, 6 amp., 4 v.
4 amp., 2 v. 2 amp., 14/6. P. & P. 1/6.
1000-0-1000 250 mA. 4 v. 3 amp.,
37/6. P. & P. 5/-.

P.M. SPEAKERS (closed field)

	with	less
2½ in.	trans.	trans.
3½ in.	.....	15/6
5 in.	.....	13/6
6½ in.	.....	16/6
8 in.	.....	12/6
8½ in.	.....	18/6
P. & P. on the above 1/ each.		15/-
10 in. less trans., 19/6. P. & P. 1/6.		
5 in. M.E. field coll 750 ohms with O.P. trans., 17/6. P. & P. 1/-.		
Truvox BX11. 12in. P.M. 5 ohm speech coll., 45/- P. & P. 3/6.		
6 in. M.E. Speaker, 1,000 ohm field 15/- P. & P. 1/6.		
E.R. & A. T.V. Energised 6½ in. speaker with O.P. trans., 6½ in. 6½ matching, field coil 175 ohms. Requires a minimum 150 mA. to energise, maximum current 250 mA. 15/- P. & P. 2/-.		
Extension Speaker Cabinet, in contrasting walnut veneer, size 15 x 10½ in. Will take 6½ or 8 in. speaker 17/6. P. & P. 2/-.		
Volume Controls, Long spindle less switch, 50K, 500K, 1 meg., 2/6 each. P. & P. 3d. each.		
Volumes Controls, Long spindle and switch, 1/2, 1 and 2 meg., 4/- each; 10K & 50K, 3/6 each, 1 and 1 meg., long spindle double pole switch, minia- ture, 5/- P. & P. 3d. each.		
Trimmers, 5-40 pf., 5/-; 10-110, 10-250, 10-450 pf., 10/-.		
Twin-gang .0005 Tuning Condenser, 5/- With trimmers, 7/6. P. & P. 1/6. Line Cord, 2-way 0.3 amp., 60 ohms, per foot, 1/3 per yard.		
Twin-Gang .0005 with feet, size 3½ x 3½ in., 6/6.		
3-gang .0005, with feet, size 4½ x 3 x 1½ in. 7/6.		
Hoover Variable Speed 600-1,200 rev. Tape Recording Motor. Silent running, 200/250 v. A.C. Shaded pole with bearing. Weight 5 lb., 27/6. Plus P. & P. 2/6.		
PERSONAL SHOPPERS ONLY. 9 in. Enlarger 17/6, 12in. 27/6.		
Germanium Crystal Diode, 2/3 post paid.		
Television Masks, White Rubber 9in. with glass, 7½. Green Rubber, 12in., with armour-plate glass, 15/-, 18in. Cream, 17/6 plus 1/6 P. & P. 2/6.		
T.V. Width Controls, 3/6.		
T.V. Sub Assembly, all-chassis, 12in. x 3½ in. with frame osc., line osc., 12 mfd., 275 wkg., Metrosil, 8 condensers, 4 resistors and tag panel 15/-, P. & P. 1/6.		
CRYSTAL PICK-UP by famous manu- facturer complete with sapphire trailer needle and volume control 23/- P. & P. on each 1/-.		
Amplifier case, black rexine covered- leather carrying handle, chrome plated corners, rubber feet, felt lined, detach- able lid. External dimensions, 13½ x 18½ x 9½ in., £1. P. & P. 2/6.		
Mains Delters, 0.3 amp., 460 ohms, tapped 280 and 410, 1/8; 0.2 amp., 717 ohms, tapped at 100 ohms, vitreous, 1/6; 0.3 ohms, 950 ohms, tapped 700 and 825, 2/6; 0.2 amp., 1,000 ohms, vitreous, tapped, 2/6; Vitreous .3 amp., 700 tapped 680, 640, 600, 3/6. P. & P. on each 3d.		

D. COHEN

RADIO AND
TELEVISION COMPONENTS

Terms of Business: Cash with order. Despatch of goods within 3 days from receipt of order. Where post and packing charge is not stated please add 1/- up to 10/-, 1/6 up to £1, and 2/- up to £2. All enquiries and lists, S.A.E.

SPECIAL NOTE: NO GOODS SENT WHERE CUSTOMS DECLARATION IS APPLICABLE.

23 HIGH STREET (Uxbridge Road)
ACTON, W.3 Telephone: ACOrn 5901

Hours of Business: Saturday 9—6 p.m. Wednesday 9—1 p.m. Other days 9—4.30 p.m.

HIGH-IMPEDANCE PLASTIC RECORDING TAPE, by famous manufacturer, 1200 ft., on aluminium spool. 17/6, post and pkg. 1/6.



change switch, 2/-; 32 x 32 mfd., 4/-; bias condenser, 1/-; resistor kit, 2/-; condenser kit, 4/-.

M. & L. Superhet Coils with circuit, 6/6; iron cored 46 IFs, 7/6; min. gang, 5/6; volume control with switch, 4/-; wave-change switch, 2½ in.; heater trans., 7/6; 4 v.b.; obsolete ex-Govt. valves, metal rectifier a-d Xtal diode with circuit, 14/6; 25 x 25 mfd., 1/-; 16 x 16 mfd., 3/3; condenser kit (17), 7/6; resistor kit (14), 3/6.

USED 4-VALVE PLUS METAL REC. A.C. MAINS 230/250 SUPERHET. Valve line-up: 6K8, 6K7, 6A7 and 6P6. Medium wave, in mahogany cabinet, size 14 x 9 x 7½ in. These have been checked and are in first-class working order, and first-class performance. 64in. P.M. We have checked and are in first-class working order, and first-class performance. 64in. P.M.

USED 5-VALVE REC. A.C. MAINS 200/250 3 WAVEBAND SUPERHET. Complete in outstanding walnut cabinet, size 22 x 14 x 10½ in. Valve line-up: 6K8, 6K7, 6BBG, 6F6, and U50 rec. 8in. P.M. speaker. In first-class working order. £7/19/6. P. & P. 12/6. We have a few of these in A.C.D.C. price as above, or £2/10/- dep., 6 monthly payments of £1/1/-.

T.V. POWER SUPPLY CHASSIS size 13 x 5½ in. A.C. mains 200/250 v. Complete with smoothing choke, mains transformer, 40 mfd., 350 wkg., 3.16 mfd., 450 wkg., 32 mfd., 480 wkg., 5½4G, twin mains fuse, 1½ pin output socket and mains lead. Smoothed output 350 v. 200 mA. heaters 6.3 v. 7 amp., 70/6. P. & P. 5/-.

FULLY SHROUDED MAINS TRANSFORMER, input 110/250, sec. 350-0-350 175 mfd. 6.3 v. 7 amp., 5 v. 3 amp., 35/- P. & P. 3/-.

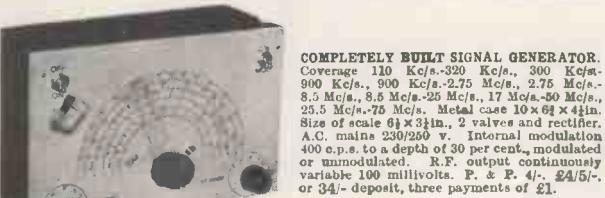
FULLY SHROUDED PUSH-PULL TRANS. Pri. 6,000 ohms, sec. 15 ohms (2 L66's in push-pull) £1. P. & P. 2/-.

FULLY SHROUDED CHOKE 16 Henry 180 mfd., 15/- P. & P. 2/-.

FULLY SHROUDED CHOKE 5 Henry 120 mfd., 8/6. P. & P. 2/-.

These last four items by very famous manufacturer.

USED C.R.T. TUBES. Heater cathode short 9in., 45/- 12in. 75/- Ion burn 9in., 35/- 12in. 55/- P. & P. on each 7/6.



COMPLETELY BUILT SIGNAL GENERATOR.

Coverage 110 Kc/s.-320 Kc/s., 300 Kc/s.-
900 Kc/s., 900 Mc/s.-2.75 Mc/s., 2.75 Mc/s.-
8.5 Mc/s., 8.5 Mc/s.-25 Mc/s., 17 Mc/s.-50 Mc/s.,
23.5 Mc/s.-75 Mc/s. Metal case 10 x 6½ x 4½ in.
Size of scale 6½ x 3½ in., 2 valves and rectifier.
A.C. mains 230/250 v. Internal modulation
400 c.p.s. to a depth of 30 per cent., modulated
or unmodulated. R.F. output continuously
variable 100 millivolts. P. & P. 4/6. 24/5/-
or 34/- deposit, three payments of £1.



CONSTRUCTOR'S PARCEL

comprising chassis 12½ x 8 x 2½ in.,
cad. plated 18 gauge, v.h., 1½ in.
and trans. cut-outs, back-
plate, 2 supporting brackets, 3
waveband scales, new wave-
length station names. Size
of scale 6½ x 3½ in., 2 valves and rectifier.
A.C. mains 230/250 v. Internal modulation
400 c.p.s. to a depth of 30 per cent., modulated
or unmodulated. R.F. output continuously
variable 100 millivolts. P. & P. 4/6. 24/5/-
or 34/- deposit, three payments of £1.

BATTERY CHARGER KIT comprising metal case 4½ x 5 x 4½ in., transformer 230/250 v., and metal rectifier. Will charge 6 or 12 v. battery 1½ amp. 19/6. P. & P. 2/6.

PERSONAL PORTABLE CABINET. In cream-coloured plastic; size 7 x 4½ x 3½ in. Complete 4-valve chassis. Scale and 3 knobs. Takes miniature 90 v. and 7½ v. batteries 9/- post and pkg. 1/6.

3½ in. P.M. Speaker to fit above, 10/-. Miniature output transformer, 5/-. Miniature wave-change switch, 1/6. Miniature 1-pole 4-way used as Volume and Off, 1/6. 4L70 valve 11½ in. 2½ in. Midget twin gang tin dia. 1½ in. long and pair medium and longwave T.R. coils 1½ in. long x 1½ in. wide; complete with 4-valve all-dry mains and battery circuit 8/8. Condenser Kit, comprising 11 miniature condensers, 3/6. Resistor Kit comprising 16 miniature resistors 4/-. The above receiver (less valve and batteries) could be built for approximately 51/- All valves to suit above available. Point to Point Wiring Diagram 1½/-.

R.L. MAINS TRANSFORMERS, chassis
mounting, feet and voltage panel
Primaries 200/250.

300-0-300 60 mA. 6.3 v. 1 a., tapped at
4 v. 6.3 v. 2 a., tap 4 v., 13/6.

350-0-350 75 mA. 6.3 v. 3 a. tap 4 v.
6.3 v. 1 a., 13/6.

350-0-350 70 mA. 4 v. 5 a. 4 v. 2.5 a.
18/6. P. & P. on the above
transformers, 2/-.

500-0-500 125 mA. 6.3 v. C.T. 4 a.
6.3 v. C.T. 2 a. 5 v. C.T. 2 a., 27/6.

500-0-500 125 mA. 4 v. C.T. 4 a. 4 v.
C.T. 4 a. 4 v. C.T. 2.5 a., 27/6.

500-0-500 250 mA. 4 v. C.T. 5 a. 4 v.
C.T. 5 a. 4 v. C.T. 2.5 a., 39/6.

P. & P. on the above transformers 3/-.

Line and E.H.T. transformer 9KVA, using ferric core complete with built-in-line and width control. Mounted on small all-chassis. Overall size 4½ x 1½ in., EY51 rec. winding. 27/6. P. & P. 2/6.

Valve Holders, moulded octal Mazda and loctal, 7d. each. Paxolin, octal, Mazda and loctal, 4d. each. Moulded B7G, B7V, B7A and B9A, 7d. each. B7G mounted with screening can, 1/6 each.

32 mfd., 350 wkg. 2/-
16 x 24 350 wkg. 4/-
4 mfd., 200 wkg. 1/3
40 mfd., 450 wkg. 3/6
16 x 8 mfd., 500 wkg. 4/6
16 x 16 mfd., 500 wkg. 5/9
18 x 16 mfd., 450 wkg. 5/9
32 x 32 mfd., 350 wkg. and 25
mfd., 25 wkg. 6/6
25 mfd., 25 wkg. 11d.
250 mfd., 12 v. wkg. 1/-
16 mfd. 500 wkg., wire ends ... 3/3
8 mfd., 500 v. wkg., wire ends ... 2/6
8 mfd., 350 v. wkg., tag ends ... 1/6
50 mfd., 25 v. wkg., wire ends ... 1/9
100 mfd., 350 wkg. 4/-
100-120 mfd., 350 wkg. 9/6
12-14 mfd., 350 wkg. 3/3
Ex-Govt. 8 mfd., 500 v. wkg.,
size 3½ x 1½, 2 fo. 2/6
16 x 32 mfd., 250 wkg. 6/-
50 mfd., 180 wkg. 1/9
65 mfd., 220 wkg. 1/6
8 mfd., 150 wkg. 1/6
60+100 mfd., 280 wkg. 2/6
12-16 mfd., 12 wkg. 11d.
33+32 mfd., min., 275 wkg. 4/-
50 mfd., 50 wkg. 1/9
Miniatire wire ends moulded,
100 pt., 500 pt., and .001 ea. 7d.

Combined 12in. mask and escutcheon in lightly tinted perspex. New aspect, edged in brown. Fits on front of cabinet, 17/6. P. & P. 2/-.

Frame Oscillator Blocking Trans. 4/6. Tube Mounting Bracket, size 9½ x 4½ in., 12in. tube clamps, 2/-.

Smoothing Choke, 2 henry 150 m.a., 3½, 250 mA. 3亨利. 5亨利, 5/-; 280 mA., 10 henry, 10/6; 5 henry 250 m.a., 60 ohms, 8/6.

P.M. Focus Unit for any 9 or 12 in. tube except Mazda 12in., with Vernier adjustment, 15/- P. & P. 1/6.

P.M. Focus Unit for Mazda, 12in., with Vernier adjustment 17/6. P. & P. 1/6. Wide Angle P.M. Focus Units, Vernier adj., state tube, 25/- P. & P. 2/-.

Embossed Focus Coil, low resistance mounting bracket, 17/6 plus 2/- P. & P. Scan Coils, low line high impedance frame, complete with O.P. transformer. 17/6. P. & P. 2/-.

Ion Traps for Mullard or English Electric tubes, 5/- post paid.

465 kc. L.F.s, size 2½ x 1½ in. Q.110 removed from American equipment. 5/- per pair. Standard 465 Kc. Iron-cored IFs, 4 x 1½ x 1½ in., per pr. 7½. Wearite standard iron-cored 465 Kc. Ifs, 3½ x 1½ x 1½ in., per pr., 9/6.

Iron-cored 465 Kc. Whistle filter, 2/6.

OUTPUT TRANSFORMERS. Standard type, 5,000 ohms imp., 4/9. 42-1 with extra feed-back windings, 4/3. Miniature 42-1, 3½. 3. Multi-winding, 3,500, 7,000 and 14,000, 5/6. 10-watt push-pull, 6½ matching 7½. 90-1 3 ohm speech coil, 6/6.

PUSH-BACK CONNECTING WIRE. Doz. yds., 1/6, post paid.

STANDARD WAVE-CHANGE SWITCHES. 4-pole 3-way, 1/9; 5-pole 3-way, 1½; 3-pole 3-way, 1/9; 9-pole 3-way, 3½; Miniature type, long spindle 3-pole 4-way, 4-pole 3-way and 4-pole 2-way, 2/6 each. P. & P. 3d.

465 KC. MIDGET L.F.s. Q.120, size 1½ in. long, 1½ in. wide, 1½ in. deep by very famous manufacturer. Pre-aligned adjustable iron-just cores, per pair, 12/8.

Prices slashed at Clydesdale

F24 AIRCRAFT CAMERA in Transit Case.



Full Details:

Lens S.11, f/4 with internal iris diaphragm stops to f/11, fixed focus set at infinity, screw-in housing projects 5½ in. Focal plane shutter, speeds 1/60th to 1/1,000th of a second and time, fitted in film magazine designed for 5½ in. wide film, picture size 5½ x 5½ in. Shutter release and rewind spindle for standard spanner. Hand operated as it stands. Nett weight 17lb. Packed in fitted transit case 42lb. Dimensions: body 6½ x 9 x 9½ in., overall including lens housing 11½ x 9 x 9½ in. Provision for external motor drive (not supplied). Lens housing grooved for fitting to aircraft camera port. A precision Air Survey Camera, could be adapted for Laboratory, Industrial or Portraiture use.

ASK FOR X/H302 £4.19.6 each CARRIAGE PAID

F24 AIRCRAFT CAMERA in Transit Case. With 8in. f/2.9 lens, otherwise as H.302. ASK FOR X/H300 £9.19.6 each CARRIAGE PAID

1in. f/5.6 LENS FOR F/24 CAMERA Complete with Iris, Filter, Mount and Extension. In Transit case. ASK FOR X/H563 £6.19.6 each CARRIAGE PAID

CAMERA CONTROL ELECTRICAL, type 35 No. 20, Ref.: 14A/3208, Input 24 volts D.C. Time interval selection switch 15-51 second, calibrated in height, thousands of feet. Suitable as the basis of an enlarger timer or many other timing uses. Dim.: 8 x 3½ x 4½ in. overall including controls. In Transit Case.

ASK FOR X/H962 15/- each POST 1/6 EXTRA

RECORDER MK. II 24 VOLTS As previously described, Used. Good condition, in Transit Case. ASK FOR X/H883 27/- each POST PAID

ONLY AVAILABLE with Recorder Mk. II. Film Cassette, 25ft. Capacity. ASK FOR X/H960 10/- each POST PAID

We are unable to supply external fittings or films for these units at present.

GLASS DOME INSULATOR, with Threaded Terminal Top and Metal Lead-through Rod. Dome dim.: 2½ x 1½ in. high, lead-through projects 6½ in. Overall length 9½ in. ASK FOR X/H54 2/- each POST 3d. EXTRA

CERAMIC AERIAL SPREADER individually boxed. Length overall 11in., between centres 9½ in. ASK FOR X/H718 1/- per pair POST 3d. EXTRA

BLACK PLASTIC CHAIN AERIAL INSULATORS Comprising 3 links, 3½ in. long, 1½ in. wide, each link. Total length 7½ in. A.M. ref. 10A/1275. ASK FOR X/H525 9d. per pair POST 3d. EXTRA

TRANSMITTER TUNING UNITS

Each having Vernier tuning dial, Variable Capacitor, Tank Coil unit on ceramic former, Ceramic Switch, etc., etc. In metal cabinet 17½ x 7½ x 8in. Finish black. Unused, but externally soiled, scratched and dented, due to being loose stored.



TU.7B Range 4,500-6,200 Mc/s. Ask for X/H29. TU.8B Range 6,200-7,700 Mc/s. Ask for X/H30. TU.9B Range 7,000-10,000 Mc/s. Ask for X/H467. EITHER UNIT 10/- each CARRIAGE 2/- EXTRA

I.F. RECEIVER R3108. Ref.: 10DB/505 Contains Motor Generator Input 12 v. 3.8 A. Output 480 v., .04 A. D.C. with a gearbox operating a switching mechanism to detune the receiver at time intervals. Data available for converting to 250 v. 50 c/s use as motor. Plus: 4/VR65A (SP.4), 2/VR92 (EA50), 2/CV6 (Det. 20). Valves, etc., etc. Metal case: Dim. 12 x 12 x 8in. Wgt. 24lb. ASK FOR X/H961 19/6 each CARRIAGE PAID

26 WATT OUTPUT TRANSFORMER Parmeko type AF5084/IA (Mfg. Surplus). Primary: 6,600 ohms. C.T. Sec's. 3.5, 5, 7.5 or 10 ohms. Dim.: 3½ x 2½ x 3½ in. Fully shrouded. Wgt. 3lb. ASK FOR X/H565 19/6 each POST PAID

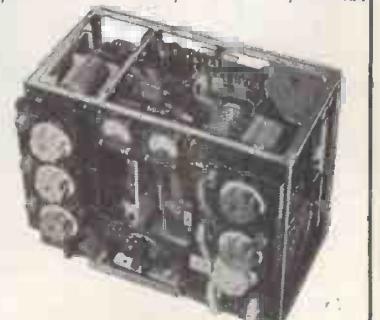
WAVE FORM GENERATOR TYPE 26 With valves VR55, 2/VR54, VR116, 3/VR56, 6/VR65, 2 relays, plus cond., etc. Input 80 v. 2,000 c/s A.C. In metal case: 12 x 7½ x 11½ in. ASK FOR X/H884 21/- each CARRIAGE 2/6 EXTRA

RI155 RECEIVER UNIT Communications, D.F. and "ham", 20, 40, 80, 5 ranges 18-7.5 Mc/s., 7.5-3 Mc/s., 1,500-600 Mc/s., 500-200 kc/s. and 200-75 kc/s. Complete with 10 valves. S.M. drive, M.E. tuning, B.F.O., etc. In metal case 16½ x 9 x 9in. External Power Supply required. Used, good condition. In Transit Case. ASK FOR X/H916 £8.19.6 each CARRIAGE PAID

RI155, as above, but loose stored. ASK FOR X/H898 £5.19.6 each CARRIAGE 7/6 EXTRA

TI154 TRANSMITTER UNIT Medium/high powered for C.W.-M.C.W. R/T, 3 ranges 10-5.5 Mc/s., 5.5-3 Mc/s., 500-200 kc/s. Complete with 4 valves, etc., in metal case 14in. x 16½in. x 8½in. External Power Supply required. ASK FOR X/E54 39/6 each CARRIAGE 7/6 EXTRA

TI154 as above, but less valves. ASK FOR X/E58 15/- each CARRIAGE 7/6 EXTRA



VISUAL INDICATOR TYPE I, Ref. 100/2

Dual reading left/right D.F. meter for RI155, 2½ in. Scale overall dim.: 3½ in. x 2½ in. In used condition. Ask for X/H862A

12/6 each Post Paid.



POWER UNITS FOR TI154/RI155 UNITS

Each a Motor Generator Unit, smoothed, etc., in metal case 16in. x 7½in. x 6in.

LOOSE STORED.

Types 33 or 33B, Input 24 v. D.C. 16A. Output 1,200 v. D.C. 200 mA.

ASK FOR X/E7A 42/6 each CARRIAGE PAID

Type 35A. Input 18 v. D.C. 12 A. Outputs 7.2 v. D.C. 13 A. and 225 v. D.C. 110 mA.

ASK FOR X/E8A £1.00 each CARRIAGE PAID

Order direct from:-

CLYDESDALE

Phone: South 2706/9

SUPPLY CO. LTD. 2, BRIDGE STREET,

GLASGOW - C.5

Branches in Scotland, England and Northern Ireland.

RECEIVERS • TEST EQUIPMENT • AMPLIFIERS • RECORDERS, ETC.

Britain's most comprehensive Suppliers of Electronic Equipment for "Hams" and Industry.

All readers are cordially invited to call and inspect our stocks.

AMPLIFIERS • RECORDERS • SOUND EQUIPMENT

The latest Webster Tape Recorder in case (1953), £75. TRISETTE 3-speed player as NEW £25. Baird type 2 tape recorder, £45. Microphones. Lustraphone, STC, Ronette, Tannoy, etc. Rogers Amplifiers, £20. Disc cutting gear MSS, BSR, U.S.A. 2-speed motors and cutting gear 10 v., £11. Loudspeakers in stock. Goodmans, Wharfedale, Vitavox, etc.

BRITISH TEST EQUIPMENT

AVO Model 7 as NEW, £15. Model 40, £12. AC/DC minor, £6/15-. Roller panel valve testers, £12. Electronic test meter by AVO, £30. Wide range signal generator, £22. AVO valve characteristic meter, £50. Taylor : 65B signal generator, £9. 65C signal generator, £13. 90A test meter, £10. 260A TV Wobblulator, as NEW £30. Evershed Wee meggers 500 v., £14. Bridge type and others in stock. Marconi : Signal generator types TFI44G, TFS17, TF390/G. Valve voltmeters, output meters. Marconi BFO type L0800A, etc. Cossor Double Beam oscilloscopes, type 3339, 339 from £35.

TRANSMITTERS

U.S.A. 1953 Harvey Wells, type TBS50. Phone CW, 80, 40, 20, 15, 10, 6 and 2 metres. Crystal Oscillator VFO switching. AS NEW. Less power supply, £45. ELMAC transmitter 50 w. Phone or CW. VFO or crystal control, 75, 20, 11, 10 bands. Dual scale meter, less power supply mobile or fixed, £50. Latest Job, £55 NEW. Hallicrafters HT17's, £25.

RECEIVERS

All receivers are in good working order and condition unless stated. SX28, 550 kc/s-42 Mc/s., £45. SX24, 550-42 Mc/s., £28. S20R, 550-42 Mc/s., £25. S20, £20. S29, AC/DC portable, battery 550-32 Mc/s., £25. S38

AC/DC 110-250 v. 550-30 Mc/s., £25. Also in stock S27, 30 Mc/s-150 Mc/s., S27CA, 150-230 Mc/s., HT11 A Marine 12 v. radiotelephones. HRO receivers junior and senior types with all coils and power supplies from £27, complete. National NC44, NR100, NC81X, NC200. Marconi CR100. 60 kc/s-30 Mc/s., £32. RME 69, £35. Eddystone receivers : Types 640, £22/10; 740, £35; 750, £50; 680, £65; 670, £35; 504, £25. RCA receivers, AR88D and LF from £55. Set of three dials for model D, £1/10-. **MANUALS** for the following receivers : AR88D-LF, AR77E, Marconi CR100, S20, S20R, B2 Transmitter/Receiver, H.R.O.s. Photostatic copies of originals £1/7/6.

Also in stock. Receivers by many other makers. MCRI receivers, £8. B2 Transmitter/Receiver, £20.

U.S.A. MICROWAVE TEST GEAR

No technical manuals for sale. Please write for prices.
TS3. S band power frequency meter. TS10. APNI Test set. TS13. AP. X band signal generator. TS14. S band signal generator. TS34. Radar Synchroscope. TS36. X band power meter. TS62. X band echo box. TS69. 300-100 Mc/s. frequency meter. TS127. 300-700 Mc/s. frequency meter. TS226. 300-1,000 Mc/s. power meter. BC221. Frequency meter (Bendix). BC1277. S band signal generator. TS45/AP. 3 cm. signal generator. I-222A. 8-15 Mc/s., 150-230 Mc/s. signal generator. IE-19 signal generator. TS89. Pulse voltage divider. TS47. 40-500 Mc/s. signal generator. TS174. 20-250 Mc/s. FERRIS. 22A signal generator, Dumont scope, type 224A. GENERAL RADIO 804B. 300-300 Mc/s. signal generator.

RECEIVERS • KLYSTRONS • MAGNETRONS

American Receivers. APR4 and tuning units. 30-1,000 Mc/s., APR5, 1,000-6,000 Mc/s. Klystrons 723/AB, 707A, 707B, CV129. Magnetrons 725A, 2132, 2K33, 2K25, TR cells 1B24, and many other items of equipment covering HF, VHF, UHF and centimetric bands.

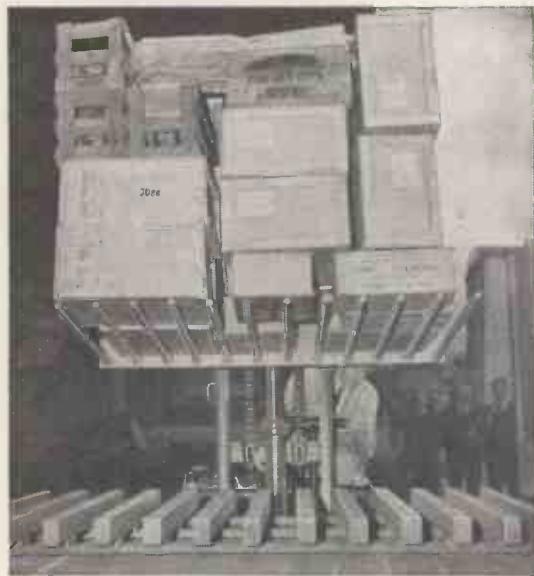
★ OUR ONLY ADDRESS IS WE ARE ALWAYS PREPARED TO PURCHASE EQUIPMENT SIMILAR TO THE RANGE NOW OFFERED

UNIVERSAL ELECTRONICS

*27 LISLE STREET, LEICESTER SQ., LONDON, W.C.2

Shop hours, 9.30 a.m. to 6 p.m.

Write, Call or Telephone
GERrard 8410 (Day)
MEAdway 3145 (Night)



This system, described recently in MECHANICAL HANDLING, eliminates the need for pallets to travel in vehicles. Goods are stacked on the corrugated wooden structure, the multi-fork device then being inserted into the spaces beneath the load. The latter is then lifted.

MECHANICAL AIDS TO PRODUCTIVITY

NEW IDEAS solve old problems

In the production of many articles handling may account for up to 80% of the final cost ; it is usually the biggest expense factor. This old problem can be solved by modern ideas, layouts and equipment.

MECHANICAL HANDLING—the monthly British journal devoted entirely to the subject—provides technical and general information on handling schemes and devices for every industry. Articles by experts, drawings, diagrams, charts and photographs explain clearly how the planned use of the latest equipment can immediately slash movement costs and accelerate output. The picture shown here is just one example. MECHANICAL HANDLING will keep you and your executives fully informed . . . your Organization in the forefront. Complete the coupon below and post to-day to make certain of the current issue.

TO _____
W.W.2.

MECHANICAL HANDLING

DORSET HOUSE • STAMFORD STREET • LONDON S.E.1

Please enter my name as a subscriber for the next 12 issues. I enclose remittance value £1 15s. (U.S.A. \$5.00, Canada \$5.00.) Remittances from overseas should be made by money order or bank draft in sterling on London out of a registered account.

Name Address

Date

POST THIS FORM TODAY



5 Harrow Road, Paddington, W.2

PADDINGTON 1008/9 and 0401

OPEN MONDAY to SAT. 9—6. THURS. 1 o'clock.

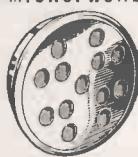
RADIO-GRAM CHASSIS

3 Wave-band Superhet. Med., long and short.
5 Latest Type MULLARD Valves.
4 Position Switching. Gram., med., long and short.
Provision for A.C. Mains Extension Speaker. 110/250 volts. Chassis 11in. x 7in. x 2½in. Scale Bin, Square. Or Chassis 13½in. x 6½in. x 2½in. Dial 10in. x 5½in. PRICE £10/5/-
BRAND NEW AND GUARANTEED CARR. PACKING AND INS. 10/-.

SEND
STAMPS
FOR
NEW
1954.
28-PAGE
CATALOGUE

CRYSTAL MICROPHONE INSERTS

8'6
POST FREE



8'6
POST FREE

Ideal for tape recording and amplifiers. No matching transformer required.

PYE 45 M/C.S. STRIP, TYPE 3583 UNITS

Size 16in. x 8in. x 2in. Complete with 45 Mc/s. Pye Strip, 12 valves, 10 EF50, 10 EB34 and EA50, volume controls and hosts of Resistors and Condensers. Sound and vision can be incorporated on this chassis with minimum space. New condition. Modification data supplied. Price £5. Carriage paid.

INDICATOR UNIT TYPE 182A

Unit contains VCB517 Cathode Ray 6in. tube, complete with Mu-metal screen, 3 EF50, 4 SP61 and 1 MU4G valves, 9 wire-wound volume controls and quantity of resistors and condensers. Suitable either for basis of television (full picture guaranteed) or Oscilloscope. Offered BRAND NEW (less relay) in original packing case at £7/6. Plus 7/8 car.

VOLTMETERS

15 v. (50 c.) A.C. M.I. 2½in. flush panel mounting	10/-
20 v. M.C. 2½in. square panel mounting	7/6
150 v. M.C. 2½in. flush panel mounting	10/-
3,000 v. M.C. 2½in. flush panel mounting	21/-
4,000 v. M.C. 2½in. flush panel mounting	21/-
3,500 v. M.C. 3½in. Projection	21/-

MILLIAMMETERS

500 Microamp. M.C. 2½in. round panel mounting	15/-
1 m.A. M.C. 2½in. square panel mounting	12/6
1 m.A. M.C. 2½in. flush panel mounting	22/6
5 m.A. M.C. 2½in. square panel mounting	7/6
10 m.A. M.C. 2½in. flush panel mounting	10/-
30 m.A. M.C. 2½in. round panel mounting	7/6
30 m.A. M.C. 2½in. flush panel mounting	10/-
50 m.A. M.C. 2½in. square panel mounting	7/6
200 m.A. M.C. 2½in. flush panel mounting	10/-
300 m.A. M.C. 2½in. flush panel mounting	10/-
500 m.A. M.C. 2½in. flush panel mounting	12/6

AMP-METERS

1 amp. T.C. 2½ Projection	6/-
3 amp. T.C. 2½in. square panel mounting	6/-
6 amp. T.C. 2½in. flush mounting	7/6
20 amp. M.I. 2½in. round	10/-
15 amp. M.I. (60 c.) Projection	35/-
30 amp. M.I. 2½in. panel mounting	7/6
300 watts 50 cy. A.C. 3in. dial projection type	50/-
M.C. = Moving Coll. M.I. = Moving Iron.	

T.C. = Thermally-Coupled.
All Meters are Brand New and in original cartons.

TRUVOX TAPE DECK MARK III

Incorporating high impedance mu-metal twin-track heads. Two-speed capstan, for tape speeds of 7½ and 3½ inches per second. Three heavy-duty motors allowing for fast forward and rewind facilities without tape handling. All controls operated by electrically and mechanically interlocked push buttons.



Price £23/2/-, carriage free. (Available from stock).

★ TAPE-DECK AMPLIFIER AND POWER UNIT ★
This unit is specially designed for the "Truvox" unit and we believe this quality amplifier lifts tape recording from the novelty, into the quality class.

★ 2—6BR7, 2—V6GT, 1—6JS, 1—6U5G ★ Variable selective negative feed back circuits ★ Variable tone control ★ Magic eye level indicator ★ Four watts undistorted output ★ Amplifier complete with valves, £13/5/-
Chassis size 10in. x 6in. x 2½in.

POWER UNIT (AC200/250 volts)
Chassis size 9in. x 5in. x 2½in., complete with 5Z4..... £4 15 0

Amplifier and Power Unit complete £16 16 0

COMPLETE KIT OF PARTS for Amplifier and Power Unit £13 10 0

CALL FOR DEMONSTRATION OR SEND FOR FULL DETAILS

6 WATT AMPLIFIER (UNDISTORTED)

Manufactured by Parmeko and Sound Sales for Admiralty 4 valves, PX25, 2-AC/HL, MUI4. Output Matching and 3Ω and 15Ω, 100/250 v. A.C.
COMPLETE IN STEEL GREY AMPLIFIER CASE

£12/10/-

CALL FOR DEMONSTRATION

R.F. UNITS

Type 24
20-30 Mc/s.
Switched Tuning.
With 3-SP61's.

15/- EACH
BRAND NEW.

Type 25
40-50 Mc/s.
Switched Tuning.
With 3-SP61.

19/6 EACH
BRAND NEW



R.F. UNITS

Type 26
50-65 Mc/s.
Variable Tuning.
2-VR136. I—VR137

45/- EACH
BRAND NEW

Type 27
65-85 Mc/s
Variable Tuning
2-VR136. I—VR137

45/- EACH
BRAND NEW.

T.V. PRE-AMPLIFIER FOR LONDON AND BIRMINGHAM

Complete with 6AM6. Ready to plug in to your set, 27/6. P.P. 2/6.

BOWTHORPE CONTINUITY METER

Dual scale 0-500 ohms and 100-200,000 ohms moving coil operated from 4½-volt internal battery. Size 6in. x 3in. x 4in. Original price £8/6/- Our price, brand new, £3/5/-

RECEIVER R1355.

As specified for "Inexpensive Television". Complete with 8 valves VR65 and 1 ea. 5U4G, VU120, VR92. Only 29/6, carriage 5/- Or brand new in original packing cases 55/- carriage 5/-

NO. 38 "WALKIE TALKIE" TRANS-RECEIVER

complete with Throat Mike, phones,

Junction Box and Aerial Rods in canvas bag.

Freq. range 7.4 to 9 Mc/s. Range approx. 5 miles. All units are as new and tested before despatch. £4/10/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in., 45/-

units are as new and tested before despatch.

Dimensions: 8½in. x 6½in. x 11½in.,

GW SMITH & CO. (RADIO) LIMITED

Racks. Standard P.O. "U" Channel type 6' with back screen 7½ each.

Uniselector Switches. 4 Bank double wiper 32/6 each ; ditto 8 Bank 45/- each.

Handsets. Standard P.O. telephone type 12/6 each.

A.C. Mains Transformers, suitable for many purposes. Input voltage 200/250 volts A.C. Output 45 volts 4 amps. Enclosed in attractive ventilated case with carrying handle. Size: 5in. x 4in. x 3in., 19½ each.

Ceramic Switches. 3 pole 4 way 4 bank, standard size wafer, 10/6 each.

ACOS Crystal Microphones Inserts. Tried and approved by many leading Hams. Extremely sensitive, 4/6 each.

American Rotary Transformers. 12 volts D.C. input. Output 255 volt at 65 M/a. Size 4½in. x 2½in. For Car Radio Operation. Also suitable for running Electric Shavers from your car supply, 22/6 each. Brand new.

Muirhead Switches. Precision built. 8 pole 2 way. Key switch action, brand new, boxed, heavy contacts, 4/6 each.

Valves. VU111, 4 volt E.H.T. Rectifier output 6,000 volts 50 M/a., brand new and boxed, 2/6 each. SP61 ex-units, 2/6 each. EF50 ditto, 3/6 each.

Transformers. Ex-W.D. A.C. input 230 volt 50 cycle. Outputs 330 x 330 volt at 100 M/a., 4 volt 3 amp., 10/6 each.

Ceramic Transmitter Switches, with extra heavy duty silver-plated contacts, 3 bank single pole 6 way, spacing between contacts lin. spacing between wafers 1½in. and 5in., 9/6 each.

Venner Hour Meters for Time Recording, capacity zero-10,000 hours, incorporating synchronous 200/250 volt 50 cycle motor. For component and instrument life check. Brand new, 69/6 each.

Midget Model Motors for operation on 24 volt A.C./D.C. 2in. x 1½in. diameter with drive pulley, 1/100 h.p., with built-in variable speed governor 5,000/600 r.p.m., 5/6 each.

Mains Isolation Transformers for industrial purposes. 230 volt A.C. 50 cycles input. Output 230 volt 50 cycle 1,000 watts, supplied complete in heavy duty metal case, size 13in. x 10½in. x 8in. Price £6/10/-.

Smoothing Chokes. Heavy duty. 20 Henry 300 M/a., 2,000 volt insulation test, Admiralty rating will pass 500 M/a., 17½ each.

American R.U.19 Test Meter 0-35 M/a., 2½in., complete with black crackle case. Brand new, 10/6 each.

Mains Transformers. 230 volt Primary, Secondary 500 x 500 at 170 M/a., 4 volt 4 amp. C.T. W.D. rating insulation test 3,000 volts. Ample space for additional 6.3 winding if required, 22/6 each.

H.R.O. 6 volt Vibrator Power Packs. Output 165 volt 80 M/a., 6.3 volt at 3 amps., 6 x 5 rectifier. Choke condensers smoothed, complete in self-contained crackle cabinet size 7in. x 7½in. x 6in., battery leads with croc. clips supplied. Brand new, 29/6.

Ceramic Switches. Standard spacing, 4 pole 3 way 3 bank. Special price 6/6 each. Brand new and boxed.

Indicator Units, Type 96. Brand new in sealed boxes. Complete with VCR97 tube, 6SP11, 2 EB34 valves. High voltage condensers. Pots resistors, etc., etc. The unit for Television of Scope conversion. Our price 52/6 each.

Smoothing Chokes. Ex-W.D. 15 Henries at 275 M/a. Ministry rating, resistance 125 ohms, 10/6 each.

Meter Switches. Standard Yaxley Wafer Type, 8 bank, single pole 9 way, 11 way or 12 way. Size 2½in. diameter, switch length 5½in. plus spindle, 2½in. Price 7/6 each.

A.C. Mains Transformers, 0/230 to 250 volt 50 cycle input. Outputs 250 volts h/w 60 M/a., 6.3 volt 1½ amps. Size 3in. x 2½in. x 2½in., with fly leads, brand new, 8/6 each.

Microamp Meters. 0-100 Microamps. 2½in. Flush Panel Mounting scaled 0-1,500 yards. Brand new and boxed. 42/6 each.

Rotary Convertors. 24 volt D.C. input. Output 230 volt A.C. mains 50 cycle at 100 watts. 92/6 each, ditto 12 volt input, 102/6.

Mains Transformers. Input voltages 200/250 at 50 cycle. Output 350 x 350 volt 180 M/a. Lt. Windings 6.3 volt, 5 amp., 5 volt 3 amp. Brand new. Ex-W.D. 29/6 each.

Charging Transformers. 200/250 volt at 50 cycle. Outputs 14 volt 1½ amps also 4 volt 1½ amps. Brand new, 7/6 each.

Chokes. Heavy Duty Ex-W.D. 20 Henry 120 M/a., size 3in. x 4in. x 2½in. 10/6 each.

Please print your name and address clearly, also include postage or carriage on all items.

Hours of Business : 9 a.m.-6 p.m., excluding Thursday, 1 p.m. Open all day Saturday.

G.W. SMITH & CO., (RADIO) LTD.
3-34 Lisle Street, London, W.C.2
Telephone: Gerrard 8204/9155

Nearest Tube Stations: Piccadilly or Leicester Square.

RADIO TRADERS LTD.

23 WARDOUR ST., LONDON, W.I. (Coventry Street end)
Phone No. GERrard 3977/8
Grams: "Radiotrade"

Component Specialists for 20 years.
The Largest Selection of Radio and
Electronic Components in the Country.

SPECIAL OFFER

CONDENSERS

	Per doz.
16 x 8 Mfd. Metal Cans Electrolytic, 350 v.	15/-
32 x 8 Mfd. Metal Cans Electrolytic, 275 v.	15/-
64 Mfd. Metal Cans Electrolytic, 350 v.	18/-
2 Mfd. 150 v. Tubular Paper (aluminium tubes)	30/-
100 Mfd. 50 v. Metal Cans	15/-
25 Mfd. 50 v. Tubular Cardboard	12/-
12 Mfd. 50 v. Tubular Paper (aluminium tubes)	12/-
100 Mfd. 6 v. Tubular Paper (aluminium tubes)	12/-
.00005 Tubular Miniature ... 3/6 .05 Tubular 350 v.	4/-
.001 Tubular 350 v. 4/6 .05 Tubular 500 v.	10/-
.005 Tubular 200 v. 3/6 .01 Tubular 500 v.	10/-
.02 Tubular 500 v. 4/6	5/- per doz.

	4/-
200 Assorted Moulded Micas. Popular Values	£2 10 0
200 Assorted Silver Micas. Popular Values	£2 10 0
200 Assorted Carbon Resistors : 1, ½ and 1 watt. Good selection	£1 10 0
CARBON RESISTORS : ½ watt 2/6 ; ½ watt 3/- ; 1 watt 4/- ; 2 watt 6/-;	5 watt 9/- per doz.

HIGH STABILITY RESISTORS :

Tolerance :	1%	2%	5%	
½ watt	1/-	2/-	5d.	each
½ watt	1/3	1/-	5d.	each
1 watt	1/9	1/3	1/-	each

8-13 MEG 2 watt 2/6 each

W/W AND VITREOUS RESISTORS. 5 watt, 1/6 ; 10 watt, 2/6 ; 15 watt, 3/- ; 20/30 watt, 3/6 each.

W/W CONTROLS. COLVERN and B-NSF. 5K PRESET and other values, 2-3 watt, 2/- each. 10K Isolated Spindle.....

500 ohms, 1K, 20K, 25K, 50K, with spindle

V/CONTROLS WITH SWITCH : 50K, 500K, B-NSF.....

V/CONTROLS: Less Switch, Preset and Spindle. MOSTLY TWIN MIDGET GANGS, .0005, with trimmers, PERSPEX COVER

4-WAY PUSH BUTTON UNITS

PUSH BUTTON KNOBS

TAG STRIPS: 3-way, 2/- doz.; 4-way, 2/6 doz.; 5-way, 3/- doz.; 7-way 4/- doz.; 28-way 10/- doz.

ASSORTED PILOT LIGHT HOLDERS

FUSES 1½in. Most values from 750 mA. to 10 amp.....

POINTER KNOBS. Small black, with line, ½in. hole.....

STANDARD ROUND KNOBS : Small, ½in. hole, 6/- ; Large, ½in. hole, 7½ ; with spring clip, ½in. hole

CLIX WANDER PLUGS. Type MP2. Red, black, blue.....

PHILIPS TRIMMER TOOLS

BELLING & LEE. P/M FUSE HOLDERS, Type L356.....

WEARITE COILS : Types PA4, PO4, PA5, PO5

VALVE HOLDERS : Moulded, B9A, 7½ ; B7G 6/- ; EF50, 6/- ; ENGLISH OCTAL, 3/- per doz. SCREEN CANS for B9A, B7G, 6/- doz. ; PAXOLIN—B7G. MAZDA 4-pin UX

BELLING & LEE. PLUGS AND SOCKETS. Ex-Govt. BRAND NEW, 5-pin, Chassis and Cable, 7-pin.....

BULGIN. P.73, Plug and Socket, 2/9 each ; P74, Plug and Socket, 2/6 ; P200, Plug and Socket, 2/- ; Rotary Switches, S.255, 2/- ; Dolly Switches, S.267, 2/- ; Dolly Switches, S.259, 1/6 ; Standard Switches, Ex-Govt., On-off

POST OFFICE LAMP JACKS, No. 10

Lamp Covers for same

L.F. CHOKES. 300 w., 60 mA. CH5

OUTPUT TRANSFORMERS: Multi Ratio, 5/- ; Pentode or Power

VALVE SCREEN CANS for Standard Valves

DRUM DRIVES. 4½in. 1/6 each

WESTECTORS. WX6, WX12, WI, W12, W4

ARCOLECTRIC (Whitney Lamps). Red, green, clear.....

SIGNAL LAMP HOLDERS P/M, complete with adjusting lamp holders

AIR SPACE TRIMMERS. Preset and spindle types, SPL, 10PF, 15PF, 20PF, 25PF, 50PF, 75PF, 15/- ; 100PF Preset

JONES PLUG AND SOCKETS. 4-pin, 2/6 ; 6-pin, 3/- ; 8-pin, 3/6 ; 10-pin, 4/- ; 12-pin

NUTS. 8BA, 3/- ; 6BA, 2/6 ; 4BA, 3/- ; 2BA

SOLDER TAGS 1/6 gross

SHAKEPROOF WASHERS WASHERS, 2, 4 and 6BA

SHAKEPROOF SOLDER TAGS, 4BA and 6BA, 2/- ; 2BA 2/3

REDUCED PRICES FOR LARGE QUANTITIES

ALL CINCH COMPONENTS IN STOCK

CASH WITH ORDER OR C.O.D. ALL ORDERS FOR LESS THAN

£2 ADD POSTAGE

Trade Counter open 9.30 to 5.30 Mondays to Fridays.

Callers Welcomed.

WHOLESALE, MANUFACTURERS' AND EXPORT

ENQUIRIES INVITED

★ SEND FOR LISTS ★

Best Buy at Britain's

MICRO-AMP. METERS

100 MICRO-AMP. METER. 2½in. barrel, 3in. flange, panel mounting. Scaled 0-1500 in 15 clear divisions. These meters have just arrived and are BRAND NEW in original maker's cartons. Now in short supply, they are a real bargain at 42/- each.
50 MICRO-AMP. METER. 2½in. barrel, 3in. flange, panel mounting. Scaled 0-100 in 50 equal divisions. Price ONLY £3/10/- each.

COMMUNICATION RECEIVERS

SKY CHAMPION S20R. This super Hallicrafter receiver covers 550 kc/s to 45 Mc/s (550 to 6½ metres) without gaps. Has bandspread tuning, R.F. stage, two I.F. stages, etc. Built-in power-pack for 200/250-volts 50 cycles A.C. mains operation. Complete with all nine valves, built-in speaker and ready for operation. Each set tested prior to despatch and demonstrated to callers. In case size 18in. x 8½in. x 10in. Price £21, plus 10/- carriage and packing.

SKY RIDER DEFIANT SX24 is similar to above but includes crystal I.F. filter and S meter, etc. Complete with valves and crystal for £27/10/-, plus 10/- carriage and packing. For further details send S.A.E.

COMMUNICATION RECEIVER RI155 for world-wide reception. Can be heard at any time during shop hours. Air tested prior to despatch. Brand new at £11/19/6. A few slightly used at £7/19/6.
TRAWLER BAND. RI155N, with super slow motion drive, available at £17/19/6. Carriage in original transit cases 10/6 extra on all models. Send 1/3 for full details and circuit.

A.C. MAINS POWER PACK OUTPUT STAGE enables the RI155 to be used to operate speaker from 200/250 volts A.C. without ANY MODIFICATIONS WHATSOEVER. All our Power Packs have heavy duty transformers, are complete with leads and Jones plugs and are guaranteed for 6 months.

Type A. In neat black box, size 8½in. x 4½in. x 6½in. Less speaker. Price £4/10/-, plus 3/6 carriage.

Type B. With built-in 5in. speaker in black case, size 13½in. x 5½in. x 7½in. Price £5/5/-, plus 3/6 carriage.

Type C. With 8in. R.C.A. speaker, built in R.C.A. speaker cabinet as described below. Price £6/10/-, plus 3/6 carriage.

SAVE £££££'S. Deduct 10/- when purchasing any RI155 and power pack together.

VISUAL INDICATOR TYPE I Ref. 10Q/2—the cross-over Left/Right indicator for D.F. operation and Loop Aerials Type 4, ref. 10B/420. Both Brand new and boxed. We have these items in stock and those interested in complete D.F. installations should contact us for quotations.

R.C.A. SPEAKER. 8in. P.M. unit in beautiful black crackle cabinet. Size 11½in. x 10½in. x 6in. A de Luxe job. Brand new at 45/-, plus 2/6 carr.

U.S.A. DYNOMOTOR. 12 volts D.C. input, 250 volts 60 mA. output. Weight 2½ lbs. Size 4½in. x 3in. diameter. Ideal for car radio, mobile amplifiers, small transmitters, etc. All tested prior to despatch. ONLY 22/6, post paid.

POLICE, FIRE, WROTHAM

THE RI132A receiver covers 100-124 Mc/s with variable tuning. Very easily altered to other frequencies. Complete with all 11 valves. Requires only 250 volts and 6.3 volts when it is ready to operate. Complete circuit supplied. Only 45/-, plus 7/6 carriage. BRAND NEW. Will operate from our standard RI155 power pack using special lead, price 10/- extra.

POWER PACK NO. 3. Standard 19in. rack-mounted power packs for 200/250 volts mains operation. Paper smoothing, two heavy duty chokes, VU39 rectifier. Output 250 volts D.C. 100 mA., 6.3 volts 4 amps. Two types : Mark I with H.T. current meter at £4/4/-; Mark II with H.T. current and voltmeters at £4/10/-, carriage 5/-. Suitable for use with P48, RI132, RI1481, RI1392, RI155, etc. Lead for any specified set with Jones plugs, 10/- extra. All power packs guaranteed in working order.

TRANSFORMER BARGAINS. 350-5-350 volts at 180 mA., 6.3 v. 5 Amps and 5 v. 3 Amps. Standard 200/250 volt 50 cycle screened primary. Size 4in. x 4in. x 5in. Brand new and unused 29/6 plus 2/6 post. Filament Transformers—Standard tapped primary, two types—Type "A" 12 volts 1½ Amps., 6.3 volts 1½ Amps. Type "B" 12 volts 1½ Amps., 4 volts 1½ Amps. Either type 7/6 each.

H.R.O. 6 VOLT VIBRATOR PACK gives 165 volts 80 mA. smoothed D.C. Uses Mallory vibrator, 6X5, heavy duty smoothing choke, etc. In black crackle cabinet size 7in. x 7in. x 6in. Brand new only 29/6, plus 2/6 postage.

GROUNDED GRID TRIODES TYPE CV82— A few of these in stock.

C.R. TUBES for G.E.C. "Miniscope" price 35/- each. New and Boxed.

VARIACS. semi-variable. Rated .8 kVA, oil filled. Adjustable for 30 volts above and below the mains input. Price £5.

METER BARGAINS

UNIVERSAL AVOMETERS MODEL 40—very little used, thoroughly checked and tested. First-class multi-range test meter for ONLY £9/19/6.

1 Milli-amp. 2½in. square panel mtg., 15/-. 5 Milli-amp. M/c. 2½in. square panel mtg., 7/6. 200 Milli-amp. M/c. 2½in. square flush panel mtg., 10/6.

20 Amps. 2½in. diameter M/coil, 7/6. 20 Volts 2in. square panel mtg., M/coil, 7/6. 500 Milli-amps. Thermo-couple 2in. square panel mtg., 5/-. All the above meters are brand new and boxed.

G.E.C. 1 mA. METER RECTIFIERS, BRAND NEW AT ONLY 11/6.

BLOCK CONDENSERS

4 mfd. at 1,000 volts. Size, 4½in. x 4in. x 1½in., 5/-. New and boxed.

5 mfd. at 1,000 volts D.C. test, will work at 600 volts. Size, 2in. x 3in. x 3in. New and boxed. SPECIAL PRICE at 3 for 10/6. .25 mfd. at 1,500 volts. Size, 2½in. x 2in. x 1½in. Price, 3 for 4/6, post paid. All the above are metal cased with paper insulation and fixing feet. .04 mfd. 12.5 kV. ONLY 6/- each.

BATTERY CHARGERS. Contained in black crackle case, size 6in. x 7in. x 12in., includes a heavy duty transformer, metal rectifier, 0.5 ammeter, on/off mains switch and 2 Slydlock fuses. 230 volts 50 cycles input; output 4 amp., 6 or 12 volt battery. The transformer, etc., is conservatively rated and the whole unit is of sturdy construction and super quality. Made to a very stringent specification, this equipment is well worth the price of £4/19/6, plus 5/- carriage and packing. In brand new unused condition.

METAL RECTIFIERS

Selenium 230 volts 60 mA. at 5/-; 300 volts 100 mA. at 7/6; RM2 at 4/3 or two for 8/-; RM4 at 17/-; Selenium Full Wave Bridge 6 or 12 volts—1 Amp. at 7/6; 2 Amp. at 11/3; 3 Amp. at 12/6; 4 amp. at 15/-. Heavy duty selenium rectifier, square fins, size 8½in. x 4in. x 4in. Two units in full wave bridge give 48 volts 10 Amps. D.C. Brand new at £4 per pair.

COLLAR THREE SPEED AUTO CHANGER 3RC521 complete with two separate crystal heads. BRAND NEW AND BOXED. Only £9/19/6.

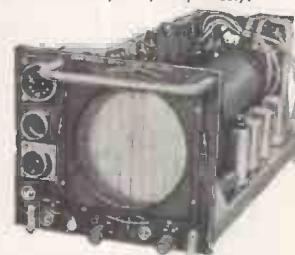
GOODMANS AND B.T.H. 12in. 15 watt 15 ohm heavy duty speakers in stock. Brand new and boxed at bargain prices for callers.

PUSH PULL OUTPUT TRANSFORMERS 15 watts, push-pull 6V6's to 15 ohms. A bargain for ONLY 7/6 each.

HEAVY DUTY CHOKES 5Hy 300 mA. 500 ohm, size 3in. x 4in. x 4½in. high. Potted type, chassis mounting. A beautiful job, brand new and boxed. 12/6. 30H 150 mA. 300 ohms, universal mounting size 4in. x 3in. x 2½in. Price 10/6.

INDICATOR UNIT 182A

contains 3 EFSO, 1 SU4G, 4 SP61 and a 6½in. C.R.T. type VCR517. This tube will replace the VCR97 without any alteration, is completely free from cut-off and has a more pleasant tube colour. Contains in addition a very large assortment of pots, resistors, condensers, etc. Tubes demonstrated. Supplied BRAND NEW (less relay) for only 67/6, plus 7/6 carriage in original transit cases. Original circuit supplied FREE with each order, or 1/6 separately.



NOTE PRICE REDUCTION

45 Mc/s PYE STRIP. Vision unit for London frequency, complete with 6 EF50 and 1 EA50. Circuit provided. Price £3/10/-, plus 2/6 carriage. **TV PRE-AMP.** Uses 2 EF50's and tunes to 45 Mc/s. Easily altered to other frequencies. With valves, 19/6, less valves, 10/-, post 1/- extra. **E.H.T. TRANSFORMER** for the VCR97, etc. Mains input. Output 2,500 volts, 4 volts 2 amps. 2-0-2 volts 2 amps. Fully guaranteed at 35/- each, plus 1/- post.

CO-AXIAL CABLE. Brand new 70/80 ohm. with STRANDED inner conductor. Not ex-Govt. Price 9d. per yard. Minimum per post, 7/6 per doz. yards.

HEAVY DUTY twin circular polythene cable, weatherproof, suitable for extension mains lead, etc. Price 9d. per yard. Minimum per post 8/6 per doz. yards. SPECIAL OFFER of 100 yard coil for 50/-, plus 3/6 carriage.

TELEVISION RECTIFIERS 3½in. long, 2½in. dia., 235 volts A.C. input. Type A—Output 300 mA., price 13/6. Type B—Output 380 mA., price 14/6. These are BRAND NEW. Either type plus 1/- postage.

COIL PACKS. We have a bargain line in S. M. and L. wave packs for 465 kc. I.F. Single hole fixing. Price 14/6, BUT regret CALLERS ONLY this item.

I.F. TRANSFORMERS iron dust core, 465 kc/s., brand new, manufacturer's surplus, ONLY 6/9 per pair.

TYPE 12 TRANSMITTER. Mains operated transmitter covering 1.2-17.5 Mc/s in four bands, crystal or V.F.O. Size 24in. x 12½in. x 17½in., weight 134 lbs. Complete with all valves, ready for operation. In first class condition and tested before despatch, with circuit and instructions ONLY £16/16/-, plus 14/- carr. A few, soiled, for callers only at bargain prices.

STANDARD TRANSFORMERS

Transformers of current manufacture. Two types, both standard tapped primaries. Universal mounting. (1) 350-0-350 volts 80 mA., 0-4-6.3 volts 4 amps., 0-4-5 volts 2 amps. (2) 250-0-250 volts 80 mA., 0-4-6.3 volts 4 amps., 0-4-5 volts 2 amps. Both these transformers are new and boxed, fully guaranteed at 18/- each, post paid.

30 VOLT TRANSFORMER standard primary, Secondary 30 volts 2 amps., tapped to give 3, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24 volts. Has countless uses. Price 17/6.

METAL RECTIFIER, 12 volt 2 amp. full wave bridge type. Suitable for use with the above transformer. Price 11/3.

CHARLES BRITAIN (Radio) Ltd.

II UPPER SAINT MARTIN'S LANE,
LONDON, W.C.2

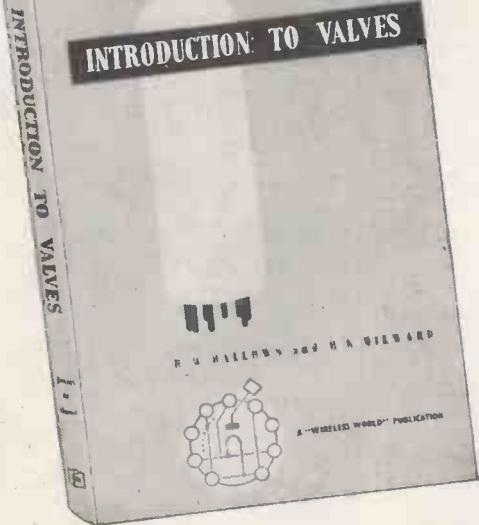
One minute from Leicester Sq. Sta. (up Cranbourn St.) TEMple Bar 0545
Shop Hours: 9-6 p.m. (9-1 p.m. Thursday)

Open all day Saturday



**A valuable NEW book
for the radio student**

INTRODUCTION TO VALVES



By R. W. Hallows, M.A.CANTAB., M.I.E.E., and H. K. Milward, B.Sc.LOND., A.M.I.E.E.

Describes the principles of operation of the radio valve and its uses in circuits of various types. Following an explanation of the fundamental thermionic valve, the book deals with diodes as rectifiers and detectors; triodes and their various applications; tetrodes and pentodes; multiple-grid valves for frequency-changing; power-output valves; and valves for v.h.f. and e.h.f. operation. Special-purpose types and the construction of modern miniature and sub-miniature valves are also covered.

8 $\frac{1}{2}$ " x 5 $\frac{1}{2}$ " 152pp. 107 Illus. 8s.6d. net By Post 8s. 10d.

Published for "Wireless World"

Obtainable from all booksellers or from: ILIFFE & SONS LTD., DORSET HOUSE, STAMFORD ST., LONDON, S.E.1



THE EDDYSTONE MODEL "840" AC/DC COMMUNICATION RECEIVER

Price £45

A Communication Receiver of the highest class. A.C. or D.C. 110/115 v. 220/230 v. R.F. stage. B.F.O. and high flux built-in speaker. 7 valves. Tuning by flywheel-loaded mechanism. Auxiliary band spread scale. Comprehensive instructions and 12 months guarantee.

Price £45 (exempt from Purchase Tax). Or on our convenient H.P. terms. £15 deposit and 18 monthly payments of £2. Deliveries in rotation.

All models available on our convenient terms. Comprehensive stocks of Eddystone components.

THE EDDYSTONE SPECIALISTS
H.P. RADIO SERVICES LTD.
55 COUNTY ROAD, LIVERPOOL, 4
Telephone : AINTREE 1445 ESTAB. 1935

MIDLAND INSTRUMENT CO. —

RECEIVERS TYPE 5C/2264, a self-contained portable instrument (weight 8lb.) for direct vision of Infr.-Red sources, consists of the viewer which has optical lenses, image converter P.E. cell, fluorescent screen, electrodes and image receiving glass, coupled by lead to the 3.000 v. Zamboni dry plate metal cased battery, new unused, fraction of original cost, our price 50/-, post and packing 2/-.

"HOTRIC" IMMERSION HEATERS. 220/230 v. 2,600 watts, requires 13in. dia. tank fixing hole, stem length from fixing nut 18 in., complete with cover and cable entry, new unused and fully guaranteed, fraction of list price, 32/6, post and packing 2/6.

IMMERSION HEATER THERMOSTATS by "Sunvic" Controls Ltd., 250 v. 15 amp. A.C., variable graduated control to cut out from 100 to 190 deg. F., standard immersion type, complete with tank sheath and fixing nut, new unused, 17/6, post 1/-.

Heated and thermostatic, 50/-, post paid.

PERMANENT MAGNETS. 100 oz. weight, 12 gauge wire, finest quality, .03 insulant, tinned copper, 1/0/32 (21 s.w.g.) in brand new 250 yd. coils, colour brown, green, red, yellow, purple, 12/6 per coil, post 1/8, 5 coils one of each colour 50/-, carriage 5/-.

T.R.S. FLEXIBLE, twin rubber covered 16/0/12, approx. 1/8 in. dia., 250 v. Insulation, worth 1/6 yd., our price 100 yd. coils, 50/-, carriage 5/-.

VARIABLE RHEOSTATS, wire wound on ceramic, laminated wiper, 50 ohms at 1 amp., easily altered to 12.5 ohms at 2 amps., new boxed, 12/6, post 1/-.

PLESSEY A.C. MAINS. 230-v. shaded pole gram motors, as used on the 3-speed gram units, size 3in. x 3in. x 2in., brand new boxed, 12/6, post 1/2.

REVERSING MOTORS, 12 v. 1 amp. shunt, ball-bearing shaft, very powerful, size 4in. long, 2in. dia., new boxed, 60/-, our price 7/6, post 1/4.

WIRE STRIPPERS. Strips the insulation from flexes and cables up to 1/2 in. dia. micrometer adjustment, brand new boxed, usual workshop price 15/-, our price 5/-, post 6d.; 2 for 10/-, post paid.

Thermostats. Close at low temperatures, adjustable 30 to 60 deg. F., ideal for greenhouses, car-heaters, frost warnings, etc., new 2/6, post 4d.

TELEPHONE SETS. Consists of 3 combined receivers and microphones, provides point-to-point communication (up to 1 mile with extra flex), self-powered, no battery required, supplied with 20ft. connecting flex, complete ready for use, brand new boxed 12/6, post 1/-.

AIR COMPRESSORS or vacuum pumps, Romeo rotary valve type, develops constant 40/50 lb. sq. in. pressure, fitted 2in. long 1/2 in. dia. splitted shaft, size 1/2in. dia. case, 4in. long, 4in. dia., brand new in sealed cartons, 20/-, post 2/-.

ELECTROLYTIC CONDENSERS. "Zenith" etc., 32 mfd. 480 v. D.C. All new and guaranteed perfect, sealed cartons of 25 condensers, 20/-, post paid.

EVERSHED AND VIGNOLES OHMMETERS. In green bakelite cases, size 5 1/2 x 4 x 2 1/2in. scale with selector switch, 0-1,000 and 100-200,000 ohms and infra-red leather case with leads, fitted new battery and tested, 60/-, post 2/-.

VEEDEE COUNTERS. 0-999 fitted zero reset, in black crackle cases, drive fitted pulley (detachable), worth 30/-, our price 3/6, post 4d.

ARROW SWITCHES. 250 v. 25 amp. panel mounting 4-way rotary, 3-heat and "off" series parallel, new boxed with knob, 2/6, post 1/-.

TELEPHONE WIRE. Green P.V.C. covered, 880 yd. (1-mile) coils, new unused 20/-, post 2/-; 10 coils £8/15/-, carriage 10/-.

STABILIZING HEADS. Has micrometer control vertical and horizontal action, with graduated scales, fitted Sperry gyroscope includes fine cut gears, worms, helical traverse, etc., etc., weight 16 lb., fraction of original cost, unused, our price 15/-, carriage 7/6.

RELAY WASHER UNITS. Consists of 2 G.P.O. type 500 ohm slugged relays (16 platinum points) provides approx. 120 flashes per minute from 12-24 v., fully radio suppressed, in diecast cases size 4 1/2 x 3 1/2 x 3in., easily worth £5, our price, new boxed, 20/-, post 1/6.

Many other bargains to offer; send 6d. for Lists.

MIDLAND INSTRUMENT Co., MOORPOOL CIRCLE, BIRMINGHAM 17
Tel.: HAR 1308

"MUST HAVE" BARGAINS

RECEIVER R3118, ideal for conversion to TV, having a built-in A.C. mains Power Pack or 180-240 volts, is tremendously powerful employing 7 I.F. stages of 12 Mc/s. with 1 Mc/s Bandwidth and has 16 valves as follows : 6 of SP61, 4 of EA50, 2 of VR136, 1 each VR137, P61, 5Z4, and Y63 "MAGIC EYE" IN NEW CONDITION, only 97/- (carriage, etc., 7/6).

"PYE" 45 Mc/s. I.F. STRIP. Ready made for the London Vision Channel. Complete with 6 valves EF50 and 1 EA50. BRAND NEW. ONLY 70/- (postage, etc., 2/6).

I.F. STRIP 194. An easily modified strip recommended for TV constructors who want good results at moderate cost, or for those who have built televisions but are having trouble in the sound or vision receivers. Size 18in. x 5in. x 5in., it is complete with 6 valves VR65, 1 of VR92, and 1 of VR56 or VR53. Mod. data supplied. ONLY 45/- (postage, etc., 2/6). Less valves, 19/6 (post, etc., 2/6).

RF UNITS TYPE 26 and 27. For use with the R.1355 or any receiver with a 6.3 v. supply. These are the variable tuning units which use 2 valves EF54 and 1 of EC52. Type 26 covers 65-50 Mc/s (5-6 metres), and Type 27 covers 85-65 Mc/s (3.5-5.0 metres). Complete with valves, and BRAND NEW IN MAKER'S CARTONS. ONLY 59/6 each.

RF UNITS TYPE 24 and 25. Complete with 3 valves SP61 and full details of modification required to cover all TV Stations. ONLY 25/-.

TELESCOPIC AERIAL. Pulls out of metal tube 15in. long to extend to 73in. BRAND NEW. ONLY 7/6 (postage, etc., 10d.).

AMPLIFIER 208 Ideal for conversion into a high-gain TV pre-amp. Complete with 2 valves EF50. ONLY 15/- (postage, etc., 1/6).

CHOKES. 3H 40 mA., 3/6. 10H 60 mA., 4/-. 30H 100/150 mA., 12/6. (Postage 1/-).

CHASSIS OF POWER UNIT 529. An ideal unit for component value or for building an amplifier, etc. Contains valveholders, resistors, potentiometer chokes, and block and tubular condensers. Housed in grey metal case, size 12in. x 8in. x 7½in. BRAND NEW. ONLY 10/- (carriage, etc., 3/6).

AMERICAN 12 v. DYNAMOTORS. Output 255 v. 60 mA. ONLY 22/6.

24 v. BLOWER MOTORS. ONLY 17/6.

C.R. TUBE VCR97. Tested full screen. BRAND NEW IN MAKER'S CRATES. ONLY 42/6.

6 v. VIBRATOR UNITS. Made by the National Co. of America for use with H.R.O. Communications Receivers, supplying 165 v. at 85 mA fully smoothed D.C. Complete with vibrator and 6X5 rectifier in black crackle cabinet size 7in. x 7½in. x 6in. ONLY 29/6 (postage, etc., 2/6).

COMMUNICATIONS RECEIVER R.1155

The famous ex-Bomber Command Receiver known the world over to be supreme in its class. Covers 5 wave ranges : 18.5-7.5 Mc/s, 7.5-3.0 Mc/s, 1,500-600 kc/s, 500-200 kc/s, 200-75 kc/s, and is easily and simply adapted for normal mains use, full details being supplied. Aerial tested before despatch. BRAND NEW AND UNUSED IN MAKER'S TRANSIT CASES. ONLY £11/19/6.

USED RECEIVERS, also tested working before despatch, £7/19/6.

R.1155 "N" Model. This is the latest version which covers the Trawler Band and in addition has ultra-slow motion tuning. Used, in good condition, and tested working before despatch £17/19/6.

A Factory-made Power Pack, Output Stage and Speaker, contained in a black crackle cabinet to match the receiver, can be supplied for ONLY £5/10/-. Plugs on to the receiver, and operates it immediately.

DEDUCT 10/- IF PURCHASING RECEIVER AND POWER PACK TOGETHER.

Please add carriage costs of 10/6 for receiver, and 5/- for Power Pack.

AMPLIFIER A1135A Complete with 3 valves, 1 each EL32, EK32, EBC33. A handy little unit for conversion or breakdown. ONLY 17/- (postage etc., 2/6).

TRI196 TRANSMITTER SECTION. In perfect condition, less valves. ONLY 12/6 (postage, etc., 2/6).

OSMOR H.O. COIL PACK. The 3 superhet pack recommended for the TRI196 Receiver conversion. ONLY 48/-. 1196 conversion data supplied with coil pack, or separately 1/-. post paid

500 KCS. CRYSTALS. Standard 2-pin mounting. Ex. new equipment and perfect. ONLY 15/- (postage, etc., 1/-)

159 RECEIVER UNIT. Contains 1 each valve, types EF50, EA50, SP61, RL37 and 24 v. selector switch. ONLY 15/-.

VACUUM PUMPS. For Handymen and Model Makers. Ex-R.A.F. Type B3-Mk. III, made by Romec. BRAND NEW IN MAKER'S CARTONS, ONLY 15/- (post, etc., 2/-).

TRANSFORMERS. Manufactured to our specification and fully guaranteed. Upright mounting, fully shrouded, normal primaries.

425 v. 0-425 v. 250 mA., 6.3 v. 4 a., 6.3 v. 4 a., 5 v. 3 a., 50/-

350 v. 0-350 v. 160 mA., 6.3 v. 6 a., 6.3 v. 3 a., 5 v. 3 a., 42/6.

350 v. 0-350 v. 150 mA., 6.3 v. 5 a., 5 v. 3 a., 32/6.

250 v. 0-250 v. 100 mA., 6.3 v. 6 a., 5 v. 3 a., 32/6.

Please add 2/- per transformer postage.

TRANSFORMERS, FILAMENT. 6.3 v. 2 a., 7/6 ; 6.3 v. 3 a. 10/6 (postage 1/-).

TRANSFORMERS, EHT. Upright mounting.

EHT for VCR97 Tube 2,500 v. 5 mA. 2 v.-0.2 v. 1.1 a., 2 v.-0.2 v. 2 a., 37/6.

EHT 5,500 v. 5 mA., 2 v. 1 a., 72/6.

EHT 7,000 v. 5 mA., 2 v. 1 a., 82/6.

EHT 7,000 v. 5 mA., 4 v. 1 a., 82/6.

Please add 2/- per transformer postage.

TRANSFORMERS, EX.W.D. AND ADMIRALTY. built to more than 50 per cent. safety factor with normal A.C. mains primaries. All brand new and unused, 330-0-330 v. 100 mA. 4 v. 3 a., 22/6.

E.H.T. 1,400 v. 2 mA., 520 v. 10 mA. 300 v. 10 mA., 2 v. 1.5 amp., 21/-.

L.T. 6.3 v. 7.7 amp., 4.2 v. 2.5 amp., 4 v. 1 amp., 19/6.

L.T. 4 v. 20 amp. C.T., 30/-.

Please add 2/6 per transformer postage.

INTERNATIONAL OCTAL PLUG Fits into 1.O. valveholder, 2/- (post 3d.).

GANGED POTENTIOMETERS. Double 50K and double 1 meg., 7/6 each.

CERAMIC 2-WAY 3-BANK SWITCHES. 7/6 each.

P.M. SPEAKERS. 6in. ROLA with transformer 17/6, 10in. LECTRONA with transformer 27/6. 12in. GOODMAN, less transformer, 15 ohms speech coil, 99/6. ALL SPEAKERS BRAND NEW IN MAKER'S CARTONS. Postage 2/- each please.

INDICATOR UNIT TYPE 62A

Built on a two-deck chassis, this contains VCR97 Cathode Ray Tube with mu-metal screen, 12 valves EF50, 4 of SP61, 3 of EA50, and 2 of EB34. An economical way of buying a VCR97 and EF50s. IN NEW CONDITION IN MAKER'S TRANSIT CASES. ONLY 99/6 (carriage, etc., 10/6).

ROTARY POWER UNITS TYPE 104

Input 12 v., Output 230 volts 65 mA. and 6.3 volts 2.5 amp., Fully filtered and smoothed and noise suppressed. Ideal for car radio, etc. BRAND NEW. ONLY 15/- (postage, etc., 2/6).

100 MICROAMPS METERS

2½in. circular flush mounting. Widely calibrated scale of 15 divisions marked "yards", which can be rewritten to suit requirements. These movements are almost unobtainable to-day and being BRAND NEW IN MAKER'S CARTONS are a snip at ONLY 42/6.

METERS

BRAND NEW, MOVING COIL, FLUSH MOUNTING 1 mA. 2½in. square, 15/ ; 5 mA. 2in. square, 7/6 ; 100 mA. 2½in. round, 12/6 ; 500 mA. 2½in. round, 12/6 ; 20 amp. 2in. round, 7/6 ; 40 amp. 2in. round, 7/6 ; 500 mA. thermo couple 2in. square or round, 5/-, or 3 for 13/6 ; 30-0-30 amp. moving iron, car type, 5/-.

POWER UNIT TYPE 3

Made for use with the R.1132A, this is a standard rack mounting job to match the receiver, and is for 200/250 v. 50-cycle mains with outputs of 250 v. D.C. 100 mA., and 6.3 v. 4 amp. Fitted with H.T. current meter and voltmeter, this is a first-class unit, and can be used for a variety of receivers. Used, but tested working before despatch. ONLY 90/- (carriage, etc., 5/-). Connecting Cable with Jones Plugs for receiver and power unit, 10/-.

U.E.I. CORPORATION

Cash with order please, and print name and address clearly

(Open until 1 p.m. Saturdays. We are 2 mins. from High Holborn (Chancery Lane Station) and 5 mins. by bus from King's Cross)

AMOUNTS GIVEN FOR CARRIAGE REFER TO MAINLAND ONLY.

Radio Corner, 138 Gray's Inn Road, London, W.C.I. Phone: TERMINUS 7937

UNIVERSITY RADIO LTD.

Offer Guaranteed Used Equipment at Attractive Prices

Labgear Signal Generator and Test Bridge, as new, 230 to 250 A.C.	£10 0 0
Webster Wire Recorder, as new complete with spare wire and mike	£38 10 0
E.D.C. Rotary Converters in metal cabinets:	
110 v. D.C. input to 230 v. A.C. output; 220 v. D.C. input to 220 v. A.C. output. Prices from £10 0 0	
B.T. 400 G.E.C. Communication Receiver, as new	£80 0 0
National N.C. 45, A.C. or D.C. 110 to 230 v. as new	£30 0 0
H.R.O. Coils, 50 to 100 kcs., 100 to 200 kcs., other ranges in stock	15 0
G.E.C. Single Side Band Selector, as new	£30 0 0
Avo Valve Voltmeter, as new..	£28 10 0
C.D.P. Disc Recorder, 15 ohm imp. head, as new 78 r.p.m., less amp.	£15 0 0
Taylor Circuit Analyser Model 110, as new	£9 0 0
MSS Disc Recorders, less amp., easy convert to 33 1/3 v. A.C. input, cutting head 2,500 ohm imp.	£20 0 0
Simon Sound Recording Outfit, complete with ball and biscuit mike amplifier and speaker, all in portable cases	£52 10 0

Garrard RC 75a Automatic Record Changer, with two Decca f/r heads 110 A.C. to 250 A.C. As new	£12 10 0
Leak pre-amplifier, without vari-slope, as new	£4 10 0
Leak Long Playing Pickup with transformer, as new	£5 0 0
Williamson Amplifier, without pre-amp.	£10 0 0
Sound Sales D.X. Plus 7 tuner and Amplifier, as new	£17 10 0
Amplifiers, from 10 to 30 watt output, all makes with and without speakers and mikes. From Tapemaster Tape Deck without amp. as new, built in relay and power supply for switching...	£12 10 0
Garrard A.C. or D.C. Record Changer, as new. Model R.C.65A.	£7 10 0
Eddystone 640 Receiver, complete with speaker, as new...	£14 0 0
Collaro Record Changer, in portable case with amp.	£22 0 0
Latest Model Grundig Tape Recorder, two speeds as new	£15 10 0
E.M.I. Ribbon Tweeter, with T.X. from 5 ohm crossover frequency, 5 kcs.	£68 10 0
G.E.C. Selector Test Universal Test Meter, as new	£20 0 0
Tamsa Tape Deck Oscillator Units for use with 6V6 valve ...	12 6

Advance Type B3 Signal Generator, with calibration chart, as new	£15 0 0
Collins Transmitter Receiver, with antenna loading unit but no power pack, with manual, as new	£25 0 0
Evershed Bridge Megger as new, 500 volt test	£25 0 0
AVO Resistance Capacity Bridge	£7 0 0
American Valve Tester for use on 200 to 250 v. A.C.	£10 0 0
Garrard R.C.65a Record Changer, 110 to 250 A.C. as new	£8 10 0

WE URGENTLY REQUIRE FIRST CLASS NEW OR USED STANDARD OR SUB-STANDARD SIGNAL GENERATORS OF EVERY DESCRIPTION. TEST EQUIPMENT, ETC., CONVERTERS, MOTORS, AMPLIFIERS, RECORDERS, ETC.
WE ARE AN OLD ESTABLISHED FIRM. WE WILL PAY THE VERY TOP PRICE. DO NOT BE MISLED. WE REALLY DO PAY MAXIMUM PRICES FOR FIRST CLASS EQUIPMENT. WHEN SENDING GOODS STATE WHETHER T.M.O. OR CHEQUE REQUIRED.

WE HAVE A LARGE SELECTION OF AS-NEW WHARFEDALE SPEAKERS, ALL TYPES, AT BARGAIN PRICES.

THESE ITEMS ARE ONLY A SMALL SELECTION FROM OUR STOCK OF EQUIPMENT. YOUR ENQUIRIES FOR ANYTHING THAT YOU MAY NEED WILL BE WELCOME.

WE HAVE OTHER EQUIPMENT ARRIVING DAILY!

CASH OR CHEQUE WITH ORDERS.

ALL ITEMS LISTED ARE CARRIAGE EXTRA.

ALL ENQUIRIES S.A.E. PLEASE.

22 LISLE STREET, LEICESTER SQUARE, LONDON, W.C.2

OUR BRANCH AT 39a (opposite) IS OPEN ALL DAY THURSDAY.

Phone: GERlard 4447, 8582 and 5507.

Hours 9 to 6.

Thursdays 9 to 1.

HAVE YOU A TYPE 18-19-21 OR 22 TRANS./RECEIVER—if so buy these brand new and boxed ARP12 Valves at 4 for £1—while they last.

NEW TYPE 6H OR 182A OSCILLOSCOPE UNITS. Containing VCR97 or 517—with mu metal screen and rubber mask. EF50s or VR65s, 3 EB34s. Dozens of H.V. condensers, resistors and pots. Now is the time to buy these units before they are gone. Price £3/10/- including "W.W." T.V. Scopé Circuit.

LABORATORY TEST EQUIPMENT. For aligning and checking Trans./Receivers covering 150 to 234 Mc/s. comprising: Type BC906. Frequency Dip Grid Meter. 145-235 Mc/s. Type I-196-B. Signal Generator. 150-234 Mc/s. Type BC1066-R. Radio Receiver. 150-234 Mc/s. Price £12 the set. Carriage extra.

VALVES. 15A, 8/6; 6AG5, 10/6; 117Z6, 12/6; 6SH7, 5/6; EF50, 6/6; 955, 954, 6/-; SG215, 6/6; Pen 220A, 6/6; TTII, 8/6; 42, 10/6; 9001, 9002, 9003, 7/6; 954-955, 6/6.

MAINS TRANSFORMERS. Input 200/240 v. Output 350-500 or 250-250 volts 80 mA. and 4 and 6.3 v. 4 a. and 4 and 5 v. 2 a. Price 21/6. Input 200/240 v. Output tapped 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30 volts 2 amps., 21/6. All with one year's guarantee.

D.P.D.T. RELAYS. Operate at 200/300 volts D.C., 8/6. We can supply any type of voltage and contacts at varying prices.

NEW SELENIUM RECTIFIERS. F.W. 12/6 volt 3 amp., 14/6; 4 amp., 22/6; 6 amp., 30/-; 1 amp., 8/6; 12 v. 100 mA., 3/-; H.W. 250 v. 100 mA., 9/-; 80 mA., 6/6; 250 v. 275 mA., 17/6.

GERMANIUM CRYSTAL DIODES. 3/9.

VCR97 CRTS. New and crated. Picture tested, 45/6. Bases, 3/6. **NEW P.M. SPEAKERS.** By leading manufacturers. 5In., 15/-; 6In., 16/6; 8In., 20/-; 10In., 26/6.

MIC MICROPHONES with matched Trans., 15/6.

F.L.S FILTER UNITS. 8/6. Same as FL8 but less switch. FL8, 12/6.

TYPE FT243 FREQUENCY CRYSTALS. 5.8 to 8.6 Mc/s. In 25 Kc. steps, 8/-. Lists supplied.

6 VOLT VIBRATOR PACK. Output 250 v. 60 mA. Complete in steel case, 22/6.

TRI96 TRANSMITTER SECTION. New and complete but less valves. 4.6-6.8 Mc/s. Easily converted, 15/-. With valves £2.

L.R. ARMY HEADPHONES. 8/6.

TIME DELAY RELAYS. We specialise in units giving varying time constants. Please send us your requirements or problems.

FISHING ROD AERIALS. Set 3—12ft., 7/6; screw type, 9/6.

RUBBER MOUNTING BASES 3/6

All Carriage paid in the U.K. from Dept. W.W.

The RADIO & ELECTRICAL MART
253B PORTOBELLO ROAD, LONDON, W.11
Phone: PARK 6026

G2AK

This Month's Bargains

G2AK

NOISE LIMITERS. Plug-in type, no re-wiring required. 3 positions. Brand new in cartons. 15/- each, post 1/-.

TEST METER. 7 ranges as follows: 1.5 v. 3 v. 150 v. 6 mA., 60 mA., 5,000 ohms, 25,000 ohms. 2½in. Dia. scale M.C. meter. Rotary selector switch. Black bakelite case, 6 x 4½ x 4½, fitted with removable lid, also provision for internal batts, ranges can be easily extended. Bargain Price 30/- plus 1/6 post.

DEAF AID CRYSTAL MIKE UNITS 12/6 each, post 9d.

CRYSTAL HAND MICROPHONES. Complete with lead and plug. High Quality, very sensitive, chrome finish. List price 2 gns. Our price 25/-, few only.

CERAMIC SWITCHES, 2 bank, 2 pole, 4 way each bank, 6/-, post 9d.

SPECIAL TRANSFORMER OFFER. PRI. 115, 210, 249 v. SEC., 260/260 v. 100 mA., 6.3 v. 3 a., 6.3 v. 1 a. (for 6X5 Rec.) Universal Mounting. Limited Quantity, 17/6 each, post free.

SPECIAL OFFER, AR88 SPARES. Cabinets complete with base, feet and side strips, £4/15/- each. Pkg. and Carr. 5/- Set of 14 valves for "D" or "LF" model receivers, £5/10/- Panel escutcheons 22/6 each. "D" type I.F.S., 12/6 each. Matching Speakers by R.C.A., fitted rubber feet and 6ft. lead, 65/-.

TAPE RECORDING EQUIPMENT. Desks by Bradmatic, Tamsa, Lane and Quatapa. Ex stock. Heads, Oscillator Coils, Tape and Reels always available. **GERMANIUM DIODES.** B.T.H. 2/4, G.E.C., 2/6.

METERS. 2½in. Flush mounting M.C. 100 mA., 12/6 each; 2in. Flush Square 5 mA., 10/-; 4 amp. thermo., 5/-; 2½in. thermo. 0.2-2 a., 7/6; 2½in.

SPECIAL VALVE OFFER. 83 MV Rectifiers, 10/-, 866A, 17/6 each, or 30/- pair. 807's, 10/- each or 17/6 pr. 931A, 45/-, 832, 35/-, 829B, 80/-, 813, £5.

Carriage paid on all orders over £1 except where stated. Please include small amount for orders under £1.

Please print your name and address.

CHAS. H. YOUNG, G2AK

Mail-orders to 102 HOLLOWAY HEAD, BIRMINGHAM 1

Phone: MIDLAND 3254

All callers to 110 DALE END, BIRMINGHAM, 4

Phone: CENTRAL 1635

CLYNE RADIO LTD.

18, TOTTENHAM COURT ROAD, LONDON, W.1

MUSEUM 5929/0095.

All goods specially selected for quality and value. Prompt service—Money-back guarantee—It will pay you to visit our new rebuilt shop premises. Situated 50 yds. only from Tottenham Court Road Tube! (Genuine)



THE "ECONOMY FOUR" T.R.F. KIT. A three valve plain metal rectifier receiver. A.C. mains 200/250 v. 50 Hz. Medium and Long waves. We can supply all required components right down to the last nut and bolt. Valve line-up: 6K7, 6J7 and 6V6. Chassis ready drilled—Cabinet size 12in. long by 6in. high by 5in. deep—Choice of ivory or brown bakelite, or wooden, walnut finish cabinet. Complete instruction booklet with practical and theoretical diagrams. Each component brand new and tested prior to packing. Our price £5/15/- complete—Remember this set is being demonstrated at our shop premises. We proudly claim that our fully illustrated instruction booklet is the most comprehensive available for this type of receiver—Booklet available at 1/6 post free—This is allowed if kit is purchased later—Please, 2/6 packing and carriage for complete kit.

EX-W.D. CATHODE RAY TUBES. Guaranteed full picture. VCR97 at 40/-, VCR517C at 35/-, Also VCR139A—Ideal for oscilloscope 21in. screen at 35/- We also have VCR97 with slight defect, which is suitable for scientific, testing purposes, etc., at 16/6 only! All these tubes are brand new, in original packing, and tested before despatch. Please add 2/6 packing and carriage for any of the above tubes.

INTRODUCING LT. RECTIFIERS TYPE R.K. A newly manufactured range, fully guaranteed for 12 months. 6 v. 1 A. Centre Tapped, 5/- each.

6 or 12 v. 1 A. F.W. bridge type 7/6
6 or 12 v. 2 A. F.W. bridge type 11/3
6 or 12 v. 3 A. F.W. bridge type 12/6
6 or 12 v. 4 A. F.W. bridge type 15/-
6 or 12 v. 6 A. F.W. bridge type 23/6
6 or 12 v. 10 A. F.W. bridge type 37/6

COLLARO RECORD CHANGERS TYPE RC3/521. Complete with two GP27 Crystal Plug-in heads—One for standard and one for Long-playing records. Brand new in sealed cartons at very low price of 29/19/6—Or the same changer with orthodynamic turn-over head, at 10/9/6, carriage free. Tax Paid.

VERY SPECIAL HIGH-QUALITY RADIO-GRAM CHASSIS. We have purchased a limited quantity of these chassis by Britain's leading manufacturers of quality radiograms. Circuit is a 3-waveband five-valve superhet with A.V.C. Valves 6K8G frequency-changer 6B8G I.F. amplifier, detector and A.V.C. 6SL7GT. Combined pick-up amplifier and A.F. Amplifier on Radio and Gram. 6V6 beam-power output pentode, 6SK7G full-wave rectifier—Kinetics special circuit for gramophone pre-amplification—A continuously variable tone-control provides ample treble correction without accentuating the bass. Large glass dialed horizontal tuning measuring 11in. x 3in. Chassis measurement: 14½in. x 9in. x 5in. This is a superior chassis designed to sell originally in a Radiogram costing £7. Our price is £13/19/6 only, tax paid, plus 5/- packing and carriage. We will gladly demonstrate this chassis or any other working item from our stocks, to personal callers!

CONSOLE RADIOMEGA CABINETS. This is an attractive figured walnut cabinet, originally intended for the above superhet chassis.

It is constructed to take the chassis in the top dial, part being permanently visible through sloping front. Underneath, the gramophone unit is housed in a drawer which slides forward on steel runners—when required for use—Total Cabinet measurement is 36in. high by 20in. wide, by 10in. deep—Our price for the cabinet only is 29/17 6 plus 10/- packing and carriage.

The Collaro changer listed above fits neatly in drawer of this cabinet! ●

We can supply the three units, cabinet, chassis and changer, if purchased together at one time, at a price of £32/10/- plus 20/- packing and carriage. May we suggest an 8in. Elac P.M. Speaker at 17/6?

Fully assembled model being demonstrated at our shop premises.

Please add postage under £1. C.O.D. or Cash with order. C.O.D. charge extra—Open 9 a.m.—6 p.m., Monday to Friday. Sorry but we close at 1 p.m. on Saturday. ●

THE NEW R.C. HIGH-FIDELITY AMPLIFIER. R.P. 6V6 output. Freq. 25—18,000 cps.—60db at 6½ watts. Treble boost and cut—Bass boost—L.P. correction. Provision for Feeder Unit Max. UNDISTORTED OUTPUT 8½ watts. Price 16 gns. plus 7/6. NOW AVAILABLE. Kit of Parts, complete with fully illustrated instructions, 13 gns., plus 5/- carriage. Illustrated booklet available separately at 2/6. Attractive metal cover, now available. With built-in carrying handle, 19/6.

F.S.D.	Size	Type	Fitting	METERS	Price
250 microamp	2½in.	M.C.	F.R.		40/-
500 microamp	2in.	M.C.	F.R.		18/6
500 microamp	2½in.	M.C.	F.R.		35/-
1 mA.	2in.	M.C.	F.Sq.		15/6
1 mA.	2in.	M.C.	F.Sq. (Scale Calib. 1.5kv.)		27/6
1 mA.	2½in.	M.C.	Desk Type		27/6
5 mA.	2in.	M.C.	F.Sq.		10/-
10 mA.	2½in.	M.C.	F.R.		15/-
15 mA.	2in.	M.C.	F.R.		12/6
20 mA.	2in.	M.C.	F.R.		10/-
50 mA.	2in.	M.C.	F.Sq.		7/6
200 mA.	2in.	M.C.	F.R.		10/-
500 mA.	2in.	M.C.	R.P.		10/-
0.5 amp.	2in.	M.C.	R.P.		10/-
1 amp.	2in.	Thermo.	F.Sq.		10/-
2.5 amp.	AC/DC 2in.	M.I.	F.R.		8/6
3 amp.	2in.	Thermo.	F.Sq.		12/6
5 amp.	2in.	M.C.	F.Sq.		7/6
20 amp.	2in.	M.C.	R.P. (with blunt)		13/6
10 v.	2in.	M.C.	R.P.		10/6
15 v.	2in.	M.C.	F.R.		8/6
R.P. = Round projection.			Thermo.	Thermo-couple.	15/-
F.Sq. = Flush Square.			M.C.	Moving Coil.	
F.R. = Flush Round.			M.I.	Moving Iron.	

ALL-PURPOSE TEST METERS. We also offer very limited supply of Ex-Naval All-purpose test meters by Everett, Edgcombe. These instruments are not brand new, but all have been serviced and guaranteed 100 per cent condition. Complete in strong wooden case. Size 9in. x 6in. x 5in. Leather carrying handle. 3½in. Scale—1,000 ohms per volt—Measures 0-1,000 volts AC/DC—Capacity .02 mfd-16 mfd—Resistance to 10 megohms—While stock lasts—Price 27/10/6 only! Plus 2/6 packing and carriage.

SPECIAL OFFER.—Garrard AC/DC model "E" centre drive motor—Auto-stop and start for 78 r.p.m.—Speed regulator—Few only at 27/11/6, plus 2/6 packing and carriage. We also have in stock—Connoisseur 3-speed motors, pick-ups. Pick-up heads, by Garrard, Decca, Collaro, Acos, Chancery, etc., etc., all at current prices!

BRAND-NEW R1155A RECEIVERS guaranteed serviceable in original packing cases, £11/19/6. Fully assembled Power Pack and output stage, to plug straight in to R1155 for A.C. 200/250 volts, at 79/6—Deduct 10/- if purchasing receiver and power pack at the same time.

45 Mc./P.M. STRIP.—Brand new complete with 6 valves type EF50 and one EA80, 70/- only.

PORTABLE RECORD PLAYER CABINETS. Manufacturer's surplus, brand new. External dimensions 15in. x 16in. x 8½in. deep. Finished attractively in dark brown rexine. Motor board cut for B.S.R. Monarch Changer, but will take any standard single player; also room for amplifier. Front view shows attractive grille for speaker. Leather carrying handle, two snap locks. Price 45/- only, plus 2/6 packing and carriage. Also available to take any standard single player—brown leatherette covered. Complete with locks and carrying handle. Size 15in. x 13½in. x 5½in., 22/6 only, plus 2/6 packing and carriage.

P.M. SPEAKERS. Elac 2in., 15/-; Elac, 3in., 15/-; Plessey, 3in., 9/11; Plessey, 5in., 14/-; 6in. Goodmans at 16/6; 8in. Plessey at 15/6; 8in. Elac at 17/6; 10in. Plessey at 16/6; 10in. Elac at 22/6; 10in. Lectrona at 17/6; 10in. Hols with Transformer 28/6; 12in. Truvox 47/6. All 13 ohm speech colls. Also the new Baker, 12in., 15 ohm 15 watt. A quality speaker at 115/6. Also 2in. Elac 15 ohm at 15/6. In addition to the above, we can definitely supply from stock, the complete range of new W.B. "Hi-Fi" Speakers, Wharfedale and Goodmans. Also, Wharfedale Cross-over units, Transformers, etc. Limited quantity only of 6in. reconditioned P.M. Speakers, by ELAC, Goodmans, etc., at 10/6 each. Also, mains energised Plessey 8in. 1,500 ohm field at 27/6 each.

4-WATT 2-STAGE AMPLIFIER. Valve line-up: 6E7, EF37 and GZ32, complete with 10in. Mains Energized Speaker, 26/19/6, plus 5/- packing and carriage.

STUPENDOUS HALF-PRICE OFFER.

DECCA 7 RECORD PLAYERS. MODEL 33A.

A complete playing-desk, brand new, ready to play. 12in. turntable supplied with either standard or long-playing Crystal heads, 24/13/6, or complete with both heads at 25/13/6. Also available from stock at current list prices, Collaro A.C. 3/534, RC3/531, RC3/532, etc. Garrard RC75A, Garrard RC75, A.C./D.C., RC80A, and perhaps by time of appearance of this advert, RC110! Also, ex-stock Connoisseur 3-speed motors, Pick-ups by Collaro, Decca, Connoisseur, Rothermel, Acos, Chancery, etc.

TAPE RECORDER CABINETS. We can offer a well-constructed cabinet, handsomely finished in grey or brown rexine, made specifically to take Truvox or Wearite Tape Decks. Measures 22in. x 14in. x 9in. deep. Completely portable, shows attractive speaker grille at end, and made to take up to 8in. Speaker. We guarantee satisfaction and will be pleased to refund cash if dissatisfied. Antennae from stock at 10/- each. Price 79/6, plus 2/6 packing and carriage.

N.B. We can supply from stock the latest Truvox and Wearite Tape Decks at 22 guineas and £35 respectively. Reduction of 20/- on cabinet if purchased at the same time as either of these tape decks!!

MAINS TRANSFORMER — MANUFACTURERS SURPLUS. Black tropical finish. Size 3in. x 3in. x 2½in. 250-0-250, 60 mA. 6.3 v. 3 A. (Centre Tapped) 5 v. 2 A., 10/6 each, plus 1/6 packing and postage.

LIGHTWEIGHT CRYSTAL HEADPHONES. Brand new, by Rothermel. List price 70/- Our price 25/- 11 Limited supply.

R.F. UNITS. All new condition and complete. Case size 9½in. x 7½in. x 5in.

Type 24—20-30 Mc/s, 15/6. Switched Tuning. Type 25—40-50 Mc/s, 18/6. Switched Tuning. Type 27—65-85 Mc/s, 45/- Variable Tuning.

We have a limited supply of RF27 new condition and complete, but tuning dial damaged. Price 30/- each only. ALL these units Post Free! 11

ELPICO 4-WATT AMPLIFIER. AC/34. A small 3-valve 2-stage audio-amplifier. AC 200/250 v. Output 4 watts, 2/3 ohm. Suitable for Radio, Microphones or Gramophone input. Volume and Tone Controls—Valve line up, 6SL7, 6V6, 573—Engraved front panel. Size of chassis only—7in. x 5in. x 2in. Overall height—5in. Price 7/10/- A.C./D.C. version also available at 26/13/- only. Each amplifier guaranteed for 12 months.

H.T. RECTIFIERS BY S.T.G. Type RM1 at 4/6, RM2 at 5/-, RM3 at 6/-, RM4 at 18/-, DRM1B at 9/6, DRM2B at 10/6. H.T. Rectifiers Type K3/25 at 5/3, K3/40 at 7/6, K3/45 at 8/2, K3/50 at 8/6, K3/100 at 14/8, K3/160 at 21/6, and K3/200 at 26/6. New Surplus 300 v. 80 mA, 8/6.

METER RECTIFIERS. 1 mA by G.E.C. at 11/6, also 5 mA by Westinghouse at 8/6.

LF. TRANSFORMERS. SPECIAL OFFER. All iron-cored 465 K/C/S. By Weymouth.

Size 3in. x 1in. x 1in., 8/6, or Philips, size 2in. x 1in. x 1in., diameter (cylindrical), 7/6 pair. By Invicta—Cylindrical, 2½in. x 1in. diameter, 8/6 pr. Also, our own special ultra-midget, size 1in. x 13/16in. x 13/16in. Only 9/6 per pair.

WHIRL AERIALS. All copper, 3 sections each of 4ft. Screw in 7/6 complete.

Painton, miniature 12-way Plug and Socket. Complete 34/-

5000-1,200 v. PAPER BLOCK CONDENSERS. Size: 5in. x 4in. x 3in., 15/- each. Many others in stock.

CO-AXIAL CABLE. Standard 80 ohms.

Size 3in. x 1in. x 1in., diameter (cylindrical), 7/6 pair. By Invicta—Cylindrical, 2½in. x 1in. diameter, 8/6 pr. Also, our own special ultra-midget, size 1in. x 13/16in. x 13/16in. Only 9/6 per pair.

WIND AERIALS. All copper, 3 sections each of 4ft. Screw in 7/6 complete.

Painton, miniature 12-way Plug and Socket.

Complete 34/-

5000-1,200 v. PAPER BLOCK CONDENSERS. Size: 5in. x 4in. x 3in., 15/- each.

Many others in stock.

CABINETS. We can supply a cabinet for every requirement. Table Model, Extension Speaker, Portable Player, Console, even for Projection T.V.! Why not call and see us?

BRANDENBURG E.H.T. UNITS. 6-9 KV.

12-16 KV., 9 gns.; 6-9 KV. Coil, 39/-; 10-15 KV. coil, 55/- Wiring diagram supplied.

CABINETS. We can supply a cabinet for every requirement. Table Model, Extension Speaker, Portable Player, Console, even for Projection T.V.! Why not call and see us?

BRAND-NEW AND GUARANTEED.

CARR. PACKING AND INS. 10/-.

We can also supply and demonstrate any of the "Dulci" well-known Radio-Gram Chassis advertised elsewhere in this issue—

at list prices.

PRICE £10/5/-.

BRAND-NEW AND GUARANTEED.

CARR. PACKING AND INS. 10/-.

We can also supply and demonstrate any

of the "Dulci" well-known Radio-Gram Chassis advertised elsewhere in this issue—

at list prices.

PROVISION FOR EXTENSION SPEAKER. 110/250 volts.

CHASSIS 11in. x 7in. x 2½in. Scale 8in. Square. Or Chassis 13½in. x 6½in. x 2½in. Dial 10in. x 5in.

PRICE £10/5/-.

BRAND-NEW AND GUARANTEED.

CARR. PACKING AND INS. 10/-.

We can also supply and demonstrate any

of the "Dulci" well-known Radio-Gram Chassis advertised elsewhere in this issue—

at list prices.

APPOINTMENTS

In AC and DC laboratory and electronics laboratory

If you have outstanding ability and would like to share in the unique part this company is playing in aviation progress, our Personnel Department will be pleased to know of your qualifications. Immediate Vacancies are limited, but others occur from time to time due to continued expansion. Only men of high calibre, experience and technical attainment will meet the requirements.

WRITE, AS FULLY AS POSSIBLE, TO
PERSONNEL MANAGER, GROUP D, ROTAX LTD., CHANDOS RD., WILLESDEN JUNCTION, LONDON, N.W.10

OUTSTANDING OFFERS

- **TRANSMITTERS**
RCA ET-4336, Hallicrafters BC-610, GO-9, all with accessories.
- **RECEIVERS**
AR-77, AR-88, BC-348
- **TRANSMITTER-RECEIVERS**
W/S Nos. 11, 17, 18, 38, 58, 68. SCR-522, SCR-610.
- **RADAR EQUIPMENT**
APS-3, APS-6, BM-1, BN-1, VF, AN/APA, Mk. 26 and AN/APN Series of Radio and Radar Equipments.
- **TEST EQUIPMENT**
TS-10A/APN, TS-36/AP, TS-51/APG-4, TS-56A/AP, TS-127/U, IE-46, Type 205A, Type LR-1, BC-221, AN/UPM, SE-2, 79-B, W/117, etc.
- **MOTORS**
Accelerating, Aircraft, Generators, Dynamotors, Inverters, Rotary Converters, wide range of U.S. production.
- **SPARES**
(Radio and Radar U.S.A.) Full range of spares for most U.S.A. Aircraft, Naval and Ground Radio and Radar Units. (SCR-187, 188, 193/269, 274-N, 287, 399, 508-10, 17, 536, 566, 593, 608-10 (very large quantities) 694, 695, MRN-3, TRA-1-ABK, BM, BN, SM, SO, SQ, SK, APS-2, 3, 4, 6, 15 etc.), Klystrons 2K33.
- **AIRCRAFT INSTRUMENTS & ACCESSORIES**
British and U.S. (catalogues supplied upon request).

SPECIAL EQUIPMENT (NOT ADVERTISED ABOVE) AVAILABLE FOR N.A.T.O. GOVERNMENTS AND THEIR ACCREDITED CONTRACTORS.

All enquiries to be addressed exclusively to

BRITISH SAROZAL LTD.

(Head Office)

1, 2, & 3 MARYLEBONE PASSAGE, MARGARET ST., LONDON,
W.I.

Telephone: LANgham 9351 (3 lines). Cables: Sarozal, London

ALL EQUIPMENT AS ADVERTISED IS AVAILABLE FOR IMMEDIATE DELIVERY FROM STOCK AND IS FULLY CHECKED AND TESTED—PRIOR TO DESPATCH—IN OUR OWN WORKS AND LABORATORY.

We buy for cash American surplus equipment.

DEVELOPMENT ENGINEERS

Minimum requirements are higher national certificate, but an engineering degree is preferred.

ELECTRONICS ENGINEERS

Should have experience in electronic servo systems and, preferably, experience of magnetic amplifiers.

H.R.O. SENIOR RECEIVERS. With A.C. P.P., 5 coils, £37/10/-.
D.S.T. 100 RECEIVERS, as new. Coverage is 7 bands from 30 Mc/s. to 50 Mc/s., £30 each.

HAMMERLUND BC779B. Mint condition, rack mtg., £42/10/-.
HALLICRAFTERS SX28, S27, S41, S38, etc. All in perfect condition.

AR88LF, AR88D, CR100, from stock. **RI155 RECEIVERS**, new. A.C./D.C. MOTORS, suitable for sewing machines, 47/6 each. A.C./D.C. 12 v.-15 v. MOTORS, long spindle for models, 15/- each. **20 WATT P.A. RACK MOUNTING AMPLIFIERS**, complete with power pack, 200/250 v. A.C., less valves, £6/10/- Valves—2 type PX25, 1 MH4 and 1 MU14, £2/15/- per set.

NEW M/C MICROPHONES, hand type, with 12 yds. heavy duty screened cable, £3/15/- each.

B.C.221 FREQUENCY METER, from stock. Many items of American equipment available.

TEST EQUIPMENT. We hold a comprehensive stock. Multi-range meters at 1,000 and 20,000 o.p.v., valve testers, signal genes, 4,000Ω EARPHONES, 11/6 pr.

10,000Ω POTENTIOMETERS, large size, by Calvern, enclosed, 8/6 each. 100k, 15w, 9/6 each.

C.R.100 RECEIVERS, perfect order, £27/10/-.

MAINS TRANSFORMERS. Special offer, not ex-W.D., 200/250 v. input tapped. Output 250-0-250 v. at 100 mA., 5 v. 3 a., 6.3 v. 4 a., 21/6 each.

350-0-350 v. Ellison at 120 mA., 6.3 v. 5 a., C.T. 5 v. 3 a., 37/6. All types in stock.

EVERSHED BRIDGE MEGGERS, 250 v. Special price, £17/10/- each.

COSSOR DOUBLE BEAM OSCILLOSCOPE, perfect, £33.

G.E.C. 7 WATT V.H.F. MOBILE TX/RX. Complete with 12 v. rotary p/pack, 80.9, 81.1 and 81.3 Mc/s., special offer, £30.

EDDYSTONE 640 RECEIVER. Perfect, at £22.

6 VOLT (3 at 2 v.) BOXED ACCUMULATORS, 24/-.

.1μF350 v. METAL CASED TUBULARS, U.S.A. at 4/6 doz. (minimum 2 doz.).

H.R.O. COILS. .46-.96 Mc/s., etc., at £2/5/- per coil.

LARGE STOCKS OF MOTORS. A.C./D.C. and A.C., 1/16, 1/12, 1/8, 1/4, 1/2 h.p.

EDDYSTONE "750," as new, £45/10/-.

Your post enquiries welcomed. S.A.E. for reply, please. Orders, C.W.O. or Pro-forma Invoice, no C.O.D. Prices quoted do not include carriage and packing

All types of equipment purchased Top prices paid.

SERVICE RADIO SPARES

4, LISLE STREET, LONDON, W.C.2

Telephone: GERrard 1734.

Most types of coil winding undertaken. Very quick deliveries, small or large quantities. Transformers, Chokes, Solenoids, Relay Coils, etc., wound on your own bobbins or formers for your own assembly. Impregnating (varnish) on all work done if required. Best quality material used. Single prototypes made to high standards, regulation and cool running, etc.

FOR CATHODE RAY TUBE FAILURES.

Special low capacity secondary winding for Heater/Cathode shorts to restore picture after this fault has occurred. All Primaries tapped, framed and tag panelled. 200/250, 2 v. at 2 a., 4 v. at 2 a., 6.3 v. at 2 a., 10.8 v. at 0.3 a., to 29/6 each.

(Discount to trade)

EMISSION REJUVENATORS.

200/250 tapped output tapped in steps 2 v. to 2½ v. to 2½ v. at 2 a., at 35/6 each.

Output 200/250 tapped in steps 6.3 v. to 7 v. to 8 v. up to 9½ v. at 2 a., at 37/6 each.

(Discount to trade)

Both space wound for Heater/Cathode shorts also

T.V. HEATER TRANSFORMERS.

200/250 6.3 v. at 7 a., 0.2-6.3 v. at 2 a., at 19/6 nett.

T.V. AUTO TRANSFORMERS.

0-190-210-230-240 at 6.3 v. at 7 a., 0.2-6.3 v. at 2 a., at 27/6 net.

T.V. FRAME TRANSFORMER.

60 H. magnetic deflection, suitable for most home constructed sets at 15/6 net.

HALF SHROUDED.

200/250 input, 250/0 250 80 mA, 6.2 v. 3 a. and 5 v. 2 a., 12/9 net plus 1/1 P. & P.

NORTHERN TRANSFORMER CO.

215 BARKEREND ROAD,
BRADFORD, YORKS.

GRAMOPHONE AND SOUND EQUIPMENT

SURPLUS AND SECONDHAND

LOWTHER pick-up with Diamond and P.M. 2 unit; no reasonable offer refused.—Box 2564.

FERROGRAPH tape recorder, latest 2A model November, 1953, £69; would exchange for disc recorder, late model and perfect, or would purchase same for cash.—Box 2587, c/o W.W.

BOOSEY & HAWKES type wire recorder combination with record player, excellent condition; £28.—Burgess, Lane & Co., Block J. Sunleigh Wks., Sunleigh Rd., Wembley, Wem. 2378. [2135]

ANY of you tape types building your own? Although we deal primarily in standard cine equipment, it's quite possible that our "Bits and Pieces" list might be useful; s.a.e. please. We also wish to buy tape desks, recorder components, etc.—Burgess, Lane & Co., Block J, Sunleigh Works, Sunleigh Rd., Wembley Tel. Wem. 10253.

YOUR tapes to disk (78 & LP, Microgroove, genuine), tape, disks, accessories; trade terms on above; E.M.I. & Ferrograph Recorders; 2 BSR disk recorders, condition excellent; reasonable; studio and mobile service, professional standards, "Eroica" Recording Services (Reed, 1949), Peel St., Eccles, Manchester, Eccles 1624, Musical Director Thurlow Smith, A.R.M.C.M.

NEW COMPONENTS

CRYSTAL microphone inserts (Cosmocord Mc-6), guaranteed brand new; 15/6, post free.—Radio-Aid, Ltd. (Retail Dept.), 29, Market St., Bradford. [0036]

TRANSFORMERS.—Single phase 230 volts to 12 volts; output 15/17 amps, 15/9; cash with order; post free U.K.—Barleynew Engineering, Ltd., Betchworth, Surrey. [2309]

2 SKV ringing choke, with EY51 mountings, 12/6; EY51 fitted, 35/-; two models, negative or positive output, first-class job, tested and guaranteed .001mf² 4 kv 3/6.—Cretton, 349, Copnor Rd., Portsmouth. [2194]

V.H.F. Hi-Fi F.M. receivers, complete parts kit, with valves, wound coils, chassis, £7/5, aerials, and alignment service available; as 144 M/cs Rx with mod., colsets, F.M., TV, colformers, canned .5in x 1½in., 2/3—Bell Sound Products Co., Marlborough Yard, N.19. [0186]

FOR really good results you can do no better than use Osmor coils and colpacks, ask anyone of experience! Send 5d (stamps) today for beautifully-drawn free circuits, our new catalogues, and latest lists of matched radio components. A speedy mail order department is at your service, and remember, all Osmor items are guaranteed. (Trade enquiries invited.) Dept. G.W.

OSMOR RADIO PRODUCTS Ltd., Bridge View Works, Borough Hill, Croydon. Tel. Croydon 5148-9. [10046]

FLUORESCENT 80 watt 230v complete ballast unit, 39/6; 80w brick choke and starter lamp, 14/6; 40 watt complete ballast 250v, 28/6; complete fluorescent fittings from 45/-; metal rectifiers, 12v 4amp f/w bridge, 13/9; suitable charger transformer, 16/6; 0.4 ampmetre, 8/6; brand new small radio cabinets, 16/6; multi-ratio output transformers. Goodmans, 7/6; Diamond H switches 4/6; 4-pole cooker switches, 5/-; charge your dry cell batteries with our special charger from mains, complete unit, 14/9; new G.E.C. 1/4hp electric motors, 230v S/p, £4/16.—Maiden Transformer Supplies, Rear of 5, Coombe Rd., New Malden, Surrey. Tel. 2655 (Longside of Malden S.R. Station). [0038]

COMPONENTS—SURPLUS AND SECONDHAND

SUPREME RADIO, 746s, Romford Rd., Manor Park, London, E.12. Tel. 11f. 1260. Est. 17 years.

AMAZING bargains in vol./controls, small size, with long spindle and S/P switch, 1meg, 1/2meg or 1/4meg, our price, 2/6 ea.; also 1/2meg vol./control, less switch, 1/6 ea., 2meg standard size vol./control, long spindle, less switch 1/6 ea.

LOOK! Crystal sets in brown bakelite case, 3/4in x 2½in x 1½in, wired ready for use, amazing bargain value at 7/6 ea.; this crystal set uses a crystal diode.

NEW stocks electrolytics, metal can, small, 16mf² 350v, 1/11 ea.; 16+16mf² 350v, 2/3 ea.; 16+24mf² 350v, 2/6 ea.; 32mf² 350v, 2/6 ea.; 32+32+16mf² 350v, 3/6 ea.; large can types, special bargains, 32+32mf² 450v, 50/50, surge, our price 4/11 ea.; 60+150mf² 275v d.c. wkg. 4/11 ea.

TUB-CARD wend types, 8mf² 450v, 1/11 ea.; also T.C.C. type 8mf² 450v, 550v surge, 2/9 ea.; 4mf² 150v dryline type, 10d ea.

SELEKTRON super converter, mains trans., by Permeke, unusual finding, primary tapped, 0-200-220-240v, sec. 290-0-290, 60 m.a., 6.3v 3amp, and 6.3v tapped at 4v 2amp, with screen, our price 5/11 ea.; or 3amp type 8/11 ea.

DUAL range Litz wound T.R.F. coils, 5/11 per pr., with circuit, for 200-2000mtrs. OUR new season radio-television list now ready.

ANOTHER good buy small mains trans., with vol./panel, tapped 200-210v, 220-230v, 240-250v, primary; secondary, 250-0-250v, 60m.a., with 6.3v tapped at 5v, our price 11/9, inc. p/post.

FILAMENT trans., primary, 0-250v, sec. 6.3v at 1.5amp, 5/11 ea.; or 3amp type 8/11 ea.

DUAL range Litz wound T.R.F. coils, 5/11 per pr., with circuit, for 200-2000mtrs. OUR new season radio-television list now ready.

TERMS: c.w.o., no c.o.d.; send 9d extra for postage orders under £5; 2½d s.a.e. all enquiries and list. [0021]

SOUTHERN RADIO'S WIRELESS BARGAINS

TELESONIC 4-Valve Battery Portable. Complete with 4 Hivac Valves. In Metal Carrying Case. Easily convertible to Personal Portable. £2 including conversion Sheet.

TRANSMITTERS-RECEIVERS. Types "38" Mark II and III. "18" Mark III. Still available as previously advertised. ALSO R109 RECEIVERS. See October issue of "W.W."

BOMBSIGHT COMPUTERS. Just arrived new parcel of this USEFUL Unit. Ex-R.A.F. Brand New. Contains GYRO, MOTORS, REV. COUNTERS, GEAR WHEELS, ETC., ETC. Worth many Pounds to Model Makers, Experimenters, etc., etc. £3/5/-.

CRYSTAL MONITORS. Type 2. Brand New in transit case. Less Crystals. 8/-.

LUFRA HOLE CUTTERS adjustable fin. to 3½in. For use on Wood, Metal, Plastic, etc. 6/6.

THROAT MICROPHONES. Brand New. Magnetic with Long Lead and Plug. 4/6. Button Type ex-U.S.A. 4/6.

RESISTANCES. 100 ASSORTED USEFUL VALUES WIRE-ENDED. 12/6 per 100.

CONDENSERS. 100 ASSORTED VALUES

TUBULAR, METAL AND MICA. 15/- per 100.

PLASTIC CASES. 14in. by 10in. Transparent.

Ideal for Maps, Display, Photos, etc. 5/6.

STAR IDENTIFIERS. Type 1 A.N. Covers Both Hemispheres. Complete in Case. 5/6.

WESTECTORS. Wx6 and WI12. 1/- each.

AERIAL FILTER UNITS. MARCONI. P.O. SPECIFICATION. 4/6.

CONTACTOR TIME SWITCHES. 2 im-pulses per sec. Thermostatic Control. Complete in Sound Proof Case. 11/6.

REMOTE CONTROL for use with above. 7/6.

DIMMER CONTROLS. Bakelite covered. Wire Wound. Brand New. 1/3 each.

IMPELLER PUMPS. Approx. length 20in. Diam. 2in. 24 volts at 2 amps. D.C. or 12 volts at 4 amps. Self cooling. Ideal as Bilge Pump or pumping liquid of all kinds. BRAND NEW. 32/6.

MORSE TAPPERS. Heavy Duty. Totally enclosed "Type D" Mounted on Base. 8/6. List of Radio Publications, 2½d.

SOUTHERN RADIO SUPPLY LTD.

11 LITTLE NEWPORT STREET, LONDON, W.C.2

Gerrard 6653

THE MODERN BOOK CO.—

BRITAIN'S LARGEST STOCKISTS of English and American Technical Books

Electronic Gadgets for the Constructor by E. N. Bradley. 3s. 6d. Postage 3d.

Soft Magnetic Materials for Telecommunications edited by C. E. Richards and A. C. Lynch. 63s. 0d.

Sound Recording and Reproduction by J. W. Godfrey and S. W. Amos. 30s. 0d. Postage 1/-.

Principles of Transistor Circuits edited by R. F. Shea. 88s. 0d.

Television Test Equipment by E. N. Bradley. 5s. 0d. Postage 3d.

Telecommunications Principles by R. N. Renton. 37s. 6d. Postage 1/-.

Art and Science in Sound Reproduction by F. H. Brittain. 2s. 6d. Postage 3d.

Basic Mathematics for Radio Students by F. M. Colebrook. 10s. 6d. Postage 4d.

Amplifiers by G. A. Briggs and H. H. Garner. 15s. 6d. Postage 6d.

Television Faults by N. Stevens. 5s. 0d. Postage 4d.

Radio Receiver Design : Part II by K. R. Sturley. 56s. 0d. Postage 9d.

Sound Reproduction by G. A. Briggs. 17s. 6d. Postage 9d.

Radio Engineering by F. E. Terman. 50s. 0d. Postage 1/-.

"Practical Wireless" Encyclopaedia by F. J. Camm. 21s. 0d. Postage 9d.

Radio Valve Data compiled by "Wireless World." 3s. 6d. Postage 3d.

WRITE OR CALL FOR NEW CATALOGUE

19-23 PRAED STREET

(Dept. W.12).

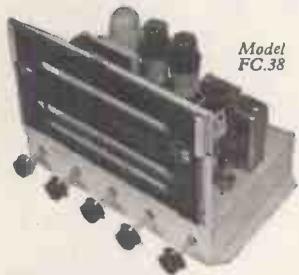
LONDON, W.2

Open all day Saturday. PAD 4185

H. HARRIS
ORGANFORD DORSET
Telephone : Lychett Minster 212

Armstrong

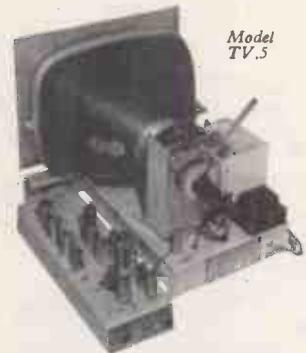
Specialists in the manufacture of the
HIGHEST QUALITY CHASSIS
for over 20 years



Model FC.38

MODEL FC.38 An 8 Valve Super-heterodyne chassis giving 8 watts push-pull output with negative feedback and separate BASS and TREBLE lift controls, Flywheel tuning and a magic eye. Three wavebands covering 16-50' metres, 190-550 metres and 1,000-2,000 metres. PRICE £23/13/-, including tax.

MODEL RE.41 A 10 Valve Super-heterodyne chassis giving 10 watts push-pull output with negative feedback and separate BASS and TREBLE lift controls, also a highly sensitive R.F. stage before the mixer. Flywheel tuning and a magic eye. Four wavebands covering 12-90 metres, 190-550 metres and 800-2,000 metres. PRICE £31/19/8, including tax.



Model TV.5

TV.5 TELEVISION RANGE

A 19 Valve Superheterodyne Circuit with instantaneous 5 channel selector switching and aluminised rectangular flat-faced Cathode Ray Tube with tinted filter. 14in. and 17in. Models available.

**THE T.V. CHASSIS THAT
★ GIVES THE TRUE BLACK ★
AND WHITE PICTURE**

PRICES:

TV.5 14in. Chassis, £54/0/3 (inc. P.T.)
TV.5 17in. Chassis, £64/15/11 (inc. P.T.)
Also available in handsome Cabinet form.

Our Showroom at the address as below is open daily from 9 a.m. to 6 p.m. (Saturdays 5 p.m.) and we are always delighted to demonstrate any of our Models or supply any information regarding them. If unable to visit us please send for specifications required.

ARMSTRONG WIRELESS & TELEVISION CO. LTD.
WARLERS ROAD, HOLLOWAY, LONDON, N.7
Telephone: NORth 3213/4

COMPONENTS—SURPLUS AND SECONDHAND

RADIO CLEARANCE, Ltd., 27, Tottenham Court Rd., London, W.1. Tel. Museum 9188. ELECTROLYTICS, capacity, voltage, size, type of mounting, price post paid: 400, 6V 1×2in. lug, 1/9; 250+250, 6V, 1×2in. lug, 2/-; 500+500, 6V, 1×3, lug, 2/6; 40+40, 150V, 1/4×2in. clip, 2/9; 40, 150V, 1×2, clip, 2/6; 20+20, 275V, 1×2, lug, 3/3; 16+32, 275V, 1×2, lug, 3/3; 16+16, 275V, 1×2, clip, 3/3; 32+32, 250mf 25V, 1×3, lug, 3/6; 60+100, 275V, 1/4×3, lug, 4/6; 100, 275/350V, 1/4×3, clip, 3/6; 32+32, 500mf 350V, 1/4×2, clip, 4/6; 16+16, 350V, 1/4×2, lug, 4/6; 40, 300V, 1×3, lug, 3/6; 10, 450V, 1/4×2, lug, 1/8; 16, 450V, 1/4×2, tag, 2/9, 20, 450V, 1/4×2, lug, 2/3; 32, 450V/525V, 1/4×2, clip, 3/9; 32+32, 450V, 1/4×3, clip, 5/6; 30+30, 450V+20mf 25V, 1/4×3, lug, 5/6, 15+15, 450V+20mf 25V, 1/4×3, lug, 4/6; 200, 6V, 1/4×1/4, clip, 1/6; 100, 12V, 1/4×1/4, clip, 1/9; 8, 450V, 1/2×2, clip, 2/-; 50, 12V, 1/4×1/4, tag, 1/6; 150, 25V, 1/4×1/4, clip, 2/-; 250, 12V, 1/4×1/4, wire, 2/3; 350, 25V, 1/2×1/4, clip, 2/6; 16+16, 450V, 1/4×2, clip, 4/4; 40+40, 275V, 1/4×2, clip, 3/3; 16+32, 450V/525V, 1/4×2, clip, 5/5; 24+24+16, 350/425V, 1/4×2, clip, 4/9; 60+200, 275/350V, 1/4×4, clip, 6/6; 4, 150V, 1/4×1/4, clip, 1/1; 500, 12V, 1/4×23, clip, 2/-; 6, 350V, 1/4×2, clip, 6/6; 100+175, 275/350V, 1/4×4, clip, 6/6; 32+32, 350/425V, 1/4×2, clip, 5/5; 8+16, 450V/525V, 1/4×2, clip, 4/4; 450V/525V, 1/4×1/4, tag, 1/8; 2, 350V, 1/4×1/4, tag, 1/3; 1,000, 6V, 1/4×2, clip, 2/9; 8, 450V, 1/4×2, clip, 1/8; 6,000, 6V, 1/4×3, clip, 4/9; all cans, some with sleeves all voltages. WKG. surcharge where marked new stock, guaranteed.

TELEVISION! Set of 3 components comprising line output trans., with E.H.T. winding to give 7KV, using EY51 (heater winding for EY51 also included), and fitted with width control scanning coils, low impedance line and frame, focus coil (res. 10,000Ω, current approx. 20 mA); this set of 3 for 42/- plus 2/- post, diagram of line trans., sup. post, diagram of PERSONAL receivers, 3 valve T.R.F. using IT4s, contained in handsome bakelite case with lift-up lid, size 7×64×5in with lid closed, plastic carrying handle, fram. AE in lid, these receivers cover the medium waveband and operate from self-contained dry batte., standard types, WI435 and U2, output to a pair of lightweight phones (H.R.), controls, SM tuning and reaction, opening lid switches on supplied brand new, with valves, batteries, phones, an ideal set for invalids hos. patients, etc., these receivers are not Govt. surplus and are offered ready to play, car. paid £4/10.

UNIVERSAL amplifiers, 8 watt 20 watt A.C./D.C., black crackle chassis, and black and chrome cover, overall size 15½in×7in×7in. First-class components (Partridge O.P.T., and direct, Gardner chokes, A.E.E. Mu-Metal input trans., for mike). Valves 4×EF57, 4×CL33, 2×UR3C. Switched input for high or low volt., top cut and bass cut switches, V.O. mains switch, mains plug and socket, 220-250V, isolated chassis, 150 output. Wired and tested, ready for use, with valves, brand new, £10/19/6, car. paid.

5 mA meters, moving coil, Bakelite case, 2in square, flush mounting, new, boxed; 8/- post paid.

RADIO CLEARANCE, Ltd., 27, Tottenham Court Rd., London, W.1. Tel. Museum 9188. 10015

SOUTHERN RADIO SUPPLY, Ltd., 11, Little

Newport Street, London, W.C.2. See our displayed advertisement, page 132.

T.V. tubes, £1 9in. 30/- 12in, work perfect,

but have ion burns, ideal for testing or

standby; post and insurance 15/6 extra.—Duke & Co., 621, Romford Rd., Manor Park, E.12.

[1217]

—WANTED, EXCHANGE, ETC.

VHF test equipment.

TS47AP, TS174, TS175/U, TS148 or TSX-4SE; analysers; BC221 freq. meters, TS69, and any U.S.A. test gear; Klystrons type 723/AB, 2K33 2K39 2K41; receiver, APR4 and units TN16 18-19; RCA AR88D, S27 and SX28s and S27CA; microwave equipment; highest offers given by return.—Ger. 8410. Universal Electronics, 27, Lisle St., Leicester Square, London, W.C.2.

[10229]

WANTED, Wilcox Gay V.F.O. units in new

or modified condition.

MCELROY-ADAMS MFG. GROUP, Ltd., 46, Greyhound Rd., London, W.6. Tel. Fulham 1138/9

[10194]

WANTED, receivers A.P.R.4, also T.N. 16. 17.

LESLIE DIXON & Co., 214, Queenston Rd., Battersea, S.W.8. Macaulay 2159.

[10176]

WANTED, R.C.A. transmitters, all types or

and metal work.

MCELROY-ADAMS MFG. GROUP, Ltd., 46, Greyhound Rd., London, W.6. Tel. Fulham 1138/9

[10196]

A COLLINS 75A receiver wanted.—Parvin,

A 19, Fellbrook Ave., Acomb, York. Tel. 78283.

[2323]

WANTED, set manufacturers' or ex-Govern-

ment radio equipment, large or small quan-

tities of valves, electrolytics, speakers, meters,

also components.

LOWE BROS. 5, Fitzroy St., London, W.1.

Tel. Museum 4389

[19745]

WANTED, H.R.O. coils, Rxs., etc., A.R.88s,

BC348s, S27s, etc.—Details to R.T. & I.

Service, 254, Grove Green Rd., London, E.11.

Tel. Leycester 4986.

[10163]

THE NEW DUODE



IS THE BEST
INVESTMENT
FOR ANYONE
WHO SEEKS
GOOD SOUND

Barker Sound Units, however old, are never a write off. To the best of our belief, they are the only units for which it is possible to obtain a "bringing up-to-date" service at most reasonable cost.

At any time when you buy, you are already ahead of existing standards and are able to enjoy unmatched naturalness which satisfies the most critical ear for a very long time.

Improvements can only be small but in due course a number combine to justify a change, such as the new Duode. Then the owner of an older Barker unit scores heavily, for he can experience the fresh pleasures of even better reproduction at a fraction of the cost of a new unit.

The New Duode gives more than twin units of conventional design. It gives full frequency range; it has built-in crossover and feed-back; it will positively not boom or fizz of its own accord. Its price is only 12 gns. and easy H.P. is available.

You can pay much more for much less : you cannot pay less for what the new Duode brings you.

INSIST ON HEARING IT
ASK A GOOD DEALER
or write for details to :

BARKER
NATURAL REPRODUCERS

3 Newman Yard, London, W.1

Excellence in design..



AIR DIELECTRIC TRIMMER Protected by Acetate Case

Capacities from 4 to 70pf in voltages of 500 and 1,000 D.C. Width 16.5 mm. Length 22 mm. Acetate dust cover optional. Insulation over 10,000 megohms. Power factor less than .001.

Type approved Cat. A. No. 464.

OXLEY

DEVELOPMENTS CO. LTD.
ULVERSTON, NORTH LANC'S.
TEL.: ULVERSTON 3306

NEW G.E.C., S.T.C. AND "WESTALITE" SELENIUM RECTIFIERS. Largest L.T. range in Great Britain. Latest Current Products. NOT Surplus.

CURRENT PRICE LIST

S.T. & C. E.H.T. K3/15, 4/5 ; K3/45, 8/2 ; K3/50, 8/8 ; K3/100, 14/8.

BRIDGE CONNECTED FULL WAVE

17 v. 1.2 a. 16/4 ; 1.6 a. 26/- ; 2.5 a. 29/- ; 3 a. 30/- ; 4 a. 34/6 ; 5 a. 37/6, all post free. 33 v. 0.7 a. 24/3 ; 1 a. 28/- ; 1.5 a. 45/- ; 2 a. 51/- ; 3 a. 52/- ; 4 a. 62/- ; 5 a. 67/- ; all post 1/- . 54 v. 1 a. 38/6 ; 1.5 a. 62/- ; 2 a. 69/- ; 3 a. 70/- ; 4 a. 93/- ; 72 v. 1.2 a. 49/- ; 1.5 a. 78/- ; 2 a. 81/- ; 3 a. 92/- ; 5 a. 122/- ; 100 v. 1 a. 70/- ; 1.5 a. 112/- ; 2 a. 128/- ; 5 a. 174/- ; all post 1/2.

BRIDGE CONNECTED HEAVY DUTY 7.5 in. SQUARE COOLING FINS. 17 v. 6 a. 49/6 ; 10 a. 56/- ; post 1/6.

BRIDGE CONNECTED HEAVY DUTY

Funnel Cooled, also 7.5 in. SQUARE COOLING FINS. Revised price, same both types. 17 v. 12 a. 102/- ; 20 a. 118/- ; 30 a. 164/- ; 50 a. 112/15/- ; 33 v. 6 a. 91/- ; 10 a. 104/- ; 12 a. 168/- ; 20 a. 188/- ; 54 v. 6 a. 120/- ; 10 a. 142/- ; 72 v. 6 a. 154/- ; 10 a. 178/- ; 100 v. 6 a. £11/- ; 10 a. £12/15/- ; all post 1/10.

"WESTALITE" (BRIDGE), 12-15 v. D.C., 1.2 a. 15/10 ; 2.5 a. 27/8 ; 5 a. 31/9 ; 10 a. 54/6 ; 20 a. 99/6 ; 30 a. 144/10 ; 50 a. 257/- ; 24 v. 1.2 a. 15/10 ; 2.5 a. 27/8 ; 5 a. 51/- ; 10 a. 92/7 ; 20 a. 176/2 ; 36 v. 1.2 a. 27/8 ; 2.5 a. 51/- ; 5 a. 69/10 ; 10 a. 130/9 ; E.H.T. RECTS., 14D, 134, 22/- ; 36 E.H.T. 60, 31/10, all post extra.

Wholesale and Retail

T. W. PEARCE

66 GREAT PERCY STREET, LONDON, W.C.1
Off Pentonville Rd. Between King's Cross and Angel

WANTED, EXCHANGE, ETC.
WANTED. TCS/6 or TCS/12 transmitters in mint condition; also control boxes for same. MCELROY-ADAMS MFG. GROUP, Ltd., 46, Greyhound Rd., London, W.6. Tel. Fulham 1138/9. [0195]

WANTED, platinum and mercury for spot cash.—A. Hamburger & Sons, Ltd., 57, Lower Tower Street, Birmingham, 19. Tel. Aston Cross 1548-9. [1977]

No. 10 headsets or No. 13 microphones, large or small quantities required top prices paid.—Industrial Suppliers (Cambridge), Ltd., 15a-17, Brecknock Rd., London, N.7. Gulliver 5891. [2018]

WANTED, R.C.A. speech amplifiers, type M1-11220 J. or K and Arfel tuning units BC939a; offers stating quantity and price to—P.C.A. Radio, Office and Works, Beaver Lane, Hanmersmith, W.6. Tel. Riv. 8006. [0079]

WANTED, BC-610 Hallicrafters, R.C.A.-4336 transmitter SX-28, AR-88, S-27 H.R.O. receivers and spare parts for above; best prices.—P.C.A. Radio, Office and Works, Beaver Lane, Hanmersmith, W.6. Tel. Riv. 8006. [0080]

ALTHAM RADIO Co. pay highest prices in the trade for all American equipment, including test sets, transmitters, receivers, teleprinting gear, etc.—Jersey House, Jersey St., Manchester, 4. Tel. Central 7834-6. [0228]

WANTED, AN/APR-4 receiver, any units; any other good quality U.S. surplus radio and radar tubes, test sets; laboratory equipments, etc.; give condition and price in first letter.—Engineering Associates, 434, Patterson Rd., Dayton, 9, Ohio, U.S.A. [0234]

WANTED, good quality communication rxss. domestic radios, test equipment, etc.; top prices paid, established since 1937.—Miller's Radio, 33a, Newport Court, 1 min from Leeks Sq. Tube. Tel. Ger. 4638. Call, write or send. Hours of business 10-6 p.m. Open all day Saturday. [0199]

WANTED, signal generators types 30, 31, 51, 53, 54, 56 and 101; also any American test equipment with prefix TS or BC. American receivers types AR88, APR4 or similar.—Send price and details to Hathfield Instruments, Ltd., 175, Usbridge Rd., Hanwell, W.7. Tel. Ealing 0779/9857. [0037]

WANTED: we will pay 10% more for the following American equipment; test sets with TS prefix, BC221, APR4 receivers, APR4 tuning units, BC342, BC312, power units No. 15 and PE98, teleprinter equipment.—Altham Radio Co., Jersey House, Jersey St., Manchester, 4. Tel. Central 7834-5-6. [0227]

WILL buy ART/13-T47A or T47 type transmitter; R5/ARN7 radio compass receiver; BC348 receiver; ARC3 radio complete; R77 receiver; EC312 and BC342 receivers; APN9 Lorain transceiver; R89B Gildepeth; 788C altimeter receiver; IEI52C scope; RA20 power units; TI17 microphones; TS67 test sets.—Write H. J. Burke Co., 49, Washington Avenue, Little Ferry, N.J. [2310]

VALVES WANTED
VALVES urgently wanted for export, types 813, 723A/B, 250T, 633, any quantity, highest prices paid.—Write Pye-Hayes Radio, 606, Kingsbury Rd., Birmingham, 24 (Erdington 4942.) [2016]

45/- paid for £13 valves, 60/- ; 723 A/B; 2K33, T240, 808, etc.; any quantity, write Pye-Hayes Radio, 606, Kingsbury Rd., Birmingham, 24. [1861]

BATTERIES

JUST released by the Ministry.—All-dry H.T./L.T. batteries, 72 volt H.T.+1.5v L.T., layer type size, 6in×5in×2in; also 60v H.T.+1.5 L.T., ideal for deaf aids, personnel sets, models, etc., size 4in×3in×1.5in, all tested and guaranteed full voltages before despatch; our special price 4/6 each, post and packing 1/3 or two for 8/-, post and packing 1/6.—Walton's Wireless Stores, 48, Stafford St., Wolverhampton. [0061]

CABINETS

LEWIS RADIO have the best selection and finest finish.—See page 142. [0224]

WALNUT radio gram cabinets; details.—Cabinetware, 1a, Heyes St., Blackburn.

TELEVISION, radio, radiogram and tape-recording cabinets.—157, Bromsgrove St., B'ham. Mid. 1054. [2133]

CABINETS made to order; send details for quotations. **BASS REFLEX CABINETS**, finished in period or contemporary styles. See display advertisement, page No. 138. Open till 5.30 Saturdays.—A. Davies & Co. (Cabinet Makers), Hampstead. Gulliver 5775. [2319]

REPAIRS AND SERVICE

MAINS transformers rewound, new trans-formers, any specification. MOTOR rewinds and complete overhauls; first-class workmanship; fully guaranteed.

F.M. ELECTRIC Co., Ltd., Potters Bldrs., Warser Gate, Nottingham. Est. 1917. Tel. 47899. [0113]

TRANSFORMER rewinding service, mains. E.H.T. transformers and chokes, prompt delivery, range of replacement types ex stock or manufactured to your specification.

METROPOLITAN RADIO SERVICE Co., 75, Kilburn Lane, London, W.10. Ladbrooke 2296. [0200]

PLACE IT -

ON RECORD -

WITH A TAPEMASTER

TAPEMASTER RECORDING COMPONENTS
Suitable for use with either Hartley or Culpits circuits.

JUNIOR MODEL. Play/record, imp. 3,000 ohm at 1 Kc. Erase...at each £1 19 6

SENIOR MODEL. Play/record, imp. 5,500 ohm at 1 Kc. Erase...at each £2 5 0

Oscillator Coil in can each 10 6

Oscillator Unit, incl. coil and 6V6GT valve each £2 5 0

TAPEMASTER MAGNET FEATURES. Electrically balanced to ensure low "hum" level. Play/Record Model with .0005in. gap ensuring max. top response. Beryllium Copper, non-magnetic, gapping. Mu-metal cores for Play/Record models. Track width, Play/Record, .082in, Erase, .10in. To match for tracking, Bias frequency 45 Kc, exactly matching Tapemaster oscillator units and coils. Output 10 mV. Recording level, 15-20mV. With optimum bias, recording level and suitable correction of Amplifier response in frequency equals tape speed in inches/sec. Full instructions included for oscillator units and amplifier circuits.

AVAILABLE FROM ALL GOOD
RADIO DEALERS.

WINTER TRADING CO. LTD.

6, HARROW RD., LONDON, W.2.

Free from distortion



cannot introduce hum

E.M.G.

STEEP-CUTTING INFINITELY VARIABLE FILTER

No other filter combines all the advantages of this model which are, briefly, to cut response above any desired level between 4,000 and 8,000 c.p.s. at an average steepness of 30 db. per octave, easy fixing (connects between 15 ohm speaker and amplifier output), robust construction, no distortion or appreciable loss of volume. Recommended for reducing surface noise on '78' records, cutting 'edge' on some L.P. records, and eliminating high-pitched interference on radio. Price £4/10/0. Leaflet on request.

E.M.G. HANDMADE GRAMOPHONES, LTD.
6, Newman St., Oxford St., W.1
Telephone: Museum 9971-2-3

GALPIN'S

ELECTRICAL STORES

408 HIGH STREET, LEWISHAM, S.E.13.

Tel.: Lee Green 0309. Nr. Lewisham Hospital.

TERMS: CASH WITH ORDER. NO C.O.D.

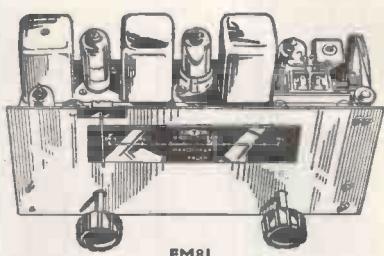
All goods sent on 7 days' approval against cash.

EARLY CLOSING DAY THURSDAY.

MAINS TRANSFORMERS, Input 180/250 volts, output 435/0/435 volts, 250 m/amps, 6.3 volts 10 amps 6.3 volts 8 amps, 6.3 volts 8 amps, 5 volts 6 amps, 65/- each.**MAINS TRANSFORMERS**, 200/250 volts input, output a combination of 6, 12, 18, 24, 30 and 36 volts at 6 amps, 45/- each, post 1/6.**MAINS TRANSFORMERS**, 200-250 volts input, output 400/0/400 volts, 280 m/amps, 6.3 v. 8 a., 2 v. 3 a., 5 v. 3 a., 4 v. 2 a., 4 v. 2 a., the last two heaters insulated at 8,000 volts, 85/- each; another 200/230 volts input, output tapped 0.9, 18 volts at 4 amps, 25/- each, post 1/6.**MAINS TRANSFORMERS**, Input 200/250 volts, output 45/50 volts, 70 amps, suitable for arc welding, £15 each; another 70 volts, 50 amps, £15 each.**3 KILOWATTS DOUBLE-WOUND VOLTAGE CHANGER TRANSFORMERS**, 110/130 volts or vice-versa, as new, weight approx. 100lbs., £12/10/- each, carriage forward.**1,000 WATT AUTO WOUND VOLTAGE CHANGER TRANSFORMER** tapped 0/110/200/230/250 volts, £5/15/- each, carriage 4/6.**WELDER TRANSFORMER**, 200/250 v. Input, output 0/60/80 volts, 800 amps. Complete, on trolley, £32/10/-, c/fwd.**METERS**. Moving Coil, 0 to 14 amps, 18/6 each. Ditto, Moving Iron, suitable for A.C. 0 to 30 amps, 25/- each. Another moving coil, 100 to 250 amps. D.C., 35/- each, all 4in. scale.**ELECTRIC LIGHT CHECK METERS**, useful for subletting, garages, etc., all for 200/250 volts A.C. mains, 5 amp load, 19/- each; 10 amps, 22/6; 20 amps, 27/-; 25 amps, 32/6; 40 amps, 38/6; 50 amps, 46/6; and 100 amps, 57/6 each, all carriage paid.**EX-U.S.A. ROTARY CONVERTORS**, 12 volts D.C. input, outputs 500 volts 50 m.a., 275 v. 100 m.a. Complete with smoothing, 22/6 each, carriage 2/6, as new.**EX-NAVAL ROTARY CONVERTORS**, 110 v. D.C. input, 230 volts A.C. 50 Cy, 1 ph 250 watts output. Weight approx. 100lbs., £12/10/-, c/forward.**D.C. MOTORS**, 230 volts, 3 h.p., 3,000 r.p.m., in good condition £3/5/- each; ditto Fan Motors, 230 volts D.C., 20/- each; 110 volts D.C., 17/6 each.**6 or 12 VOLT RECTIFIERS** at 4 amps output, complete with suitable transformer, 200/230 volts input, 45/- each, post 1/6.**12/24 VOLT RECTIFIERS** at 4 amps, with suitable Mains Transformer, 200/230 volts input, 55/- each.**METAL RECTIFIERS**, suitable for 6/12/24 volts at 10 amps charging with the correct transformer, complete with TX 97/6 each, Rectifier only 35/- each.**Ex-W.D. U.S.A. HAND GENERATORS**, less winding handle, output 425 volts at 110 m/a., at 6.3 v., 2½ amps, complete with smoothing, 30/- each, carriage 2/6.**MAINS TRANSFORMERS (NEW)**, 200/250 volts input in steps of 10 volts, output 0, 6, 12, 24 volts 6 amps, 42/6 each, post 1/6. Another, as above but 10-12 amps, 55/- each, post 1/6; another as above but 25/30 amps, 75/- each, carriage 3/6; another, input as above, output 0/18/30/36 volts 6 amps, 47/6 each, post 1/6.**MAINS TRANSFORMERS (NEW)**, input 200/250 volts in steps of 10 volts, output 350/0/350 volts, 180 m/amps, 4 volts 4 amps, 5 volts 3 amps, 6.3 volts 4 amps, 45/- each, post 1/6; another 350/0/350 volts 180 m/amps, 6.3 volts 8 amps, 0/4/5 volts 4 amps, 45/- each, post 1/6; another 500/0/500 volts 150 amps, 4 volts 4 amps C.T., 6.3 volts 4 amps, C.T., 5 volts 3 amps, 47/6 each, post 1/6; another 425/0/425 volts 160 m/amps, 6.3 volts 4 amps, C.T. twice 5 volts 3 amps, 47/6 each, post 1/6.**MAINS TRANSFORMERS (NEW)**, suitable for spot welding, input 200/250 volts, in steps of 10 volts, output suitably tapped for a combination of either 2/4/6/8/10 or 12 volts 50/70 amps, 95/- each, carr. 7/6.**REPAIRS AND SERVICE** ELECTRIC blankets and clocks repaired: efficient service. Tullibardine Rd., Sheffield. [1994]**MAINS** transformers, E.H.T. line outputs, chokes and field coils, etc., promptly and efficiently rewound or manufactured to any specification; 12 months guarantee. LADBROKE REWIND SERVICE, Ltd., 820a, Hornby Rd., Kensal Rise, N.W.10. Tel. Shepherd's Bush 5819. [2022]**REPAIRS**—Mains, E.H.T. or O.P. transformers, field coils and chokes, also armatures and motors. New transformers designed to specification. All items fully vacuum impregnated. TRANSFORMER SERVICE CO. 2a, Fritillary Gardens, Shepherd's Bush, W.12. Tel. Shepherd's Bush 5819. [2075]**ELECTRICAL** test instruments repaired and standardized, all types British or American, ammeters, voltmeters, ohmmeters DC/AC multi-range meters, etc.; meters converted to specification. THE ELECTRICAL INSTRUMENT REPAIR SERVICE, 329, Kilburn Lane, London, W.9. Tel. Lad. 4168. [2011]**AUDIO** equipment repaired, rebuilt, modified, A disk or tape recorders, amplifiers, tone control units, sound projectors; quotations without obligation.—Bernard J. Brown, 33, Goldhawk Rd., London, W.12. [2025]**REWINDS** and conversions to mains and output trans., pick-ups, fields, clock coils, etc., from 4/6; PP equipment a speciality; all work guaranteed.—N.L. Rewinds, 173, High Rd., Willesden Green, N.W.10. Tel. Wordsworth 7791. [2306]**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. [2520]**ALWAYS** at your service, high quality transformers made to suit your requirements or rewound to the original specifications. Woodrow Transformers, Ltd., now removed to larger premises, thus enabling the employment of more labour and a quicker turn round of orders.—New Address, 7, Dudden Hill Lane, Willesden, N.W.10. All work fully guaranteed. [2243]**ARMATURE** rewinding service to the trade, A vacuum, drills, grinders, hood dryers, dental motors, vacuum cleaner armatures replaced from stock, 24 hours service; every job guaranteed; we also specialise in complete overhauls and rebuilds of vacuum cleaners; all vacuum cleaner parts, hoses, bearings, fans, brushes, for any make in stock.—Regent Electric, 95, Park Lane, Leeds, 1. [2253]**PAINTS, CELLULOSE, ETC.** PAINT spraying handbook, 3/6 post free, cellulose and synthetic paints and all spraying requisites supplied; catalogues free.—Leonard Brooks, 53, Harold Wood, Romford. [2027]**BUSINESS OPPORTUNITIES** OLD-ESTABLISHED firm of exporters in the electronic field, invite manufacturers seeking overseas sales, to communicate Box 0239.**WORK WANTED** ASSEMBLY, wiring of all types of electronic eqpt., control panels, switchboards, etc.—R.A.E., 377, High Rd., London, N.2. [2019]**ASSEMBLY** and wiring of electronic equipment to G.P.O. standards, high-quality work at competitive rates.—Write, Medley Radio, 48, Battersea Rd., Catford, S.E.6. [2251]**LABELS**, panels, engraved, quantities hot press process, keen prices, prompt delivery.—Plastic and Metal Engraving Co., 26, Lower Richmond Rd., Putney 8930. [2254]**POLYSTERENE** machined, electro-mechanical and miniaturised work undertaken; precise toroidal and resistor winding; pulsed power supplies at 20kV, to order.—Bel Sound Products Co., Gen. Electronic Mfrs., A.I.D. approved contractors, Marborough Yard, London, Archway, N.19. [2183]**CAPACITY AVAILABLE** CAPACITY available; manufacturer of trans-formers up to 3 k.v.a. to R.C.S. 214, chokes, solenoids, etc.; have capacity available and invite enquiries from manufacturers; small runs of electronic assembly also undertaken; 1/6th h.p. induction motor in production, good delivery.—Avis & Baggs, Ltd., 11, Gosbrook Rd., Caversham, Reading. Tel. 71763. [2076]**MISCELLANEOUS** SALE TV/radio service sheets, 2/- each, s.a.e.; list available, 1/-; s.a.e.—"Ratele," 171, Norris St., Preston, Lancs. [2301]**METALWORK**, all types cabinets, chassis, racks, etc., to your own specifications; capacity available for small milling and capstan work up to 1in bar.—PHILPOTT'S METAL WORKS, Ltd. (G4B1), Chapman St., Loughborough. [2028]**TAPE** recordings transferred to disc, very reasonable prices, guaranteed satisfaction: write—"Personaldiscs," 50a, Powney Rd., Maidenhead, Berks. [2092]**EX-GOVERNMENT** steel instrument cases, copper plated and finished grey, size 23in long, 10in high and 7in deep: 10/- plus 2/6 carriage.—Weatherhead's, Bletchley, Bucks. [2088]

TUNERS

V.H.F./FM



FM81

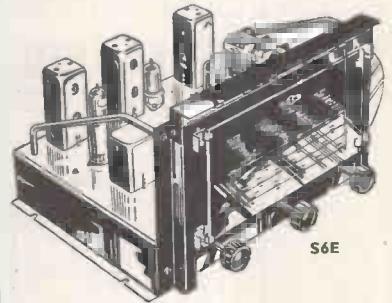
After considerable research into the many problems of V.H.F. Frequency Modulation reception, we are pleased to announce that our Tuner Type FM81 is available to experimenters and enthusiasts.

The excellent reproduction with absence of background noise provides an amazing degree of realism when used with Wide Range reproduction equipment.

The FM81 uses the latest valves and techniques: Tuned R.F. stage; Frequency Changer; 2 I.F. stages; Ratio Discriminator; A.V.C.; FM/AM switch.

Tunable between 87.5 Mc/s.-100 Mc/s., the FM81 will receive the B.B.C. Frequency Modulated or Amplitude Modulated V.H.F. transmission approximately 50 miles radius from WROTHAM.

Please send for leaflet.



S6E

9 Band (6 Electrical band spread) with R.F. F.C. 2 I.F. Delayed Amplified A.V.C. Variable Selectivity, Fly Wheel Tuning. Tropicalised. Suitable for use with any High Quality Amplifier. £44. Tax paid.

S6 A new model similar to the well-known S6BS but only 3 Wave Bands; 16m-50m, 195m-550m, 800m-2,000m. £30. Tax paid.

S6E As S6 but 4 Wave Bands; 12.5m-37m, 35m-100m, 90m-250m, 190m-550m. £30. Tax paid.

S5 3 Wave Bands, 16m-2,000m, R.F. pre-Amplifier, variable selectivity I.F. Delayed amplified A.V.C. very low distortion. £21/6/8. Tax paid.

S5E As S5 but 12.5m-550m. £21/6/8. Tax paid.

S4 The Standard high-quality Feeder Unit. Specification as S5 but without R.F. amplifier. £16. Tax paid.

A modified version of all models is available for use with Leak, Acoustical and other High Quality Amplifiers.

C. T. CHAPMAN (Reproducers) LTD.

RILEY WKS., RILEY ST., CHELSEA, S.W.10

FLAxman 4577/8

Export Enquiries Invited

DIRECT FROM THE MANUFACTURER

Dulci Radio/Radiogram Chassis

A/C 100-120 & 200-250 VOLTS.

All chassis 11½ in. x 7 in. x 8½ in. high. Latest type valves 6BE6, 6BA6, 6AT6, 6BW6, 6X4. Flywheel tuning. Negative feedback over entire audio section. Engraved knobs. 3 Tone position for Radio and Gram.



FULLY GUARANTEED

Model B3, Long, Med., Short (5 Valves)	£12. 12. 0
B3 Plus Push Pull Stage (6 Valves)	£15. 15. 0
B3 Double Feature P/Pull & RF Stage (7 Valves)	£18. 18. 0
Model B6 Six Wavebands Med. L, 4 Short (BD-Spread)	£15. 15. 0
B6 Plus Push Pull Stage (6 Valves)	£18. 18. 0
B6 Double Feature P/Pull & RF Stage (7 Valves)	£23. 2. 0

ALL PRICES TAX PAID

Escutcheon for 9in. x 5in. dial, 4/9 extra. Matching speakers P.M. type 3 ohms 8in or 10in available. Money back guarantee. Free particulars from the Manufacturers.

THE DULCI CO. LTD.
97 VILLIERS ROAD, LONDON, N.W.2
Telephone : Willesden 7778

THE POLLOCK M.C. PICKUP

Response 10 c.s. to 20 Kc/s. H.F. resonance 25 Kc/s., L.P. 20 Kc/s. Kit of parts to make pickup complete, including 100:1 transformer and sapphire stylus, 001 or .0025 in., and full building instructions £4.8s. 6d. Parts sold separately, prices: head and stylus 38/6d.; head for min. thorns 31/-; arm/pivot 26/-; transformer 26/-; all prices post free. S.A.E. for details to:

A.M. Pollock, 14 Broomfield Lane, Hale, Cheshire

ELECTRADIX for Satisfaction

LIGHTING PLANTS. ELECTRADIX Plants are all guaranteed. They are completely reconditioned, tested on load and as new when they leave our Works. You can buy with confidence. **D.C. Plants.**, 550 watts, 12/18 v. air cooled £34. 360-watt Alco Lyon 12/20 v. with switch board, £25. 1,260 watts Villiers 36 v. 36 amps., £40.

A.C. PLANTS. 15 kVA. Lister-Mawdsley Diesel Electric Set, 27 h.p. 3-cyl. Lister Engine with Mawdsley 230 volt 65.3 amp. 50 cy. S.P. Generator 15 kVA. with Exciter, Regulator and Switchboard on trailer with towing and parking brakes. Write for list and full specification.

WAVEMETERS. R.C.A. R.E.149. 200 kc/s. to 30 Mc/s accuracy 0.005 per cent. In original packing case with Crystal Spares and Instruction Book, £25.

PRECISION TEMPERATURE CONTROL OVENS for Quartz Crystals, 230 v. 50 cy. S.P. will give stability with suitable Crystals of better than two parts in one-million. Fitted precision thermostat and thermometer. Temperature adjustable 40/60 degrees, £9/10/-. Carriage 5/-.

Send for List of Laboratory Gear and Test Equipment stating your requirements.

ELECTRADIX RADIOS
Dept. A, 214 Queenstown Road, London, S.W.8
Telephone: MACaulay 2159

MISCELLANEOUS

A HIGH vacuum impregnation unit or single or batch coil impregnation service to R.I.C. specification 214 or individual requirements.—Blickvac, 505, Lordship Lane, S.E.22. Tel. Forest Hill 7089. [0310]

YOUR own tape recording transferred to disc. Write, call or phone Queensway Private Recording Studios, 123, Queensway, W.2. Tel. Bay, 4922. Studio recordings, tape recording service. [2187]

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. Bat. 5793. Brass, bronze, erinoid, Perspex dials; one knob or repetition equally entertained. [0034]

COPPER wires enamelled, tinned, Litz, cotton, silk covered, all gauges; B.A. screws, nuts, washers, soldering tags, eyelets, ebony and laminated bakelite panels, tubes, coil formers: Tuinol rod; headphones flexes, etc.; latest radio publications, full range available; list, s.a.e.: trade supplied.—Post Radio Supplies, 35, Bourne Gardens, London, E.4. [0138]

PATENTS

THE proprietor of British Patent No. 573313, entitled "Multiple section electronic tube and method of making it," offers same for licence or otherwise to ensure practical working in Great Britain.—Inquiries to Singer, Stern & Carleberg, 14, East Jackson Boulevard, Chicago 4, Illinois, U.S.A. [2191]

SITUATIONS VACANT

The engagement of persons answering these advertisements must be made through the local office of the Ministry of Labour and National Service, etc., if the applicant is a man aged 18-64 or a woman aged 18-59 inclusive, unless he or she or the employer is excepted from the provisions of The Notification of Vacancies Order 1952.

ELECTRONIC engineers.

ENGINEERS interested in radar as a career, are invited to apply to Decca Radar, Ltd., to join the Company on its development programme, covering a wide field of radar and associated techniques. Applicants must have H.N.C. and a thorough knowledge of basic circuitry; British nationality essential; there are good starting salaries and prospects of rapid advancement with this expanding company.—Write quoting ref. RLA/11, Decca Radar, Ltd., Research Laboratory, 2, Tolworth Rise, Surbiton, Surrey. [0257]

ELECTRICAL engineers.

WAYMOUTH GAUGES & INSTRUMENTS, Ltd., a subsidiary company of Smiths Aircraft Instruments, Ltd. have vacancies in their Aircraft Fuel Gauge Laboratory for Assistant Engineer, required for development of electronic fuel gauging equipment; they should have an engineering degree or Higher National Certificate. Technical Assistants also are required for experimental work in electrical measurements; preference to be given to applicants holding a technical qualification. Apply in writing to the Chief Development Engineer, Waymouth Gauges & Instruments Ltd., Station Road, Godalming, Surrey. [2293]

TELEVISION.—Careers for young men.

LIMITED vacancies exist upon work which is an introduction to checking and adjusting of electronic circuits on TV receivers; specialized knowledge not necessary, as suitable applicants will receive training.—Apply in writing to Personnel Manager, Pye, Ltd., St. Andrews Rd., Cambridge. [2273]

ELECTRONIC engineers are required by

THE ENGLISH ELECTRIC Co., Ltd., Luton, for work on a high priority defence project. Applicants will be required to undertake the engineering of circuitry already developed, which involves close liaison with, and the progressing of work through, the drawing office and production department. Applicants with experience of the engineering of radar and/or aircraft electronics for production will be especially welcome. The posts are permanent and progressive and a staff pension scheme is in operation. Applications to Dept. C.P.E., 556-2114, Strand, W.C.2, quoting ref. 1211. [2114]

VACANCIES in Government Department.

DRAUGHTSMEN are required, with experience in the layout of telecommunication and electronic equipment, involving detailed mechanical design, preparation of all mechanical drawings, sub-assemblies and final assembly, circuits, specifications, and stock-lists; suitable for prototype and batch production manufacture.

PRACTICAL workshop experience, and knowledge of modern methods an asset but not essential.

SALARY. FOR a week of 44 hours: £374 per annum at age 21, rising by annual increments of £20 to £597 per annum.

AN extra duty allowance of 3% will also be paid for working 45½ hours each week.

APPLY IN WRITING.—

PERSONNEL Officer, G.C.H.Q., 53, Clarence St., Cheltenham. [2311]

RADIO/television service engineer required, salary from £600 per year.—Tel. Pri. 1161. [2294]

METAL RECTIFIERS

6 or 12 v. 1 amp. F/W.....	5/6
6 or 12 v. 2 amp. F/W.....	8/6
6 or 12 v. 3 amp. F/W.....	11/6
6 or 12 v. 4 amp. F/W.....	12/6
6 or 12 v. 6 amp. F/W.....	18/6

TRANSFORMERS

By well-known makers.

Fully guaranteed.

Prim. 230 v. Sec. 6.3 1.5 amp.	6/6
Prim. 110/230 v. Sec. 6.3 3 amp.	11/6
Prim. 230/240 v. Sec. 2 v. 2 amp. air spaced	10/-
Prim. 230/240 v. Sec. 6.3 v. 2 amp., air spaced	13/9
Prim. 200/210, 220/230, 240/250 v. Sec. 2 v. 1 amp. max. load 2 amp.	12/6

250 M/A. Prim. 200/210, 220/230, 240/250 v. Sec. 350-0-350, heaters 2 v. 6.3 amp., 2 amp., 4 v., 5 v., 3 amp. 6.3 v., 6 amp. 4 v., 8 amp.	£3/19/6
---	---------

For Williamson Amplifier 150 M/A. Prim. 200/210, 220/230, 240/250 v., Sec. 425-0-425 6.3 v. 7 amp., 5 v. 3 amp., fully shrouded	£2/18/6
---	---------

80 M/A. Prim. 200/210, 220/230, 240/250 v., Sec. 350-0-350, heaters 6.3 v. tapped 4 v., 4 amp. 5 v. tapped 4 v. 2 amp., unshrouded, Tag panel connection	£1/-
E.H.T. Transformer, Prim. 230 v. 5-6 Kv. E.H.T. 2 v. Fil with U22 TRect.	£1/17/6

Send stamp for comprehensive catalogue.

JACKSONS RADIO SUPPLIES
163 Edgware Road, London, W.2

WATERLOO RADIO

METAL RECTIFIERS. Bridge, 2 Amp. 11/3, 3 Amp. 12/6, 4 Amp. 15/-, 6 Amp. 23/6, post 1/4.

TRANSFORMERS for use with above rect. Input 200-250v 60~0~A.C. to charge 6 or 12 Volts at 1.5 Amps 13/9, 3 Amps. 22/8, 6 Amps 32/6, post 2/1.

HARMONIC WAVE, 22/8, 6 Amps 32/6, 125 A.C. input RM1, 60mA 3/8, RM2, 100mA 4/3, RM3, 125mA 5/3, RM4, 250V A.C. in. 275mA, for TV 15/6, post 6d.

Overseas enquiries invited.

35 TENISON WAY, LONDON, S.E.1

MAGNEGAPH

TAPE AND WIRE RECORDERS, second-hand of all types bought, sold, exchanged.

NEW RECORDERS

Ferrograph 2A	76 gns.
Vortexion 2A	80 gns.
Grundig 700L	80 gns.
Magnegraph	59 gns.
B. & H. Reporter, battery operated	£55 0
B. & H. Reporter, with speaker	£59 0

SECONDHAND RECORDERS

K-B EVR-60 Wire Recorder	£27 10
Soundmirror, complete	£40 0
B. & H. Travacorda 3½ i.p.s. battery portable, complete	£65 0
Grundig 700L, complete	£65 0
Ferrograph D, with microphone	£65 0
Magnegraph, complete, from	£45 0

ACCESSORIES

Footswitches	£1 10
Tape Racks	£2/2/6
Limpet Telephone Pickups	£1 5
All types new and secondhand Tape, Wire, Microphones, Stands, Speakers, etc.	
REPAIRS, mechanical and electronic on all types of recorders carried out by specialists.	

HIRE SERVICE in Greater London Area only from 2 gns. per week.

1, HANWAY PLACE, OXFORD ST., LONDON, W.I. Tel.: Lan 2156

PERSONAL SHOPPERS !!

See our NEW Showroom (address below) and inspect these and hundreds of additional bargains. Send 3d. for Bargain List.

1,500FT. BEAM FOCUSING TORCH

Highly polished nickel-plate finish, heavy duty, 14in. long, five standard U.2 batteries. Brand new. Complete with Ever-Ready batteries. 19/-.

**400FT. BEAM TORCH**

Fully focusing, nickel-plated. 7½in. Complete with Ever-Ready batteries. 9/11.

SELENIUM METAL RECTIFIER

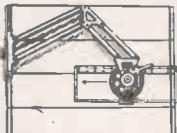
Suitable for 2, 6, and 12 v. battery chargers. Max. capacity 15 v. at 1 amp. New and boxed. 9/6.

MODEL MAKERS MAINS TRANSFORMERS

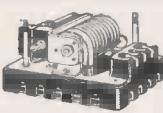
All purpose—low voltage. Input 210/250v. Output 3, 4, 5, 6, 8, 9, 10, 12, 15, 18, 20, 24, 30v. Rating 2 amps. Brand new, fully guaranteed. 24/-.

**DOOR CHIMES**

Frustrated Export Order enables us to offer these attractive door chimes at BELOW COST, suitable for operation direct from 200/240 Volt Mains. Brand New, in original cartons. 35/-.

**CHART BOARD**

Ideal as drawing board. 17in. sq. complete with pantograph arm, protractor head and Perspex scale. Each 25/-.

**ACCUMULATOR CUT-OUT**

12 or 24 v., 60 A. Ex-R.A.F., originally cost over £6 each, suitable for battery charging, etc. Limited quantity at 15/- each.

**"MEGGER" CIRCUIT TESTING OHMMETER**

4½ v. battery operated, 2 ranges 0-1,000 ohms and 100-200,000 ohms. Size 5½ x 4 x 2½in., complete with fitted leather case, test prod and full instructions. Unrepeatable at £3/19/6.

**Set of TWIST DRILLS**

9 drills, 1/8-1in., complete with plastic case and stand. Brand new. 4/6

**OMMETER.**

4 scales, 2½in. diameter, reading 0-5,000 ohms, 0-60 mA., 0-1.5 v., 0-3 v., suitable for continuity testing. Will operate from 1.5 v. battery, strong case, with full instructions engraved on back. Brand new, 19/6. Carrying sling. 1/- ex.

TOOL BOX

U.S.A. manufacture, size 18in. x 12in. x 5in. Strongly made waterproof ply, all external edges reinforced. Subdivided as illus., leather carrying handle. Outside resprayed green.



17/6

ALL ITEMS CARRIAGE PAID IN U.K. ONLY

TERMS—CASH WITH ORDER. C.O.D. 1/- EXTRA. Phone Orders Accepted—Money Back Guarantee.

SHERMAN'S SUPPLY CO. (W.9)
479 HARROW RD., LONDON, W.10
LADbrooke 1718.

SITUATIONS VACANT

microwave engineers are required by THE ENGLISH ELECTRIC Co., Ltd., at Luton, for work on a high priority defence project. Applicants should have a good theoretical background to degree standard and experience of design or engineering of microwave equipment for development work on aerial and receiving systems. This work includes investigations of new methods of construction with a view to miniaturisation and weight reduction, the design of new components and engineering to the production stage. Successful applicants will be required to take charge of a group and to be responsible for one or more aspects of the system. The posts are permanent and progressive and a staff pension scheme is in operation. Applications to Dept. C.P.S., 336-7, Strand, W.C.2, quoting ref. 1160B. [21215]

MARCONI INSTRUMENT Co., Ltd., St. Albans.

VACANCIES exist for both Senior and Junior Electronic Engineers with this well-known company. The vacancies which arise from an expansion of the company's business, cover a large field. Applications are particularly welcomed from young graduate engineers who have had some industrial experience. For the junior vacancies the minimum technical qualifications required is the City and Guilds Final Certification in telecommunications. The posts are both permanent and permanent.

APPLICATIONS, which will be treated with the strictest confidence, should be sent to Dept. C.P.S., 336-7, Strand, London, W.C.2, quoting Ref. No. S.A.34A. [2211]

THE STEEL COMPANY OF WALES, Ltd. (Tinplate Division), Trostre Works,

ELECTRONIC technicians required for maintenance of various types of industrial electronic control, consideration will be given to applicants without experience in the above, but with at least five years' experience in the radio industry on maintenance; excellent wages and working conditions in modern cold reduction plant.—Applications, giving details of age, qualifications and experience, should be submitted to:

THE Supt. Labour and Wages, The Steel Company of Wales, Ltd. (Tinplate Division), Carmarthen Rd., Swansea. [2225]

TECHNICAL Instructor (Broadcasting) re-

quired by the NIGERIAN Government on contract for two tours of 12-15 months; possibilities of permanency; salary, etc., according to experience in scale £1,170 rising to £1,269 a year; outfit allowance £60; free passages for officer and wife and assistance towards cost of children's passage or grant up to £150 annually for their maintenance in this country; liberal leave on full salary; candidates must have been employed at the B.B.C. Technical Training School at Evesham and have reached Grade C minus or above.

WRITE to the Crown Agents, 4, Millbank, London, S.W.1. State age, name in block letters, full qualifications and experience and quote M20/30305/W.F. [2266]

METROPOLITAN EAR, Nose and Throat Hospital, 14-16, Granville Place, London, W.1. (A HOSPITAL OF THE Fulham and Kensington Group.)

HEARING Aid Technician required immediately. (Temporary post in first instance.) National salary scales and conditions.

APPLICATIONS, giving full particulars, should be made to the Administrative Officer (WW/156) immediately. [2258]

A PPLICATIONS are invited from Senior Development Engineers with experience in one of the following fields:—

1. V.H.F./U.A.F., including tuners, for television and for communications equipment.
2. TELEVISION receiver design.
3. VARIABLE capacitors.
4. RELAYS and switches for special circuit applications.

APPLICANTS should possess an engineering degree or equivalent qualification and have experience in industry or one of the technical establishments engaged on this type of work. Initial salaries will be in accordance with qualifications, experience and age. The appointments are of a permanent and progressive nature and a company pension scheme is in operation.

APPLICATIONS, which will be treated in strictest confidence, should be addressed, quoting reference WW/844, to Box 2347. [2249]

FERRANTI, Ltd. (Computer Dept.), Moston, Manchester, have vacancies for the following:

(1) ELECTRICAL Engineers possessing at least a good Honours Degree for development work on large-scale electronic digital computers. Ref.: DCD.

(2) ELECTRICAL Engineers of approximately graduate status to be trained for the maintenance of the Ferranti computers. Experience in the servicing of large electronic equipments such as radar systems would be an advantage. Successful applicants would be based on the Moston factory but should be free to travel in the normal course of their work as maintenance engineers.

THE work might also be regarded for some candidates as post-graduate training in electronic equipment prior to joining the development section of the department. Ref.: DCM. PERMANENT staff appointments with pension benefits. Application forms on request from Mr. R. J. Hebert, Staff Manager, Ferranti, Ltd., Hollinwood, Lancs. [2095]

THE WORLD'S LOWEST PRICED TEST GEAR

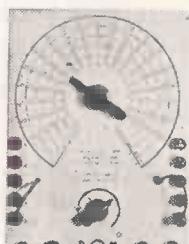
SUPPLIED IN KIT FORM
READY CALIBRATED

**RES./CAP. BRIDGE****SIX RANGES**

10 to 1,000 ohms.
1,000 to 100,000 ohms.
50,000 to 5 megs.
.50pf to .01mf.
.01mf to 1mf.
.2mf to 50mf.

31/6 P & P 1/6

NO CALIBRATING NO METAL WORK
JUST ASSEMBLE AND USE

**INDUCTANCE BRIDGE****FIVE RANGES**

50μH to 1,000 μH
1,000 μH to 20 mH
20 mH to 400 MH
400 MH to 8 H
8 H to 100 H

42/6 P & P 1/6

NO CALIBRATING NO METAL WORK
JUST ASSEMBLE AND USE

**THE R.M.TWIN MULTI-OHMER**

A Heavy Duty 2,000 ohm w/w variable, calibrated in 50 ohm steps, plus all useful fixed resistance values up to 7 megs, switched. Separate outlets for each function.

25/- P & P 1/6

NO CALIBRATING NO METAL WORK
JUST ASSEMBLE AND USE

I.F. ALIGNER

Fully screened.
Tunes over the 465 kc/s range of I.F. frequencies.

PRE-TUNED**NO METAL WORK**

JUST ASSEMBLE AND USE

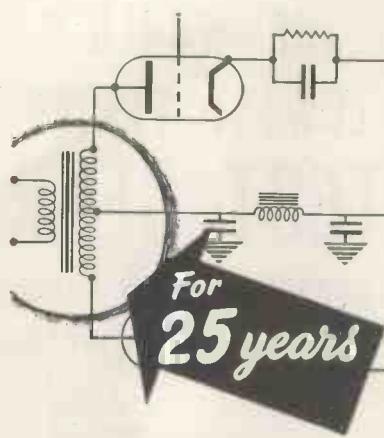
SIMPLE AND COMPREHENSIVE INSTRUCTIONS AND DIAGRAMS FOR ASSEMBLY AND USE WITH EACH OF THESE FAMOUS KITS.
CASH WITH ORDER OR C.O.D.

FULL INSTRUCTIONS AND DIAGRAMS FOR ANY KIT SUPPLIED SEPARATELY. PRICE 1/6 POST PAID.
5/- FOR THE SET OF FOUR.

STAMP FOR ILLUSTRATED LEAFLET.

RADIO MAIL

DEPT. D,
RALEIGH ST.,
NOTTINGHAM



Enthusiastic amateur and experienced research workers send testimonials of Savage accuracy and reliability. Here is one of many.

'A transformer and 2 chokes of your make purchased about 1932 are still doing yeoman service.
T. F. MacD., London'



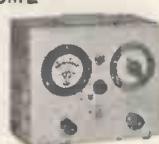
SAVAGE TRANSFORMERS LTD.
Nursteed Road, Devizes, Wilts.
Telephone: Devizes 536.

NEW! Easco HOME BATTERY CHARGER

For 12, 6 or 2 volt batteries
Charging Rate 2½ Amp.

Price Only £5.15s.

EASCO ELECTRICAL LTD.
Dept. W.W.
Brighton Terrace, S.W.9
Phone/Grams: Brixton 4961-23.



EUREKA & CONSTANTAN RESISTANCE WIRES

Prices per ounce

SWG	Enam.	DASC.	SWG	Enam.	DASC.
16	1/6	1/6	28	2/1	2/6
17	1/6	1/6	29	2/2	2/6
18	1/6	1/6	30	2/2	2/6
19	1/6	1/6	31	2/3	2.8
20	1/6	1/6	32	2/3	2/9
21	1/6	1/6	33	2/4	3/-
22	1/6	1/8	34	2/6	3/-
23	1/6	1/10	35	2/8	3/3
24	1/8	2/-	36	2/9	3/6
25	1/10	2/2	37	3/-	3/9
26	2/-	2/4	38	3/3	4/3
27	2/-	2/4	40	3/6	4/9

COPPER WIRE

SWG	2ozs.	4ozs.	2ozs.	4ozs.
16	1/4	2/-	1/4	2/-
18	1/4	2/2	1/4	2/2
20	1/5	2/4	1/5	2/4
22	1/6	2/6	1/6	2/6
24	1/7	2/8	1/7	2/8
26	1/8	2/10	1/8	2/10
28	1/9	3/-	1/9	3/-

SEND STAMP FOR LIST. TRADE SUPPLIED
POST RADIO SUPPLIES
33 Bourne Gardens, London, E.4

SITUATIONS VACANT

ELECTRONICS Division of Murphy Radio have vacancies in their design unit at Ruislip for:

1. PHYSICS or electrical engineering graduates preferably with experience of electronic design.
 2. DRAUGHTSMEN with experience in this field.
- APPLICATIONS should give full details of experience and qualifications and may be addressed in confidence to Personnel Department, Murphy Radio Limited, Welwyn Garden City when arrangements will be made for suitable applicants to be interviewed at the Ruislip Works. [2288]

RADIO testers required, some V.H.F. experience desirable together with some servicing knowledge on domestic or service equipment. MODERN factory; pleasant working conditions; single board available.

APPLY IN writing, with full details of past experience, to Personnel Manager, Pye Telecommunications, Ltd., Ditton Works, Chelmsford, Essex. [2280]

TELEVISION and radio engineer required, good appearance, conversant with all makes and able to drive.—Write Maurice Richards, Ltd., Radio House, Leatherhead, Surrey. [2305]

KELVIN & HUGHES, Ltd., Barking-side, Essex have vacancies for research engineers for experimental work relating to underwater sound apparatus.

APPLICANTS should be of degree standard and should have a sound knowledge of communications, particularly electronics.

APPLICATIONS, stating salary required, should be addressed to the Personnel Manager, Kelvin & Hughes, Ltd., New North Rd., Barking-side, Essex. [2278]

RADIO and Radar Engineers required for work in test department, preference will be given to radio engineers with experience of testing communication receivers, or RADAR Engineers with experience on H2S aircraft equipment.

SUCCESSFUL applicants will be employed as testers, and must be capable of working with a minimum of supervision.

ATTRACTIVE conditions and rates to successful applicants.

APPLY IN writing, or phone to Airtech, Ltd., Aylesbury and Thame Airport, Haddenham, Bucks (Tel. Aylesbury 1163). [2252]

SALES Manager required, electronic equipment for services and industry, engineering background essential; London; exceptional opportunity for young man.—Box 2426. [2263]

TV service engineer wanted Heston, Middlesex; good salary, permanency; must drive, good appearance and ability; inside and outside work; progressive situation.—W. A. Fowler, 331, Vicarage Farm Rd., Heston. [2247]

TELEVISION engineer required, fully experienced, able to drive; permanent, progressive position; £600 p.a.—Full particulars to Central Radio, Ltd., 15, Langley Rd., Eastbourne. [2305]

TELEVISION—RADIO service engineer required, used to all makes of TVs; clean licence; flat available if required.—Write, stating experience, wages. Paynes, 11, Ford St., Coventry. [2274]

FIRST-CLASS car radio mechanic required by Rootes Group distributors, good salary and prospects, permanent position; apply in writing in first instance with copies of references.—Kirbys, Ltd., 45, Duke St., Liverpool. [2284]

TELEVISION—RADIO 1st engineer required to take charge of service, ability to drive an advantage; old-established firm London, N.W.3; salary in accordance with abilities; permanency.—Box 2496. [2281]

ELECTRONIC engineers required for research and development work on the application of electronic digital computing techniques to business accounting machines; there are vacancies for the following:

(i) UNIVERSITY graduates with Honours Degree in Physics or Electrical Engineering; 1 or 2 years' experience in electronic research and development field an advantage but not essential.

(ii) ENGINEERS holding Higher National Cert., Ordinary National Cert., or similar qualifications, and with practical experience of electronic equipment.

APPLICANTS without academic qualifications would be considered if they have had experience of electronic equipment, preferably of pulse techniques as used in digital computing, radar, etc.; salaries will be based on qualifications, experience and age.—Applications, stating age, qualifications, experience, etc., to Personnel Office, British Tabulating Machine Co., Letchworth, Herts. [2142]

SENIOR position in servo analysis group (A) working on guidance weapon control systems; applicants should hold honours mathematics degree, have some experience in servo mechanism systems or electrical engineering; age 28 to 32 approximately.

ELECTRONIC engineer (B) with desire to produce instructional literature on new product; engineering background, diplomatic approach and command of words more important than knowledge of printing; will ultimately function as technical editor in charge of section of publications department.

PLEASE write in detail quoting reference of post sought to Personnel Manager, de Havilland Propellers, Ltd., Hatfield, Herts. [2151]

RADIO REPAIR SERVICES WOOL, DORSET

1. AC 5 v. Chassis 14½in. W. x 5½in. D. x 2in. H. With valve holders (Octal) fitted 2/-
 2. AC/RG6 v. chassis 10½in. x 7½in. x 3½in. With valve holders fitted 2/-
 3. AC/DC 5 v. chassis 10½in. x 5½in. x 2in. With valve holder fitted 2/-
 4. AC/DC 5 v. chassis 9in. x 5in. x 1½in. With valve holders fitted 3/-
- CABINETS to fit Chassis 1, 16in. x 7½in. x 2½in. [27/6]

- SCALE AND BACK PLATE:
To fit Cabinet and Chassis 1 3/6
To fit Cabinet and Chassis 2 2/-
To fit Cabinet and Chassis 3 1/-
To fit Cabinet and Chassis 4 1/-

REVERSE VERNIER DIAL DRIVES (post paid)

- TRIMMING SCREWDRIVERS (non-metallic) (post paid) 1/-

AMPLIFIERS

- 2 watt AC/DC, with valves £3 0 0
2 watt AC, with valves £3 10 0
4 watt AC, with valves £4 0 0

RECEIVERS as Chassis above complete (new)

- Superhet. State AC or DC, Minifix Aerial with 25ft. of lead-in wire, 7/6.

FIRE GUARDS for slow-burning fuses from 12/6.

- State 12in., 14in. or 16in. when ordering. Orders for wire-work taken against specifications.

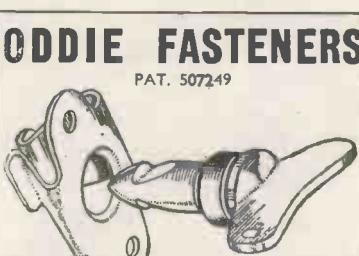
Converter Units. 3-valve Superhet. Convert your single channel TV to your area Station. E.G. Wenvoe on London set. Unit costs £7/10/-.

BASS REFLEX CABINETS

Walnut, Mahogany or Oak veneered, 30" high for 12-in. Speakers, 10-in. Speakers, 8-in. Speakers Prices £10.00 £9.10.00 £9.00.00 Carr. paid

CORNER CABINETS for Goodmans Axim 150 Mk. II veneered and french polished £16.00 carriage paid. Without finishing mouldings £10.00 less.

A. DAVIES and Co. (Cabinet Makers), 3 Parkhill Place, off Parkhill Road, London, N.W.3. (Gulliver 5775)



THIS FASTENER WITH ENDLESS APPLICATIONS—SIMPLE—POSITIVE SELF-LOCKING. MADE IN A VARIETY OF TYPES AND SIZES.

SPECIAL FASTENERS TO SUIT CUSTOMERS' REQUIREMENTS.

WIDELY USED IN THE RADIO INDUSTRY.

Illustrated brochures and other information will be gladly sent on request.
DEPT. "W.W."

Oddie, Bradbury & Cull Ltd., Southampton
Tel.: 55883. Cables: Fasteners, Southampton

SHORT WAVE RECEIVERS R103a. For use on 100/110 volts 230/250 volts A. and 12 volt battery. Comprising six valves and built in vibrator unit. Covering 1.7 mc/s. to 7.5 mc/s. Brand new in perfect working order £9/15/- plus 5/- carriage.

BRAND NEW AND BOXED METERS AS UNDER.

0/3500 volt meters D.C. Moving Coil 3in. scale 4in. stand off 20/- each. 0/6 amp. Thermo Couple 2½in. flush, 7/6 each. 0/30 Ma. Moving Coil D.C., 10/- each. 0/15 Volt A.C. Moving Iron 2½in. Flush 15/- each. 0/300 M.a. Moving Coil D.C. 2½in. Flush, 10/- each. 0/200 M.a. Moving Coil D.C. 2½in. Flush, 10/- each. 0/1 M.a. Moving Coil 2in. square, 15/- each. Postage 9d. extra on all meters.

LOUDSPEAKING TELEPHONE UNITS.

These units are complete with 1 Large Press Button TRUVOX Carbon Mike and C.L.R. Headphones. Working off 12 volt battery they can be used to speak to four positions at the same time. Brand new in cases at only £1/15/-, car. free.

BUZZER VALVE UNITS Type 2. Can be used as Morse Training Aids with facilities for Interference input. Less valves (2) 7/6 each, car. free.

SIGNALLING TORCHES. Still a few available at 3/9 each, post 9d.

CUT-OUTS. 12 and 24 volt 60 amp., as previously advertised, 10/- each, post 9d.

0/50 A.C. MOVING IRON 4in. PANEL MOUNTING METERS. Last few now offered at the knock-out price of 17/6 each, post 1/-.

TELEPHONE OPERATOR HEAD AND BREAST SETS.

Twin Phones No. 2, 12/6 each, post 1/-.

TAPE DECK CABINETS. Finished in Imitation Lizard Skin. Colours Green, Red, Grey, Blue, Brand New, with space for amplifier, £3/12/6 each, Carriage 2/-. Please state alternative colour.

SOLDER. 1lb. reels of 40/60, 5/- per reel, post 1/-.

EARPHONES. 60 Ohm. C.L.R., 5/- pair, and 4,000 Ohm, 17/6 pair, post 1/-.

JONES PLUGS. 8-way chassis mounting, 7/6 doz. 8-way with covers, 9/- doz. 4-way chassis mounting, 6/-, post 9d. doz.

JONES SOCKETS. 8-way chassis mounting, 7/6 doz. 8-way with covers, 9/- doz. Post 9d. doz.

JONES PLUGS AND SOCKETS, MIDGET. 12-way plug shrouded, 2/6 pair, post 3d.

BRAND NEW. 50 mfd. Motor Capacitors. 10/6 each, post 9d.

Manufacturers of Standard Post Office relays to your own specification.

Quotations by return—prompt delivery.

UNIVERSAL ENGINEERING CO.

Havelock Works, Havelock Place, Harrow, Middlesex. Harrow HA3.

TELETRON SUPER INDUCTOR COILS

Miniature Dust Core Types.

Type H.A.X.R.F. Transformer, Triple wound for Germanium Xtal Diodes. • Q 100 • Gain 33 Times • No overlap. Unique performance. Each 3/-.

DUAL WAVE TRF. COILS

Type TRF.A/H.F. or TRF.A/D. Tuned anode with reaction. Ae. Primary windings designed with rising characteristic to balance fall in ckt. Q. Matched pairs. Pr. 7/- 8/8et. range for S.M. and L.W. Pr. 6/-. I.F. Transformers, Filters, etc. Stamp for circuits and data.

THE TELETRON CO.,
266, Nightingale Road, London, N.9.
Trade enquiries to sole distributor: SAM MOZER,
95, Kendal Avenue, N.18. Edm. 7707.



SITUATIONS VACANT
RADIOSERVICE mechanics required by Smiths (Radiomobile), Ltd., for all parts of the country.—Write details of experience and qualifications to Personnel Officer, Goodwood Works, North Circular Rd., London, N.W.2. [2032]

MCMICHAEL RADIO, LTD. require experienced radio technicians for the inspection, testing and servicing of Government radio and electronic equipment.—Apply to Personnel Manager, Wexham Rd., Slough, Bucks. [2129]

ARE you seeking a well paid permanent situation, with congenial conditions of employment? We have vacancies for television and radio engineers at our Service Dept.—Apply James & Adams, Ltd., 1064, High Rd., Whetstone, N.20. Hillsdale 5555. [2235]

DAUGHTERMAN required immediately for light electrical engineering factory, Stockport district; must be experienced in electronic instruments and test gear; 5-day week, canteen facilities; write stating salary required and qualifications.—Box 2603. [2236]

FIRST-CLASS public address engineers required by leading company for London and Home Counties; good remuneration to right men; own car an advantage.—Apply Tanney Products, Ltd., West Norwood. Gipsy Hill 1131. [2238]

RADIO and television engineer required for old-established firm, high wages and permanent position for suitable applicant; all applications considered.—Apply A. Hartill & Sons, Ltd., 8-12, Mount Pleasant, Bilston, Staffs. [2152]

RADAR engineering.—Two important vacancies exist on the permanent staff of an influential company concerned with high priority production and installation in Hertfordshire of radar systems, much of which involves American equipment. BOTH positions are progressive, pensionable and well salaried.

THE first is for a production controller (Ref. P.C.) who should already have had first-class experience of a similar nature and be thoroughly conversant with radar and/or radio engineering production of a high order; he will be competent executive who knows assembly line production, can handle production layouts, in fact all aspects of this highly important function.

THE second vacancy concerns a production engineer (Ref. P.E.), who has already established his abilities in an efficient, well organized production unit, and who has an intimate knowledge of detailed engineering production in the radar/radar field.

APPLY, quoting above references, in strict confidence, to Box 2488. [2271]

YOUNG graduate engineers are invited to apply for interesting positions with The English Electric Valve Co., Ltd., at Chelmsford; experience of microwave work whilst desirable is not essential.—Write, quoting ref. 419K, to Dept. C.P.S., 336-7 Strand, W.C.2. [2256]

TECHNICAL Representative required in London area to deal with electronic instruments for marine purposes (not navigational or radio equipment); basic knowledge of physics and electronics essential; degree an advantage. Box 2420. [2262]

ACOUSTICAL vibration general engineers for a new acoustic and physical laboratories; experienced men wishing to specialise in either or both subjects, please apply stating qualifications, age, salary required.—Goodmans Industries, Ltd., Axiom Works, Wembley. [2265]

EXPERIENCED radio testers and inspectors required for production of communication and radio apparatus, also instrument makers, wiremen and assemblers, for factory test apparatus.—Apply Personnel Manager, E. K. Cole, Ltd., Ecko Works, Malmesbury, Wilts. [0238]

DAUGHTERMAN, experienced, required by Deccas Radar, Ltd., for permanent posts in the expanding field of radar engineering; excellent opportunities for advancement exist, the salary ranges being well beyond A.E.S.D. rates; staff pension scheme; British nationality essential.

POSTS are to be filled in the following grades: Senior section leader, checker draughtsman and senior design draughtsman; intermediate draughtsman; circuit draughtsman; installation draughtsman.—Apply ref. R.D.J., Deccas Radar, Ltd., Radar Research Laboratory, 2, Tolworth Rise, Surbiton, Surrey. [2250]

ELECTRONIC engineers with practical factory experience in technical training, preferably with H.N.C. standard required for liaison and development work on radar and allied equipment; staff and pensionable positions.—Apply to Personnel Dept. (CE/18), E.M.I. Factories, Ltd., Hayes, Middx. [2252]

RADIO and radar testers, first-class men required for work on V.H.F. communication gear and Government contracts for radio and radar equipment by Midland Manufacturers. Men with wide experience of fault finding in any of the fields mentioned should write, giving full details, to Box 1562. [2046]

APPLICATIONS are invited from craftsmen for radio and television service in areas within Herefordshire and Shropshire; applicants must be fully experienced in the repair and maintenance of all types of radio and television receivers; rate of pay at present 3/8 per hour, N.I.L.O. conditions.—Apply in writing to Sub-Area Manager, Midlands Electricity Board, Ditherington, Shrewsbury. [2307]



W. B. STENTORIAN HF1012

No loudspeaker has gained such popularity within so short a time as this new 10in. unit.

The unique cone construction puts bass resonance as low as 35 c.p.s. and output is well maintained to the higher frequencies. A powerful magnet of 12,000 gauss is employed, and the speaker will handle up to 10W. 3 or 15 ohm.

High fidelity speakers have until now been priced considerably higher, and the performance of this speaker at only 73/6 has been a revelation to all who have heard it.

Also 9" 67/-d., 8" 60/6d., 6" 50/6d.

Special Offers ...

10in. loudspeakers, famous make, cast chassis, 12,000 gauss, 15 ohm. Usually 69/- reduced to 52/6. Bass Reflex Console Cabinets, 30in. high, for 10in. speakers, heavy ply built, polished walnut veneer. Usually £9/5/- reduced to £7/18/6.

"The Gramophone" AMPLIFIER

Performance vies with the most expensive models, yet inherent simplicity makes it much lower in cost. We offer it either ready built or in kit form

Amplifier 17 gns. Complete with valves, tested. Pre-Amplifier for magnetic p.u., 5 gns. Control Unit for crystal p.u., 45/-

Extended Payment Terms

Amplifier and Pre-Amp.

£7/14/- and 12 monthly payments of £1/8/3.

Amplifier and Control Unit

£6/14/- and 12 monthly payments of £1/4/6.

9 w. output, 20 dB. feedback, only 0.1 per cent harmonic at 5 w., 20-20,000 c.p.s., latest Mullard valves, 3/15 ohm output, 200-250 v. A.C. mains.

Home Construction details 1/9 post free.

Decca 'H' L.P. Pickup

This smaller, lighter head attracted much interest at Earls Court. Interchangeable with earlier type with 3-pin fitting. Less record wear and better quality. Head only with sapphire 55/- With diamond £6/18/-. Complete pickup with two heads, £6/9/6.

RECORD MAIL SERVICE

Order your L.P. records by post with the assurance of factory fresh, perfect copies. POST FREE in U.K. Cash with order or C.O.D. Overseas Tax free at only 4/5ths home prices incl. postage and packing. Monthly RECORD REVIEW annual subscription 11/-.

QUALITY MART

d. Dartmouth Park Avenue, London, N.W.5. • GULiver 1131.

Order by Mail. Demonstrations by Appointment.

SPECIAL OFFERS

INSTRUMENT KNOBS. 2½ inch with 3 inch skirt, Black bakelite 3/- ea. Post 6d.

RECEIVER R1132A. We can offer you this well known 11 valve Superhet covering 100/124 Mc/s together with a standard 200/250 v. A.C. Power Pack No. 3 at the special price of £2/15/-, car. 10/- These units are brand new and unused including valves, but as they have been in storage some are slightly marked.

AMPLIFIERS. A high fidelity unit with separate Bass and Treble controls, constant impedance attenuator for setting volume level. In most cases with handles, 15 watt output, for 200/250 v. A.C. Mains operation. Although intended for use with the Gaumont British Projector, this fine amplifier is ideal for P.A. work, dances, etc.

SPECIAL OFFER. LEES VALVE, £12/10/- Or complete with all valves, £15/12/6. Carriage 10/- SPEAKERS P.A. Goodman P.M. 12in., 15 ohms, Type T.2. A high class speaker at a low price. Ideal for above amplifier. £5/10/-.

SPEAKER CASE, suitable for above. 19 x 17 x 13in. With lock, carrying handle, compartment for cable. £3/10/- Worth double.

AMMETER, 2½in. Flush 0/25 amps. Moving Iron. D.C. 7/6, post 1/-.

MILLIAMMETERS. Moving Coil, D.C., 2½in. Flush 0/200, 0/250, 12/6 ; 3½in. Flush, reading 150-0-150, 0/22/6, 12/6.

VOLTMETERS. Electrostatic 2½in. Flush 0/200, 40/-, 0-300 Flush D.C. Moving Coil, 10/6 ; 0-200, 2in. Flush Moving Coil, 7/6 ; 0-40 2in. Flush M.C., 10/6, post 1/-.

RECEIVER R.1355. As specified for "Inexpensive Televisor." In original packing, as new. Complete with all valves. 38/6, carriage 7/6.

SLOW-MOTION DIALS. 6in. Scaled 0-100, reduction 200 to 1 or direct, ideal for wavemeters, signal generators, etc. Our price, while they last, 5/6, post 1/-.

"ELF" CIRCUIT BREAKER. Avoids blowing mains fuses if circuit is overloaded. Reset in an instant. Very useful on test bench. Size 3in. round, 9/6, post 1/-.

PYREX AERIAL INSULATORS. Glass dome type with threaded rod and terminals each end, 2½in. diam. with fixing flange. Ideal for all aerials and in particular cabin walls or panels, etc. Price only 2/-, post 6d.

Comprehensive List Now Ready 6d.

WILCO ELECTRONICS
DEPT. WW
204 LOWER ADDISCOMBE RD., CROYDON



Accurate tests
High, Low and Grid
Bias Batteries.
Write for leaflet 30M.

RUNBAKEN

MANCHESTER



9 Hanworth Trading Estate, Feltham, Mdx. Tel.: Feltham 2677



THE
SERVICE ENGINEER'S
FIRST CHOICE

SITUATIONS VACANT

EXPERIENCED fault-finders wanted by Midland manufacturers of radio equipment; permanent posts located in the Midlands are offered to men with experience of radar, radio control, V.H.F. equipment.—Write, stating fully experience and salary required, to Personnel Manager, Box 1563 [2047]

DEVELOPMENT engineers required by Short Brothers & Harland, Ltd., Belfast, for work on Guided Weapons and other interesting projects; ideal conditions in new laboratories for applicants with a degree or equivalent, and good practical experience in one of the following fields:—

(1) ELECTRONICS, preferably D.O. Amplifiers, Electronic Computation, Pulse Techniques or Miniature Equipment.

(2) SMALL Electro-Mechanical Devices, Servos or Instruments.

(3) PRECISION Mechanical Engineering, including Hydraulics or Pneumatic Servos, Medium/Light Mechanisms or Instruments.

GOOD salaries and prospects for men with initiative.

PENSION scheme, assistance with housing. SEND full particulars of age, qualifications and experience, with salary required, to Short Brothers & Harland, Ltd., Precision Engineering Division, Castlereagh, Belfast, quoting Ref. No. E.3.

A TECHNICAL sales engineer possessing the ability to interpret electronic circuits is required by a large radio and electronic component manufacturing firm; this post offers excellent opportunities to a man of the right calibre.—Applicants who should be over 30 years of age, please reply to Box 2207. [2071]

A COUSTICAL MANUFACTURING Co., Ltd., Huntingdon, require an electronic engineer for building A.F. equipment up to 1 K.W.; technical knowledge and experience essential, including some knowledge of sheet metal work involved; permanent position for suitable applicant. [2302]

E XPERIENCED radar, radio, or electrical control equipment mechanics required for maintenance of Anti-Aircraft equipment in South Wales, Midlands and North West, wages £7/7 to £8/9, minimum age 21 years.—Application forms from O/C, 4 A.A. Group Workshops, R.E.M.E., Deybrook Lane, Liverpool, 12. [2320]

T ELEVISION production engineer is required by a large company on Merseyside, knowledge of radio and experience in manufacturing techniques with particular reference to the production of television receivers is essential.—Reply stating age, experience and qualifications to Box 2549, quoting ref. ABAD. [2289]

A PRODUCTION manager who has considerable experience in the production of all types of paper dielectric capacitors is required by a large and well-known firm; this position carries high remuneration, and only men of proved ability should apply.—Applicants reply, in confidence, to Box 2206. [2188]

YOUNG electronic engineer required for development of equipment for the measurement of stress and vibration in rotary and fixed-wing aircraft. Degree desirable. Applications, with details of training and experience, should be made to the Personnel Manager, The Fairey Aviation Co., Ltd., Hayes, Middlesex, quoting reference TO/1. [2108]

T HE M.S.S. Recording Co., Ltd., Poyle Close, Colnbrook, Bucks, have a vacancy for a technical assistant required for electronic development work on magnetic recording equipment; practical experience or knowledge of mechanical design an advantage.—Apply in writing, stating age, qualifications and experience to the above address. [2192]

S ALES office manager, age 30-40, required to run small sales office, part of a large established business in Wiltshire, must be capable of handling customer's telephone enquiries, etc.; knowledge of radio an advantage; good prospects and opportunities; write stating age, past experience and salary required to—Box 2495 [2228]

L ARGE firm of telecommunication engineers (East London) require a junior capacitor engineer; successful candidate will be trained in the design of capacitors for a wide variety of applications; ordinary National Certificate or Inter. B.Sc. in physics or engineering essential; salary according to age and experience.—Write, giving full details, to Box 2372. [2255]

E LECTRONIC engineer B.Sc. or H.N.C. for laboratory development work on miniature equipment using transistors; work in Slough/Marlow area; 5-day week; canteen; pension scheme; wide scope for energetic, versatile man with progressive ideas.—Full details of age, experience, salary required to Box M.1069, Haderslev, Salisbury Sq., E.C.4. [2254]

T HE Brown's Lane division of the G.E.C. Stanmore laboratories urgently require a man for work in connection with radar development; a suitable applicant should have a knowledge of service procedure and a general, rather than specialized, knowledge of electronics; a degree or equivalent qualification is desirable, but a well-experienced man would be considered.

A PPLICATIONS should be made in writing to the Staff Manager (Ref. R/BSP/AMMV), G.E.C. Stanmore Laboratories, Brown's Lane Division, The Grove, Stanmore Common, Stanmore, Middlesex, stating age, qualifications and experience. [2279]

"AUTOMAT"

Foolproof, Unwreckable,

CHARGER KITS AND CHARGERS.

Selenium Rectifiers, Westalite,
S.T.C. etc.



"AUTOMAT" HEAVY DUTY HOME CHARGER for A.C. mains, to charge 6 v./12 v., output 2 amps., wt. 7 lb., self-regulating, unbreakable, selenium rectification, impregnated transformer, fine casework. 59/6. p.p. 2/- Ditto, 12 v. 3 amp., 69/6. 6 v. 3 amp., 59/6. p.p. 2/- Ditto, 12 v. 5 amp., 68/6. 117/- 24 v. 3 amp., 117/- 24 v. 5 amp., 117/- 24 v. 8 amp., 117/- 24 v. 12 amp., 117/- 24 v. 15 amp., 117/- 24 v. 18 amp., 117/- 24 v. 22 amp., 117/- 24 v. 25 amp., 117/- 24 v. 30 amp., 117/- 24 v. 35 amp., 117/- 24 v. 40 amp., 117/- 24 v. 45 amp., 117/- 24 v. 50 amp., 117/- 24 v. 55 amp., 117/- 24 v. 60 amp., 117/- 24 v. 65 amp., 117/- 24 v. 70 amp., 117/- 24 v. 75 amp., 117/- 24 v. 80 amp., 117/- 24 v. 85 amp., 117/- 24 v. 90 amp., 117/- 24 v. 95 amp., 117/- 24 v. 100 amp., 117/- 24 v. 105 amp., 117/- 24 v. 110 amp., 117/- 24 v. 115 amp., 117/- 24 v. 120 amp., 117/- 24 v. 125 amp., 117/- 24 v. 130 amp., 117/- 24 v. 135 amp., 117/- 24 v. 140 amp., 117/- 24 v. 145 amp., 117/- 24 v. 150 amp., 117/- 24 v. 155 amp., 117/- 24 v. 160 amp., 117/- 24 v. 165 amp., 117/- 24 v. 170 amp., 117/- 24 v. 175 amp., 117/- 24 v. 180 amp., 117/- 24 v. 185 amp., 117/- 24 v. 190 amp., 117/- 24 v. 195 amp., 117/- 24 v. 200 amp., 117/- 24 v. 205 amp., 117/- 24 v. 210 amp., 117/- 24 v. 215 amp., 117/- 24 v. 220 amp., 117/- 24 v. 225 amp., 117/- 24 v. 230 amp., 117/- 24 v. 235 amp., 117/- 24 v. 240 amp., 117/- 24 v. 245 amp., 117/- 24 v. 250 amp., 117/- 24 v. 255 amp., 117/- 24 v. 260 amp., 117/- 24 v. 265 amp., 117/- 24 v. 270 amp., 117/- 24 v. 275 amp., 117/- 24 v. 280 amp., 117/- 24 v. 285 amp., 117/- 24 v. 290 amp., 117/- 24 v. 295 amp., 117/- 24 v. 300 amp., 117/- 24 v. 305 amp., 117/- 24 v. 310 amp., 117/- 24 v. 315 amp., 117/- 24 v. 320 amp., 117/- 24 v. 325 amp., 117/- 24 v. 330 amp., 117/- 24 v. 335 amp., 117/- 24 v. 340 amp., 117/- 24 v. 345 amp., 117/- 24 v. 350 amp., 117/- 24 v. 355 amp., 117/- 24 v. 360 amp., 117/- 24 v. 365 amp., 117/- 24 v. 370 amp., 117/- 24 v. 375 amp., 117/- 24 v. 380 amp., 117/- 24 v. 385 amp., 117/- 24 v. 390 amp., 117/- 24 v. 395 amp., 117/- 24 v. 400 amp., 117/- 24 v. 405 amp., 117/- 24 v. 410 amp., 117/- 24 v. 415 amp., 117/- 24 v. 420 amp., 117/- 24 v. 425 amp., 117/- 24 v. 430 amp., 117/- 24 v. 435 amp., 117/- 24 v. 440 amp., 117/- 24 v. 445 amp., 117/- 24 v. 450 amp., 117/- 24 v. 455 amp., 117/- 24 v. 460 amp., 117/- 24 v. 465 amp., 117/- 24 v. 470 amp., 117/- 24 v. 475 amp., 117/- 24 v. 480 amp., 117/- 24 v. 485 amp., 117/- 24 v. 490 amp., 117/- 24 v. 495 amp., 117/- 24 v. 500 amp., 117/- 24 v. 505 amp., 117/- 24 v. 510 amp., 117/- 24 v. 515 amp., 117/- 24 v. 520 amp., 117/- 24 v. 525 amp., 117/- 24 v. 530 amp., 117/- 24 v. 535 amp., 117/- 24 v. 540 amp., 117/- 24 v. 545 amp., 117/- 24 v. 550 amp., 117/- 24 v. 555 amp., 117/- 24 v. 560 amp., 117/- 24 v. 565 amp., 117/- 24 v. 570 amp., 117/- 24 v. 575 amp., 117/- 24 v. 580 amp., 117/- 24 v. 585 amp., 117/- 24 v. 590 amp., 117/- 24 v. 595 amp., 117/- 24 v. 600 amp., 117/- 24 v. 605 amp., 117/- 24 v. 610 amp., 117/- 24 v. 615 amp., 117/- 24 v. 620 amp., 117/- 24 v. 625 amp., 117/- 24 v. 630 amp., 117/- 24 v. 635 amp., 117/- 24 v. 640 amp., 117/- 24 v. 645 amp., 117/- 24 v. 650 amp., 117/- 24 v. 655 amp., 117/- 24 v. 660 amp., 117/- 24 v. 665 amp., 117/- 24 v. 670 amp., 117/- 24 v. 675 amp., 117/- 24 v. 680 amp., 117/- 24 v. 685 amp., 117/- 24 v. 690 amp., 117/- 24 v. 695 amp., 117/- 24 v. 700 amp., 117/- 24 v. 705 amp., 117/- 24 v. 710 amp., 117/- 24 v. 715 amp., 117/- 24 v. 720 amp., 117/- 24 v. 725 amp., 117/- 24 v. 730 amp., 117/- 24 v. 735 amp., 117/- 24 v. 740 amp., 117/- 24 v. 745 amp., 117/- 24 v. 750 amp., 117/- 24 v. 755 amp., 117/- 24 v. 760 amp., 117/- 24 v. 765 amp., 117/- 24 v. 770 amp., 117/- 24 v. 775 amp., 117/- 24 v. 780 amp., 117/- 24 v. 785 amp., 117/- 24 v. 790 amp., 117/- 24 v. 795 amp., 117/- 24 v. 800 amp., 117/- 24 v. 805 amp., 117/- 24 v. 810 amp., 117/- 24 v. 815 amp., 117/- 24 v. 820 amp., 117/- 24 v. 825 amp., 117/- 24 v. 830 amp., 117/- 24 v. 835 amp., 117/- 24 v. 840 amp., 117/- 24 v. 845 amp., 117/- 24 v. 850 amp., 117/- 24 v. 855 amp., 117/- 24 v. 860 amp., 117/- 24 v. 865 amp., 117/- 24 v. 870 amp., 117/- 24 v. 875 amp., 117/- 24 v. 880 amp., 117/- 24 v. 885 amp., 117/- 24 v. 890 amp., 117/- 24 v. 895 amp., 117/- 24 v. 900 amp., 117/- 24 v. 905 amp., 117/- 24 v. 910 amp., 117/- 24 v. 915 amp., 117/- 24 v. 920 amp., 117/- 24 v. 925 amp., 117/- 24 v. 930 amp., 117/- 24 v. 935 amp., 117/- 24 v. 940 amp., 117/- 24 v. 945 amp., 117/- 24 v. 950 amp., 117/- 24 v. 955 amp., 117/- 24 v. 960 amp., 117/- 24 v. 965 amp., 117/- 24 v. 970 amp., 117/- 24 v. 975 amp., 117/- 24 v. 980 amp., 117/- 24 v. 985 amp., 117/- 24 v. 990 amp., 117/- 24 v. 995 amp., 117/- 24 v. 1000 amp., 117/- 24 v. 1005 amp., 117/- 24 v. 1010 amp., 117/- 24 v. 1015 amp., 117/- 24 v. 1020 amp., 117/- 24 v. 1025 amp., 117/- 24 v. 1030 amp., 117/- 24 v. 1035 amp., 117/- 24 v. 1040 amp., 117/- 24 v. 1045 amp., 117/- 24 v. 1050 amp., 117/- 24 v. 1055 amp., 117/- 24 v. 1060 amp., 117/- 24 v. 1065 amp., 117/- 24 v. 1070 amp., 117/- 24 v. 1075 amp., 117/- 24 v. 1080 amp., 117/- 24 v. 1085 amp., 117/- 24 v. 1090 amp., 117/- 24 v. 1095 amp., 117/- 24 v. 1100 amp., 117/- 24 v. 1105 amp., 117/- 24 v. 1110 amp., 117/- 24 v. 1115 amp., 117/- 24 v. 1120 amp., 117/- 24 v. 1125 amp., 117/- 24 v. 1130 amp., 117/- 24 v. 1135 amp., 117/- 24 v. 1140 amp., 117/- 24 v. 1145 amp., 117/- 24 v. 1150 amp., 117/- 24 v. 1155 amp., 117/- 24 v. 1160 amp., 117/- 24 v. 1165 amp., 117/- 24 v. 1170 amp., 117/- 24 v. 1175 amp., 117/- 24 v. 1180 amp., 117/- 24 v. 1185 amp., 117/- 24 v. 1190 amp., 117/- 24 v. 1195 amp., 117/- 24 v. 1200 amp., 117/- 24 v. 1205 amp., 117/- 24 v. 1210 amp., 117/- 24 v. 1215 amp., 117/- 24 v. 1220 amp., 117/- 24 v. 1225 amp., 117/- 24 v. 1230 amp., 117/- 24 v. 1235 amp., 117/- 24 v. 1240 amp., 117/- 24 v. 1245 amp., 117/- 24 v. 1250 amp., 117/- 24 v. 1255 amp., 117/- 24 v. 1260 amp., 117/- 24 v. 1265 amp., 117/- 24 v. 1270 amp., 117/- 24 v. 1275 amp., 117/- 24 v. 1280 amp., 117/- 24 v. 1285 amp., 117/- 24 v. 1290 amp., 117/- 24 v. 1295 amp., 117/- 24 v. 1300 amp., 117/- 24 v. 1305 amp., 117/- 24 v. 1310 amp., 117/- 24 v. 1315 amp., 117/- 24 v. 1320 amp., 117/- 24 v. 1325 amp., 117/- 24 v. 1330 amp., 117/- 24 v. 1335 amp., 117/- 24 v. 1340 amp., 117/- 24 v. 1345 amp., 117/- 24 v. 1350 amp., 117/- 24 v. 1355 amp., 117/- 24 v. 1360 amp., 117/- 24 v. 1365 amp., 117/- 24 v. 1370 amp., 117/- 24 v. 1375 amp., 117/- 24 v. 1380 amp., 117/- 24 v. 1385 amp., 117/- 24 v. 1390 amp., 117/- 24 v. 1395 amp., 117/- 24 v. 1400 amp., 117/- 24 v. 1405 amp., 117/- 24 v. 1410 amp., 117/- 24 v. 1415 amp., 117/- 24 v. 1420 amp., 117/- 24 v. 1425 amp., 117/- 24 v. 1430 amp., 117/- 24 v. 1435 amp., 117/- 24 v. 1440 amp., 117/- 24 v. 1445 amp., 117/- 24 v. 1450 amp., 117/- 24 v. 1455 amp., 117/- 24 v. 1460 amp., 117/- 24 v. 1465 amp., 117/- 24 v. 1470 amp., 117/- 24 v. 1475 amp., 117/- 24 v. 1480 amp., 117/- 24 v. 1485 amp., 117/- 24 v. 1490 amp., 117/- 24 v. 1495 amp., 117/- 24 v. 1500 amp., 117/- 24 v. 1505 amp., 117/- 24 v. 1510 amp., 117/- 24 v. 1515 amp., 117/- 24 v. 1520 amp., 117/- 24 v. 1525 amp., 117/- 24 v. 1530 amp., 117/- 24 v. 1535 amp., 117/- 24 v. 1540 amp., 117/- 24 v. 1545 amp., 117/- 24 v. 1550 amp., 117/- 24 v. 1555 amp., 117/- 24 v. 1560 amp., 117/- 24 v. 1565 amp., 117/- 24 v. 1570 amp., 117/- 24 v. 1575 amp., 117/- 24 v. 1580 amp., 117/- 24 v. 1585 amp., 117/- 24 v. 1590 amp., 117/- 24 v. 1595 amp., 117/- 24 v. 1600 amp., 117/- 24 v. 1605 amp., 117/- 24 v. 1610 amp., 117/- 24 v. 1615 amp., 117/- 24 v. 1620 amp., 117/- 24 v. 1625 amp., 117/- 24 v. 1630 amp., 117/- 24 v. 1635 amp., 117/- 24 v. 1640 amp., 117/- 24 v. 1645 amp., 117/- 24 v. 1650 amp., 117/- 24 v. 1655 amp., 117/- 24 v. 1660 amp., 117/- 24 v. 1665 amp., 117/- 24 v. 1670 amp., 117/- 24 v. 1675 amp., 117/- 24 v. 1680 amp., 117/- 24 v. 1685 amp., 117/- 24 v. 1690 amp., 117/- 24 v. 1695 amp., 117/- 24 v. 1700 amp., 117/- 24 v. 1705 amp., 117/- 24 v. 1710 amp., 117/- 24 v. 1715 amp., 117/- 24 v. 1720 amp., 117/- 24 v. 1725 amp., 117/- 24 v. 1730 amp., 117/- 24 v. 1735 amp., 117/- 24 v. 1740 amp., 117/- 24 v. 1745 amp., 117/- 24 v. 1750 amp., 117/- 24 v. 1755 amp., 117/- 24 v. 1760 amp., 117/- 24 v. 1765 amp., 117/- 24 v. 1770 amp., 117/- 24 v. 1775 amp., 117/- 24 v. 1780 amp., 117/- 24 v. 1785 amp., 117/- 24 v. 1790 amp., 117/- 24 v. 1795 amp., 117/- 24 v. 1800 amp., 117/- 24 v. 1805 amp., 117/- 24 v. 1810 amp., 117/- 24 v. 1815 amp., 117/- 24 v. 1820 amp., 117/- 24 v. 1825 amp., 117/- 24 v. 1830 amp., 117/- 24 v. 1835 amp., 117/- 24 v. 1840 amp., 117/- 24 v. 1845 amp., 117/- 24 v. 1850 amp., 117/- 24 v. 1855 amp., 117/- 24 v. 1860 amp., 117/- 24 v. 1865 amp., 117/- 24 v. 1870 amp., 117/- 24 v. 1875 amp., 117/- 24 v. 1880 amp., 117/- 24 v. 1885 amp., 117/- 24 v. 1890 amp., 117/- 24 v. 1895 amp., 117/- 24 v. 1900 amp., 117/- 24 v. 1905 amp., 117/- 24 v. 1910 amp., 117/- 24 v. 1915 amp., 117/- 24 v. 1920 amp., 117/- 24 v. 1925 amp., 117/- 24 v. 1930 amp., 117/- 24 v. 1935 amp., 117/- 24 v. 1940 amp., 117/- 24 v. 1945 amp., 117/- 24 v. 1950 amp., 117/- 24 v. 1955 amp., 117/- 24 v. 1960 amp., 117/- 24 v. 1965 amp., 117/- 24 v. 1970 amp., 117/- 24 v. 1975 amp., 117/- 24 v. 1980 amp., 117/- 24 v. 1985 amp., 117/- 24 v. 1990 amp., 117/- 24 v. 1995 amp., 117/- 24 v. 2000 amp., 117/- 24 v. 2005 amp., 117/- 24 v. 2010 amp., 117/- 24 v. 2015 amp., 117/- 24 v. 2020 amp., 117/- 24 v. 2025 amp., 117/- 24 v. 2030 amp., 117/- 24 v. 2035 amp., 117/- 24 v. 2040 amp., 117/- 24 v. 2045 amp., 117/- 24 v. 2050 amp., 117/- 24 v. 2055 amp., 117/- 24 v. 2060 amp., 117/- 24 v. 2065 amp., 117/- 24 v. 2070 amp., 117/- 24 v. 2075 amp., 117/- 24 v. 2080 amp., 117/- 24 v. 2085 amp., 117/- 24 v. 2090 amp., 117/- 24 v. 2095 amp., 117/- 24 v. 2100 amp., 117/- 24 v. 2105 amp., 117/- 24 v. 2110 amp., 117/- 24 v. 2115 amp., 117/- 24 v. 2120 amp., 117/- 24 v. 2125 amp., 117/- 24 v. 2130 amp., 117/- 24 v. 2135 amp., 117/- 24 v. 2140 amp., 117/- 24 v. 2145 amp., 117/- 24 v. 2150 amp., 117/- 24 v. 2155 amp., 117/- 24 v. 2160 amp., 117/- 24 v. 2165 amp., 117/- 24 v. 2170 amp., 117/- 24 v. 2175 amp., 117/- 24 v. 2180 amp., 117/- 24 v. 2185 amp., 117/- 24 v. 2190 amp., 117/- 24 v. 2195 amp., 117/- 24 v. 2200 amp., 117/- 24 v. 2205 amp., 117/- 24 v. 2210 amp., 117/- 24 v. 2215 amp., 117/- 24 v. 2220 amp., 117/- 24 v. 2225 amp., 117/- 24 v. 2230 amp., 117/- 24 v. 2235 amp., 117/- 24 v. 2240 amp., 117/- 24 v. 2245 amp., 117/- 24 v. 2250 amp., 117/- 24 v. 2255 amp., 117/- 24 v. 2260 amp., 117/- 24 v. 2265 amp., 117/- 24 v. 2270 amp., 117/- 24 v. 2275 amp., 117/- 24 v. 2280 amp., 117/- 24 v. 2285 amp., 117/- 24 v. 2290 amp., 117/- 24 v. 2295 amp., 117/- 24 v. 2300 amp., 117/- 24 v. 2305 amp., 117/- 24 v. 2310 amp., 117/- 24 v. 2315 amp., 117/- 24 v. 2320 amp., 117/- 24 v. 2325 amp., 117/- 24 v. 2330 amp., 117/- 24 v. 2335 amp., 117/- 24 v. 2340 amp., 117/- 24 v. 2345 amp., 117/- 24 v. 2350 amp., 117/- 24 v. 2355 amp., 117/- 24 v. 2360 amp., 117/- 24 v. 2365 amp., 117/- 24 v. 2370 amp., 117/- 24 v. 2375 amp., 117/- 24 v. 2380 amp., 117/- 24 v. 2385 amp., 117/- 24 v. 2390 amp., 117/- 24 v. 2395 amp., 117/- 24 v. 2400 amp., 117/- 24 v. 2405 amp., 117/- 24 v. 2410 amp., 117/- 24 v. 2415 amp., 117/- 24 v. 2420 amp., 117/- 24 v. 2425 amp., 117/- 24 v. 2430 amp., 117/- 24 v. 2435 amp., 117/- 24 v. 2440 amp., 117/- 24 v. 2445 amp., 117/- 24 v. 2450 amp., 117/- 24 v. 2455 amp., 117/- 24 v. 2460 amp., 117/- 24 v. 2465 amp., 117/- 24 v. 2470 amp., 117/- 24 v. 2475 amp., 117/- 24 v. 2480 amp., 117/- 24 v. 2485 amp., 117/- 24 v. 2490 amp., 117/- 24 v. 2495 amp., 117/- 24 v. 2500 amp., 117/- 24 v. 2505 amp., 117/- 24 v. 2510 amp., 117/- 24 v. 2515 amp., 117/- 24 v. 2520 amp., 117/- 24 v. 2525 amp., 117/- 24 v. 2530 amp., 117/- 24 v. 2535 amp., 117/- 24 v. 2540 amp., 117/- 24 v. 2545 amp., 117/- 24 v. 2550 amp., 117/- 24 v. 2555 amp., 117/- 24 v. 2560 amp., 11



NUSOUND SOVEREIGN. The latest super quality Amplifier. All Triode line up. P-Pull PX4 output. Frequency response 20-25 kcs. $\pm .6$ d.b. and continuing up to 50 kcs. $\pm .9$ d.b. Sensitivity 120 mv. for max. 10 w. output. Total harmonic distortion .1 per cent at 1,000 c.p.s. at 6 watts. 20 d.b. neg. feedback. Independent Treble and Bass controls. Chassis size : 14 x 1 x 7½ in. high. A.C. model only, £26.

Any good amplifier can produce the most disappointing results if the input circuit is not correctly matched to the radio or gramophone unit feeding it. Most amplifiers are made without any knowledge of the other equipment to be used with them and the input circuit, therefore, is a compromise which may or may not result in a satisfactory performance. The Nusound 8½ watt is not a mass produced product of this kind. The basic circuitry is identical in all models but the input circuit is designed to individual requirements. The customer tells us which pick up or feeder units are to be used (our own or any other good make) and the amplifier is supplied to ensure the very best results possible from the combination.



Nusound 8½ watt Quality Amplifier — PP 6V6—Independent Bass and Treble boost and cut—neg. Feedback—provision for Radio Feeder Unit—Freq. response 25 to 20,000 c.p.s. + ½dB—hums 80 DB down at 6.5 watts—Feedback 14 DB. Available with Remote Control Unit. Price £17/10/-, or as illustrated.

GARRARD AUTOCHANGERS & PLAYERS
R.C.80, less Head..... £15 3 3
R.C.75A, less Head..... £13 10 0
T/AC, less Head..... £7 17 9

HIGH-FIDELITY FEEDERS
VARIABLE SELECTIVITY, 3-BAND, £16/10/-
SUPERHET, L.M.S., £12/14/-

S/H PRE-SET, 3-STATION, £8/4/-

T.R.F. PRE-SET, 3-STATION, £7/0/9.

N.S.P. PRECISION SCRATCH FILTER, 59/6

NUSOUND PRODUCTS LTD.
(Dept. W2) 136 WARDOUR STREET
LONDON, W.I. Tel.: GERrard 8845

Hours of business : 9 a.m.—5.30 p.m.

Saturdays 9 a.m.—1 p.m.

Stamp for leaflets on our other products.



Approved

A.I.D.

TRANSFORMERS

of all types up to 25 KVA for Single or Three Phase operation, Phase Conversion, etc.

MAINS

Output, and Special Purpose Transformers for Radio Equipment; Chokes, etc.

COILS

for Contactors, E.M. Brakes, Air Valves, etc., and Coil WINDINGS for all purposes.

SOLENOIDS

for A.C. and D.C. Operation.

W. F. PARSONAGE & Co., Ltd.

INDUCTA WORKS • Park Rd • Bloxwich • Walsall

Telephone: BLOX. 66464

SITUATIONS VACANT
SERVICE engineers required for installation, flight testing, and servicing of aircraft navigational and auto-pilot equipment; applicants must be prepared to travel; essential to have sound knowledge of radio and electronic principles and practice, preferably to C. and G. Radio III standard; good conditions, pension scheme.
APPLY, with full details and salary required, quoting No. 1439, to Personnel Manager, Sperry Gyroscope Co., Ltd., Great West Road, Brentford, Middx. [2239]

PHYSICISTS required to take charge of a development group on valve manufacture in London area; applicant should have some engineering background and a pronounced ability in administering a development group, age 27/8 years; salary £800-£1,000 to commence; give full details of qualifications and experience—Apply Box 2458. [2228]

DRAUGHTSMEN required. Electronic instrument, or radio experience. Salary according to qualifications. Saturday interview if required. Opportunity to broaden experience with reputable firm. Near City centre and all amenities. Within easy access of London—Marconi Instruments, Ltd., Longacres, Hatfield Rd., St. Albans. [2209]

ENGINEERS required for (a) maintenance and design of electronic test equipment, and (b) for quality control and investigational work on radio valves and other electronic devices; Inter B.Sc. or Higher National Certificate standard.—Write, giving experience and salary required, to Personnel Superintendent, The Edison Swan Electric Co., Ltd., Cosmos Works, Brimsdown, Enfield, Middlesex. [1966]

ELECTRO-ENCEPHALOGRAPHY recordist, Grade II, is required at Royal Edinburgh Hospital for Mental and Nervous Disorders, Morningside, Edinburgh; qualifications necessary and salary to be paid will be as laid down by Whitley Council.—Applications, with references, should be sent now to the Physician Superintendent, stating age and details of previous experience. [2297]

FIRST-CLASS television field and workshop engineers required, fully experienced on all popular current models, in the following areas: York, Leeds, Leicester, Banbury, Stratford, Slough, Southampton; attractive salary and congenial working conditions are offered to top grade men.—Apply to Personnel Manager, Belcher (Radio Services), Ltd., 59, Windsor Rd., Slough, Bucks. [2234]

MITCHAM WORKS, LTD., require a graduate for development work in radio and television; applicants should have 3 years' experience in similar work; salary according to qualifications and experience but not less than £650 p.a.—Applications, in writing, should be addressed to the Personnel Officer, Mitcham Works, Ltd., New Rd., Mitcham Junction, Surrey, quoting reference R.2. [2296]

RADIO and television service engineer required for work on domestic receivers by a progressive organization with central service depot in Bedford; vacancies also at branches in Hitchin, Northampton, Kettering and Luton; good working conditions; financial compensation by salary, and bonus scheme for energy and initiative; housing assistance provided for suitable applicant.—APPLY Service Manager, David Robinson, Ltd., 47, St. Peter's Street, Bedford. Tel. 61375. [2296]

SENIOR and junior engineers required for responsible work in radio and television laboratories; applicants for senior position should be able to undertake development work with minimum supervision; excellent conditions and salary available for applicants who are accepted.—Apply in first cases to Personnel Manager (Dept. R.D.), McMichael Radio Ltd., Wexham Rd., Slough. Applicants must be of British nationality. [2201]

THE ENGLISH ELECTRIC CO., LTD., Luton, have a vacancy for a designer of low power (up to 1kw) low frequency transformers and chokes; previous experience very desirable and applicant should be thoroughly familiar with winding and impregnation processes; varied interesting work, involving development of a number of designs for small quantities.—Applications to Dept. C.P.S., 336-7, Strand, W.C.2, quoting Ref. 1137A. [2204]

ELECTRONIC INSTRUMENTS, LTD., of Richmond, Surrey, has vacancy for Chief Inspector; applicants must have sound practical experience in testing mechanical and electronic apparatus, together with administrative ability; a key post in expanding firm; application in first instance by letter giving full details of experience and salary; junior posts also available for electronic engineers, aged 23 upwards, having H.N.C. or equivalent qualification. [2229]

CHIEF Engineer, microwave link development; Deca Radar Limited is creating an appointment at the rank of chief engineer, to lead a growing division engaged in the development and exploitation of microwave link systems; the successful applicant must have had, in either this or closely allied fields, considerable industrial experience at a senior level; this experience must provide evidence of a faculty for leadership, organising ability, and a capacity for drive; British nationality is essential; a starting salary commensurate with the level of the appointment will be paid.—Replies, which will be treated as strictly confidential, should be addressed to the Research Director, 2 Tolworth Rise, Surbiton, Surrey. [20450]

H. FRANKS

58 NEW OXFORD STREET
LONDON, W.C.1

PHONE: MUSEUM 9594

One minute from Tottenham Court Road Sta.

COLD CATHODE RELAY UNITS, fitted two S.T.C. Cold cathode tubes, No. G240/2D, two Siemens High Speed Relays, 1700/1700 ohms, size of unit approx. 6in. x 7in. x 4in. £3/2/6 each.

METROPOLITAN VICKERS D.C. RELAYS, Type B.I., 10/24 V. D.C., coil resistance, 425+425 ohms, four heavy make carbon contact, two medium break contacts. Housed in metal case, 7½in. x 6in. x 2½in. 37/6 each.

HEAVY DUTY 12/24 V. D.C. HIGH-SPEED RELAYS, Pattern 6357, Type J6. Made by Plessey & Co. Two heavy make contacts, fitted in glass case, 5½in. x 3½in. x 4in. 27/6 each.

SOLENOID OPERATED D.C. CONTACTORS, 200/250 volts, coil resistance 2,000 ohms, silver contacts to carry 10 amps. 25/- each.

RECTIFIER UNITS, Input 230 V. A.C., 50 cycles, output 15/18 V. D.C., 1 amp, ideal for chargers, model work, etc. 31/- each.

PREDICTOR UNITS, made by Sperry, type AA/5, fitted 4 variable speed gear boxes, 115 volts A.C., constant speed motor numerous worm, right-angle gears, 8 differential gear units, approx. 75 ballfaces, cost over £300 each to make, nett weight 78 lb., new, in original packing cases, £11 each.

PORTABLE FIELD TELEPHONE SETS. Type D, fitted handset, extra headset, tuned buzzer, morse tapping key, etc. £5 the pair.

"**STANCOR**," U.S.A. 2.5 K.V.A. 50/60 cycle auto-transformers. Input, 115/250 v. Output, 110 v. Completely shrouded. £11 each.

WESTINGHOUSE RECTIFIER SETS, Style 288 G.P.O. Input 200/250 volts A.C., 50 cycles, output 50 volts D.C. 1½ amps. £3/10/- each. Carriage 10/-.

VARIABLE RHEOSTATS. Graduated ½ amp to 2 amps., 45 ohms. Ideal for chargers, voltage control, etc. Ref. 50/728. Fitted in Bakelite case 4in. square 1½in. deep. 12/6 each.

SPERRY'S CONSTANT-SPEED 115 volt, 50 cycles motors, 2,400 r.p.m., 3½in. diam. 6in. long, 5/16in. spindle, 1½in. long. Serial No. LB1931. 37/6.

MINIATURE CLOCK-WORK TIMERS. Variable, 10 seconds to 3 minutes. Ideal for model work, photographic timing, etc. With slight modifications will run 15 mins. full wind, size ½ x 1½ x 9/16in. 3/6 each.

20-WATT POTENTIOMETERS. 200 k. Fitted slow motion dial with vernier control, 3½in. diam., overall height 4½in. Pattern 8419. Price 37/6 each.

CANADIAN FULLY SMOOTHED ROTARY TRANSFORMERS, housed in metal case 8½ x 6 x 4½in. Input 12 v. 2.5 amps. Output 220 v. D.C. 60 mA. Price 40/- each.

HOover BLOWER MOTORS, Ref. No. 10KB/115 for 12/24 volts A.C./D.C., ideal for car heaters, cooling, etc. 27/6 each.

STEP-DOWN TRANSFORMERS, input 180/230 volts A.C., 50 cycles, output 4.2 + 4.2 volts, 10 amps., ideal for soil heating spot welding, etc. 35/- each.

ROTARY RHEOSTATS, 7½ ohms, 6½ amps. 25/- each.

SANGAMO MOTOR UNITS, model 7, final speed one rev. 24 hours. 200/250 v. A.C. 50 cycles. Price 27/6 each.

SANGAMO MOTOR UNITS, Model 7, final speed one revolution per seven days, 200/250 v. A.C. 50 cycles. Price 30/- each.

"**KLAXON**" 24 v. D.C. SHUNT-WOUND MOTORS. 1/20th h.p. 2,500 r.p.m. Price 40/- each.

P.O. Type **POLARIZED RELAYS**, type 320A.N. 110 plus 110 ohm coils, 20/- each.

MINIATURE IMPULSE MOTORS, made by "Gents," size 3 x 2 1½in. Suitable for operating models, switches, etc. Operates on 4/6 volts A.C./D.C. and is very powerful for its size. Price 8/6 each. Post paid.

10,000 G.P.O. type 3,000 and 600 relays, assorted contacts and coils. Siemens High Speed Relays, Uniselectors, Telephone Keys, Handsets, etc.

Mailing Lists. Price 6d. each.

LEWIS RADIO CO.

invite you to send 1/- for our 1954 Catalogue of ALL types of :—

CABINETS
AUTO-CHANGERS
RADIO AND T/V CHASSIS
AND LOUDSPEAKERS

CABINETS

Made to individual specification.

TAPE RECORDERS

Send for full details of the "ELIZABETHAN." Portable 2-speed Tape Recorder at 48 gns. All "Soundmaster" parts stocked—send for list.

TELEVISION

All "Viewmaster" and "Tele-King" parts stocked. Send for our lists.

AMPLIFIERS

Full details available of our 4½ and 5 watt domestic amplifiers.

**Dept. 254; 120, Green Lanes,
 Palmers Green, London, N.13**

Tel: BOWES PARK 6064

**BRASS, COPPER, DURAL,
 ALUMINIUM, BRONZE**
 ROD, BAR, SHEET, TUBE, STRIP, WIRE
 3,000 STANDARD STOCK SIZES
 No Quantity too Small List on application

H. ROLLET & Co., Ltd.
 6 Chesham Place, S.W.1. SLOane 3463
 ALSO AT LIVERPOOL · BIRMINGHAM · MANCHESTER

TANNOY
 PRODUCTS
 SOUND EQUIPMENT
 clearly the best for
 all occasions
 WEST NORWOOD, S.E.27. - GIPSY HILL 1131 (7 lines)

HIGH GRADE TRANSFORMERS

FOR ALL PURPOSES

SINGLY OR IN QUANTITIES
 TO YOUR SPECIFICATION

VARNISH IMPREGNATED

BAKED WINDINGS

WITH OR WITHOUT TAG PANELS

GOOD DELIVERIES

Our rewind dept. will handle your
repairs promptly and efficiently.

P. HOWORTH
(Dept. W.W.)

51 POLLARD LANE · BRADFORD

Tel.: 37030

SITUATIONS VACANT

ELECTRONIC Engineer for responsible position on advanced applications development work in London area; applicant should hold a degree and have a thorough background of current circuit practice as used in radio, television and electronic control, etc.; an experimental flair essential; age limits 25-35; salary over £1,000 to commence; give full particulars of qualifications and experience quoting "E.E." —Apply, Box 2457. [2267]

MURPHY Radio require an engineer for the design and development of specialised electronic apparatus making use of the latest developments in circuit technique; the salary of £650 p.a. and upwards will be paid to one having the necessary qualifications.—Applications, giving full details of experience, etc., may be forwarded, in confidence, to Personnel Dept., (A2), Murphy Radio, Ltd., Welwyn Garden City, Herts. [2286]

METHODS engineers required for senior positions in expanding manufacturers, S.E. London; principal duties concern radio and TV line layout; preference given to those with job study experience; to right applicants these will prove permanent and progressive posts with commensurate salaries.—Write in confidence with full particulars and salary required, Box D B.2221, A.K. Adv., 212a, Shaftesbury Ave., London, W.C.2. [2285]

SERVICE engineers required by cinema sound equipment company for duties in London area; applicants must have practical ability and good general knowledge principles of electricity and audio amplifiers; clean driving licence and reliable telephone contact essential; salary to scale £400-£500 plus car allowance and expenses; state age, education, experience and whether car and telephone available.—Box 2497. [2283]

LABORATORY technician (male), age 20-23 years, required for physics; commencing salary up to £360 per annum, according to age and qualifications; the post is a temporary one, but if a person suitably qualified in radio maintenance should prove satisfactory, there is a possibility of permanence at a later date on a higher salary.—Written applications should be addressed to Head of Department of Physics, Chelsea Polytechnic, Manresa Rd., S.W.3. [2276]

BRITISH RELAY Wireless and Television Group of Companies have vacancies for television and radio engineers in grades offering wage rates between £7/15 and £10 per week. Applicants should consider their appointment as a stepping-stone in a career offering excellent opportunities. Superannuation scheme and active sports and social club. Apply in writing, stating age, experience and qualifications, to British Relay Wireless and Television, Ltd., 397, Albany Rd., S.W.3. [2312]

MCMICHAEL RADIO, Ltd., require senior and junior engineers in their equipment division laboratory at Slough; training and experience in the field of applied electronics (including communications) and experience of working with Government Departments are the chief qualifications required.—Write, stating age and full details of training, qualifications and experience, to the Chief Engineer, Equipment Division, McMichael Radio, Ltd., Slough. Bucks. [0198]

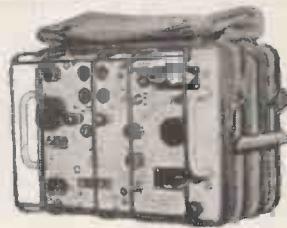
FILTER design group of Automatic Telephone & Electric Co., Ltd., Liverpool, has vacancy for engineer to deal with the problems associated with quantity production of electrical wave filters; previous experience in this or similar work is essential, and a degree in electronics or physics is desirable. Permanent staff position with contribution to permanent fund and usual staff conditions.—Write to Personnel Manager, Automatic Telephone & Electric Co., Ltd., Edge Lane, Liverpool 7, giving full details of experience, qualifications and age. [2150]

SALES representative, young, London resident, convenient with design and manufacture of Fixed Capacitors required by manufacturers with London Head Office; preference given to man with established connections in the radio and electronics industries and who has had actual production experience of all stages of fixed capacitor manufacture, must have a clean driving licence, car owner preferred.—Write fully stating age, experience, married or single and salary required to Box 2551. [2229]

MURPHY RADIO, Ltd., have vacancies in their Electronics Division Laboratories at Welwyn Garden City for qualified Engineers to develop V.H.F. communication equipment and instruments, salary £600-£1,000 p.a. depending on experience. Further posts available with salary £350-£750 p.a. for Technical Assistants.—Applications should give age, full details of qualifications, experience and salary required and may be forwarded in confidence to P.D. (EDL), Murphy Radio, Ltd., Welwyn Garden City, Herts. [2290]

ELECTRONIC Engineers are invited to apply for senior posts of exceptional interest and opportunity with Decca Radar, Ltd., to work in their laboratories on an extensive and expanding programme of line and radar development. Applicants must have had responsible development experience in the electronic field. Posts are permanent and pensionable. Good starting salaries and considerable prospects of advancement.—Write, quoting Ref. RLA/6, The Research Director, Decca Radar, Ltd., Research Laboratories, 2, Tolworth Rise, Surbiton, Surrey. Tel.: 37030. [0256]

NEW-YEAR BARGAIN OFFER



RECEIVER 109

This is an 8 valve ex-Army receiver, in new condition complete with built-in power supply and loud speaker and four spare valves. Frequency range on 2 bands, 1.8-3.9 mc/s, 3.0-8.5 mc/s. This unit is designed to operate from a 6 v. battery, no other power supply required. The whole is contained in a waterproof metal case with waterproof canvas cover over front panel. Front panel measurements 13 x 10 1/4". Supplied complete with diagram. Price, £3.18.6 each. Carriage 10/-.

RECEIVER CHASSIS TYPE 22

containing a 4 gang and a single gang .0005 condenser, 3 microphone transformers, 3 toggle switches, aerial tuning coil former, approximately 2in. diameter by 8in. long, 2 Yaxley switches, 4 potentiometers, complete set of coils, approximately 100 variaous resistors and condensers, 100 and 200 mfd. condensers 12 volt working. These chassis have been stored in the open with the result that some of the chassis and the front panels are rusty, but the components are usable. Offered in 3 grades according to condition, 5/6, 10/-, and 15/-, carriage on each set is 5/6 or 12/6 for 4. These sets can be supplied with 3 465 IFT's at a further 5/- per set.

A. T. SALLIS,
93 NORTH RD., BRIGHTON, SUSSEX
Telephone: Brighton 28806

WE WELCOME YOUR ENQUIRIES S.A.E. PLEASE

RADIO & TELEVISION COMPONENTS

WE OPERATE A PROMPT & EFFICIENT MAIL ORDER SERVICE.

"VIEW MASTER" & "TELE-KING" specialists

Easy terms available.

JAMES H. MARTIN & CO.,
FINSTHWAITE, NEWBY BRIDGE,
ULVERSTON, LANCS.

TAPE-DISC SERVICE

Have your favourite tape-recording made into a gramophone record. 1½d. stamp for free literature to . . .

H. R. McDermott, 10, Duke Street, Darlington, Co. Durham



METERS



FOR WORKSHOP AND LABORATORY

Electrical test instruments repaired and calibrated, all types and makes, ammeters, voltmeters, ohmmeters, DC/AC multirange meters, etc., meters converted and rescaled to specification. Quick service for industry.

THE ELECTRICAL INSTRUMENT REPAIR SERVICE

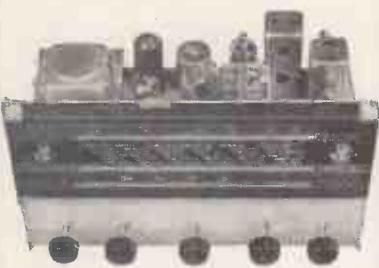
329 Kilburn Lane, London, W.9. Tel. LAD 4168

THE HAYES COMPANY

**BUILD A LUXURY
RADIOGRAM !!!**

**REPLACE THAT WORN-
OUT CHASSIS !!!**

Whichever you choose
a Hayes chassis will
give you better listening.



RG/250. 10 valve chassis with contrast expansion, variable selectivity, £35.

RG/160. 7 valve chassis, bass and treble controls, push-pull output. £20.

RG/127. 6 valve all-wave chassis with push-pull output. £17/5/-.

TU/100/6. All-wave tuning unit for use with amplifiers. 6.3 heaters. £14/15/-.

TU/100/4. For 4 v. heater supply. £15/5/-.

Full details gladly sent on request.

16 Mare Street, London, E.8. Amh 1400

BENSON'S BETTER ARGAINS

METERS. New and boxed.

Scale FSD	Size	Type	Fitting	Price
5 mA	2in.	MO	Proj.	7/-
30 mA	2in.	MO	Proj. R.	7/-
100 mA	2in.	MO	Flush R.	8/-
300 mA (100 mA)	2in.	MO	Square	7/-
500 mA	2in.	MO	Flush R.	8/-
1 A	2in.	TC	Fl. or proj.	8/-
3 A	2in.	TC	Square	6/-
20 A	2in.	MT	Flush R.	8/6
30 A	2in.	MO	Proj.	8/-
50 A	6in.	MI	Proj. Met.	30/-
Freq. 45-55c	7in.	230 v.	Proj. Met.	75/-
6 mA (500 uA)	2in.	MC/TC	Flush R.	17/6
15 v.	2in.	MI	Flush R.	10/6
150 v.	2in.	MC	Flush R.	10/6
3,500 v. (5 mA)	3in.	MO	Proj.	15/-

AERIALS UHF with EA50, 3/6. JACKS, Bakelite' DP closed, 1/-. BC810 Tank Coils, 5/-; POTENTIOMETERS Sln. dia. 20k, 10 w. 3/-; E.F. UNITS type 24.20/-; 25.20/-; 27.40/-; COILS. Eddystone Tx types "P" and "Q" 5-pf. hor. base, each 3/6/-; DYNAMOTORS, solled cases, D.C. (approx) 250 v. 80 mA at 6 v., 8/6. CONTROL BOXES, with double epicyclic drive, 3/6. RELAY 12 v. ac/dc, double toothed, bakelite' white, 2/6. TEST SETS: Admetly type 8.E.2, 160/230 v. 200-230 v. 500 mA and h.i.c.; VALVES 2/6/J, 2/6/A50, 1/6/C52, 1/6/X1, 1/6/V12B, 500 micro A met. New, in metal-lined case, 60/- (carr. 8/6). BLOWERS, 4x3in. dia. 24 v., 7/6; 12 v., 8/6. FILTERS, EHT, with 15 kV. cond., 500 pf. and 750 pf. and chokes, 5/-; for H.T. and L.T., with 4 cond. and 4 dustchokes, 2/6. CHOKES, Admiralty, 50 H. 20 mA, 4/6. Headphone CORDS (with plug), 18ft. long, 2/6. CONDENSERS : .02 mfd. 8kV.m. met. tub., 2/6; var. miniature, single, 15, 25, 50 and 75 pfa. spindled, each 1/6. I.F.'s canned, 11/13 Mcs., 1/3; 7 Mcs. (R1355), 1/6, double-wound 10 mc., 1/6; 7 mc. IP traps, 9d. KEYS, Morse, small brass, 2/6. L.U.51, turret collaissy, 8 S.W. coils, 5/6. RESPONSER, WAT790 160/220 mcs., 6/13 mc. IFTs and 10 valves, for TV, Bands 3 or 1, by addition of trimmers, 30/- (carr. 5/-). R1155: BFO boxes, 5/-; I.F. Filter, in can, 2/6. TRANS. E.M.I. Input 110/240 v., Outputs 350/0/350 v. 120 mA, 6.3 v. a., 4 v. 2 a., 18/- p. paid.

List and enquiries, S.A.E. please!
Terms: Cash with order. Postage extra.
Immediate delivery.

Callers and Post
W. A. BENSON (WW), SUPERADIO (W'chapel)
308 Rathbone Rd., LTD., 118 Whitechapel,
Liverpool 13. STO 1604 Liverpool, 1 ROY 1180

SITUATIONS VACANT

KELVIN & HUGHES, Ltd., Barkingside, Essex, require immediately a senior research engineer, directly responsible to the division head, to take charge of a team engaged in the development of ultrasonic apparatus; applicants should possess an honours degree in physics or engineering, and have a sound mathematical background; good practical experience of electronics is essential and some knowledge of metallurgy would be an advantage. THE salary would be in accordance with the responsibilities of the post. APPLICATIONS should be addressed to the Personnel Manager, Kelvin & Hughes, Ltd., New North Rd., Barkingside, Essex. [2277]

TELEVISION trouble shooters are offered an opportunity to train as maintenance and development engineers of electronic test gear with a large manufacturer in East London; the posts which are permanent and pensionable, will provide experience on all types of test gear connected with television and radio equipment and there are excellent prospects of promotion; the company works a 5-day 40-hour week, and has excellent canteen and sports facilities.—Write, quoting reference WW/843, giving full particulars of previous experience, to Box 2348. [2250]

THE GENERAL ELECTRIC Co., Ltd., Brown's Lane, Coventry, requires senior and junior electronic development engineers for work on guided weapons and like projects, particularly in the field of microwave and pulse applications, mechanical development engineers, designer draughtsmen and draughtsmen, preferably with experience of modal-type equipments, also required for the above projects; salary according to age, qualifications and experience.—Apply by letter, stating age and experience, to the Personnel Manager (ref. R.G.). [2293]

MURPHY RADIO have the following vacancies in their Electronics Drawing Office: (1) Senior Designer-Draughtsman, applicants should be of H.N.C. standard, fully experienced and capable of leading a design team. (2) Senior Draughtsman who must have considerable experience of Electronic Equipment and Ministry Contract procedure to work as Drawing Office checker. (3) Senior Draughtsman experienced in Ministry Contract procedure of Electronic Equipment as a modification draughtsman. Applications should include full details of experience and qualifications, age and salary required and may be forwarded to P.D. (EEDO). Murphy Radio Ltd., Welwyn Garden City. [2291]

SPECIFICATION engineers are required by Marconi's Wireless Telegraph Company, Ltd., Chelmsford; these engineers will be expected to consult heads of design and production units and reflect their requirements in purchasing and user specifications based on B.S. or other national codes of practice; men with sound experience of this type of work are needed but additionally, consideration will be given to young candidates possessing some design or production engineering experience, together with qualifications up to H.N.C. or degree standard; the appointments are permanent and offer scope for advancement; pension scheme; good salaries will be offered dependent upon qualifications and experience.—Please apply giving full details and quoting reference 881A/1 to Dept. C.F.S., 336-7, Strand, W.C.2. [2257]

VACANCIES for engineers and draughtsmen of senior and intermediate grades exist at the Ilford works of The Plessey Company for development work on components and mechanisms for radio, television and communications equipment; these vacancies occur as a result of the enlargement of the laboratories to permit a substantially increased interest in the design of circuits and components for specific applications; all positions are permanent and pensionable and the expansion now in progress offers great scope for advancement; salaries are progressive and attractive initial salaries are offered to men who are qualified by reason of educational attainment or practical experience.—All applications will be dealt with in confidence and should be addressed, quoting reference WW/845, in the first instance, for the attention of the Personnel Manager. [2248]

ADMIRALTY—Royal Naval Scientific Service. Engineers and Physicists (particularly with electronics) required for appointments in Experimental Officer and Assistant Experimental Officer grades in Experimental Establishments in London, Portsmouth, Weymouth and Gloucester, Arrears and Scotland. Candidates, British Subjects, must possess one of the following qualifications: University degree in Science, Engineering or Maths. Graduate Membership of appropriate professional institute. Higher National Certificate Final Certificate or five-year grouped course in relevant subjects at City and Guilds of London Institute or comparable institution. Higher School Certificate, General Certificate of Education, Scottish Leaving Certificate, Scottish Universities Preliminary Examination, Northern Ireland Senior Certificate (all in appropriate subjects and at appropriate levels). London salary inclusive of pay addition (men) E£74-£607. All appointments unestablished, but with some opportunities to compete for established posts.—Application forms from M.L.N.S. Technical and Scientific Register (K) 26, King St., London, S.W.1, quoting 247/52/A. [2321]

GEE-RADIO

ASTRO COMPASS MK. II. Complete in wooden carrying case, brand new, 13/6, p.p. 2/-.

HALF MILE OF TWIN DON "8" TELEPHONE WIRE on wooden drums. Brand new, £2/12/6 per drum, 8/6 packing and carriage.

TANNOY LOUDSPEAKER PRESSURE UNITS, NO. YA.2804. Complete in wooden speaker case. Speaker guaranteed perfect, although cases slightly soiled. 30/-, p.p. 5/-.

10 AMP ELECTRIC LIGHT CHECKMETERS, A.C. 220/240 v. Perfect condition. 15/-, p.p. 2/6.

ROTARY CONVERTER FROM NO. 11 WIRELESS SET. 12 v. D.C. Input, 230 v. D.C. output at 30 mA. Completely smoothed. Input and output plugs, pilot light, resistors, etc., etc., £1. p.p. 3/6.

MANSBRIDGE CONDENSERS. 26 mfd. 250 v. A.C. working. Size: 4in. x 4½in. x 5in. 15/-, p.p. 2/-, each.

R.F. OSCILLATOR COIL TYPE "F". 18-kv. Complete with circuit, guaranteed for 6 months. 30/-, p.p. 1/-.

15 V. H.T. BATTERIES. (Ex-Govt. ex-38 Set). Size 5½in. x 6in. x 1½in. In very good condition, each one tested before despatch. Also, we have in stock again 90/1½ V. BATTERIES, size 8½in. x 4½in. x 3½in. Either battery 4/6, plus 1/6 p.p. on each battery. ALUMINIUM SHEET UNDRILLED, 16 S.W.G. 4/- PER SQ. FT. 12in. x 12in. (p.p. 9d.) 24in. x 24in., 24in. x 36in. (p.p. 2/6), 24in. x 12in. (p.p. 1/-). We should be pleased to quote for Ali, to be cut to your own measurements. Please enclose S.A.E. for reply with your enquiry.

WESTON ALL-PURPOSE A.C./D.C. TEST METER MODEL E.665. New and unused, complete with batteries. A very limited quantity available at £8 each only. Also WESTON BATTERY OSCILLATOR MODEL E.692, TYPE 2. Also new and unused. Coverage, 100 kc/s. to 26 mc/s. Audio output approx. 40 c/s. Available at the ridiculously low price of only £5/19/6. If these two instruments are purchased together the two will be supplied for £12 plus 10/- p.p. Booklet of instructions supplied with oscillator.

16 MM. BELL-HOWELL SOUND PROJECTOR. Completely overhauled and in perfect condition, together with portable full size screen. £95 only.

750 WATTS MAINS AUTO-TRANSFORMER 110-125 v. to 200-250 v. With switch, fuses. Complete in own carrying case, ex-Projector. £4/15. 5/- carriage.

42IN. METAL EXPONENTIAL HORNS New and unused, 1½in. fitting. £2/19/6, carriage 7/6.

ELECTROLYTIC CONDENSERS, 1,000 mfd. 25 v. working. Block type. 7/6 each, p.p. 9d.

ARTIFICIAL HORIZON MK. I 6A/599. Brand new in original maker's packing. 25/- each, p.p. 2/-.

MINIATURE CARBON RESISTORS Type 5B. Values available as follows: 470 ohms, 680 ohms, 750 ohms, 1 k., 150 k., 1.5 k., 330 k., 820 k., 2.2 meg., 2.5 meg., 69 ohms, 180 ohms, 2.7 kv., 4.1 k., 6.8 k., 5.6 k., 22 k., 47 k., 100 k. Price: 9d each or 7/6 per doz., p.p. 6d.

BAKELITE CASED OIL FILLED TUBULAR CONDENSERS, ALL AT 2/6 each, p.p. 6d.

MFD.	VOLTS	MFD.	VOLTS
.05	3.5 kv.	.25	800 v.
.01	5 kv.	.1	1.2 kv.
.002	6 kv.	.5	800 v.
.005	5 kv.	.003	6 kv.
.02	3 kv.	.03	5 kv.
.25	1.5 kv.	.001	4 kv.

THE NEW "SOLON" INSTRUMENT MODEL ELECTRIC SOLDERING IRON Weight: 3½ ozs. Length 9in. For 220/240 v. 25 watts. Only 19/8, p.p. 1/-.

SPECIAL OFFER OF 1 LB. REELS OF 50/50 ALLOY SOLDER, 12/6, p.p. paid.

TERMS: C.W.O., C.O.D., or pro-forma invoice.

15 LITTLE NEWPORT ST., LONDON, W.C.2

GERard 6794/1453

APPLICATIONS

are invited for a number of senior positions in the Guided Weapon field. Posts are permanent and will be offered to suitable applicants who have either at least 5 years experience in industry or are Graduates with two or more years experience.

Salaries will be commensurate with experience and advancement will depend upon original contribution and enthusiasm for the work. The following positions are available:

- (A) Physicist with experience in electronics.
- (B) Circuit Engineer capable of original circuit development and familiar with low frequency circuit designs and miniaturisation, and
- (C) Servo Engineer experienced in design and development of light electrically controlled servo mechanism.

Apply Box AC85667,
SAMSON CLARKS,
57-61, Mortimer Street,
London, W.1.

THE
CHAFFEY
CABINET COMPANY
50a, CHELTENHAM RD., LONDON, S.E.15
TEL : NEW CROSS 4766

TRANSFORMERS & COILS
TO SPECIFICATION
MANUFACTURED OR REWOUND
Filter Coils $\pm 1\%$ a Speciality.
JOHN FACTOR LTD.
9-11 EAST STREET, TORQUAY, DEVON
'Phone: Torquay 2162

PRODUCTION ENGINEER

Required by Short Brothers and Harland Limited, Belfast, to organise the batch manufacture of High-grade Electronic Equipment. Applicants must have had several years production experience of Radio or Electronic Apparatus and be able to provide liaison between development laboratories and factory. Knowledge of work study an advantage.

Details re salary and housing facilities available on application. Write, stating age and experience to:—The Personnel Manager, Short Brothers and Harland Limited, Queen's Island, Belfast.

SITUATIONS VACANT
SENIOR radio receiver designer required; several years' experience of similar work essential.—Applications which should include full details of qualifications and experience may be addressed in confidence to Personnel Department (S.R.D.), Murphy Radio, Ltd., Welwyn Garden City. [0230]

ELECTRONIC engineers with several years research or development experience are invited to apply for posts with a well-established company engaged primarily on the development of precision electronic laboratory instruments; applicants should preferably possess an honours degree or equivalent qualifications in physics or light electrical engineering, although this is not essential as considerable practical experience is equally acceptable; the appointments are of a permanent nature for engineers able to undertake the responsibility for the development of new projects to the prototype stage, and they offer scope for the exercise of individual initiative; furthermore, the work covers a wide range of electronic instruments and similar devices; salaries are commensurate with qualifications and experience; applications should be made in writing, stating full details, to—Chief Engineer, Furzill Laboratories, Ltd., Boreham Wood, Herts. [0030]

SITUATIONS WANTED
TECHNICAL publicity engineer, A.M.Brit.I.R.E., seeks commissions.—ARB, 13, Gainford Gdns., Manchester, 10. Fallsworth 3711. [2195]

TELECOMM'S engineer (30) C. & G. full cert. Telecomm's eng.: experience auto and carrier, telephony, power system communications and control systems; returning from New Zealand late Jan.; seeks progressive position.—Write 14X4, Wm. Porteous & Co., Glasgow. [2187]

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 144-page handbook—free and post free.—B.I.E.T. (Dept. 387A), 29, Wright's Lane, London, W.8. [0117]

TUITION

NOTHING succeeds like success! What we have done thousand times we can do again for you—see the B.N.R.S. advt. page 54. [0172]

WIRELESS operating; attendance and postal courses.—Stamp for reply to Manager, The Wireless School, Manor Gdns., London, N.7. [0191]

FULL-TIME courses for P.M.G. Certs. O.G.L.I. Telecommunications, Radar Maintenance Cert. and B.Sc.(Eng.); prospectus free.—Technical College, Hull. [0111]

LEARN it as you do it.—We provide practical equipment combined with instruction in radio, television, etc.—Write for full details to E.M.I. Institutes, Dept. WW47, 43, Grove Park Rd., London, W.4. [0179]

SEE the world.—Radio officers urgently required; we train most in shortest period; training fees payable after appointment secured; scholarships available; boarders accepted; 2d stamp for prospectus from Britain's leading college.—Wireless College, Colwyn Bay. [0018]

A.M.I.Mech.E., A.M.Brit.I.R.E., City and Guilds, etc. on "no pass—no fee" terms; over 95% successes; for details of exams and courses in all branches of engineering, building, etc., write for 144-page handbook—free.—B.I.E.T. (Dept. 387A), 29, Wright's Lane, London, W.8. [0118]

T/V & Radio.—A.M.Brit.I.R.E., City & Guilds, R.T.E.B. Cert., etc., on "no pass—no fee" terms. Over 95% successes. Details of Exams & Home Training Courses in all branches of radio & T.V., write for 144-page handbook—free.—B.I.E.T. (Dept. 387A), 29, Wright's Lane, London, W.8. [0116]

WIRELESS telegraphy: Merchant Navy offers to youths 18 upwards, after qualification lucrative positions as Radio Officers.—Apply British School of Telegraphy, 179, Clapham Rd., S.W.9 (Est. 1906). Recognised by Ministry of Education. Moderate fees. Modern equipment. Also postal courses in theory of Wireless Telegraphy for P.M.G. Certs. and Amateur Transmitting Licence. [0124]

OPPORTUNITIES in radio and television servicing.—Full-time theoretical and practical 1-year courses at E.M.I. Institutes in London; job assured on successful completion; next course commences April 1st; early enrolment is advised.—Free brochures giving details of these and other courses from E.M.I. Institutes, Dept. WW36, 10, Fembrey Sq., London, W.2. Tel. Bayswater 5131/2. [0180]

THE Institute of Practical Radio Engineers have available home study courses in every phase of radio and television engineering, specialising in the practical training of apprentices in the retail trade; enrolments limited, fees moderate.—The Syllabus of Instructional Text may be obtained post free from the Secretary, I.P.R.E., Fairfield House, 20, Fairfield Rd., Crouch End, London, N.8. [0088]

FREE! Brochure giving details of home study training in radio, television, and all branches of electronics; courses for the hobby enthusiast or for those aiming at the A.M.Brit.I.R.E., City and Guilds, Telecommunications, R.T.E.B. and other professions examinations; train with the college operated by Britain's largest electronic organization: moderate fees.—Write to E.M.I. Institutes, Postal Division, Dept. WW26, 43, Grove Park Rd., London, W.4. [0001]

RADAR ENGINEERS

MARCONI'S WIRELESS TELEGRAPH CO. LTD., CHELMSFORD

have vacancies for:—

TWO SENIOR ENGINEERS

to take charge of the development of centimetric radar projects.

Specialist knowledge of radar transmitters and modulators or radar receivers and allied equipment is essential.

These are appointments of considerable responsibility carrying appropriate remuneration.

Vacancies also for:

DEVELOPMENT ENGINEERS

to assist in the design and development of radar transmission, reception and display equipment.

Applicants should have had some experience in all or part of this field.

Attractive salaries paid in these positions which offer excellent opportunities for advancement.

Write to Dept. C.P.S.,
336/7, Strand, London, W.C.2.
quoting reference number S.A.35.

We have a large stock of

HIGH STABILITY RESISTORS

Trade enquiries invited: Marris & Cartin Ltd., 42 Brook Street, London, W.1. GRO. 5571

MORLEY TRANSFORMERS

QUALITY P.F.O./P. TRANS. 20w, copper Siliconised Section, 100% load, primary rated input 75mA, leakage Ind. 0.75H. Sec. 3 and 15 ohms primary Ind. 100mA, leakage 0.75H. Shrouded and term. wt. 5 lbs. 3 gas. Ditto 15 w., 2½ gas. L.F. CHOKES, 10H. 65 mA. 4/8 15H. 100 mA. 10/6. 20H. 150 mA. 12/6. CRT Htr. Isolation Trans. 25K. sec. boost volt. 2 v. 10/8; 6.3 v. 10/6. MAINS TRANS. 0-200/250 v. tapped prim. 350-0-350 v. 80 mA. 5 v. 2 a. 6.3 v. 4 a. etc., from 21/- 6.3 v. 1 a. Htr. Trans. 7/6. Quotations for specials and rewinds. Part P. & P. 1/- 2, PAWSONS RD., W. CROYDON, THO 1665

ENGINEERS!

Whatever your age or experience, you must read "ENGINEERING OPPORTUNITIES". Full details of the easiest way to pass A.M.I.Mech.E., A.M.I.C.E., C. & G. (Electrical, etc.), General Cert., etc., on

"NO PASS—NO FEE" 144 PAGES terms and details of Courses in all branches of Engineering—Mechanical, Electrical, Civil, Auto., Aero., Radio, etc., Building etc. If you're earning less than £15 a week, tell us what interests you and write for your copy of "ENGINEERING OPPORTUNITIES" today—FREE

B.I.E.T.

387 College House, 29-31, Wright's Lane, Kensington, W.8.

SPERRY GYROSCOPE CO. LTD.

Invite applications from Engineers holding a degree or membership of a professional Institute, for interesting development work on aircraft instrumentation, automatic controls, marine products and guided missiles. Vacancies include:-

ELECTRONIC ENGINEERS for Brentford and Feltham. Additional to above qualifications, practical experience and knowledge of production methods with experience of one or more of the following is desirable: Control circuits, D.C. Amplifiers, Computing devices, Video circuits, Micro-wave techniques.

HYDRAULIC ENGINEERS for Brentford. Essential to have apprenticeship and knowledge of production methods.

MECHANICAL & ELECTRO-MECHANICAL ENGINEERS for Brentford, Feltham and Gloucestershire. Additional to above qualifications, desirable to have apprenticeship, knowledge of production methods and experience in design of one or more of the following: gearing, instrument mechanisms, servos.

Pension Scheme.

Apply giving full details, including an indication of the salary range and location preferred, to **Personnel Manager, Sperry Gyroscope Co., Ltd., Great West Road, Brentford, Middx.**

ONLY THE BEST IN HIGH FIDELITY

285, CAMBERWELL ROAD, S.E.5

Telephone : RODney 4988

Hours 9.30-6.0 p.m. Including Saturdays.

Latest additions to our range:-

Acoustical QUAD II amplifier, £42/-.
Rogers BABY De Luxe, £22/10/- Lowther
A.M. F.M. TUNER & MASTER CONTROL
UNIT. Roger CORNER SPEAKER BI-
AXIOM SPEAKER Kit.

Usual lines also in stock.

AMPLIFIERS

RADIO TUNERS 8 receiver £23/13/- Chapman's
£4, £16/-.
Rogers, £24/16/-. Sound Sales A-Z
£17/4/-.

RADIO TUNERS

W.B. H.F. Speaker from £2/10/6. Wharfedale
Super 5 and 8, £6/13/3. Wharfedale 35 Corner
Assembly, £72/-.
Wharfedale Golden 10, £7/13/3. Goodmans
Axiom 101 and 102 from £6/12/1. Goodmans
Axiom 150 Mk. II, £10/5/6. Goodmans
Audiom 60, £8/12/6. Barker Duode, £12/12/-.
Voigt Corner Cabinet, £47/-.
Lowther Voigt
PM 2 Unit, £35/-. Tannoy 12 and 15 Dual from
£27/10/-.

PICK-UPS AND AUTOCHANGERS
Decca XMS with new type H head, £6/9/3.
Connoisseur P/U with head, £5/19/3. Con-
noisseur 3 speed motor £21/17/3.

**CABINETS TO HOUSE ALL TYPES OF
HI-FIDELITY EQUIPMENT. S.A.E. for Photos,
sizes and prices.**

Hire Purchase terms arranged. DAILY DEMON-
STRATIONS. Technicians who will install our
equipment in your home to the best acoustical
advantage.

BOOKS, INSTRUCTIONS, ETC.
OFFERS "W.W.", 1932-40, 34-39 complete;
buyer collects; cheap.—2d, Eastbourne Rd.,
Hanworth, Middx. [2272]

BOOKLETS "How to Use Ex-Govt. Lenses
and Prisms," Nos. 1 and 2, price 2/6 each;
ex-Govt. optical lists free for s.a.e.—H. English,
Rayleigh Rd., Hutton, Brentwood, Essex. [0181]

BOUND volumes "Wireless World," Nos. 10
to 46 inclusive, also volumes 1 and 2
"Modern Wireless," all perfect condition.—
Offers to Mitson, 38, Alleyne Rd., Dulwich,
S.E.21. [2275]

I.P.R.E. technical publications, 5,500 Align-
ment Peaks for Superhetradynes, 5/9, post
free; data for constructing TV aerial strength
meter, 7/6; sample copy of "The Practical Radio
Engineer," quarterly publication of the Institute
2/-; membership and examination data, 1/-
See. I.P.R.E., 20, Fairfield Rd., London, N.8. [0099]

MOTOR CYCLE Sport in Pictures: Action
Photographs of British and International
Racing Trials, Scrambles and Speedway Events.
Contains over sixty of the finest photographs of
motor cycle sport ever taken, each picture having
been specially selected by the Editor of
"The Motor Cycle." A superb volume, beauti-
fully printed, which at its price represents first-
class value. 3/6 net from all booksellers. By
post 3/9 from Iliffe & Sons Ltd., Dorset House,
Stamford St., London, S.E.1.

MOTOR CYCLE Cavalcade. By "Ixion" of
"The Motor Cycle." Gives the history of
machines from 1884 onwards and tells the
story of the men who designed, constructed and
rode them. A book every enthusiast should read,
10/6 net from all booksellers. By post 11/- from
Iliffe & Sons Ltd., Dorset House, Stamford St.,
London, S.E.1.

WIRELESS Servicing Manual. By W. T.
Cocking, M.I.E.E. Deals with the loca-
tion and cure of the innumerable faults which
can develop in broadcast receivers and their
associated equipment. A special chapter is de-
voted to servicing with the cathode-ray oscillo-
scope. 8th Edition. 12/6 net from all booksellers.
By post 12/1 from Iliffe & Sons Ltd., Dorset House,
Stamford St., London, S.E.1. [P3]

RADIO Circuits: Step-by-Step Survey of
Superhet Receivers. 3rd Edition. By W.
E. Miller, M.A. (Cantab.), M.B.I.R.E., Editor of
"The Wireless and Electrical Trader." Al-
though this book deals mainly with the superhet
receiver it is equally applicable to the straight
set. The circuit of the superhet is dealt with
section by section up to the complete receiver.
5/- net, from all booksellers, or 5/4 by post,
from Iliffe & Sons Ltd., Dorset House, Stamford
St., London, S.E.1. [P3]

MORSE CODE Training



COURSES for BEGINNERS
and OPERATORS, also a
SPECIAL COURSE for passing
the G.P.O. Morse Test for
securing an AMATEUR'S
TRANSMITTING LICENCE.

Send for the Candler
BOOK OF FACTS

It gives details of all Courses
Fees are reasonable.

TERMS: Cash or Monthly
Payments.

THE CANDLER SYSTEM CO.
(55W) 52b ABINGDON RD., KENSINGTON
LONDON, W.8

Candler System Co., Denver, Colorado, U.S.A.

CHEAP, ODD LENGTH COILS CABLES & FLEX

Nothing under 20 yds. All prices per 100yd. lot. All

TWIN FLAT 3/029 3/029 7/029 7/029 7/044 1/044
W/E W/E

T.R.S. 49/- 59/- 83/- 101/- 156/- 39/-
CAPOTHENE 52/- 64/- 84/- 110/- 166/- 36/-
V.I.R. Single 21/- — 34/- — 66/- 17/-

FLEX. Plastic T.T. or flat 13/9. Maroon T.T. 24/-
Maroon 10-20 yd. Cols 20/-. Twin Circ. p. and b. 42/-
3-core p. and b. 72/- Less than 100 yd. lot of anything
supplied, just add 5%. Add extra carriage to small orders
please. Full lists of many other types on request.

British Distributing Co., 591 Green Lanes, London, N.8.
MOU. 0055/6.

TR1154/55 RECTIFIERS

Input:—200/250v., 50~S.P. Output:—6.3v.,
13A.—220v., 110m.A.—1200v., 200mA.
NEW CONDITION—TESTED—GUARANTEED
£17-10-0 per set. Carriage extra.

A. J. WHITTEMORE (Aeradio) LTD.
Croydon Airport. Tel: Croydon 5791, 4383, 7744
Surrey. Grams: Aeradio, Croydon.

MONEY BACK GUARANTEE DUKE & CO.
621 ROMFORD ROAD, LONDON, E.12
CWO or COD • TEL: GRA 6677

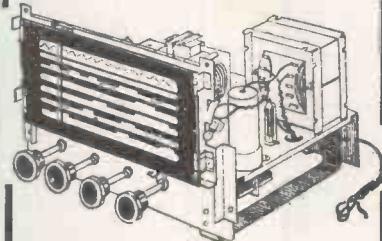
9/8 AMPLIFIERS. Bargain. Brand new (ex-W.D.,
unused). Contain EF36, two transformers, 400 ohm
relay, volume control, various condensers, resistors
etc. Case measures 5in. x 5in. Post 1/6.

RECTIFIERS. 11/9. T.V. type. Salvage, guaran-
teed. 300 volt at 250 mA. Also 250 volt at 80 mA.
8/9. 180 volt at 40 mA. 3/9. Post 1/-.

TRANSFORMERS. I.F.s 465 kc/s., new, 2/9 each.
O.P. salvage trans., 1/9. Pick-up trans., E.M.I.
type, new, 3/9. Microphone trans., cased, ex-W.D.,
3/9. Post 1/-. Car radio trans., 5/9. Post 2/-.
SPOTLIGHTS. Butlers, ex-W.D., 8/9. New, with
reflector and glass. Post 1/3.

SIDE LAMPS. Infra-red glass, ideal tail lamps.
New, ex-W.D., 1/9. Post 9d.

**RADIO-GRAM CHASSIS
FROM £10. 17s. 6d.**



Latest show, band spread tuning, feed-back, all
band new. 6-band (Illustrated) 15 valves,
with volume control, 3-wayhead (BS2), a
12 guinea £10/17/6, (X9), similar to above
but by another manufacturer. All models have 5
valves (latest miniatures), flywheel tuning, negative
feed-back, gain switch, extension speaker and pick-
up sockets. Post 3/6.

TUNING CONDENSERS. Two gang, .0005 mfd.,
standard size. Store sold, but all tested. CLEAR-
ANCE OFFER 2/9. Post 9d.

MICRO-SWITCHES. New American miniatures,
250 volts, 3 a., 1/2 in. x 1/2 in. x 1/4 in. BARGAIN
OFFER 3/6 each.

CONDENSERS. Guaranteed. Assorted pairs of
fixed and waxed (wire ends). .0003, .001, .0047,
.0068, .004 and 1,000 pf. 45 for 10/- or 100 for £1.
Post 1/6.

EXTENSION SPEAKERS. Brand new 6 1/2 in. P.M.
speaker (low impedance). Mounted on polished and
veneered baffle stand or normal box type cabinets,
gold fret, 5ft. lead ready connected. ONLY 19/8.
Post 1/9.

EXTENSION SPEAKERS. 37/8. In polished cab-
inet with 8in. speaker. Post 2/6.

CRYSTALS. Germanium. Brand new, made by
B.I.H. Give first class results. SPECIAL OFFER
2/3. Post 6d.

INDICATOR UNITS. Ex-W.D., but brand new
condition. Valves and C.R. tubes only have been
removed. Chassis, valve-holders, resistors, con-
densers, etc., alone are worth more than our price.
Units include Design "L" type 6C. BARGAIN
at 12/6 each. Carriage 4/6.

POWER UNIT 657. New, 22/6 less valves. With
valves 77/6. (2-EF50, 1-4X5G, 2-CV188, 1-VU120/
HVE2, 2-524, 2-504, 1-5V6). Carriage 4/6.

INSULATING TAPE. New and wrapped, 1/2 in. wide.
1/2 in. rolls. Listed at 3/6. OUR PRICE 1/6.

TELESCOPIC MASTS. Ex-W.D., but unused.
Extend to 7ft. 6in. Base diameter 1/2 in., tip 1/2 in.
Closed length 15in. Ideal aerial. GIFT PRICE
5/9. Post 1/3.

AERIAL COILS. For portable sets. Brand new.
On aluminium frame measuring 1in. x 1in. BAR-
GAIN AT 2/6. Post 6d.

FUSE HOLDERS. Porcelain. 15 amp. MEM,
Kantark Minor (brand new). Complete with fuse,
backwiring type, 250 volts. TO CLEAR AT 9d.
Post 4d.

ROTARY CONVERTER. 12/6. Ex-W.D., new.
In 12 v., out 200 v., at 50 mA., and 13 v., at 1.5 amp.
Post 2/6.

POWER SUPPLY UNIT. 47/6. Ex No. 19 set.
Z.A. No. 3108. New, 12 v. in. Two H.T. output at
275 v., and 500 v., Post 2/6.

SEND STAMP FOR 1954 CATALOGUE.

Fidelia

HAND BUILT
QUALITY
UNITS



MAJOR
10 VALVE
RADIogram
CHASSIS £32/8/4

Quietly and unobtrusively over a number of years we have been hand building high quality radio gram equipment. Designed by ourselves, we have used many features that have subsequently been "borrowed" by other people. However, it is nice to have this acknowledgement of our help in the search for reproduction suitable for serious listening. Our data sheets are well worth sending for if you are searching for something worthwhile at modest cost.

Fidelia Standard 7-valve model £21 12 0
Fidelia Plus 8-valve model £23 18 4
Fidelia de Luxe 9-valve model £24 6 6
ALL MODELS have triode output stages. Variable Selectivity, Separate Bass and Treble Controls, Cathode follower detector, 10-20,000 cycle audio response.



Electro
Acoustic
Developments

2 AMHURST ROAD,
TELMBORE CLIFFS,
Nr. Brighton,
SUSSEX

Tel: Peasehaven 3156

U.S. WAR SURPLUS WANTED

APR-4, APR-5, APR-1, ARC-3, etc.; TS-12, 13, 34, 35, 36, 45, 120, 146, 155, 173, 174, 175, 323 and other "TS" units, etc., particularly for the MICROWAVE REGION; also U.S. commercial laboratory equipment (General Radio, Ferris, etc.); special tubes such as 723A/B, 3C22, etc.; spare parts technical manuals; single units or large quantities.

Sell direct to us, receive the full top price. Describe and price to:

ENGINEERING ASSOCIATES

444 Patterson Road,
Dayton 9, Ohio, U.S.A.

PRATTS RADIO

1070 Harrow Road, London, N.W.10

(Nr. Scrub: Lane)



MODEL AC10E £10/7/6.

and gram. inputs allowing MIXING of speech and music. Input voltages, average .003 milliamp. and 3 gram. Outputs match 3, 8 or 15 ohm speakers. P/P output of 9 watts. This amplifier incorporates an 18 section O/Transistor, variable feedback from zero to 25 dB. Output imped. 3.6 to 230. Complete chassis, £13/19/6. MODEL Q4C, 4 valve 4 watt unit Bass and Treble controls. Variable feedback, O/Imp. 3 to 15 ohm. Chassis complete, £9/15/-. Complete range of accessories available. Send stamp for lists. All amplifiers are ready for use.

LONDON CENTRAL RADIO STORES

10-WATT AMPLIFIER, fitted P.U. and microphone terminals. A.C. 220/250 v. in metal cabinet, 13 x 6½ x 8ins. £28/10/- Carr., etc. 10/-.

SELENIUM FULL-WAVE RECTIFIERS. 80 v. 20 a. Approx. 11 x 6 x 6in. Used, but perfect. Weight 14lb. £3/10/-

UNISELECTOR SWITCHES. Have many applications, including automatic tuning circuit selection, etc. Operates on 25-50 v. Full Wipers, 3-band, 19x6. Half Wipers, 6-band, 27x8. Plus 1/8 P. & P.

GROOVE LOCATING UNITS enabling operator to project any point on 10, 12 or 16in. discs for playback purposes. Consists of substantial machined casting with adjustable counterpoise pick-up arm fitted with high-fidelity pick-up, and instantaneous calibrated groove selector with micrometer adjustment and "velvet touch" lever for dropping pick-up. £2/10/-, carr. paid.

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., 4½in. long x 1½ x 1in., many industrial and domestic uses, 10/- P. & P. 9d.

See previous issues for other bargains.

N.B.—We do not issue lists or catalogues. Carriage charges relate to British Isles only.

23 LISLE ST. (GERARD 2969) LONDON, W.C.2
Closed Thursday 1 p.m. Open all day Saturday

Introducing the :—

TYANA TRIPLE THREE

SMALL

SOLDERING IRON
Complete with detachable
BENCH STAND 19/6

The smallest high-power soldering iron. Length only 8½"; adjustable long bit dia. 3/16"; mains voltages 100/110, 200/220, 230/250.

THE
STANDARD TYANA
SOLDERING IRON

Retails at 16/9

Replacement Elements and
Bits for both types always
available.

KENROY LIMITED
152/297 UPPER ST., ISLINGTON,
LONDON, N.I.
Telephone: Canonbury 4905-4663

QUALITY TELEVISION COMPONENTS



HAYNES RADIO Ltd.
Queensway Enfield Middlesex

Scanning Coils
6/10 KV. R.F. E.H.T. Units
E.H.T. and Output Transformers
Line Fly-back E.H.T. Units
SEND FOR ILLUSTRATED LIST
(PUBLICATION 75)

GOODSELL LTD.

for High Fidelity Equipment

40 GARDNER ST.,
BRIGHTON, I.
Tel.: Brighton 26735.

MALVYN ENGINEERING WORKS

Precision Engineers

Manufacturers of: Chassis, Small Pressings, Machined Components, Wiring and Mechanical Assemblies to specification.

Single and Production Quantities. Enquiries Invited.

100 PARK ROAD, WARE, HERTS.
Telephone: Ware 465

FERGUSON RADIO CORPORATION LTD.

offers exceptional opportunities to DRAUGHTSMEN wishing to make their career in the world of electronics, television and radio. Candidates preferably experienced in the Radio and Television industries, must have knowledge of mass production methods and workshop practice. Familiarity with Ministry requirements an advantage. Good Salaries; Pension scheme. Well equipped Drawing Offices and good working conditions.

Apply: Employment Manager,
Ferguson Radio Corporation
Ltd., Great Cambridge Road,
Enfield, Middx.

Television • Radio • Record CABINETS MADE TO ORDER

ANY SIZE OR FINISH

CALL OR SEND DRAWINGS FOR QUOTATION

B. KOSKIE (DEPT. E.)

72-76 Leather Lane, Holborn, E.C.1

Phone: CHAncery 6791/2

QUARTZ CRYSTAL UNITS

Type
B7

The type B7 unit is mounted in the standard B7G valve envelope and is hermetically sealed and fully evacuated.

Available for the frequency ranges from 100 kc/s. to 500 kc/s. and from 3 Mc/s. to 16 Mc/s. Gold electrodes applied by cathodic sputtering give permanence of calibration. Normal adjustment accuracy 0.01%. Max. adjustment accuracy 0.003%.

Early delivery can be given of most frequencies, and we will be pleased to quote for your specific requirements.

THE QUARTZ CRYSTAL Co. Ltd.
63-71 Kingston Road,
NEW MALDEN, SURREY

Telephone: MALDEN 0334
Cables, etc.: QUARTZCO NEWMALDEN

Smith's
of
EDGWARE ROAD

for High Stability Resistors
by Welwyn, E.M.I., Dubilier

	5%	2%	1%
½ watt.	7½d	10½d	1/3
⅓ watt.	9d	1/-	1/6
⅔ watt.	10½d	1/3	1/9
2 watt.	1/-	1/6	2/-

Send for List of over 300.

H. L. SMITH & CO. LTD.
287/289 EDGWARE ROAD, LONDON, W.2
Telephone: Paddington 5891

Hours 9 till 6 (Thursday, 1 o'clock)
Near Edgware Road Stations, Metropolitan & Bakerloo

**TRANSFORMERS
COILS
CHOKES**

LARGE OR SMALL QUANTITIES
TRADE ENQUIRIES WELCOMED

SPECIALISTS IN

FINE WIRE WINDINGS

MINIATURE TRANSFORMERS, PICK-UP,
CLOCK AND INSTRUMENT COILS, ETC.
VACUUM IMPREGNATION TO APPROVED STANDARDS

ELECTRO-WINDS LTD.

CONTRACTORS TO G.P.O., M.O.S., L.E.B., ETC.

123-5-7 PARCHMORE ROAD, THORNTON HEATH, SURREY
LIVINGSTONE 2261

EST. 1933

Symons synonymous with flexibility

SIL

SILICONE ELASTOMER PRODUCTS

PRODUCT	DESCRIPTION	SPECIAL FEATURES
"Symel" Sleeving	Silicone Elastomer extruded sleeving, for operating temperatures from -50°C to +180°C.	"Symel" range of eleven colours for radio and radar coding.
"Symel" Coated Glass	Silicone Elastomer coated glass cloth, supplied as semi-cured or fully cured tape. Moisture resistant, low power factor and temperature range from -50°C to +180°C.	Semi-cured tape for traction motor armature and field coils. Complete bonding obtained on curing at 150°C.

For flexible insulating materials of consistent dependability —say Symons.

H. D. Symons & Co. Ltd.

PARK WORKS · KINGSTON HILL · SURREY

TELEPHONE KINGSTON 8881 PTE. EX.

PERSONAL

The opportunity of a lifetime is WAITING for a man with a Good Sound Product and real knowledge of electronic engineering principles and practice.

**PRACTICAL
ELECTRONIC
ENGINEER**

We are Manufacturers of High Grade electronic equipment interested in expanding our operations in the diversified field of electronic engineering.

**IF YOU HAVE AN IDEA AND YOU ARE ABLE TO ORGANISE
AND SET UP AN OPERATION WITH MODERN PLANT
IN YOUR OWN SPECIALISED FIELD**

We will put a separate division at your disposal, staffed and equipped to your specification. YOU will have complete backing and co-operation and will earn and enjoy the highest remuneration possible coupled with a profit sharing arrangement.

If you have a product you think has possibilities and want the chance to make your skill pay dividends, please write giving your background and details of what you have in mind. **STRICTEST CONFIDENCE.** Box 2398 c/o "Wireless World"

Also Suppliers of

**RELAYS
UNISELECTORS
P.O. EQUIPMENT
PLUGS & SOCKETS**

THE KEYSWITCH CO.

SPECIAL ITEMS — EX-STOCK
Switchboards U/C 10 line Mk. II
Motor-Uniselectors 16 Bank 50 Way.

SEND ALL YOUR ENQUIRIES TO
191 KENSAL ROAD, LONDON, W.10
LAD. 0666

191 KENSAL ROAD, LONDON, W.10

LAD. 0666

HIGH FIDELITY

The newest VHF FM tuner.

"Wireless World" Design.

Realise the full compass of your amplifier with the immaculate transmissions from Wrotham, Kent. Scores of quality enthusiasts, at over 35 mls. radius, report excellent results with our unit. Input 10μV to 3mV from dipole. Output 5mV to 200mV AF. Wide band with silent background. Aural tuning indicator. Convertible to AM. Fine rejection adjustment. Low power input requirements. Power reqd. only 25mA. at 220V.

Price £11/17/6

Leaflets 1/- With power supply, £15.

Fully complete kits, £7/5/-.

Demonstrations, from 6 p.m., by appt.

Trade enquiries welcome.

BEL SOUND PRODUCTS CO.,
Marlborough Yard, Archway,
London, N.19.

ARO 5078 Nr. Archway (Northern Line) Underground

"Always a good deal" at
WEST END RADIO

MINE DETECTORS. Ex-Army mine detectors complete with all components, new in transit case, £6/10/- Carr. 15/-.

CAR BATTERY CHARGING KIT. Will give 6 and 12 v. at 4 amps. Comprising transformer, selenium rectifier, Pilot lamp, Edison meter, clips etc., etc., in handsome black crackle cabinet. 8in. x 6in. x 6in., 69/- P. & P. 5/-.

H.T.-L.T. BATTERIES. Ex-Govt. 1952 manufacture, layer-built, 150 v. + 3 v. Every battery tested before despatch. Suitable for No. 38 receiver. 4/6. P. & P. 1/-.

EX-GOVT. CAR RECEIVERS, R.103. 7 valves, 6-volt type with B.F.O., etc., 2 channels 1.7-4 Mc/s and 4.7 Mc/s, I.F. freq., 465 kc/s. OUR price 75/- P. & P. 7/6.

1,000 Bargains for callers!

WEST END RADIO LTD.
14, LISLE STREET, LEICESTER
SQUARE, LONDON, W.C.2.

Phone: GER 7341

OPEN ALL DAY SATURDAY !

L. WILKINSON**19, LANSDOWNE ROAD, CROYDON**

Phone: CRO 0839

Telegrams: "WILCO" CROYDON

RELAYS—P.O. TYPE 3,000

BUILT TO YOUR SPECIFICATION—EARLY DELIVERY QUOTATION BY RETURN—PLEASE STATE RESISTANCE OF COIL REQUIRED AND CONTACT BUILD UP.

SIGNAL AND NOISE GENERATOR. For television frequencies 20/88 Mc/s in 4 Bands. Crystal controlled. Leaflet available on request. Made for H.M. forces, normally operating on 115 v. or 80 v. but suitable for conversion to 230 v. The few we have left we offer at the very special price of £8/17/6.

TEST SET 205. Wavemeter range, 3.05 to 3.35 centimetres, built-in oscillator with 9 valves including Klystron type CV.129, etc., in good condition. £20.

RACKS. Standard 6ft. P.O. type for 19in. panels, steel channel sides correctly drilled, heavy angle base.

POTENTIOMETERS. Large stocks, low prices, lists available. **HIGH STABILITY RESISTORS.** 1%, 2%, 5%, available ex stock. Best makes, most values, special prices.

INDICATOR UNIT, No. 184. A few only. Contains VCR97, VOR189A, 5 EF50's, 3 VR54, 3 VR65, 6 VR52, 4 metal rectifiers, and host of potentiometers, resistors, condensers, transformers, etc. £5 each, carriage 10/-.

INFRA-RED IMAGE RECEIVERS. Ref. No. 5c/294. This has special telescope viewing lens. Contains image converter, permanent power supply unit, is for making possible viewing of infra-red objects. New in transit cases. Price 50/- each, carriage 5/-.

HOTRIC IMMERSION HEATERS. 230 volt 2½ kilowatt. Standard domestic type. Complete with cover and cable entry. Our price 32/8 each, post 2/6.

IMMERSION HEATER THERMOSTATS to go with the above, by Sunvic Controls. 250 volts 15 amp. A.C. range 100 to 190 degrees Fahr. New. Less than half list price. 17/6 each, post 1/9.

CONDENSERS. Special high tension type. Size: 25 plus 25 mfd. 4,500 volt D.C. working. Weight 7lbs. Oil-filled. Price 5/- each, post 2/-; 48/- dozen, carriage 7/6.

L. C. NORTHALL
16 HOLLY ROAD, QUINTON, BIRMINGHAM, 32.
Phone: WOO 8166.

Callers welcome at our main showrooms:
353, BEARWOOD ROAD, SMETHWICK.
Special attention Overseas enquiries.

THE DESIGN and DEVELOPMENT
of specialised equipment for
Research and Industry.

DUN (electronics) & CO.,
17 Victoria Gardens, London, W.11. Park 6636

TELECRAFT
AERIALS ENSURE THE
BEST TELEVISION
TRY ONE AND SEE FOR
YOURSELF

COVENTRY RADIO
189 DUNSTABLE RD., LUTON

Tele.: Luton 2877.

Component Specialists Since 1925

All B.V.A. and Tungsram Valves

EDDYSTONE COMMUNICATION SETS AND
COMPONENTS

Short Wave Component Catalogue 6d.

T.C.C., Hunts & Dubilier Condensers, Welwyn and Erie Resistors.

Lab/Morganite, Erie, Dubilier, Colver and Amplion Potentiometers.

Denco, Osmar, Wearite and Weymouth Coils and Packs.

Eddystone, Denco, Wearite and Weymouth L.F.s.

Woden and Elstons Transformers.

Elac, Goodmans, Plessey, Roa/Colletion Speakers.

Avo and Taylor Test Meters.

E.M.I. Scotch Boy and Grundig Recording Tapes.

Valradio Vibrator Convertors.

These are some of the components we stock. Send for our 50-page Component Catalogue, price 6d.

SAMSON'S SURPLUS STORES

INSTRUMENTS. Admiralty Integrators Type A 901 incorporating very fine Galvo movement, 40 ohms. Centre Zero to F.S.D. 1 microampere. Small mirror 1 metre radius, 65/- Carr. 2/6. 2in. Panel mounting M.G. Meter 0-30 mA. D.C. 0-100 mA. D.G.C. 0-500 mA. D.G. 12/6. 2in. Projecting Type 0-750 microammeters, 12/6. 2in. Panel mounting M.G.D.C. 0-20 Ammeters, 10/6. Master Voltmeter 0-20 v. A.C. 50 cy. M.L. 8in. mirrored scale, 25/- P.P. on all meters 1/6.

TELEPHONE EQUIPMENT. Admiralty Sound Powered Head and Chest set comprising microphone on swivel base and headphones. 17/6. P.P. 1/6. Microphone separately, 12/6. P.P. 1/6. Sound Powered Hand sets, 17/6 ea. P.P. 1/6. Field Telephones Type D5 complete with single headphones. Hand set and batteries built in strong metal containers suitable for Farms, Building sites, Garages, etc., 49/6. Carr. 2/6. Telephone Cable Single D3 1 mile drum, 55/- Carr. 5/-

STORAGE BATTERIES. Pritchett and Gold 12 v. 75 AH Batteries built in Teak cases, 24/10/6. Carr. 7/6. 6 v. 100-125 AH as above, £4/19/6. Carr. 7/6. American 6 v. 90 AH 15 Plate Car Batteries 9in. x 9in. x 7in., £4/7/6. Carr. 5/- Exide 10 v. 5 AH Glass Accumulators suitable for HT unit construction, 9/6 each. P.P. 1/6.

169/171 Edgware Road

London, W.2. Tel.: PAD 7851
125 Tottenham Court Road, W.I.
Tel.: EUS 4982

All orders and enquiries to our Edgware Road branch, please. This is open all day Saturday.

TESTOSCOPE Mains Tester

For high and low voltage testing.—

1/30 and 100/850 volts A.C. or D.C. Write for interesting leaflet 30F.

RÜNBAKEN · MANCHESTER 1

LARGE & VARIED stocks of METERS

available for immediate delivery
Special orders executed 7-14 days

ANDERS ELECTRONICS LTD.91, HAMPSTEAD RD., LONDON, N.W.1
Euston 1639**CABINETS—RADIO CHASSIS OUTSTANDING BARGAINS**

Console Tape-Recorder; Radiogram; Radio and Television. Also many varied Table Model Cabinets. In polished walnut.

- 12in. and 16in. CONSOLE TELEVISION CABINETS, from £7/5/-
- STANDARD COMBINATION CABINETS from £7/15/-
- RADIOPHONIC CABINETS from £6/10/-, RADIOPHONIC CABINETS from 22/8.
- Changers * Loudspeakers * Magnetic Recording Equipment.
- * Resistors * Condensers * Coilpacks and Tuning Coils.
- Send now for our monthly bulletin. Many Bargain Lines.

DE-LUXE RADIOPHONIC CHASSIS

R.1. A 5-valve 3 W/E Superhet Chassis A.C. 200/250 v. Standard L.M.S. W/B Coverage with Gram position, 5 latest type "Mullard" Miniature Valves V12: ECH41, EFC41, EBC41, EL41 and EZ40. Large Edge Lit Scale, with printed English and Continental Station names, 4 controls; Vol. On/Off; Tone Control; Wavechange & Gramswitch. Chassis size 3 1/2in. x 6in. x 2 1/2in. Scale 10in. x 4in. Price £10/5/- plus 6/- cart. and ins.



TRADE ONLY SUPPLIED

V.E.S. WHOLESALE SERVICES LTD.
11 GUNNERSBURY LANE, ACTON, W.3.
Telephone: ACORN 5027

Switch on to



Solons save time, reduce costs. Solon soldering is always clean, reliable and simple. Five models, in voltage range 100-250; each with 6 feet Henley flexible. 65 watt; oval tapered or round pencil bits. 125 watt; oval tapered or round pencil bits. 240 watts; oval tapered bit.

Write for Folder Y.10



**WILL
BUY
any U.S.
surplus
radio
parts,
equipment**

*
APN-9, TS-67, R-89B/ARN-5,
ARC-1, ARC-3, ART-13,
BC-221, BC-348, SCR-522,
MN-53, MN-61, RA-1,
MN-31, MI-32, ARN-7, Headsets,
Mikes, Cannon Amphehol
plugs, 274-N, ARC-5, Dyna-
motors, Test sets, "TS-" or
"1"- prefixes.

State condition and Best Price
**Aircraft Radio
Industries, Inc.,**

85 St. John Street, New Haven,
Cables: Arico. Conn., U.S.A.

RADIO/RADIOGRAM CHASSIS. The "DULCI" 5-valve S.M.L. chassis, incorporating the most outstanding features of modern design, flywheel tuning, negative feedback over entire audio range, latest type miniature valves, etc., etc., combining to give outstanding clarity of speech, with the most faithful reproduction of music, on gram. or radio, for operation on A.C. mains, 110 to 200/250 volts, at a price offering the finest value for money, £12/12/-; or the Push-Pull 6-valve version, at £15/15/-, complete less speaker, tax paid. Offered under full guarantee, and money back conditions if not fully satisfied. Descriptive literature on request.

T.R.F. RECEIVER. Complete in stylish Bakelite cabinet, ivory finish, 11½in. x 6in. x 7½in., employing four of the latest type valves, incorporated in a highly efficient circuit giving sparkling reproduction, together with high overall sensitivity and selectivity. A.C./D.C. 200/240v. Guaranteed to please, and highly recommended for value at £6/10/-, plus 7/6 carriage and insurance.

SUPERHET TUNER UNIT. A three waveband S.M.L. superhet feeder unit, fitted handsome edgeline multicoloured dial, complete with escutcheon, flywheel tuning, three controls, complete with three valves, and plug and leads for connection to your amplifier. A feeder unit for the discriminate user, at £10/10/-, plus 7/6 carriage and insurance.

A.C. AMPLIFIER. A 3-valve amplifier for A.C. mains, 200/250 volts, employing selective feedback, bass and treble tone control lift, giving an output of 4 watts for the reproduction of gramophone records with a tonal sparkle, complete less speaker, £4/10/-, plus 7/6 carriage and insurance.

CHASSIS ASSEMBLY. Undrilled chassis, size 11½in. x 7in. x 2½in., fitted latest type horizontal drive, with multicoloured S.M.L. dial, complete with escutcheon, at 32/6, plus 2/6 P.P.

O. GREENLICK LTD.
14, Hillside Rd., Tottenham, London, N.15
Tel.: STA. 2991.

OPPORTUNITIES IN RADIO

Get this FREE Book!



We definitely Guarantee

"NO PASS—NO FEE"

If you're earning less than £15 a week this enlightening book is for you. Write for your copy today. It will be sent FREE, and without obligation.

**BRITISH INSTITUTE OF
ENGINEERING TECHNOLOGY**

388b COLLEGE HOUSE,
29-31, WRIGHT'S LANE,
KENSINGTON, W.8.



LYONS RADIO Ltd.

MORSE CODE TRAINING SETS. Valve operated oscillator sets which simulate actual listening conditions more faithfully than a buzzer. The circuit employs 2 valves ARF12 (VP23*) with facility provided for selecting one of three differently pitched notes. All controls are on front panel and include, volume, and terminals for headphones and two Morse keys. The sets are housed in wooden instrument cases with circuit diagram in hinged lid. Power requirements 60-120 v. H.T. and 2 v. L.T. PRICE including valves 25/-, carriage 3/6. Optional extras: L.R. Phones, 5/9. Morse Keys, 2/6. 7-way terminal board for group instruction, 3/9. Carriage free with above.

AMPLIFIER UNITS A.1368. These are two valve A.F. amplifiers and can be used for intercom purposes or as a mike pre-amp. With slight mod. (details supplied) can also be used as a gramophone amplifier. Valves fitted are VR21 (210LF) and VR35 (QP21). Operate from 2 v. L.T., 120-250 v. H.T. and 9 v. G.B. Housed in neat metal cases 7 x 5 x 4in. In good condition. A REAL SNIP AT ONLY 10/6. post 2/-.

TEST SETS TYPE 102. Mains operated, emitting synchronising pulses of 25 and 50 c.p.s. Amplitude calibrated 0.2 to 1.4 watts for output lamp. Provision is made for comparison of outputs by means of photometer type comparator. Housed in smart metal instruments cases 11 x 10 x 9in. and fitted with A.C. mains 50 c.p.s power pack using transformer. Pri. 200-250 v. Secs. 6.3 v., 12 v. and 300 v., 4-wave selenium rectifier, double triode valve CV18, valve 6J5, 1 spare lamp, etc. In good condition with circuit diagram. PRICE 32/6, carriage 4/6

**3 GOLDHAWK ROAD, (Dept. M.W.)
SHEPHERD'S BUSH, LONDON, W.12**

Telephone : Shepherd's Bush 1729

CLASSIFIED ADVERTISEMENTS

Use this Form for your Sales and Wants

To "Wireless World" Classified Advertisements Dept., Dorset House, Stamford Street, London, S.E.1.

PLEASE INSERT THE ADVERTISEMENT INDICATED ON FORM BELOW

- RATE: 7/- for TWO LINES, 3/6 every Additional Line. Average six words per line.
- Cheques, etc., payable to Hiffe & Sons Ltd., crossed & Co.
- PRESS DAY, JANUARY 26th FOR MARCH.

- NAME AND ADDRESS TO BE INCLUDED IN CHARGE IF USED IN ADVERTISEMENT.
- Box No. if required add 2 words plus 1/-.

Please write in BLOCK LETTERS with ball pen or pencil

NAME ADDRESS

NUMBER OF INSERTIONS REQUIRED REMITTANCE VALUE £ : : ENG.

Chassis, Cases and
all metal fittings made to
specification for the Radio
and Electronic Industry.

STAR METAL PLATE WORKS
74 CHURCH Rd., BARNEs, S.W.13
Tel.: RIV 6673/4

LOCKWOOD
makers of
Fine Cabinets
and woodwork of every description
for the Radio and allied trades

LOCKWOOD & COMPANY
Lowlands Rd, Harrow Middlesex. Byron 3704

'neo'- MAINTEST

100/200V
AC/DC
11/6

SEARCH LEAD
TEST PROB
7/6



THE PERFECT FAULT FINDER
NEO ELECTRICAL INDUSTRIES LTD
MANCHESTER 4

INDEX TO ADVERTISERS

PAGE	Advertiser	PAGE	Advertiser	PAGE	Advertiser
19	Galpins	135	Pollock, A. M.	136	
34	Gardiner, Radio, Ltd.	103	Post Radio Supplies	138	
50	Garland Bros	108	Pratts Radio	146	
20	Gee Bros., Radio, Ltd.	143	Premier Radio Co.	59, 60, 61, 62	
38	General Electric Co., Ltd.	69	Price, Norman, (Publishers), Ltd.	48	
12	Glavin, L. & Co.	140	Pye, W. G., & Co., Ltd.	46	
149	Goodmans Industries, Ltd.	21			
40	Goodsell, Ltd.	146	Quality Mart	139	
112	Grampian Reproducers, Ltd.	140	Quartz Crystal Co., Ltd.		
63	Grey, Arthur, Ltd.	104			
32	Greenlick, O., Ltd.	149			
68	Grundig (Gt. Britain), Ltd.	36			
64					
148	Hall Electric, Ltd.	95			
93	Hannay, L. F.	58			
107	Harris, H.	132			
146	Hayes Co., The	143			
103	Haynes Radio, Ltd.	146			
133	Hawley's, W. T., Telegraph Works Co., Ltd.	149			
54	Henry's	123			
52	Hivac, Ltd.	63			
38	Holley's Radio	100			
1	Homelab Instruments, Ltd.	145			
48	Household Electrix, Ltd.	58			
96	H.P. Radio Services, Ltd.	42			
32	Hudson Electronic Devices, Ltd.	126	Rola-Celestion, Ltd.		
30	Hunt, A. H. (Capacitors), Ltd.	142	Rollet, H., & Co., Ltd.		
118	Hunton, Ltd.	99	Rubber Bonders, Ltd.		
133	"Introduction to Valves" (Illiue)	142	Runbaken Electrical Products	22	
75	Industrial Electronics	126	Salford Electrical Instruments, Ltd.	140, 148	
148	International Correspondence Schools	56	Salvis, A. T.	94	
148	Jackson Bros. (London), Ltd.	40	Sammons, Surplus Stores	142	
70	Jackson Radio Supplies	50	Savage Transformers, Ltd.	148	
42	Jenroy, Ltd.	136	Schari, Erwin	138	
64	Keyswitch Co., The	146	Service Radio Spares	62	
42	Kolelectric, Ltd.	147	Sherman Supply Co.	150	
125	Koskie, B.	104	Sims, Electrical Instruments Co., Ltd.	137	
43		146	Simmonds, E. Ltd.	28	
145	Lasky's Radio	109, 110, 111	Sinmon Sound Service	101	
54	Leak, H. J., & Co., Ltd.	85	Smith, G. W. (Radio), Ltd.	124	
Cover II	Lee Products (Gt. Britain), Ltd.	68	Smith, H. L., & Co., Ltd.	147	
50	Leeviers-Rich Equipment Ltd.	62	Smith, W. H., & Son, Ltd.	38	
97	Leeds Radio Co.	142	Sound Sales, Ltd.	94	
101	Lockwood Co.	150	Southern Radio Supply, Ltd.	66	
40	London Central Radio Stores	146	Spencer-West	66	
56	Lowther Mig. Co.	101	Spicers, Ltd.	66	
Edit. 99	L. R. Supply Co., Ltd.	91	Standard Telephones & Cables, Ltd.	24, 73	
51	Lyons, Claude, Ltd.	91	Stern Radio, Ltd.	150	
Bull, J., & Sons	Lyons Radio	149	Stratton & Co., Ltd.	113, 114, 115	
Bullers, Ltd.			Sufex, Ltd.	64	
144, 149	Magnephone Recording Co.	136	Sugden, A. R., & Co. (Engineers), Ltd.	28	
Cover II	Magneto Coatings, Ltd.	58	Symons, H. D., & Co., Ltd.	42	
145	Mac One, Supply Co.	14	Szymanski, S.	147	
144	McAvoy Eng., Co.	15	Tannoy Products, Ltd.	142	
140	Marconi Instruments, Ltd.	145	Taylor Electrical Instruments, Ltd.	41	
155	Marconi's Wireless Telegraph Co., Ltd.	76, 82	Telcraft, Ltd.	35, 148	
102	Martis & Cartin, Ltd.	144	Telegraph Condenser Co., Ltd.	Cover III	
106	Martin, J. H.	142	Telegraph Construction & Maintenance Co., Ltd.	31, 93	
67	McDermott, H. R.	142	Telmechanics, Ltd.	106	
121	McElroy-Adams Mfg. Group, Ltd.	100	Tele-Radio (1943), Ltd.	36	
129	McMurdo Instruments Co., Ltd.	99	Teletron Co., The	98	
120	Measuring Instruments (Pullin), Ltd.	26	Thompson, J. Langham, Ltd.	139	
74	"Mechanical Handling" (Illiue)	122	Transradio, Ltd.	7	
79	Midland Instrument Co.	126	Trianon-Electric, Ltd.	26, 56	
148	Minnesota Mining & Mig. Co., Ltd.	94	Trix Electrical Co., Ltd.	66	
	Modern Bkck Co.	132	Trusound, Ltd.	Edit. 97	
138	Modern Electrics, Ltd.	92			
62	Modern Techniques	46			
62	Morley Transformers	144			
102	M.R. Supplies, Ltd.	54			
45	M.S.S. Recording Co., Ltd.	10			
145	Mullard, Ltd.	3, 18, 55, 72			
136	Multicore Solders, Ltd.	Cover IV			
148	Murex, Ltd.	90			
138	Nagard, Ltd.	91	Valradio, Ltd.	44	
57	Neo Electrical Industries, Ltd.	150	V.E.S. Wholesale Services, Ltd.	148	
77	Ners of England, Ltd.	105	Vortexion, Ltd.	81	
30	Newman, J. & S. Ltd.	36	Waterloo Radio	136	
136	Northall, L. C.	148	Wayne-Kerr Laboratories, Ltd., The	23	
142	Northern Radio Services	27	Webb, Radios	96	
146	Northern Transformer Co.	132	West End Radio, Ltd.	148	
29	Nusound Products	141	Whitfield, Wireless Works	37	
68	Oddie, Bradbury & Cull, Ltd.	138	Whiteley Electrical Radio Co., Ltd.	33	
147	Osmor Radio Products, Ltd.	49	Whittemore, A. J. (Aeradio), Ltd.	17	
144	Oxley Developments Co., Ltd.	134	Wilco Electronics	140	
44, 78			Wilkinson, L.	148	
83			Willesden Transformer Co., Ltd.	107	
146			Winter Trading Co., Ltd.	134	
34	Painton & Co., Ltd.	6	Woden Transformers, Ltd.	97	
144	Parker, A. B.	64	Wolf Electric Tools, Ltd.	46	
4	Parsonage, W. F., & Co., Ltd.	141	Wright & Weaire, Ltd.	5	
98	Partridge Transformers, Ltd.	131	Young, C. H.		
144	P.C.A. Radio	106			
4	Pearce, T. W.	134			
52	Philips Electrical, Ltd.	102			
141	Plasticlate, Ltd.	68			

FOCUS ON LEADERSHIP

'VISCONOL'
PAPER CONDENSERS
in Rectangular Metal Cans



This range has several advantages over the ordinary Paper Condenser and complies with the requirements of Inter-Service Specification and R.C.L.131. Our exclusive mineral oil "Visconol", with which the paper dielectric plates are impregnated, has two outstanding characteristics: it is non-void forming, and therefore gives higher insulation voltages, and its chemical stability raises the upper working temperature limit to 100°C.

Apart from having a greater margin of safety, these "Visconol" Condensers are more versatile than our ordinary tropical paper types. Two methods of mounting are available: Types 141-155 have detachable brackets, conforming to R.C.L.131, and types 120-134 have T.C.C. pattern soldered-on feet.

Capacity tolerance is $\pm 20\%$. Voltage ratings below are for 70°C.

D.C.W/kg.	0.05 μ F.	0.1 μ F.	0.25 μ F.	0.5 μ F.	1 μ F.	2 μ F.	4 μ F.	8 μ F.
200 V.	—	—	—	—	CP120K	CP120K	CP141H	CP147H
250 V.	—	—	—	—	CP124Q	CP124Q	CP121K	CP123K
400 V.	—	—	—	—	CP128T	CP128T	CP125Q	CP127Q
600 V.	—	—	—	—	CP142T	CP142T	CP130T	CP127T
600 V.	—	—	—	—	CP131V	CP131V	CP147T	CP150T
800 V.	—	CPI28V	CPI28V	CPI28V	CP143V	CP143V	CP132V	—
800 V.	—	—	—	—	CP145W	CP145W	CP146V	CP149V
1000 V.	—	—	CP141W	CP142W	CP147W	CP147W	CP149W	CP152V
1200 V.	—	CPI31X	CPI31X	CPI31X	CP130X	CP130X	CP132X	CP133X
1500 V.	—	CPI41GO	CPI42GO	CPI45GO	CP147GO	—	CP132X	CP134X
2500 V.	—	CPI44KO	CPI46KO	CP120K	CP120K	CP121K	CP122K	CP123K
2500 V.	—	—	—	CP147KO	CP150KO	CP153KO	CP154KO	CP155KO
5000 V.	—	CPI48SO	CPI51SO	CPI53SO	CP154SO	CP155SO	—	—
7500 V.	—	CPI51UO	CPI53UO	CPI54UO	CP155UO	—	—	—
10,000 V.	CPI51WO	CPI53WO	CPI54WO	CPI55WO	—	—	—	—

Fully dimensioned schedule available on request.

THE TELEGRAPH CONDENSER CO. LTD.

RADIO DIVISION

NORTH ACTON · LONDON · W.3 Tel: ACORN 0061



SPECIALISTS IN CONDENSERS SINCE 1906

THE GREEKS* HAVE A NAME FOR TROUBLE-FREE SOLDERING

*Ersin
Multicore*

*AND IT'S THE SAME IN



INDIA Phillips Electrical Co. (India), Calcutta



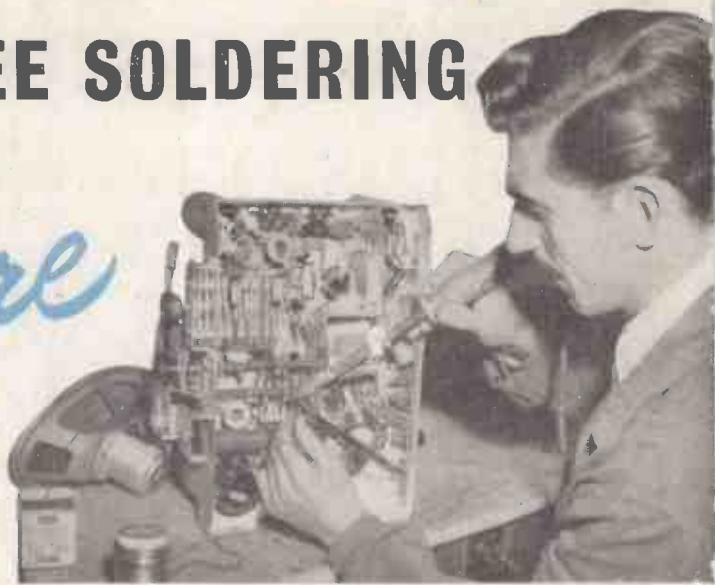
U.S.A. DuMont television factory, Newark,
New Jersey



AUSTRALIA Amalgamated Wireless (Australia)
Ltd., Sydney



ITALY Switchboard apparatus at Autelca
Mediterranea, S.A.T.A.P.



H. Karayannis & Co., Athens, Greece, use ERSIN MULTICORE SOLDER—unfailingly

You don't have to be a linguist to ask for the finest cored solder in the world. Simply say 'ERSIN MULTICORE' and your soldering problems are solved—in any continent. Wherever economical precision-soldering is essential... in the construction of radio, television, telephones, electronic equipment and in all industrial processes... manufacturers rely upon ERSIN MULTICORE SOLDER. Its 3 cores of extra-active non-corrosive Ersin Flux ensure instant liquefaction, flux continuity and complete freedom from "dry" or H.R. joints. ERSIN MULTICORE prevents oxidation and *cleans* surface oxides: joints do not corrode—regardless of climatic conditions.

MULTICORE TAPE SOLDER. MELTS WITH A MATCH

Used by engineers as well as handymen for jobs when an iron is not at hand. Manufacturers can be supplied with Multicore Tape Solder on 3½-lb. reels in width from $\frac{1}{8}$ "- $\frac{3}{8}$ " and from .005" thick.

SOLDER RINGS AT NO EXTRA COST!



Butt-jointed solder rings in Ersin Multicore Solder Wire or Precision made Solid Solder Wire can be supplied in bulk quantities. The only cost involved is that of the solder, according to the alloy and gauge required. Gauges—dependent upon the diameters specified—cover the range from 10 to 22 s.w.g. Other preforms available to special order.

SIZE 1 CARTONS 3/4 NETT. TRADE (5/- RETAIL)

Catalogue Ref. No.	Alloy Tin/Lead	S.W.G.	Approx. Length per Carton
C 16014	60/40	14	21 feet
*C 16018	60/40	18	55 feet
C 14013	40/60	13	19 feet
C 14016	40/60	16	38 feet

*Specially recommended for television work.



7-lb reels for factory use.
Size 1 cartons for service engineers.



MULTICORE SOLDERS LTD.

MULTICORE WORKS, HEMEL HEMPSTEAD, HERTS. • BOXMOR 3636 (4 Lines)