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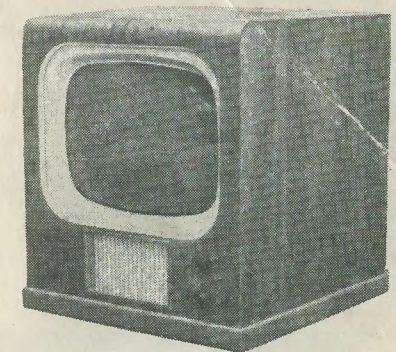
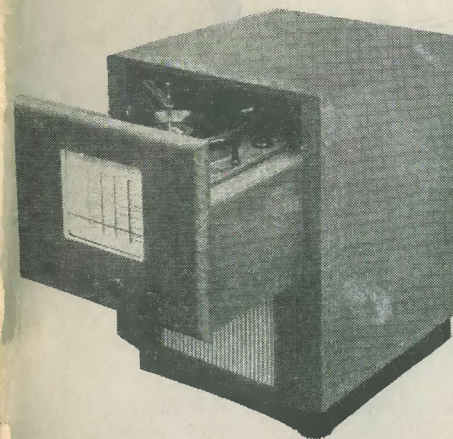


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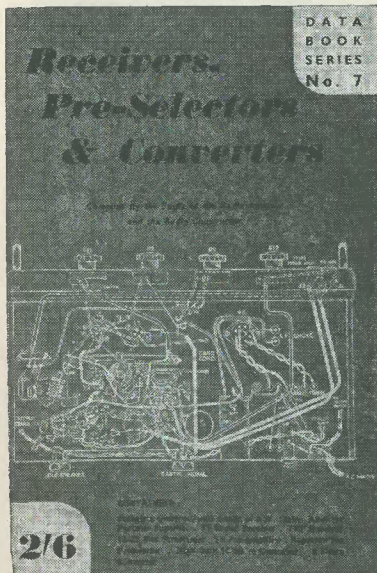
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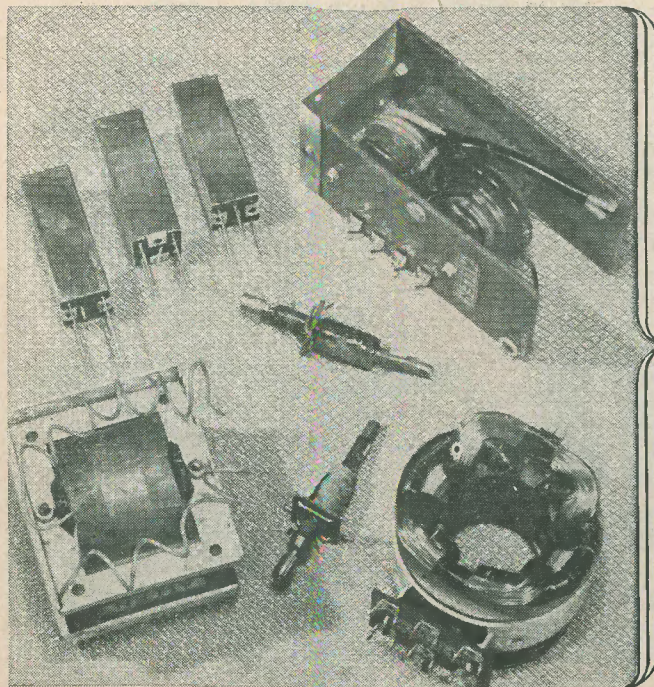
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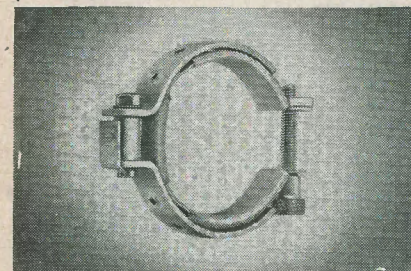
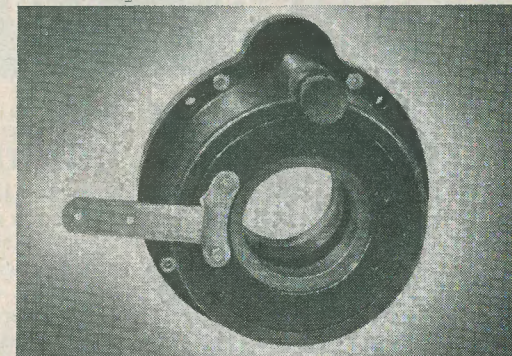
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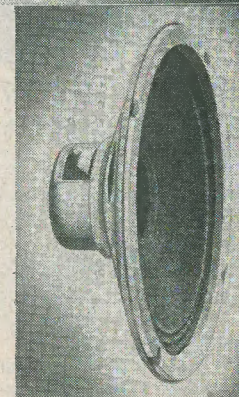


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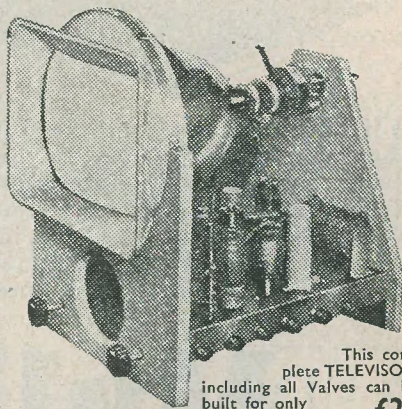
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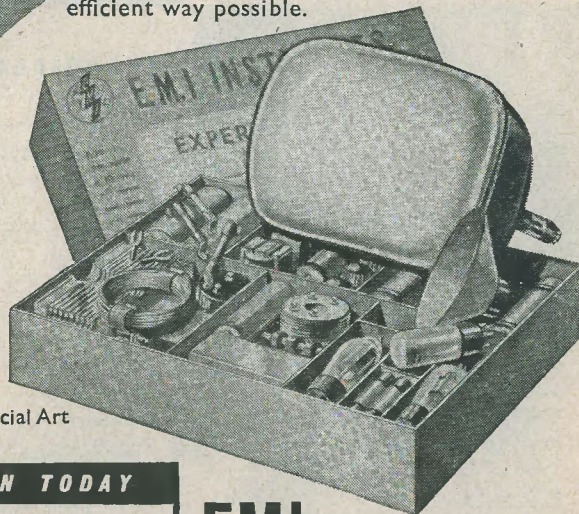
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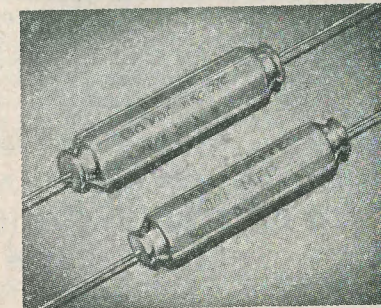
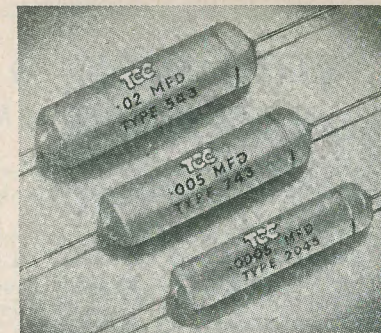
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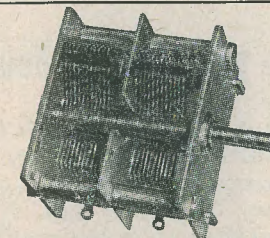
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Contents

| | |
|---|-----|
| SUGGESTED CIRCUITS: A METHOD OF ALTERING EFFECTIVE REVERBERATION, by G. A. French | 70 |
| IN YOUR WORKSHOP, by J. R. D. | 71 |
| VALVES AND THEIR POWER SUPPLIES, PART 11, by F. L. Bayliss, A.M.I.E.T. | 74 |
| OSCILLOSCOPE TRACES No. 4, by A.B. | 77 |
| A PORTABLE OSCILLOSCOPE, by L. F. Sinfield, A.M.I.P.R.E. | 78 |
| AN INEXPENSIVE THREE VALVE DOMESTIC RECEIVER, by E. Govier | 82 |
| THE "UNIVERSAL" LARGE SCREEN AC/DC TELEVISOR, PART 5, described by A. S. Torrance, A.M.I.P.R.E., A.M.T.S. | 83 |
| THE "MAGNA-VIEW"—MODIFICATIONS | 88 |
| QUERY CORNER—A RADIO CONSTRUCTOR SERVICE FOR READERS | 89 |
| RADIO MISCELLANY, by Centre Tap | 92 |
| A PHOTOCCELL RELAY UNIT, by J. W. Bagnall | 94 |
| A NOISE LIMITER, by R. G. Young | 95 |
| RADIO CONTROL EQUIPMENT, PART 8, by Raymond F. Stock | 96 |
| POWER PACK FOR A BATTERY SET, by B. B. Fisher | 101 |
| LET'S GET STARTED—THE SINE WAVE, by A. Blackburn | 105 |
| THE 20TH NATIONAL RADIO SHOW, 1953 | 108 |

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Suggested Circuits for the Experimenter

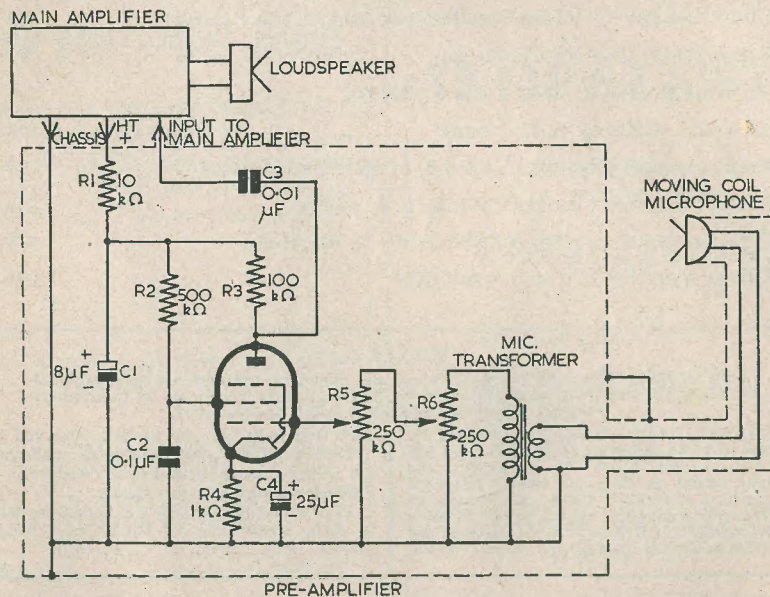
The circuits presented in this series have been designed by G. A. FRENCH specially for the enthusiast who needs only a circuit and the essential relevant data.

No. 34: A method of altering effective reverberation

IT IS WELL KNOWN that the acoustic properties of a room in which sound-reproducing equipment is installed have a considerable effect on the impression received by the listener. Thus, a room which is heavily carpeted and contains a large amount of sound-absorbent furniture can give an apparent "deadening" effect to the reproduced sound. On the other

hand, a large bare room with few furnishings can cause multiple echoes which may detract from the quality of the reproduced sound and cause loss of "presence."

This month's circuit shows an experimental method of increasing the apparent reverberation of a room or hall. Sound from the reproducing loudspeaker is picked up by a remote microphone and fed back to the



RC273

amplifier, whereupon it is once more reproduced. The effectiveness of such an arrangement depends mainly upon the time spent by the original sound in reaching the microphone; and it may be found that best results are obtained when the microphone is mounted as far away from the loudspeaker as space limitations allow.

As may be seen, the effect given is, roughly, that of a "fixed echo." Whether an apparent improvement in reproduction results depends entirely upon the local conditions of the room in which the amplifier, loudspeaker and microphone are installed; the particular recording being played (or programme being received); and, finally, upon the tastes of the listener.

Practical Points

The circuit shown here depicts a pentode pre-amplifier which obtains its power supplies from the receiver or amplifier already installed. A moving-coil microphone is illustrated. This should give adequate results, although any other type of microphone with a reasonably good response should cope just as well.

The volume level of the sound picked up by the microphone is adjusted manually by R6. R5 is a pre-set component and should be adjusted so that feedback howl between the loudspeaker and microphone cannot occur even when R6 is set to "full". The output from the pre-amplifier is fed to the most convenient grid after the volume control in the main amplifier. The valve used in the pre-amplifier may consist of any straight pentode of the 6J7 class. In some instances, sufficient gain may be obtained if the pentode is replaced by a triode; in which instance, R2 and C2 will not, of course, be needed.

As was mentioned above, best results will probably be obtained when the microphone is an appreciable distance from the loudspeaker. The effective distance may be increased by mounting the microphone behind furnishings so that it receives only those sound waves which are reflected from walls or ceiling. Such a course will also allow R5 to be set to a higher position before feedback occurs than would otherwise be the case.



In which J. R. D. discusses Problems and Points of Interest connected with the Workshop side of our Hobby based on Letters from Readers and his own experience

ON SEVERAL OCCASIONS during the past few months I have heard rumours that government surplus wireless gear is at last beginning to run out. How true this I don't know, but it is quite possible that many of the chassis which were most readily adaptable to civilian purposes have by now been snapped up. A short visit to Lisle Street some time ago showed me that plenty of business was taking place so far as components were concerned; but there were not many complete items of equipment on display. Less saleable items such as

motor-generators and similar electrical gear also took up a lot of window space.

Nevertheless, so far as components were concerned, trade was definitely brisk. A typical price was given by paper 0.01μF capacitors being sold at a penny each.

In my own case, most of the purchases of surplus equipment I have made since the market came into being have consisted of small components, or of units bought expressly for stripping down. I have been lucky in my purchases and have been able to use to good purpose almost every item

| Charge-holding time (seconds) for min. leakage res. of:- | | | | | |
|--|--------|------|-------|--------|--------|
| Capacitor Value (μF) | 100 kΩ | 1 MΩ | 10 MΩ | 100 MΩ | 500 MΩ |
| .002* | — | — | — | — | 1 |
| .005* | — | — | — | — | 2.5 |
| .01* | — | — | — | 1 | 5 |
| .02* | — | — | — | 2 | 10 |
| .05* | — | — | — | 5 | 25 |
| .1* | — | — | 1 | 10 | 50 |
| .2† | — | — | 2 | 20 | 100 |
| .5† | — | — | 5 | 50 | 250 |
| 1† | — | 1 | 10 | 100 | 500 |
| 2† | — | 2 | 20 | 200 | 1,000 |
| 5† | — | 5 | 50 | 500 | — |
| 8† | — | 8 | 80 | 800 | — |
| 10† | 1 | 10 | 100 | 1,000 | — |
| 16† | 1.6 | 16 | 160 | — | — |
| 32† | 3.2 | 32 | 320 | — | — |
| 50† | 5 | 50 | 500 | — | — |

*Check by "Spark Test."
† Check by Meter Deflection.

Fig. 1 Table showing approximate leakage resistance of various capacitors

obtained. Resistors, especially, have proved to be most reliable indeed. Capacitors have been a little more doubtful, however, and I have always made a point of checking these before use.

Capacitor Testing

Apart from open-circuits or breakdowns, the fault most likely to occur with surplus capacitors, especially the waxed paper type, is leakiness. A quick check of such capacitors can often be made by measuring the length of time over which they can hold a charge. This test can, of course, be applied to all types of capacitor which are suspected of being leaky.

If a capacitor whose value lies between 0.002 and 0.1μF is charged up to 150 volts or so, it will give a noticeable spark when it is discharged again. The spark is especially noticeable if the wire ends of the capacitor are touched against a shiny metal surface. One may gain a rough idea of the leakage resistance of a capacitor so discharged by seeing how long it will hold a charge, the presence of the charge being checked by the spark which occurs on discharge.

The time taken for a resistor and capacitor in parallel to discharge to 37 per cent of the original charging voltage is the time constant of the combination. Thus, by assuming that the capacitor will give no spark, or a noticeably weak spark, when the voltage across its plates has dropped to 37 per cent of its original value, we may gain a rough idea of its leakage resistance by working out the time constant offered by the capacitor and its leakage resistance in parallel.

The time constant, in seconds, of such a combination is given by multiplying the capacitance in microfarads by the resistance in Megohms. Thus, if a 0.1μF capacitor is found by the "spark test" to be capable of holding its charge for ten seconds, its leakage resistance should be greater than 100 Megohms. Similarly, a 0.01μF capacitor which holds its charge for five seconds will have a leakage resistance of at least 500 Megohms. Although the test is very rough and ready, it gives an approximate idea of minimum leakage resistance up to a surprisingly high value.

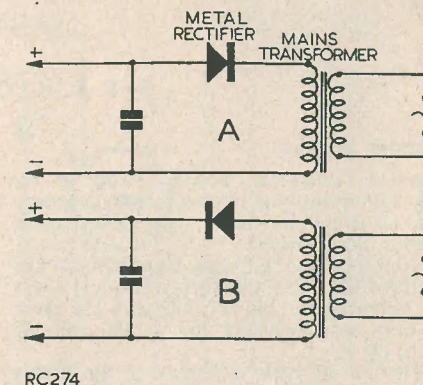
Electrolytic capacitors, and paper capacitors, having values higher than 0.1μF, may also be tested by checking the time constant. With these components, however, the "spark test" is not recommended, since it can harm the capacitor. Instead, a test for presence of charge can be carried out by connecting a voltmeter across the capacitor after the requisite number of seconds has passed. Assuming a reasonably high-resistance meter, capacitors up to 1μF or so will cause the needle to give a noticeable kick, whilst larger values will deflect the needle for a short time whilst the capacitor discharges into the meter. An idea of what is to be expected with the particular meter and capacitor value being tested may be given by comparing the effect given by the meter when connected to the capacitor immediately after it has been charged with that given after the checking time has elapsed. (Be careful! Your Editor once ruined a meter movement when checking the HT+ line for leakage to chassis. The set used 32μF condensers for smoothing and, though it had been unused for some 15 minutes or so, there was sufficient charge to convert the pointer into a "hairspring!")

A table of time constants for individual capacitors is given in Fig. 1. As was mentioned earlier, the results given by the test are approximate only, although they do give a good idea of the minimum leakage resistance of the capacitor. The figures in the horizontal columns give the time constant in seconds for each individual value of capacitance against the leakage resistances, which are shown at the heads of the columns. Thus, a 5μF capacitor will have a minimum leakage

resistance of 10 Megohms if it can hold its charge for 50 seconds. Time constants longer than 1,000 seconds (16 minutes) are not given as they will probably not be required.

What is the difference between the two regulator valves shown in Figs. 3 (a) and (b)? It is usually safe to assume that the regulator shown in Fig. 3 (a) is one having a definite cathode and anode (such as the

Fig. 2 (a) An incorrect method of depicting a metal rectifier.
(b) The correct method.



Circuit Symbols

The Editor, like the sergeant-major, has a Neye like a Neagle, and he quickly spotted a mistake I made in a circuit diagram which I submitted to him some time ago. In this circuit I had accidentally drawn a half-wave metal rectifier in the manner shown in Fig. 2 (a). The correct method should, of course, have been that shown in Fig. 2 (b). It is sometimes a little difficult to visualise the direction of current when a metal

VR150/30), in which it is important that the cathode (depicted by the circle), be connected to the negative side of the voltage source whilst the anode is connected to the positive side. The stabiliser shown in Fig. 3 (b) would, in most cases, consist of a valve which has no definite anode or cathode and which may be connected either way round. This latter type is met fairly often and usually consists of a miniature bulb

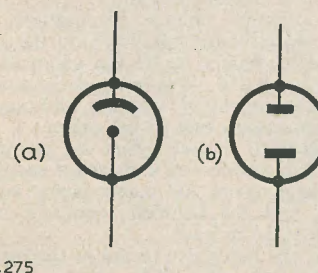


Fig. 3 (a) and (b) Two different types of voltage regulator

rectifier (or germanium diode) appears in a complicated circuit. It is often stated that the "arrow" represented by the symbol indicates the flow of "conventional" current; i.e. current from positive to negative. Alternatively, one may state that the straight-line part of the symbol represents the cathode of a diode.

into which are introduced two similar wires or two similarly-shaped electrodes. Fig. 3 (b) should not be confused with a similar symbol in which the "anodes" are shown in outline only. This latter symbol is occasionally met in circuit diagrams to depict an outlet socket.

Valves and their Power Supplies

PART 11

By F. L. BAYLISS A.M.I.E.T.

Vibrator Supplies

THE VIBRATOR POWER PACK is an important part of a car radio receiver, as it enables mains type valves to be used in that receiver.

Vibrators and vibrator transformers are readily available for both 6-volt and 12-volt car batteries, and the HT output is the same in both cases—usually 200 to 250 volts at 70 to 80 mA.

There is no basic difference in the circuit arrangement for the two voltages, the change being confined to the vibrator coil and transformer windings.

It is essential, however, that the correct voltage rating of these two components should be chosen to suit the car battery voltage, 6V types are not suitable for 12V batteries, nor *vice versa*.

In each voltage group there are two distinct types of vibrator pack, (a) the rectifier type, in which a full-wave or bi-phase rectifying valve is used to supply the HT voltage, and (b) the "self-rectifying" or synchronous type, in which a valve or other rectifier is not used.

Perhaps the more popular type, in this country, is the rectifier type, whilst in America—if ex-WD surplus is any pointer—the synchronous type appears to hold considerable sway.

In the latter type, the saving effected by not using a valve is thrust back upon the vibrator in the form of extra contacts and more complex construction of that component, so it would seem that there is little saving and little to choose.

The Rectifier Type

The circuit arrangements for both types have become largely standardised, and are governed to a great extent by the components used.

In Fig. 36 the circuit for the rectifier type is shown. Briefly, the operation is that closing the on/off switch allows battery current to flow through the vibrator coil, through the contacts shown closed, and via the armature to chassis, thus completing the circuit.

The armature is attracted to the core, makes contact with the upper of the open contacts, and allows battery current to flow through the top half of the transformer primary via the centre tap: this current also flows to chassis via the armature.

When the armature is attracted, however, the circuit for operation of the vibrator coil is broken, and, after a brief period, the armature falls away toward normal. It is spring loaded, however, and the spring tension carries it past the normal position to make contact with the lower open contact point.

Thus, current again flows through the transformer primary via the centre tap, but this time through the lower half, and via the armature to chassis. At the same time the vibrator coil contact is again closed, and the armature is attracted to the core once more.

The action repeats continuously and rapidly, whilst the on/off switch remains closed.

The transformer has a step-up ratio of about 1:40—sometimes higher—for a 6V component. 12V transformers are approximately one half of this ratio.

The primary voltage fluctuations are transferred to the secondary by induction, and, with the secondary centre tap connected to chassis, some 250 Volts is available at each end of the secondary winding, although in phase opposition one to the other.

The ends of the secondary are connected to the two anodes of a bi-phase rectifying valve, as in usual AC mains power supply circuits, and the rectified output is taken from the valve cathode.

By far the best valve to use as the rectifier is the American type OZ4, a valve specially developed as a car radio rectifier. It is a cold cathode type, i.e., there is no heater element, and it gives the great advantage that stray vibrator pulses on the LT line—the car battery—cannot be fed via the rectifier heater to the cathode, and thus become common to all receiver valve anodes via the HT+ line. With this type of valve, stability and noise reduction are most marked.

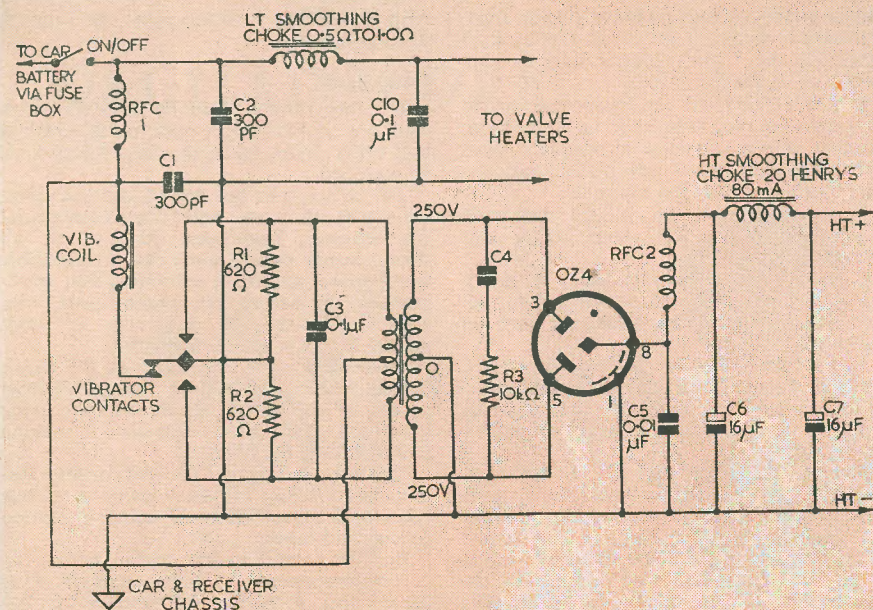


FIG. 36
RECEIVER TYPE VIBRATOR POWER PACK

RC276

The danger of pulse feedback via the receiver valve heaters—and then to the cathodes—is still there, however, and will be until a complete set of cold cathode valves for car radio are marketed.

Smoothing

Notwithstanding the facilities offered by the use of the OZ4, good smoothing is an undeniable asset in a car radio power pack. A high inductance choke—20 Henrys, or even higher—will do much to iron out stray and unwanted pulses, and to flatten the rather steep-sided curve of the ripple voltage. Such a choke, with C₆ and C₇, forms the HT smoothing.

The LT smoothing choke in the valve heater lead is helpful in keeping the heaters free of vibrator pulses. The resistance must be kept low, however, and the wire used of ample gauge to carry the total heater current.

Assuming a total heater current of 2.0A, 20 swg enamelled copper wire would be suitable, and, since 1.0 Volt may conveniently be dropped across this choke, 200 turns of this wire wound on to a standard type output transformer bobbin and core would form a useful component. (The battery, on charge, normally gives 7.5 volts, and would thus allow a volt or so drop to 6.3 volts.)

Quenching.

The heavy current—5.0A is not an unusual figure for a car radio—and the inductance of the vibrator coil and transformer primary would naturally cause considerable arcing at the vibrator contacts.

R₁ and R₂, together with C₃, however, are inserted to counteract such arcing, and their values may be varied to suit the vibrator and transformer used. For instance, C₃ may safely be increased to 0.25μF, in marked cases.

The abrupt nature of the primary voltage alternations induces very high back-EMF voltage pulses in the secondary, and to prevent damage to the rectifying valve these pulses must be absorbed. C₄, 0.01μF, carries out this absorption, and to prevent a direct short circuit on the transformer secondary—and consequent burn-out—should this capacitor break down, R₃, 10kΩ, is included to limit the current to 50mA.

It is essential that C₄ should have a working voltage rating of at least 2,000 volts, and it should be a mica component.

Ignition Filters

Whilst ignition radiation is usually dealt with by adequate screening of the receiver

and its aerial, chassis and battery leads, there is always a tendency for direct feedback to occur via the battery, particularly in cars using coil ignition systems.

The fitting of 15k Ω suppressor resistors in each sparking plug lead, close up to the plug, together with a capacitor of adequate value across the distributor interruptor contacts, does much to lessen the nuisance.

Further filtering in the vibrator pack itself is effected by the RF choke RFC₁ and capacitors C₁ and C₂.

This choke will have to carry a heavy current—some 3.0A or so—therefore, as with the LT choke, the resistance must be kept low.

Again, 200 turns of 20 swg enamelled wire may be used, but, this time, wound on to an air-cored bobbin; an old wire-reel would be very suitable. No iron laminations are required.

The use of RFC₂ and C₅, however, is optional and may depend upon the type of valve rectifier used. Their inclusion would be nothing but beneficial, in any case; RFC₂ may consist of 3,000 turns of 36 swg or 38 swg enamelled wire, wound in six slightly spaced piles of 500 turns per pile, upon a 1/2" diameter air-cored coil former, some 2" long.

Looking at the circuit of Fig. 36, the constructor may consider it a little complex

with the rather intricate filter and quench arrangements.

Interaction

If a programme is to be received which does not consist of 50% hum, mush, crackles and other noise, however, these filters must be included.

The writer, who has delved into the vibrator packs of many high class commercial car receivers, has found them to be all there—neatly packed away into an incredibly small space, and often exhibiting fine workmanship in wiring and manufacture, and considerable thought and care in component layout to avoid interaction.

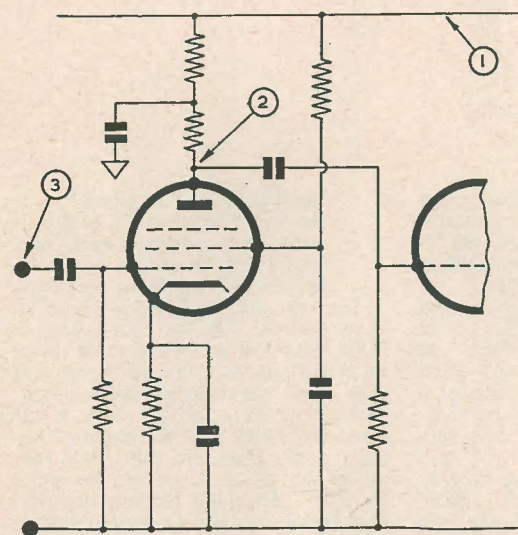
This last point is important; an RF choke placed within the field of the transformer or one of the smoothing chokes may bring to naught all the good work done in making and including the filters.

Similarly, interaction between transformer and choke (LT or HT) may set up a vicious circle of feedback that will reduce reception to rags and tatters.

But, be careful in the layout, with iron-cored components at right angle to each other, and with the RF chokes, if not screened, then at a reasonable distance from iron laminations, and there is no reason why car radio should not equal the home mains receiver at its very best.

OSCILLOSCOPE TRACES

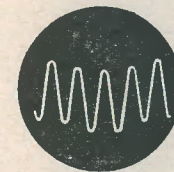
by A.B.



RC289



A



B



C

No. 4: Hum Tracing

Hum is generally introduced from one or both of two sources, i.e. pick up in high impedance circuits, or the HT line.

Trace A shows a hum-free audio signal, which is applied at point 3. If hum is present at the anode, point 2, the trace will take a form similar to that shown by B. If hum is present when the oscilloscope is connected to the HT the trace will look like C. Connection must be made via a condenser if one is not included in the oscilloscope input circuit. It is possible that the hum voltage

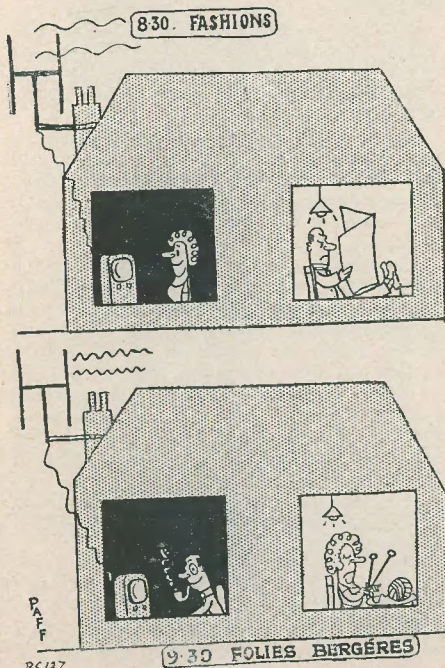
shown in C may be considerably less than that superimposed on the audio (trace B), in which case the HT line can be exonerated.

A combination of pick up and HT ripple will give waveforms of unpredictable shape, particularly if the rectifier is full wave. In this case, pick up will be 50 c/s and the HT ripple 100 c/s.

To prevent hum voltages being induced in them, the oscilloscope leads should be kept as short as possible.

**Have you entered our 'Radio Snapshots' Competition?
If not, Remember that the Closing Date is November 5th**

FULL DETAILS WERE GIVEN IN THE SEPTEMBER ISSUE



timebase waveform feeding back looks back into a low impedance. After passing through the isolating resistor (270kΩ) into this impedance, the amount of feedback is negligible even with sync at maximum.

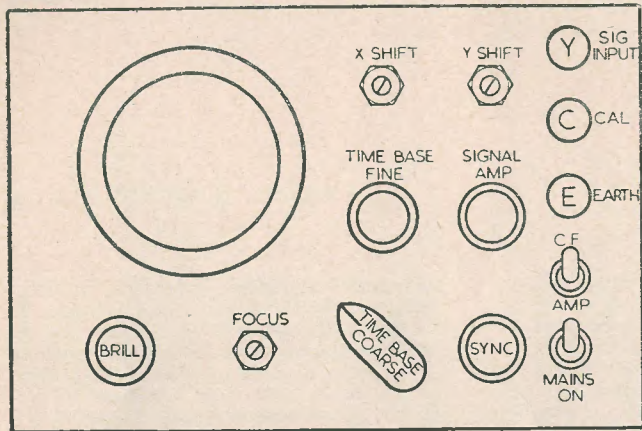


FIG. 2 PORTABLE OSCILLOSCOPE - FRONT PANEL LAYOUT

This arrangement eliminates the necessity of a separate isolating amplifier purely for sync. The actual amount of sync injected is very small, but it is sufficient to hold a signal of constant amplitude in a fixed position. (It is, of course, not possible to lock a signal of varying amplitude, such as actual audio, but this stipulation applies to all sync as normally used on scopes, and for this use the sync should be set to minimum).

The timebase itself consists of a self-running Miller-transitron. Both the grid and the suppressor condensers are switched in order to obtain optimum amplitude and short flyback time. Five ranges are provided, giving an overall range of 11.5 c/s to 54 kc/s with plenty of overlap.

Actual measured ranges are:

1. 11.5 — 130 c/s
2. 65 — 650 c/s
3. 270 — 2,800 c/s
4. 1,300 — 13,000 c/s
5. 5,500 — 54,000 c/s.

These will be found ample for normal use, as inputs in the region of 500 kc/s will only produce some 9 or 10 cycles, which is still easily discriminated. No amplitude control is fitted to the timebase, as the amplitude has been arranged to be constant on all ranges and to fully scan the tube. Silvered mica

capacitors should be used where possible on the timebase ranges, as they are the most stable.

The CRT network derives its supply mostly from a S.T.C. K3/40 rectifier to give a negative supply for the tube. In addition to this, anodes and the X2 and Y2 plates are returned to a positive voltage via a network across the HT supply. This gives extra voltage to the tube and simplifies the shift networks. If the tube is mounted with the spigot upward and the connections made as numbered, then the deflection will be correct. The 0.5μF EHT smoothing condensers are of 600V working 'bathtub' type.

All potentiometers are the bakelite-cased carbon type. The Focus, X shift and Y Shift controls are all of the screwdriver adjustment type, as they seldom require altering and this prevents the small front panel being cluttered up with unused knobs.

The mains transformer is a standard 250-0-250V with two 4V windings. Instead of connecting the centre of the HT winding to earth, however, one end is earthed and the centre unused. This makes it 500V overall, which is rectified negatively by the pencil rectifier for the tube and positively by two 250V 60mA series-connected selenium rectifiers. The reservoir is a 2μF 600V working oil-filled paper block condenser. A 1,000Ω relay and a 32μF 500V working electrolytic completes the HT smoothing. Due to the metal rectifier, the HT comes on before the valves warm up and before the load is effective, so that the HT is then very high and would break down the electrolytic. This condenser is therefore connected in circuit via a switched contact on the relay. The relay energises when the valves warm up and start to take current, so that the electrolytic is not in circuit until a load is on the HT line to keep the voltage down. A resistor across the switch contacts allows the condenser to charge to a certain extent before the switch closes, so that there is less surge and sparking at the contacts. The relay may need slight adjustment in order that it energises only when the valves draw current and not when the scope is first switched on.

The decoupling condensers in the CRT network are the usual 350V working, but

all the other 0.1μF condensers should be selected low-leakage types of at least 500V working (T.C.C. metal-cased tubulars are ideal). This applies particularly to the blocking condenser in the Y1 plate lead, as if any leakage is present the trace will shift according to whether the amplifier switch is in the "cathode follower" or the "amplifier" position. The 0.05μF and the 0.02μF condensers in the timebase should also be low-leakage types.

Layout

Fig. 2 shows the layout of controls on the front panel. Much of the circuit wiring is directly across the back of the potentiometers at the rear of the front panel, in order to keep the wiring as direct as possible. The leads to the grid of the amplifier are kept short and away from other wiring, as at this point the input signal is still at a high impedance. The input 0.1μF and the 1MΩ leak are mounted close to the rear of the Y input terminal, and a short lead taken to the top clip, which also holds the grid stopper.

Fig. 3 shows the plan layout. There should be little trouble from electrostatic pick-up, due to design precautions, but if a very compact construction is required then it is necessary to take steps to prevent hum on the trace due to magnetic induction from the mains transformer. The tube itself should be enclosed in a mu-metal shield (several spaced mu-metal shields, if available) and the mains transformer kept to the rear of the tube as much as possible. It is advisable not to secure the mains transformer until it has been orientated to give the least hum deflection on the trace.

The voltages are high in the unit, and it is best to run all the HT and EHT wiring in heavily insulated wire to avoid breakdown trouble.

Notes

The timebase is quite linear except for

slight non-linearity below 25 c/s on the lowest frequency range. This is a characteristic of this type of timebase and, as the amount and range of the non-linearity is so small, it is not worth the bother of

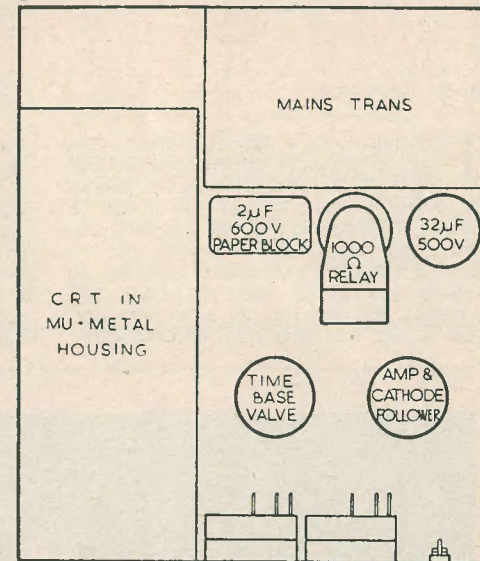


FIG. 3 PORTABLE OSCILLOSCOPE - UPPER CHASSIS LAYOUT

additional circuit complications to try to cure it.

The amplifier is flat to beyond 100,000 c/s and is adequate for television timebase and sync analysis, and for the testing of audio amplifiers (including square wave response) and is therefore suitable for testing high fidelity equipment. Greater gain can be obtained from the amplifier by increasing the anode load, but the maximum frequency response is reduced proportionately. The limits chosen should give the maximum adaptability.

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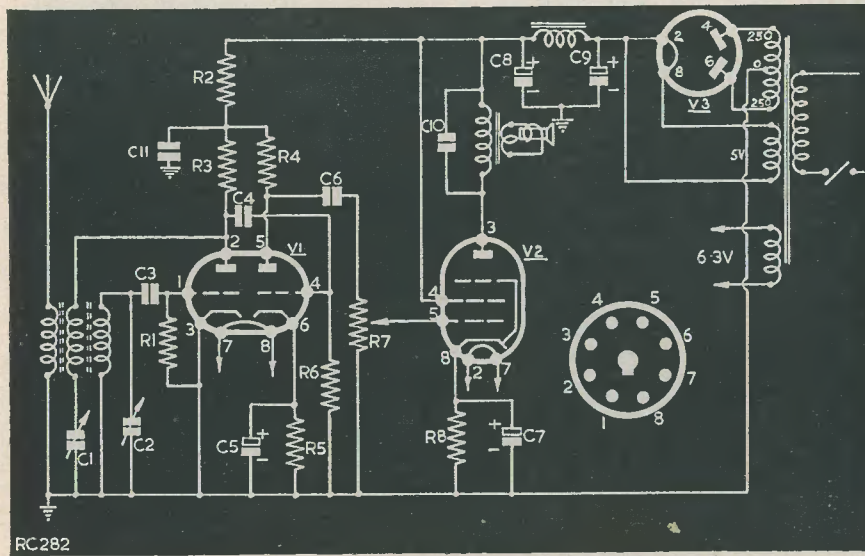
AN INEXPENSIVE THREE VALVE DOMESTIC RECEIVER

By E. GOVIER

THE NEED FOR A new domestic receiver having arisen, and the present high price of those on the market, decided the writer to cast around for a suitable cheaply constructed circuit. In common with many others, it was found that our listening pleasure was shared between two stations—the Home and the Light Programmes, and therefore the three waveband type of set was definitely not required—

both from the considerations of cost and non-usage.

Having decided on the foregoing, the next step was to draw up a circuit using as few parts as possible, and one which would give sufficient audio gain for the average living room. As a matter of interest, several circuits were hastily knocked together and tried out, but the most suitable was that shown in the circuit diagram. From this,



Component List

R1 1MΩ ½W
R2 100kΩ 1 watt
R3 50kΩ ½ watt
R4 50kΩ ½ watt
R5 1kΩ ½ watt
R6 500kΩ pot. with switch
R7 270Ω 1 watt
Coil—Osmor type QR11
Mains transformer—Ellison MT 162

C1 500pF Mica variable
C2 500pF Mica variable
C3 150pF Mica
C4 0.01μF 350V
C5 25μF 12V wkg Electrolytic
C6 0.01μF 350V
C7 25μF 12V wkg Electrolytic
C8 16μF 350V wkg Electrolytic
C9 8μF 350V wkg Electrolytic
C10 0.002μF paper 500V.
C11 8μF 350V wkg Electrolytic

it will be seen that use is made of the 6SN7 both as a leaky grid detector and as a triode first AF amplifier—a function which this valve performs extremely well. It has always been of some amazement to the writer that more use is not made of this type of valve in this country—at least in published circuits. In the U.S.A. much greater use of the 6SN7 is made than here.

The detector stage is entirely conventional—as is the whole receiver for that matter, and it is therefore capable of being constructed by the veriest beginner with little or no trouble. The coil used is the Osmor type QR11, which has proved to be eminently suitable for such a circuit. Output from the detector portion of the triode is fed into the grid of the following portion via C4, and thence from the anode of this half via C6

and R7 into the grid of the output stage, a 6V6 valve.

The output stage and the power pack (using a 5Y3 rectifier), needs little or no explanation, being entirely basic in design and with no frills. The whole receiver when completed may be fitted into a small cabinet to match the surrounding furnishings. The audio output in the writer's case was sufficient to work an 8-inch speaker at some 2½ watts approx., although in the final set-up a 5½-inch speaker was used. Selectivity using an aerial some 25 feet long was found to be adequate, with no breakthrough noticeable. Any reader constructing this receiver will find that it conforms to the specifications as stated in the opening paragraph. Simple and cheap to build, it will give good service and performance to the user.

The "UNIVERSAL" Large Screen AC/DC Televisor

Part 5: Described by A. S. Torrance, A.M.I.P.R.E., A.M.T.S.

(By kind permission of IKOPATENTS LTD.)

Tube Handling

Readers are warned that the CRT is highly evacuated, and must be handled at all times with the greatest care. Never hold by the neck. Safeguard the EHT anode connector from accidental contact. Goggles should always be worn when working on exposed cathode-ray tubes.

Switching On

When all these tests are completed, the constructor may now prepare to switch on for the first time.

A WARNING MUST BE GIVEN

Do not work at any time on a bare concrete or cement floor. A well-covered lino or carpeted wooden floor constitutes the highest safety margin. This is even more important where D.C. is to be employed.

Place all knobs in position and ensure that grub-screws are below the surface.

When the set is completed, the screw holes should be filled with wax.

The Ion-Trap Magnet

Two alternative brilliance networks have been described, and the method finally adopted by the individual reader should be recalled to mind. Remember, in one system full brilliance is achieved with the control in the fully clockwise position, and in the other with the control anti-clockwise.

Commence with the Brilliance low.

Locate the ion-trap magnet on the line provided on the neck of the CRT. This will be found in line with pin 3 of the tube base.

Increase Brilliance, and at the same time slide the ion-trap magnet backwards and forwards along the neck until maximum brilliance is achieved.

Note that it may be found necessary to switch off and reverse this component. The CRT must not be run for long without a raster being visible on the screen, if the ion-trap magnet is wrongly sited. At any setting of the Brilliance control, the magnet should be set for maximum brilliance and tightened permanently. On no account should

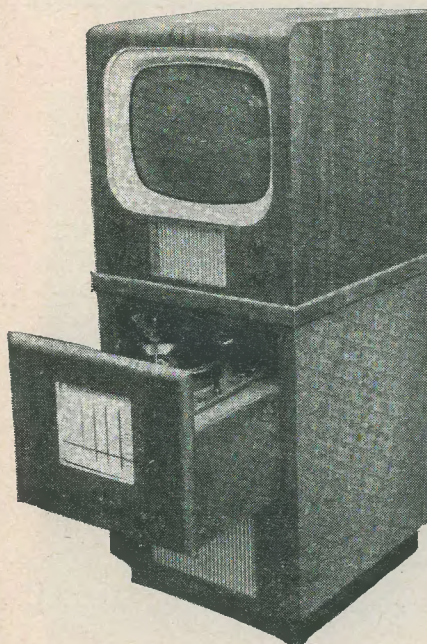
brightness be sacrificed by a wrong setting of the magnet to overcome shadowing. This should be cured by ascertaining that the deflection-coils are as far up the neck of the tube as possible, and by careful adjustment of the focus unit.

Raster

In general, if the EHT rectifier heater lights up it is almost certain that EHT is present.

Set the raster by the controls at the rear.

Turn the line drive control up until white upright lines are visible in the centre of the raster, and then turn the control back until these just disappear. Set "Height" and Focus unit for both focus and centring.



Complete instrument as it will appear when finished.

Lining-Up Receiver

Secure a plastic knitting needle and file this to a screwdriver end which will fit the slots in the cores of the coils. This improvised tool makes a most excellent trimmer. On no account should a metal screwdriver be used for lining-up. Study the chart and ascertain that the cores are as laid down for the local transmitter. Thus, for example,

readers desirous of tuning to Sutton Coldfield will use:—Iron-core for L1, Brass core for L2A, Iron core for L2B, and change C9 to 10pF (Silver Mica). All other cores would be iron.

The most important item, as mentioned before, is undoubtedly L12A/L12B. This transformer is pre-set and forms the entire basis of the tuning procedure. Quite obviously, with the sound IF set at the correct frequency of 23.25 Mc/s a datum-line is available for the entire lining-up. The component must not be interfered with. If the reader has accessibility to a signal generator, this transformer and the sound section may be checked by injection of 23.25 Mc/s into the grid of V9. With the Sensitivity, Contrast, and Volume controls at maximum, a crude setting of L1, L2A and L2B should make the sound signal audible. L2B should always be set for maximum sound. Adjust L4 and L5 for maximum sound. Varying the sensitivity control, adjust L1, L2A, L3, L4, L6 and L8 for the brightest picture.

(Note that the picture may not be synchronised at this stage, and constant adjustment should be made to the frame hold, and line hold. It is always possible that this fortunate condition may be arrived at very quickly). Readjust L5 until sound on picture is at minimum. Temporarily short to chassis the grid of V9 and adjust L7 until sound on picture disappears. (This symptom is recognisable by the picture jumping in step with the spoken word or musical notes). Minor inter-action would show horizontal black bars moving up the screen.

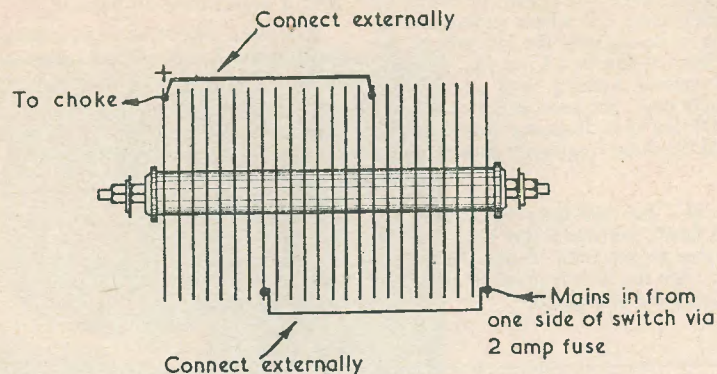
Readjust L1, L2A, L3, L6, and L8 until a picture is obtained at the lowest setting of the sensitivity control. If possible, utilise Test Card 'C' for the above. Last of all, but not until the test card is fully resolved, L12A/L12B may be given slight adjustment for maximum volume.

Notes

Readers tuning to the Alexandra Palace transmitter may experience difficulty in obtaining synchronisation. This is due to the fact that the Universal is a single-sideband receiver, and it is possible to be misaligned so that, although the picture and sound content may be good, no frame synchronisation is achieved. The remedy is to retune with the cores tending to be at the top end of the formers. The best resolution will be found by final and delicate setting of L1, L4, L6 and L8.

Linearity

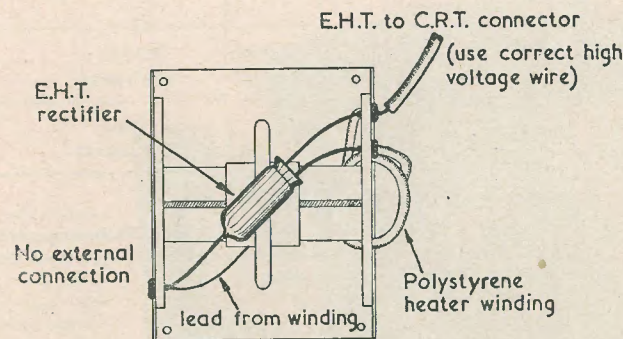
At this stage, the picture may be badly out of linearity. Once again increase the line drive control and repeat earlier procedure, slacking off any contraction or white lines



CONNECTIONS FOR WESTINGHOUSE RECTIFIER 14A/342

(Seen from underside of chassis)

TV17/10



Important note: Avoid sharp points when soldering and do not overheat. See text on soldering in of rectifier

E.H.T. RECTIFIER CONNECTION

TV17/14

seen in the centre. Adjust the Width coil and Linearity coil. Find the centre of swing of the Linearity coil, i.e. where movement of core brings in or expands the left side of the picture. Now obtain best Linearity with the line-drive control, making final setting with the Linearity coil. Set vertical Linearity and Height. Obtain best focusing (incidentally, this should be done frequently during lining up).

Note. If the auxiliary mounting is employed, black perpendicular bars may be observed due to the long leads. These will disappear when the tube is properly mounted and the leads are shortened.

Increase values to increase EHT. These may take a wide variety of values.

Remember, this receiver takes approximately two minutes for the picture to appear, and one minute for sound.

The following changes in values to those given in the Component List have resulted in greatly improved performance.

R59 changed to 6.8kΩ results in better frame form. Excessive line scan may be obviated by reduction of C58 to 2000pF. Similarly, excessive EHT was experienced with the original values of the EHT peaking condensers C60-C61. These are now reduced to 47 pF each.

| CHANNELS | L1 | L2A | L2B | AERIAL POLARISATION |
|------------------------------------|---|-----------------|------------------------|------------------------|
| 1 Alexandra Palace Glen Cairn * | Iron core do | Iron core do | Iron core do | Vertical Horizontal |
| 2 Holme Moss South Devon | Iron core | Iron core | Iron core | Vertical do |
| 3 Kirk o'shotts Brighton * | Aerial end iron core Grid end brass core | do | do | do |
| 4 Sutton Coldfield Aberdeen | do | brass core | Iron core C9 - 10pF | Vertical Horizontal |
| 5 Wenvoe Pontop Pike | do | do | do | Vertical Horizontal |

* Names likely to be changed

NOTES: Channels 3/4/5, L1 requires both iron & brass cores. Remaining cores L3/4/5/6/7/8 all iron. Aerial must be obtained to match local transmitter and mounted to suit polarisation.

RECEIVER TUNING CHART INCLUDING PROPOSED TRANSMITTERS

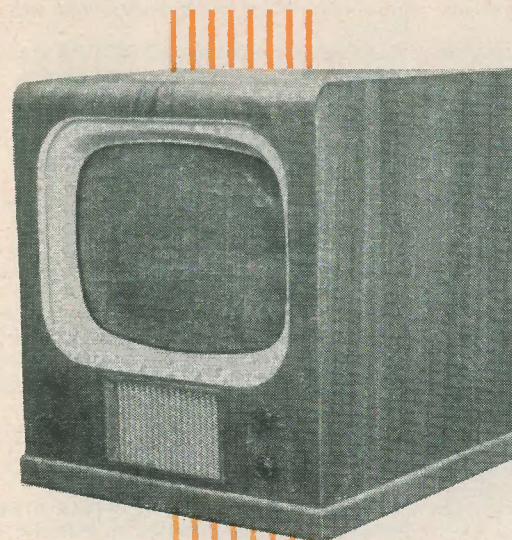
TV17/16

Component Effects

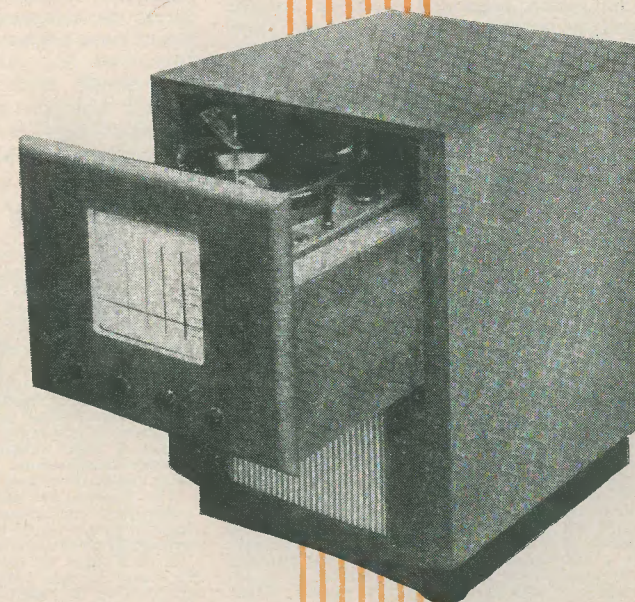
Severe non-linearity of the vertical time-base may be cured by varying the values of R59 (affects top of raster) and increasing R61. Readjust V. Linearity control at the same time. Variation of C58 will affect the picture width. C60 and C61 will vary the EHT.

Mounting Escutcheon and Perspex with Dust-Proofing Method

Study the photographs, and with long countersunk bolts secure the escutcheon and perspex to parts F. Hold in position at top with springs to the top bolts on parts G. With sticky tape, go all around the edge of



The "Universal" Large Screen AC/DC Televisor as described so far in this series.



The "Universal" Radiogram Unit to be described later in this series. Both units are complete in themselves, and may be built independently as desired. If amalgamated, they result in the striking instrument illustrated on p. 84.

the escutcheon and CRT, thus forming a dust-proof joint. Similarly, tape the perspex to the escutcheon.

Note. Remember to clean the tube screen and perspex before sealing up.

Precautions

The greatest caution must be observed at all times when operating DC or AC/DC equipment. The entire chassis is alive to one side of the mains and requires constant care. If possible, it is recommended that a neon tester be obtained and the set operated with the chassis connected to the negative side of the mains. The mains plug and socket should then be marked to ensure correct polarity, or preferably use should be made of a three-pin type. Once set, any removal of this latter type plug will be assured of proper replacement. Instal the receiver into the cabinet as

soon as possible after completion, and fill the grub-screw holes in all knobs with wax or shellac.

Do not use a metal grille for the speaker opening; fabric is highly recommended, for safety reasons.

The cabinet has been specially made by Lasky's (Harrow Road) Ltd. to take this set and no difficulty in installation should be experienced.

It is not intended to alarm constructors by the warnings given—in point of fact, all electrical apparatus under certain conditions may be dangerous. But we do implore readers to make a study of the contents and obtain a complete understanding of the points raised.

This receiver will finalise, as mentioned previously, in a complete TV—Radio-Gram, and articles on this will appear in future issues of *The Radio Constructor*.

THE "MAGNA-VIEW"

FURTHER LABORATORY TESTS have been conducted on this now popular television, and two modifications have emerged, both of them well worthy of inclusion.

The first concerns the video stage (N78) anode load resistor. This has been reduced in value to $3k\Omega$ 2W, with a subsequent improvement of HF response. The result is that clearer edges are noticeable, and the highlights become more pronounced. There is, however, a slight loss of amplification, and readers in fringe areas must decide for themselves whether or not they are in a position to forego some gain for an increase in quality. In areas of good field strength the modification is undoubtedly beneficial.

The second modification applies to any television, and will therefore be effective on both the "Magna-View" and the "Universal."

One annoying feature of TV programmes during the course of transmissions is the occasional appearance of flyback lines. These may often be seen during a film change-over; reduction of brilliance only means that this control must be set again to the original position when the original level is restored.

A simple method of overcoming this trouble is to connect a $0.002\mu\text{F}$ silver mica condenser between the anode of the frame output stage and the cathode of the CRT.

BOOK REVIEW

A FIRST COURSE IN WIRELESS, by "Decibel." Third Edition. 231 pages, 93 illustrations. Price 12/6. Published by Sir Isaac Pitman and Sons Ltd., Parker Street, Kingsway, London W.C.2.

Nearly 20 years ago a series of articles appeared in *World Radio* entitled *The Radio Circle: For Beginners Only*. Due to their popularity at the time there were many requests for the series to be made available in book form. The author, "Decibel", produced the book and Messrs. Pitman published it. As a result of the author's lucid style and the usual high quality of production on the part of the publishers, the book soon became established as a standard primer for the novice.

This present new edition is based mainly on the previous ones and the re-prints, but it has also been brought up to date, and now includes additional material. It is eminently suitable for those who have only a little knowledge of radio and the electrical theory appertaining to it, for it is written in an encouraging as well as an instructive manner. There are not many parts where mathematics are used to a great extent, but where they are resorted to it is essential for this form of explanation to be given in order to

make things clear. Even so, the standard of mathematics does not demand anything more than an elementary knowledge of simple formula and their manipulation.

The book follows the usual pattern of such primers, taking the reader from simple electricity into alternating currents, capacitors, inductors, resonant circuits, electromagnetic waves, aerials and receivers. Other chapters deal with high frequency and low frequency amplifiers, decoupling circuits and push-pull output arrangements. The principles of superheterodyne receivers are discussed, and the last two chapters provide a useful insight into circuits for resistance capacity combinations, tone control, negative feedback, automatic volume control, etc.

The diagrams are particularly clear, and free from unnecessary components which might confuse the reader, but several of them would perhaps be more complete if component values had been given.

A snap check on the Index revealed that it refers the reader to page 188 for a reference to automatic grid bias, yet the page contains only a passing mention of the subject. Far more is found on pages 190 and 191, where the principle is discussed and a typical example worked out mathematically.

NORMAN CASTLE

Query Corner

A Radio Constructor service for Readers

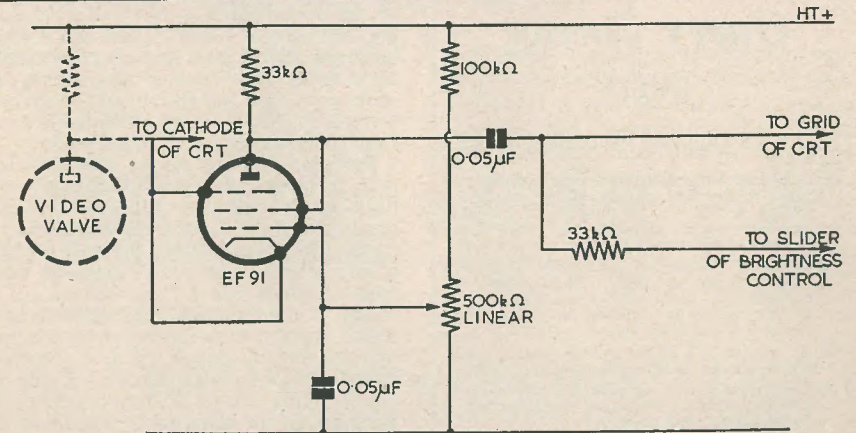
Black Spotter

I am particularly troubled by car ignition interference in my locality, and although a reasonably efficient noise limiter is employed I find the everlasting procession of white spots across the picture most distracting. Do you think a black spotter could be employed to some advantage, and if so could you recommend a circuit for such a device?

E. Pedder, Enfield

There must be many viewers whose enjoyment of a television programme is marred by ignition interference from passing traffic. There is quite a lot of relief to be obtained from this annoying trouble by the erection of a carefully positioned highly directional aerial system, and much has already been written about this matter. Also, it is important that a really good noise limiter is used, and in this connection perhaps

the best of these is the one in which the clipping level is manually set by means of a preset control. However, no matter how efficient this type of limiter is made, it can only reduce the interference to the intensity of the peak white part of the picture, and particularly on receivers which tend to defocus on highlights the effect of interference pulses is most troublesome. It would, of course, be advantageous if the white interference spots or blobs could be converted into black spots, as these would be far less obvious and distracting to the viewer, and this is the function of the device known as a "black spotter." There are many different types of black spotter, and some are very complicated and difficult to set up; however, we believe that the circuit which we are recommending constitutes the best compromise between operating efficiency and complexity.



RC 266

Fig. 1. Circuit of black spotter. If a 6.3V CR tube is used, the heater of the additional valve may be fed from the same winding as is the tube

The arrangement is very simple, and is shown in Fig. 1, the additional components being indicated by heavy lines. The video stage shown is a typical one such as is used to drive the cathode of the C.R. tube. This black spotter, for reasons which will be obvious after the following description, is only suitable for use where the video signal is fed to the cathode of the picture tube. The mode of operation is as follows:

An interference pulse whose amplitude exceeds that of the video signal drives the cathode of the spotter valve negative, causing a negative-going pulse to appear at the anode. This pulse is fed to the grid of the picture tube, causing the beam current to be cut off for the duration of the noise pulse. It will be appreciated that the effect of this interference suppressor is not to remove the unwanted pulses from the C.R. tube cathode, but to apply to the tube grid an amplified version of the pulse in the same phase. As the pulse on the grid is larger than that on the cathode, the tube is biased back causing a black spot to appear on the screen. Because the spotter valve is required to amplify the pulse without reversing its phase, the input is applied to the cathode of the valve whilst the output is taken from the anode. The bias on the valve is set so that under normal working conditions no anode current flows until the video signal exceeds the peak white level. This adjustment is made by means of the potentiometer whilst viewing the picture. The control is gradually advanced until the highlights in the picture start to darken;

it is then slackened back just enough to restore the highlights. In this position the circuit will function most efficiently as a black spotter.

TV Pre-amplifier

A friend of mine has a commercial TV receiver which, in this locality where the signal level is low, has insufficient sensitivity to provide a well contrasted picture. I have in mind fitting a pre-amplifier to boost the signal before it is fed to the receiver, and I would be grateful if you would recommend me a suitable circuit.

G. Kempson, Salisbury

This type of request arises from time to time from different parts of the country, and we feel that it is time to modernise a circuit of a TV pre-amplifier which was first published in the August 1950 issue of the *Radio Constructor*. The original circuit has proved to be very satisfactory, and we do not hesitate to present it again using a more modern miniature valve and providing coil winding details for each of the channels which are now in use. The revised circuit is shown in Fig. 2, and it will be seen that use is now made of the miniature low noise high slope pentode type 6AK5, which is also known as the Mullard EF95. The use of this type of valve enables the complete unit to be assembled on a small metal chassis 3x2x2 inches, which can be conveniently accommodated on the back panel of the receiver. No provision can be made on a chassis of this size for a power pack, and indeed there are few receivers where one would be necessary. The supplies required by the pre-amplifier are 6.3V at 0.175 Amps and 200 volts at 10mA. These can normally be tapped off the main receiver power supply. If, however, the valves in the receiver have series-connected heaters it would be advisable to feed the heater of the pre-amplifier valve from an additional 6.3V transformer.

Reference to the circuit diagram shows that a shunt resistance-capacitance combination is included between the outer conductor of the co-axial input cable and the chassis; these components are only necessary when the pre-amplifier is employed with a receiver which has a 'live' chassis. If the chassis is not connected to one side of the mains supply, then the outer of the co-ax may be directly connected to it. Both the input and output impedances of the unit are 80 ohms, so that the output socket may be linked to the aerial socket on the receiver by means of a short length of feeder cable. The gain is pre-set by means of a wirewound variable resistor in the cathode circuit of the valve.

The tuning coils are wound on standard Aladdin formers, and are fitted with dust iron cores. The coils should be mounted on either side of the valve, and each is fitted with a screening can. The table below indicates the number of turns required on the coils to tune to any of the B.B.C. TV channels.

The coils are wound with 32 swg enamelled copper wire, the two which are wound on the same former being separated by a piece of thin card, one being wound directly above the other. The heater choke is of the self-supporting type and consists of 10 turns of 22 swg PVC-covered wire wound on a

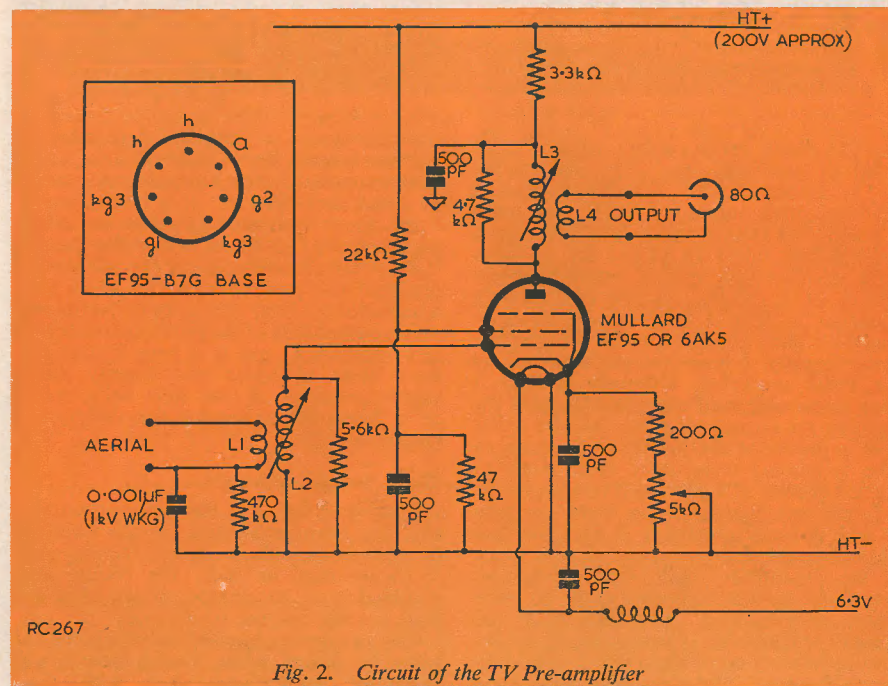


Fig. 2. Circuit of the TV Pre-amplifier

| Channel | L1 | L2 | L3 | L4 | 1/4 inch diameter mandrel. Decoupling capacitors should be of the mica dielectric type. |
|------------------------|-------|-------|-------|-------|---|
| No. 1 London | 1 1/2 | 8 | 8 1/2 | 1 1/2 | The unit is very simply trimmed by turning the coil core until maximum picture brightness is obtained, then whilst viewing Test Card "C" some slight improvement in definition may be obtained by very slightly detuning each core. |
| Glencairn | 1 1/2 | 7 | 7 1/2 | 1 1/2 | |
| No. 2 Holme Moss | 1 1/4 | 6 1/2 | 6 3/4 | 1 1/4 | |
| No. 3 Kirk o'Shotts | 1 1/4 | 6 1/2 | 6 3/4 | 1 1/4 | |
| Brighton | 1 1/4 | 6 | 6 1/2 | 1 1/4 | |
| No. 4 Sutton Coldfield | 1 1/4 | 5 | 5 1/2 | 1 1/4 | |
| No. 5 Wenvoe | 1 1/4 | 5 | 5 1/2 | 1 1/4 | |
| Pontop Pike | 1 1/4 | 5 | 5 1/2 | 1 1/4 | |

Commencing next month

THE "PATTERN-MASTER"

By D. Allenden, Grad.I.E.E.

A versatile TV Pattern Generator for serious work, covering 40-70 Mc/s.

Query Corner

RULES

- (1) A nominal fee of 2/6 will be made for each query.
- (2) Queries on any subject relating to technical radio or electrical matters will be accepted, though it will not be possible to provide complete circuit diagrams, for the more complex receivers, transmitters and the like.
- (3) Complete circuits of equipment may be submitted to us before construction is commenced. This will ensure that component values are correct and that the circuit is theoretically sound.
- (4) All queries will receive critical scrutiny and replies will be as comprehensive as possible.
- (5) Correspondence to be addressed to "Query Corner," Radio Constructor 57 Maida Vale, Paddington, London, W.9.
- (6) A selection of those queries with a more general interest will be reproduced in these pages each month.

Radio Miscellany

NO doubt many readers make a point of watching the TV programme "Inventors' Club." Such a programme promises much interest in itself, and there is always the chance that a good idea for a radio gadget might be picked up, or some little point might inspire another bright notion. This column has previously drawn attention to what I have considered commendable ideas presented in this programme. Unfortunately, I have not yet seen any of the items marketed, although perhaps I have under-estimated the probable time for them to get into production. Maybe it has been a matter of the publicity. It seems to take something more than sheer merit to make a success of a good idea nowadays!

In the recent programmes there has been no lack of ideas submitted. In fact, the time allotted could well be expanded, and many of the prototypes could, with advantage, even from the entertainment angle, be more amply demonstrated. The fullness of the present programmes is something of a contrast to its early days, when only a few items were submitted. The ideas, too, seem more technical. I remember one of the early items particularly—an expanding collar stud to safeguard the wearer of shrunken-necked shirts from being choked. Nowadays they are of a much more serious nature.

I was rather fascinated with the cable stripper recently shown. Cable strippers are, of course, no new idea, and most of us have already tried out a number of types. Many of them seem to require pretty careful handling, particularly when used on multi-stranded wires, and most especially if they are encased in a tough covering. Even the best of them seem to be restricted to a limited range of cable sizes for really efficient working.

The new pattern recently sent in by Mr. N. E. J. HALEY of Cambridge showed great promise, and made a quick and neat job of the two "strips" demonstrated in front of the TV camera. It was claimed to be capable of equally effectively dealing with a wide range of sizes. Unfortunately,

the time given to both the demonstration and the description was all too brief, and I felt disappointed their action was not shown as a real close-up.

By their treatment of this and other programmes, I always have a feeling that the B.B.C. sadly underestimate the number of practical men among viewers. Most men, whether as cyclists, motorists or handymen, pick up some idea of the principles of elementary mechanics, and it is very irritating to have ideas of which one eagerly awaits details treated as if they were being shown as a form of amusement for infants and elderly ladies.

Those Naughty Sponsors

Sponsored TV, if it has achieved nothing else, has been responsible for the utterance of some of the silliest nonsense imaginable. It seems that, as ever, the people least qualified to air an opinion on any debatable issue are the readiest to do so.

On this question Lord Mancroft quoted one eminent divine who, having denounced sponsored programmes, was asked how many of them he had seen. It transpired that he hadn't seen *any* TV at all. Perhaps, after all, that sort of thing is only what is to be expected. Busybodies always seize on the opportunity to prevent anybody else from doing anything.

The press generally, however hostile they secretly felt at this threatened intrusion on their advertising revenue, generally refrained from partisanship, although much of the drivel talked and written by those who, either from self-interest, bigotry or sincere belief, opposed it was fully quoted. To be on the safe side more than one newspaper long since applied for licenses. One of them in its Company Report warns the shareholder of the impact which sponsored TV will have on its advertising. It goes on to hastily assure them that they themselves intend to be in on the ground floor if and when it is permitted.

The entertainment world, already faced with diminishing receipts due to the rising

popularity of TV, has long been in a state of jitters. The threat of alternative and lively quality programmes has given them fresh cause for panic.

Don't Mention It!

Much has been made of the advertising aspect. It seems that everybody overlooks the simple answer that if you don't like the "ads." you can simply switch off or look at what the BBC have got to offer. That is undoubtedly just what will happen if there is too much plugging or the advertising is put over in bad taste.

No-one objects to advertisements in newspapers and periodicals—in fact most people seem to like them, or at least they read them. Women, particularly, give as much attention to the advertisement pages of the glossy covered magazines as they do to the rest of the contents. You, gentle reader, can hardly derive any feeling of masculine superiority from that. How many hobbyists have you heard admit they only bought a certain radio periodical for the sake of the

of the earliest days of broadcasting. At that time the vast majority of receivers in use were crystal sets, and one occasionally saw some brazen claims for crystals with wonderful names. In fact, the names were the most wonderful part about them, and to give them just the right touch they were invariably suffixed with "-ite" or "-tone." One firm claimed that Birmingham (5IT) transmitter was regularly heard in their London show-room on a set using one of their crystals. In those happy days broadcast stations were on what we should now regard as flea-power, and it would be quite a feat. I imagine most of the time 5IT was on the air it would be after shop hours, and in any case it wouldn't be easy to prove the weak signals in the headphones were not from Birmingham.

Another get-rich-quick back-street firm boasted that New York could be heard with their crystals. Beautiful tone, too! Optimists sent in their half-crowns for the wonderful new crystal in the expectation of hearing real DX with it. In due course they received

Centre Tap *talks about* INVENTORS' CLUB— —SPONSORED TV

advertisements? If you are quite honest, you will probably admit that in your early days as a constructor you did the same thing yourself.

I have never heard of anyone switching off when the BBC allow a few "ads." to creep in, and the TV side offends particularly in this way. The naming of plays, films, theatres, cinemas etc., has become almost a regular part of interviews. Writers plug their books, and even the Zoo man tells you what books to buy and holds up copies to make sure you buy the right ones. Film stars especially are asked by the interviewer for the name of their latest picture and even the date of release. Mr. and Madam Celebrity from *What's my Line* are given the fullest opportunity of telling viewers "this is my last two weeks at the Palladium. Next week I am appearing in Manchester after which I go on to Bristol."

It is curious that those who swallow this sort of advertising without protest should profess such horror that someone might mention the name of a brand of soap or toothpaste.

It just doesn't add up, but then human nature's like that.

Delayed Action

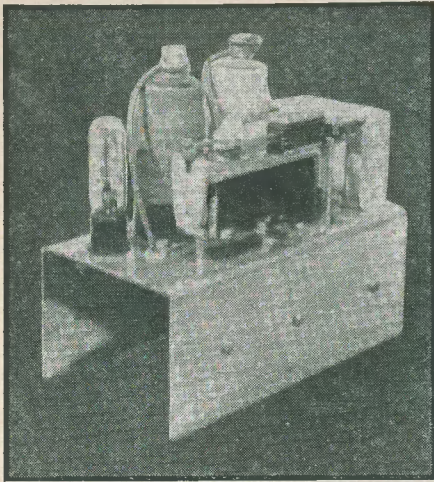
Thinking of advertisements reminds me

a shiny bit of silica that looked very much like any other crystal. In fact, it behaved very much like any other crystal; no worse but certainly no better.

When they complained to the advertiser they received a polite note saying that New York could most certainly be heard—if they took the set to New York!

Naturally the victims very nearly burst with indignation upon receipt of this. As this reaction subsided they generally had a wry laugh over it—those with the keenest sense of humour getting over it soonest. When their resentment at being cheekily defrauded wore off, they re-read the advertisement and checked through the carefully worded claim. As the silly side of the whole business became more and more apparent it seemed to them almost funny. In fact, it seemed to become funnier and funnier as the days passed, especially when they thought of all the other people who had also been so impudently swindled. As it occurred to them how comic some of their pals' faces would look when they discovered that they, too, had been stung for half-a-dollar, they'd begin to do their best to induce them also to send up for one of these wonderful crystals!

But then, as I have already said, human nature's like that.



A PHOTO-CELL RELAY UNIT

By J. W. BAGNALL

MOST of the photocell Units that the writer has seen previously have used Thyatron valves, but not having one available it was decided to see what could be done using components from the "Junk" box.

The following circuit was evolved using two SP61 valves. These were chosen as they have a steep slope, which is desirable for this purpose, and they are also readily available at low prices.

The HT supply is of the AC-DC type, but as there is no direct connection to the chassis the unit is quite safe to handle; for this reason the metalising of the valves was left unconnected. A transformer was used to supply the heaters, as the SP61 draws 0.6A, and a dropping resistor was not considered practicable as it would need to dissipate 130 watts. The relay was a Post Office type with a resistance of 6.2k Ω , but any type could be used providing it will close when a current of 3 to 4 mA passes through the energising coil. To operate the external appliance, two sets of contacts are used, one make and one break, so that one pair are made in either position of the relay. The photocell used is a caesium silver type, and it needs a polarising potential of 60 to 70 volts on its anode.

The Circuit

The polarising voltage for the photocell is derived from the chain R1 and R2. This voltage is also used to supply the screen and anode of V1 which is DC coupled to the grid of V2. This valve is normally held at cut-off point by virtue of the potential

applied to the cathode, which can be adjusted by VR1.

When the beam of light on to the photocell is interrupted it causes the cell to cease conducting, the grid voltage on V1 falls and the current flowing through the valve decreases. This causes the voltage at the anode to increase, which makes the grid of V2 less negative. The current which now flows through V2 closes the relay, which is held closed until light falls on to the photocell again. The purpose of C1 is to bypass to ground any AC that appears at the anode of V1.

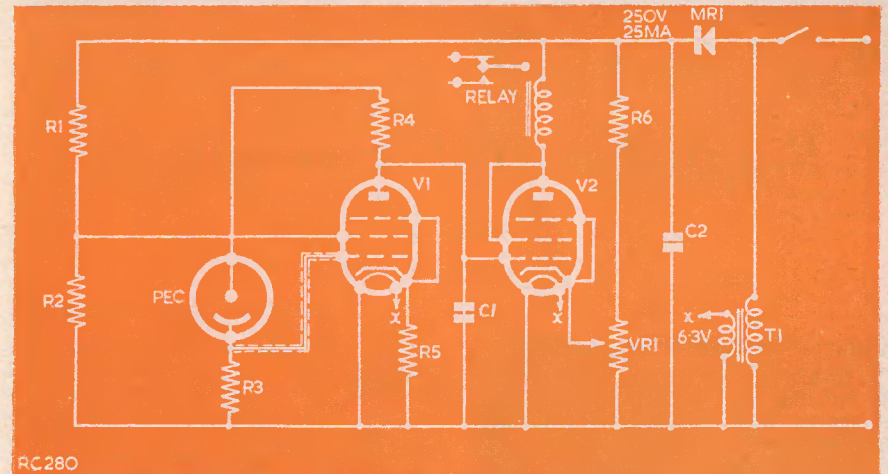
With the unit in operation, the valves should not be removed without first switching off. It will be seen that if V1 is removed the grid of V2 will have a large positive voltage on it, and the valve will pass excessive current.

Construction

No special precautions are necessary in the construction of the unit, apart from short leads to the photocell and a screened grid lead to V1; a screened grid cap was not found necessary.

To set up the device, it only needs to set VR1 so that the relay is open when there is light on the cell. This position will be found to vary according to the amount of light that falls on to the cell.

One last word of caution regarding the photocell. Too high a voltage across it will result in ionisation or "blue glow," which if allowed to continue would ruin the cathode. Should this occur when switching on the completed unit, the resistor R1 should be increased in value.



Photocell Relay Unit

Parts List

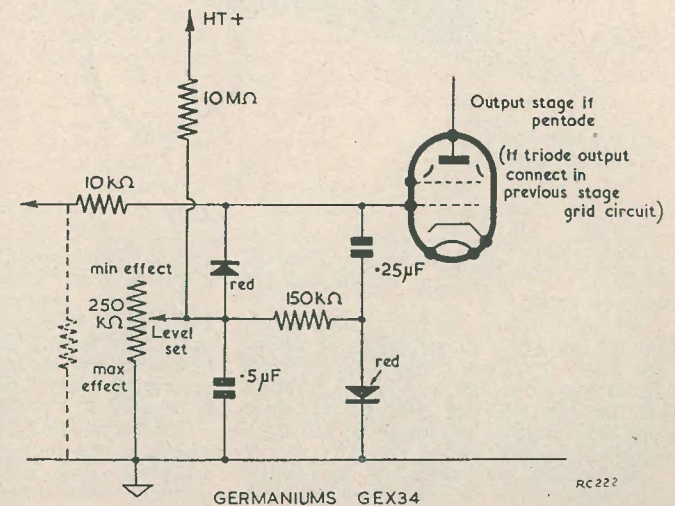
| | |
|----|---------------------|
| R1 | 33 k Ω 1W |
| R2 | 22 k Ω 1W |
| R3 | 4.7 M Ω 1/4W |
| R4 | 22 k Ω 1/4W |
| R5 | 2.2 k Ω 1/4W |
| R6 | 22 k Ω 1W |

| | |
|--------|-------------------------------------|
| VR1 | 10 k Ω wirewound |
| C1 | 0.1 μ F 150V wkg. |
| C2 | 4 μ F 350V wkg. |
| MR1 | 40 mA metal rectifier |
| T1 | 6.3V 2A heater transformer |
| V1, V2 | SP61 |
| PEC | Caesium silver photo-electric cell. |

A Noise Limiter By R. G. YOUNG

THIS circuit is equally suitable for BC, SW and TV, and can even be used as a PA Limiter with success. It may preserve the ears of some of your long-suffering readers!

The distortion produced, even at "maximum clip level" (minimum pass) is remarkably low. The circuit is, as far as I know, completely novel and has never been published elsewhere.



Radio Control Equipment

PART 8

By RAYMOND F. STOCK

Control for Non-Electric Propulsion Systems

STEAM AND INTERNAL COMBUSTION engines are less easy to control than electric motors and usually require auxiliary equipment such as clutches, gearboxes etc., which are outside the scope of this article.

It is worth bearing in mind that such items as steam control valves, reversing levers and the ignition levers of petrol engines are all susceptible to control by an electric motor and gear train.

The actuators used for these purposes are similar to those described for steering, and may either be arranged for continuous

cut-out is usually fitted by the makers for stopping. This can easily be controlled by radio, and a small electromagnet or solenoid can be coupled to the lever (which requires only a light pull). When this is worked from a 'stop' position mixed in with a steering sequence, on either a selector or escapement, it requires no artificial delay, since the control does not generally respond inside a half second or more.

Non Sequential Systems

A very well known control system depends upon the transmission of a continuous

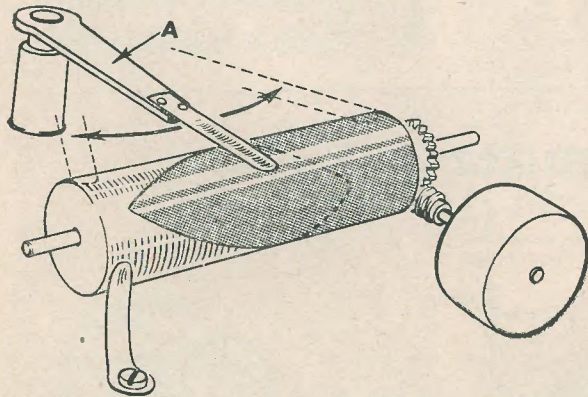


Fig. 37.
Pulse Generator

C37

rotation (using a crank to apply a push-pull effort) or may have limit switches and a reversible action.

Although electric motors have always been the standby of the newcomer to modelling, many miniature compression ignition engines are now used in first ventures as they are very tractable and reliable, apart from their obvious advantage of having a good power weight ratio.

These engines, unfortunately, are practically uncontrollable for speed, but a simple

train of pulses, at a fixed frequency but with a variable length of pulse.

The pulse length is infinitely variable from 0% to 100% and is controlled by the position of the steering wheel in the control box. Several methods are available for generating these pulses, but the easiest one is depicted in Fig. 37.

The electric motor, fed from a local power supply, drives the contact drum through a step-down gear train. The drum is of insulating material but has on, or let into,

its surface a conducting area which varies linearly from 360° at one end to 0° at the other. A light brush makes one keying connection to the conducting layer.

A second brush is moved along the surface of the drum by the steering control, and this is shown as being on the end of the lever A which moves with the control wheel (outside the control box).

When the wheel is centred, the brush is receiving current from the drum over 180° (or 50% of the time). It will be evident how the percentage pulse changes as the wheel is moved.

The operating gear for the model is often that shown in Fig. 38. In this diagram, back and front contacts of the receiver relay are wired to opposite poles of the battery and thus supply current to the motor in either direction.

When pulses are being received of 50% length, the motor is continuously caused to rotate back and forth an equal amount; the frequency of pulses is several per second and the final shaft of the motor reduction gear which carries the rudder moves only imperceptibly (if indeed at all, in view of the probable backlash in the gearings).

When the pulse length is changed, however, the motor moves more in one direction than in another and the rudder creeps over.

It should be stressed that this system is not a strictly proportional one, since the movement of the wheel is related to the *speed* at which the rudder alters, not to its *position*.

The construction of the operating gear and the control box is obvious in this case, except perhaps for the pulsing cylinder. This should really have a truly flush surface, best obtained by mounting together on one shaft a half-cylinder of insulating plastic and a half-cylinder of metal both split diagonally. These, however, would have to be skimmed up on a lathe when assembled; a fair solution is to use a length of plastic rod, about 3/8" diameter, mounted on a shaft, and to wrap around it a diagonally-cut half-cylinder of copper foil bent from a triangular shape. This can be secured by soldering it to the heads of countersunk 8-BA brass screws in the plastic.

The operating gear described has its limitations, but using the same control box a similar system can be employed in a truly proportional device.

Fig. 39 shows a circuit where the receiver relay A applies a voltage (15 or 20) to a resistor and condenser (and thus charges the latter) whenever a pulse is received.

This voltage is applied to the grid of a pentode and biases it to cut-off point, if sufficient.

Included in the grid line is the potentiometer B across a source of EMF which

opposes the other voltage. The voltage on the grid, therefore, depends upon the difference between the two opposite voltages. In the anode circuit is a relay switching the steering motor C across two batteries to reverse its direction; the motor is geared down to the rudder and to the shaft of the potentiometer.

It will be seen that whatever pulse length is being transmitted, a certain balance will be achieved between the potentiometer-controlled source of EMF and the voltage across the condenser.

Whenever the pulse length is changed the charging period of the condenser will vary—and thus its voltage—and a state of unbalance is created which can be restored only by rotation of the potentiometer; this is done by the motor which carries the rudder with it.

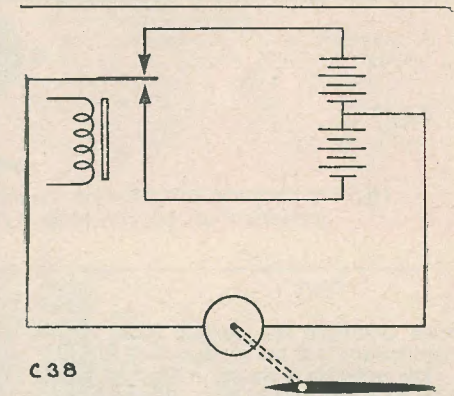


Fig. 38. Typical pulse operating gear

It is found that the armature of a suitable relay in the anode circuit can be made to float between the contacts during a state of unbalance: a Siemens relay is ideal.

The frequency of the pulses is increased to perhaps 50 or 100 per second with this gear, and the receiver relay must be capable of operation at this speed.

The values of the charging condenser and resistors are best found by experiment, since they will vary with several factors. The valve can be an output pentode such as a 3S4 in the miniature range.

A different type of equipment is also capable of giving proportional results, and with less expenditure of energy since continuous signals are unnecessary.

I originally developed this idea for use in a cabin cruiser, but have used it extensively since in other applications, and it has much to commend it; it requires, however, a more complicated mechanical side dependent

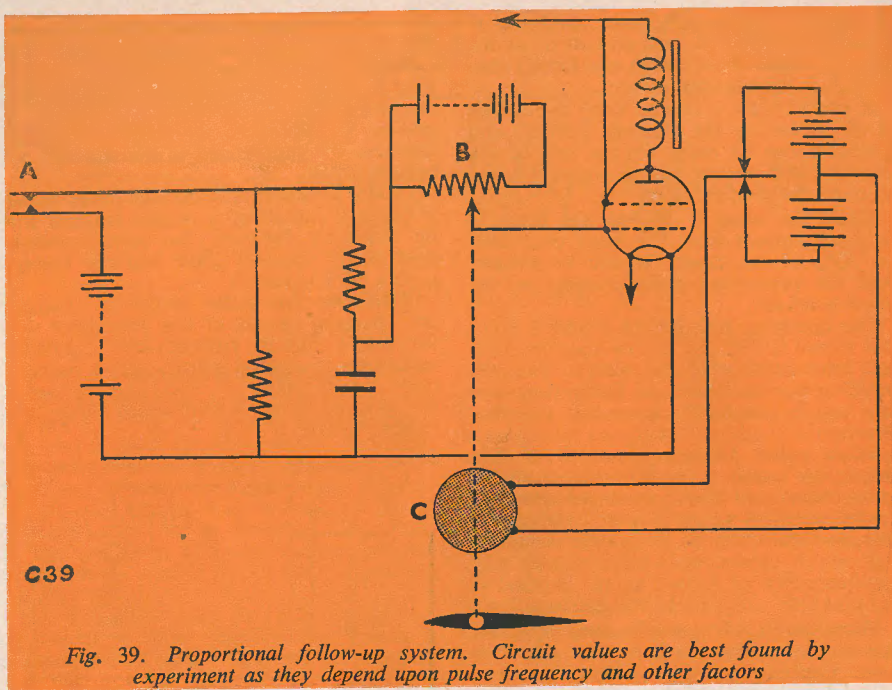


Fig. 39. Proportional follow-up system. Circuit values are best found by experiment as they depend upon pulse frequency and other factors

upon obtaining the correct gears, so the construction will not be described fully.

The principle is shown in Figs. 40 and 41. Fig. 40 is the control box. When the knob A is turned, one or other of the two contact pairs close under mechanical pressure and further movement, transmitted through them, rotates the pulsing wheel B through a 40:1 gear train. The latter (B) carries a brush which rotates against two conducting segments, one short and one long. One or other of these is brought into circuit according to which contact pair was originally closed. The brush as it rotates keys the transmitter; the number of pulses sent depends directly on how many times the brush rotates, i.e. how far the knob is turned. The type of pulse sent (long or short) depends on the way the knob is turned (to port or starboard).

The operating gear is shown in Fig. 41. The receiver relay energises electromagnets A (directly) and B (through a delay device C). A and B each have a pivoted armature and pawl, and these work upon two ratchet wheels; the latter are integral with the two bevel wheels of a differential, and the pinions turning between them rotate the output shaft in a way which represents the

algebraic sum of their two movements. Thus the output shaft moves in direction and extent exactly in phase with the control knob.

It will be realised that a long pulse will operate both A and B, but this is overcome by making the teeth of the delayed magnet's ratchet twice as large (in an angular sense) as those used on the non-delayed gear. When a delayed pulse is used, therefore, one wheel moves forward by X° and the other backward by $2X^\circ$, the final result being X° backward.

The pulses used are in a ratio of 4:1, and to prevent too much variation the control box gear train is fitted with a centrifugal governor to limit the maximum speed of turning.

With this system a very long pulse can be used to control an engine selector; it will introduce a spurious 'delayed' pulse, but this can be cancelled by adding a short pulse immediately after.

Multi-Channel Systems

Most of the interest in these systems lies in the electronic gear and is thus outside the limits of this article. Briefly, the transmitter is modulated by either (a) a single

power oscillator whose audio frequency can be varied or (b) a number of master oscillators on various audio frequencies which drive a power amplifier for modulation.

Generally the former system is used, as some of the signals to be transmitted are mutually exclusive (e.g. Port and Starboard) and therefore not required simultaneously.

The receiver, after detection and 2 stages of valve amplification, RC coupled, uses the signals to feed a discriminating device; this can be a purely electronic phase change circuit, but is more usually a multi-reed unit responsive to certain audio frequencies. The vibration of the reeds when resonating is used to make a physical contact and operate a relay. The receiver, therefore, terminates in 2 or more relays instead of one, and the operating gear following each relay is of simple electro-mechanical type such as has been described for a single channel.

One system peculiarly adapted to two-channel working is the last one described, and the short and long pulses are replaced by signals of one or the other frequency.

The carrier current may or may not be continuous when audio channels are used.

Better reception is afforded by the former case, but it should not be overlooked that a third 'channel' can be obtained by using the carrier in the normal way. Similarly, if two channels of audio are simultaneously available, yet another 'channel' is obtained by keying them together.

Tuned reed units are interesting to make, and they can also be obtained commercially.

Models for Radio Control

Model aircraft are sufficiently difficult to fly satisfactorily without control equipment, and the fitting of the latter does not, as might be thought, simplify the problem. Some little experience in the hobby is therefore essential before radio control is attempted, and in most cases there is sufficient complication to warrant a 'team' approach by an established aeromodeller and a radio enthusiast.

Land vehicles are less troublesome, as a failure of the control system is unlikely to produce expensive antics. Space is usually limited for the use of fast car models, and the most suitable prototype is therefore something like an armoured car or heavy

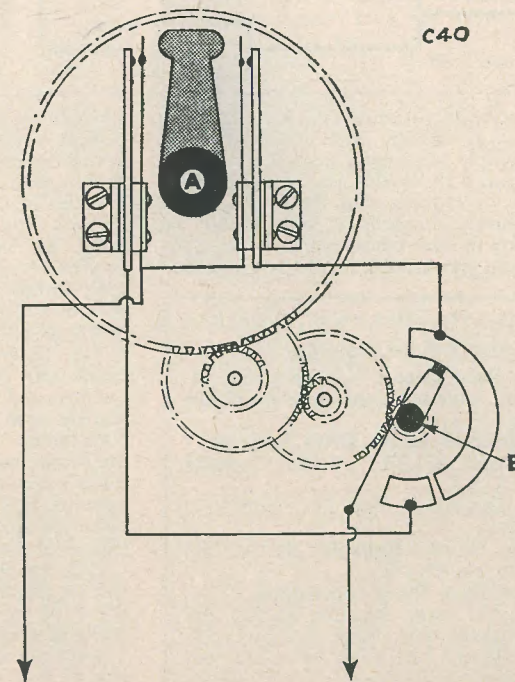


Fig. 40. The large gear wheel is mounted loosely on the shaft of A.

lorry (plenty of room in the back for equipment!) or a tank, if the tracks can be managed. The most suitable power supply is an electric motor and secondary cells, and the torque of a series-wound motor makes it ideal for traction. Such models will not require much room for working, and can accept (if low geared) poor ground. Great fun can be had in one's garden, and the transmitter can then be mains supplied, which cuts the cost.

ced. With modern miniature components, quite orthodox models no more than 18" long can be controlled, while a 40" cargo vessel would take any amount of operating gear and batteries. The most popular type of hull is the V-bottomed boat (motor cruiser, M.T.B., etc.), and this is easy to make, and has plenty of beam for stowing equipment.

Secondary cells and an electric motor are ideal for propelling the slower prototypes,

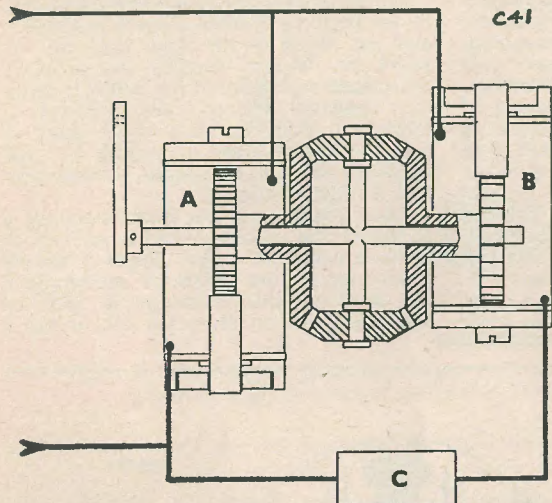


Fig. 41. C is another small relay whose natural time lag provides the very short delay period required

Any selector system giving *fine* control is suitable for vehicles, and electric traction lends itself to full engine control.

Ship and boat models are by far the most popular for control, and rightly so. They are relatively inexpensive and require no machining in their construction, while many kits of parts are available for the less experien-

and suitable cells are available cheaply from surplus stores. Local power for operating gear is no problem where electric propulsion is used, and complicated selector systems are in order here (with no damage done if they do miss a pulse once in a while!)

On the other hand, one of the most entertaining models is a fast 'diesel' powered hull; unless a clutch can be contrived no control will be possible over the speed, but this is offset by the excitement of controlling a fast model. Fortunately a commercial engine can nowadays be acquired, with no qualms and at little expense, and built straight into a hull (perhaps also from a commercial kit) in the knowledge that the combination is bound to succeed; and if radio is installed with an effective range of, perhaps, half a mile, a great deal of entertainment can be derived from trying different classes of control gear.

Even the simple three-position escapement will be found to work surprisingly well, and some of the more complex gear can be really precise in action.

Why not try a model? You might even like it!

THE RADIO AMATEUR

Contents of the September Issue:

The "Band Hopper"—a switched, all-band, table top transmitter for phone and CW.

Modifications to the HRO Receiver. On Being an XYL Radio Operator—CTIYA.

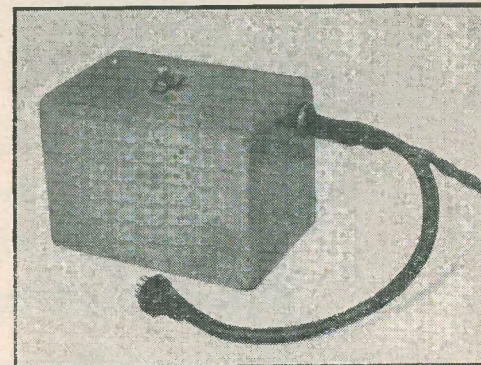
VFO Discussion—new ideas for VFO design.

Strictly for the Beginner—Buffers and Doublers, Part 3.

Narrow Band Phase Modulation. and the usual Amateur Bands, SW Broadcast and VHF features, SW BC Station List, Club News, etc., etc.

POWER PACK for a BATTERY SET

by B. B. FISHER



THE FOLLOWING ARTICLE describes a mains power pack made for a Marconi portable battery wireless set. Details are given of the power pack built by the author together with general considerations and suggested circuits for power packs which will meet the requirements of most portable battery sets. The power pack still permits the set to be run with its battery.

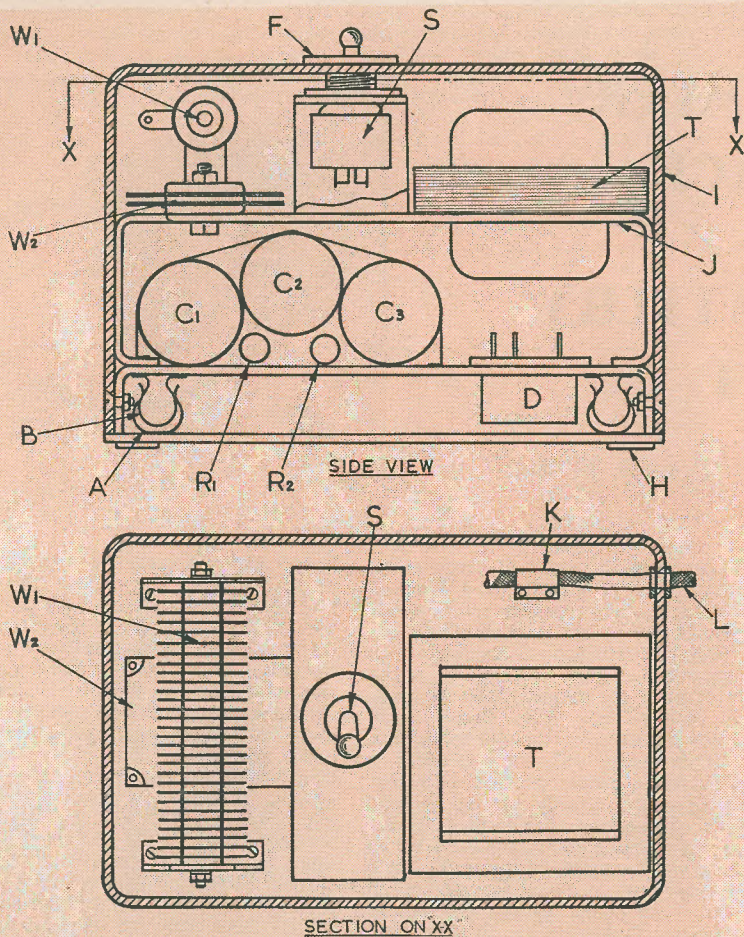
One of the main differences between a battery set and a mains operated set is that the former uses directly heated valves. The effect of applying alternating potential to the directly heated cathode is the same as applying a similar signal to the grid. Since this would result in an overpowering 50 cycles hum, the heater supply for battery sets must be rectified and efficiently smoothed. Experiments with AC heater supply and a humdinger were found to be unsuccessful. Four possible circuits of a power pack are given. They all use metal rectifiers, since these elements are more robust and allow of a more compact construction than valve rectifiers.

The first circuit shown in Fig. 1 uses a transformer with two separate windings for the HT and LT supplies. Fig. 2 shows a circuit using a transformer for the heater supply only, the required drop of voltage being obtained by means of resistance R₃. These two circuits are suitable for sets operating with heater voltages of 1.4V. With sets having an LT supply of 7.5V it is, in general, more economical to bleed the HT supply. The circuits for such sets corresponding to those of Figs. 1 and 2 are shown in Figs. 3 and 4. It will be seen that the circuits of Figs. 1 and 3 use a trans-

former giving a complete electrical isolation of the set from the mains. The use of a transformer is better suited for tap changing, and has the advantage over a dropping resistor in that it dissipates only a negligible amount of power. It allows of a construction uncramped by the necessity of keeping hot components (resistors R₈ and R₁₀ in Fig. 4) away from other parts and providing adequate ventilation. The disadvantages of a transformer are its higher cost, size and weight. It should be noted that in Figs. 3 and 4 the LT and HT supplies have one common lead. Care should therefore be taken to connect the positive LT lead to the correct output terminal of the power pack. If it is found that the valves are not glowing, the LT leads from the set should merely be reversed.

The approximate values of the components are given under each diagram, but these should merely be regarded as approximate values. Below is outlined a procedure for determining component values suitable for the particular set and for the transformer and rectifiers available.

To determine the best values of components, connect equivalent HT and LT resistances of the set across the corresponding output terminals of the chosen circuit. The smoothing and dropping resistors (R₃, R₄ and R₅ in Fig. 2) can then be adjusted to give the rated voltages. The equivalent HT and LT resistances of the set can be obtained by dividing the two voltages by the corresponding currents taken. These currents can be obtained from the valve data, or measured directly by connecting the set to the battery. It can, however, be taken as a



RC287

List of Components referring to Fig. 5

- A Terry Clips
- B Brass Supports
- C1 C3 2000 μ F electrolytic condensers
- C2 20-30 μ F electrolytic condenser
- D Tap Changer
- F Switch fixing nut
- S Switch
- W1 HT rectifier
- W2 LT rectifier
- T Transformer
- K Cable Clip
- L Input and output cable
- R1 R2 Smoothing resistors
- I Steel box
- J Aluminium chassis
- H Rubber feet
- G Chromium plated countersunk screws.

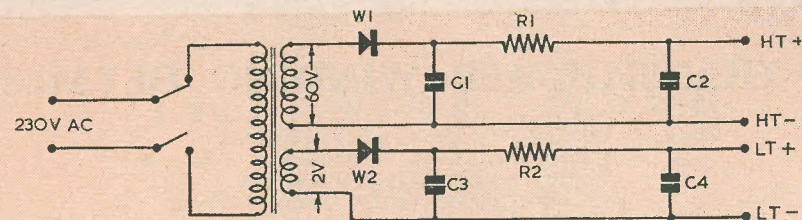


FIG. 1

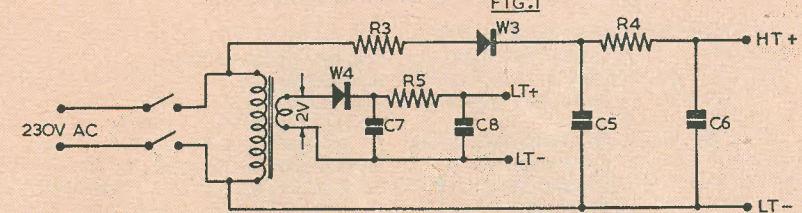


FIG. 2

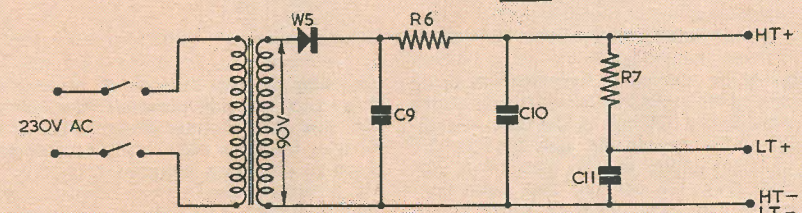


FIG. 3

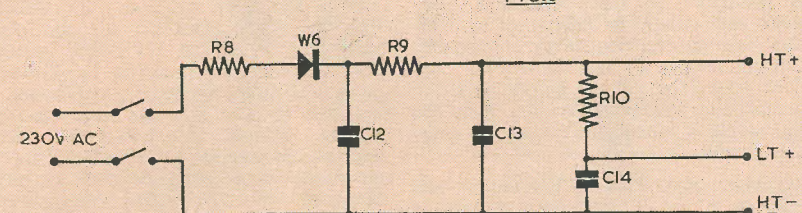


FIG. 4

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Typical Components Values for Fig. 1

- R1 5k Ω 1/2W \pm 20%
- R2 6 Ω 1/2W \pm 20%
- C1, C2 20-30 μ F 150V Elect.
- C3, C4 2000 μ F 3V Elect.
- W1 15mA 150V Rectifier
- W2 0.5A 3V Rectifier

Typical Component Values for Fig. 2

- R3 15k Ω 2W \pm 20%
- R4 5k Ω 1/2W \pm 20%
- R5 6 Ω 1/2W \pm 20%
- C5, C6 16-16 μ F 150V Elect.
- C7, C8 2000 μ F 3V Elect.
- W3 15mA 150V Rectifier
- W4 0.5A 3V Rectifier

Typical Components for Fig. 3

- R6 470 Ω 2W \pm 20%
- R7 1.5k Ω 5W \pm 20%
- C9, C10 16-16 μ F 150V Elect.
- C11 500 μ F 12V Elect.
- W5 70mA 150V Rectifier

Typical Components for Fig. 4

- R8 2k Ω 10W \pm 20%
- R9 470 Ω 2W \pm 20%
- R10 1.5k Ω 5W \pm 20%
- C12, C13 16-16 μ F 150V Elect.
- C14 500 μ F 12V Elect.
- W6 70mA 150V Rectifier

TRANSFORMER WINDING DETAILS

- FIG. 1 Output 60V at 15mA and 2V at 250mA.
Core area=0.2sq. in. Window Area=0.65sq. in.
Primary winding 6,900 turns of 40 swg.
HT secondary winding 1,980 turns of 40 swg.
LT secondary winding 66 turns of 28 swg.
- FIG. 2 Output 2V at 250mA.
Core area=0.2sq. in. Window area=0.6sq. in.
Primary winding 7,800 turns of 40 swg.
Secondary winding 72 turns of 28 swg.
- FIG. 3 Output 90V at 65mA.
Core area=0.45sq. in. Window area=0.7sq. in.
Primary winding 3,450 turns of 38 swg.
Secondary winding 1,480 turns of 35 swg.

general guide that a battery set takes an HT current of approximately 10 mA and a heater current of 250 mA in the case of 1.4V LT sets and 50 mA in the case of 7.5V LT sets. For example, in the case of a 90V HT and 1.4V LT set the two equivalent resistances are 9000 ohms (1 watt) and 6 ohms ($\frac{1}{2}$ watt). In this procedure, considerable care should be taken not to overrun the rectifiers and electrolytic condensers. Thus if condensers C1 and C2 in Fig. 1 are rated at 100V, the voltage across either of them must not exceed this value. Also the voltage across C1 must not exceed the rated rectifier output.

The power pack built by the author was that shown in Fig. 1, and the components quoted are those actually used. That circuit was chosen in preference to others due to the fact that the power pack was built for a regular traveller and had to be suitable for operation on 110V as well as 230V AC. A transformer supplying both HT and LT with a simple tap changer was considered to be a much simpler way of changing the operating voltage than a system of resistors with a complicated switching arrangement, especially as a heater transformer had in any case to be provided. The physical arrangement of components is shown in Fig. 5. Only overall dimensions are given as the particular detail arrangement will depend in each case on the components available.

The box was built of $\frac{1}{16}$ " steel. All the joints were welded and the edges neatly rounded off with a file. The box has the advantage of allowing an easy access to the tap changer D, and at the same time not

exposing the tap changer to an easy interference by outside persons. The bottom of the box carries four Terry clips A which fit over four specially bent pieces of brass B fixed to the lower aluminium chassis. Thus the bottom of the box can be easily removed and replaced. The bottom also carries four rubber feet fixed by glue. The whole box can be easily removed for servicing by removing the switch nut F and unscrewing four countersunk screws at G. C1 and C2 were a double electrolytic condenser. The resistors R1 and R2 were suspended by the wiring. It has been found that although the transformer has been designed for 230V, no change in performance of the set has been detected with the mains voltage varying between 200 and 250V. The author, therefore, does not consider it essential to provide taps for the normal variations in mains voltage. Those constructors wishing to wind their own transformer will find winding details at the end of this article.

To deliver the power into the radio, the case containing the set has been drilled for a 7BG valve base which was fixed in position by two countersunk screws. Contrary to expectations this did not spoil the appearance of the case. A four-pin socket identical with the one used in the battery was fixed inside the set, and connected to the base. Care should be taken at this stage to fix the socket in such a way as not to interfere with the space normally taken by the battery. The lead from the power pack was terminated by a 7BG plug. The set could thus be connected to the mains by inserting the 7BG plug into its base, and removing the radio plug from the battery and plugging it into the internal socket.

Let's Get Started

5 THE SINE WAVE

by A. Blackburn

AS YOU GAIN EXPERIENCE in radio, the time will come when you will start to build instruments to test faulty or newly-designed circuits. Guess work and trial-and-error techniques have their limitations: besides, test equipment provides an efficient and economic method of locating and diagnosing any trouble.

At some time, then, you may have an audio signal generator under construction, and in all probability you will use a circuit already tried successfully by someone else.

To avoid an embarrassed silence or an admission of lamentable ignorance when told: 'Of course, the output is pretty nearly sinusoidal,' I am going to briefly outline why it needs to be treated with respect.

brated in angles of degrees, 45°, 90°, and so on.

With the vector lying horizontally and pointing to the right, imagine the vector rotated until it is at an angle of 45° with the horizontal, that is, in the position shown. Projecting from the point C to the right until it meets a vertical line from the corresponding angle on the graph will give us the point D. Rotating the vector a further 45° to the vertical position and projecting again will enable us to plot another point E. When the vector has rotated through 360° and is in its original position, we will have plotted a number of points on the graph. By joining up these points we will have drawn the curve shown, which you will recognise as the sine wave.

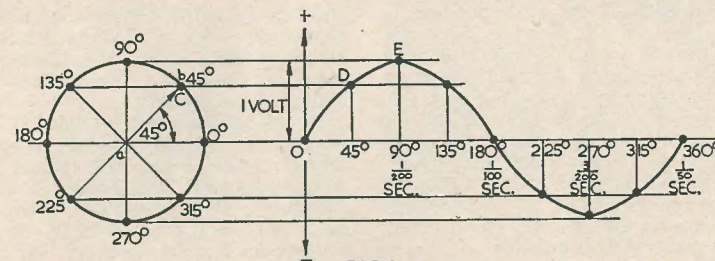


FIG. 1
GEOMETRICAL PRODUCTION OF THE
SINE WAVE

RC283

I am taking it for granted that the memory of maths, learned at school has degenerated into nothing more useful than a resolve to instil your sons with a more industrious attitude to the subject. At any rate, it is for this section of my readers that this article is intended.

On the right-hand side of Fig. 1 you will recognise a shape which has appeared many times before in this series. In almost any radio textbook it will crop up, or be referred to as the 'sine wave,' the author assuming that his readers know of what he is speaking.

The line AB in Fig. 1 is called a vector, and its length represents to some scale a current or voltage of, let's say, one volt. The base line on the right-hand side is cali-

Why It is Important

At first sight the connection between radio and all this geometry and graph drawing may not be very obvious, but suppose we replace the vector by a coil of wire rotating in a magnetic field as shown in Fig. 2? As the coil rotates it will be cut by the magnetic lines of force existing between the poles, and a voltage will be induced into the coil. This voltage will not be constant for every position of the coil in the gap, however.

If we assume the lines of force to be parallel as in Fig. 2B, the coil will cut less lines of force per degree of rotation when it approaches the vertical position than when it approaches the horizontal. In our figure

it will only cut two lines for 30° of rotation as it approaches the vertical, but 6 lines for 30° of rotation as it approaches the horizontal. I want you to notice particularly that, as one side of the coil moves from proximity with one pole to the other, the induced voltage

768 c/s (two octaves above), and so on. It is the presence of these harmonics in varying proportions which give an instrument or voice its particular character; in fact, if all instruments produced pure sine waves they would be indistinguishable from one

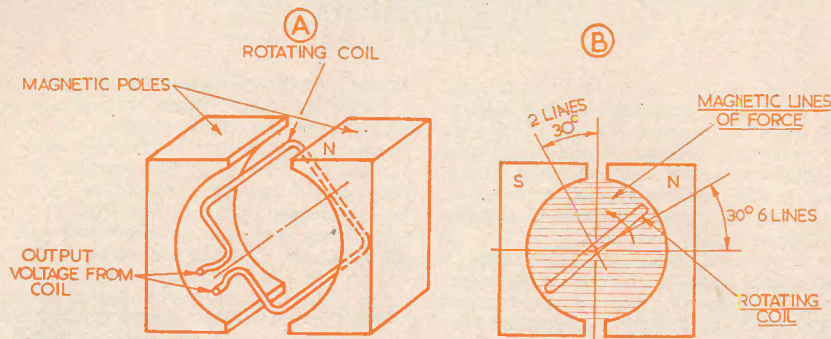


FIG. 2
SIMPLE AC GENERATOR

RC284

will be reversed—from, say, positive to negative. Now, if the voltage from this coil were plotted vertically against angular movement on a graph, the resultant curve would be the same as the one in Fig. 1.

Fig. 2 is, of course, a very simple AC generator, complicated versions of which produce for us electric light and power. The engineers responsible for the design of these huge machines go to considerable trouble to ensure that the AC voltage from them is as sinusoidal as possible.

It is not merely a question of petty exactitude which gives this particular waveform such importance in scientific engineering. The reason is that the sine wave is the only waveform containing only one frequency. If our elementary coil of wire were rotated at 50 revs/sec, the frequency of the alternating current output would be 50 c/s because one complete wave would be produced by every revolution. This explains the other markings on the base line of Fig. 1. The degrees of rotation have been replaced by the time the vector has taken to rotate to any particular point, assuming that the rotational speed of the vector is constant. Now it can be shown that any waveform which departs from sine wave or sinusoidal shape contains harmonics. These are frequencies which are multiples of the main or fundamental frequency. For example, middle C in the musical scale has a frequency of 256 c/s and its second harmonic is $2 \times 256 = 512$ c/s (an octave above middle C), and its third

another. In sound, therefore, non-sinusoidal waveforms are very important, and they are of interest in radio because amplifiers must be designed to reproduce them as accurately as possible.

In transmitters and oscillators, however, the story is very different. Consider a transmitter carrier tuned to 1 Mc/s. If some second harmonic were present in the carrier waveform, the transmitter would radiate on 1 Mc/s and (less strongly) on 2 Mc/s. This means that some of its power would be wasted in radiating an unwanted frequency, and one which would probably interfere with another transmitter.

Summing up, two apparently conflicting requirements must be met in radio. One, that amplifiers must be capable of handling non-sinusoidal waveforms without distortion, and two, that oscillators—except in special cases—must produce as nearly as possible a sinusoidal waveform. Incidentally, the oscillator described last month produces a very close approximation to the sine wave.

Measuring AC

We all know that measuring DC is a comparatively simple matter. We connect our meter and as the voltage or current being measured remains steady, the needle of the meter takes up a fixed position on the dial and stays there. But with AC, when we are measuring under different conditions, the subject becomes more complicated.

As we can see from Fig. 3, the voltage—

or current—is continually varying, so that, if the frequency were, say, 5 c/s, the needle of the meter would also vary five times a second. As the frequency is increased, however, the needle would not have time to follow rapid changes in the voltage or current.

We have assumed in the above remarks that we are always using a moving coil meter. However, if we were to use a rectifier to change AC to DC, and then apply it to a moving coil meter or, alternatively if we were to use a moving iron meter, the needle would take up a fixed position when the meter is connected to an alternating current or voltage.

I do not intend to go deeply into the subject of meters here, as it has been dealt with in an article by Mr. T. H. Robinson in the April number of the *Radio Constructor*.

The question we ask ourselves now is, what part of the alternating current waveform is the meter reading? Is it indicating the points A, B, C or D in Fig. 3? Obviously it cannot be A or C, as these are at zero. As was pointed out in Mr. Robinson's article, some meters read RMS values, some read average, and additionally some measure peak. The meaning of these terms may possibly be unknown to you.

We will start with the simplest—the peak value. As you might expect, in Fig. 3 this is 100V (point B), i.e. the maximum value to which the voltage rises from the datum line. The voltage then changes direction and begins to go negative, until it becomes -100V (point D) with respect to the datum line. So the actual voltage from the maximum at B to the minimum at D is 200V. This is called the peak to peak value. Peak values are important when considering insulation, as it is the maximum value to which the voltage rises.

Possibly the most mystifying term is RMS. Written in full this means root mean square. We will certainly not embark on an explanation of this peculiar term, as its derivation is mainly mathematical. Its significance is that, if an AC voltage of 100V peak is applied to a resistance of, say, 100 ohms, the power dissipated in the resistor would be the same as if a DC voltage of 70.7V were applied to the resistor of 100 ohms. In other words, the peak value of an alternating

current or voltage must be multiplied by .707 to give the RMS value, and the RMS value must be multiplied by 1.414 to give the peak value. In actual fact, .707 is equal to

$$\frac{1}{\sqrt{2}}$$

and 1.414 is equal to $\sqrt{2}$. The significance of RMS values can be realised by the fact that the mains voltage is always stated in RMS. Therefore, the peak value is 1.414 times this. So if your mains are 240V, the peak value is approximately 340V.

So far we have not mentioned the average value. The average value is .637 of the peak—so the average value of our 100V peak sine wave is 63.7V. Unfortunately, these figures—.707, 1.414 and .637—only apply to a truly sinusoidal waveform.

Normally voltmeters are calibrated in RMS. However, in some cases they actually read peak or average. To take a case in point, imagine that we are measuring the output voltage of an amplifier with a valve voltmeter, which actually measures peak but which is calibrated in RMS. If the output voltages were purely sinusoidal, the readings would be correct, but if distortion were occurring in the amplifier the peak value may not change very much but, due to the distortion, the RMS value may be quite different. The meter, therefore, would not be reading the true RMS value, and would not be giving a correct estimation of the amplifier performance. This is, of course, the advantage of an oscilloscope,

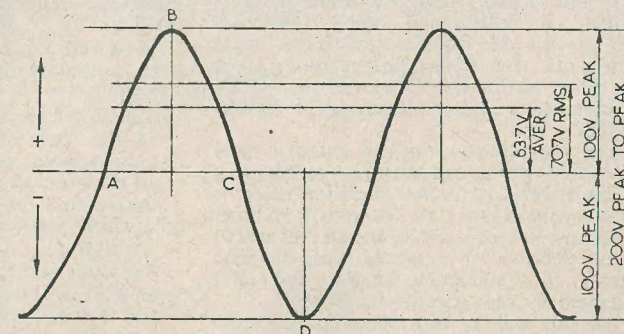


FIG. 3

SINE WAVE VALUES

RC285

which draws a picture of the waveform, and if it is clearly non-sinusoidal, errors in measurement with meters can be detected.

Having briefly outlined this theoretical aspect of radio, we return next time to a more practical footing, and have a look at a TRF receiver.

THE 20th NATIONAL RADIO SHOW

EARLS COURT - LONDON

September 1st—12th 1953

FOLLOWING THE VERY SUCCESSFUL television broadcasts of the Coronation which were seen "live" in four Continental countries and in the form of tele-recordings in many others, the British radio industry and the B.B.C. are intending to give, at the 20th National Radio Show, Earls Court, London, September 1 to 12, their best demonstration yet of how television programmes are rehearsed, photographed, transmitted and received. This will be of particular interest to visitors from countries starting or considering having a television service.

In the specially built TV studio at Earls Court, an audience of nearly 1,000 will see camera and lighting rehearsals, dress rehearsals, and actual performances which are going on the air. They will see the TV pictures on a screen measuring 21 feet by 16 feet.

The programme from this studio is only one source of the pictures which will be seen in the Exhibition on 400 television receivers of every make and size. There will be other programmes received over the air; interviews with celebrities on a special dais; one-man shows in a miniature studio; and films televised by film scanner equipment.

All this will be controlled in the Radio Industry Council Control Room—an exhibit in itself of considerable technical interest and entirely visible to visitors through its glass walls.

Television receivers, now made to any standard for export, will be seen on 36 manufacturers' stands and about 200 models will also be seen working side by side in what is known as "Television Avenue." Underwater TV will be demonstrated. There will be over 100 exhibitors in all, including manufacturers of components, valves and

batteries. Projection television receivers will be seen in the making. The Army and the Royal Air Force will stage large exhibits to show some of their latest equipment and the Ministry of Supply will show components of a guided missile. Other exhibits of technical as well as public interest, are the training display by five leading bodies, including King's College, University of London, and the B.B.C. Engineering Establishment.

A central feature of the Show will be a large three-face clock controlled by radio pulses from Rugby, and specially arranged electronic attractions in operation will include:

- Industrial X-ray equipment;
- an auscultoscope for testing heart and lungs;
- a large screen microscope;
- an electronic office message-sender;
- a high-speed sorter of beans by colour;
- an electronically controlled oxygen cutter;
- the National Physical Laboratory's machine which plays noughts and crosses with visitors;
- a plastics welder;
- an electronic stencil cutter;
- and the "electronic commissioner" which for the second year will greet foreign visitors in their own languages and give information about locations and times of demonstrations.

There will also be radio-controlled models of an army tank and an amphibious vehicle.

Tuesday, September 1, is preview day and is reserved for overseas visitors and other special guests, including Press. The Exhibition will be opened to the public on the following day, by Field Marshal Lord Montgomery.

Alphabetical List of Exhibitors

| | Stand No. |
|---|-----------|
| Aerialite Ltd. Castle Works, Stalybridge, Cheshire | 79 |
| AIR MINISTRY. Information Div., Whitehall Gardens, S.W.1 | 205 |
| ALLEN RADIO LTD., RICHARD. Caledonia Road, Batley, Yorks. | 85 |
| AMBASSADOR RADIO (R. N. FITTON LTD.). Princess Works, Brighouse, Yorks | 5 |
| ANTIFERRENT LTD. 67 Bryanston Street, Marble Arch, W.1 | 53 |
| ARGOSY RADIOVISION LTD. Argosy Works, Hertford Road, Barking, Essex | 3 |
| ASSOCIATION OF RADIO BATTERY MANUFACTURERS. 41 Gordon Square, London, W.C.1 | 99 |
| AUTOMATIC COIL WINDER AND ELECTRICAL EQUIPMENT CO. LTD. Winder House, Douglas Street, S.W.1 | 15 |
| Baird Television Ltd. Lancelot Road, Wembley, Middlesex | 59 |
| BALCOMBE LTD., A. J. 52 Tabernacle Street, London, E.C.2 | 101 |
| BELLING AND LEE LTD. Cambridge Arterial Road, Enfield, Middlesex | 202 |
| BERNARDS (PUBLISHERS) LTD. The Grampians, Western Gate, W.6 | 232 |
| BOOSEY AND HAWKES LTD. Electronics Division, Deansbrook Road, Edgware, Middlesex | 209 |
| BOWMAKER LTD. Bowmaker House, Lansdowne, Bournemouth | 210 |
| BRITISH BROADCASTING CORPORATION. Broadcasting House, London, W.1 | 200 |
| BRITISH IRON AND STEEL FEDERATION. Steel House, Tothill Street, S.W.1 | 12 |
| BRITISH RADIO AND TELEVISION. 92 Fleet Street, E.C.4 | 25 |
| BRITISH RAILWAYS. Railway Executive, 222 Marylebone Road, London, N.W.1 | 2 |
| BROWN BROS. LTD. Browns Buildings, Great Eastern Street, London, E.C.2 | 70 |
| BULGIN AND CO. LTD., A. F. Bye-Pass Road, Barking, Essex | 1 |
| BUSH RADIO LTD. Power Road, Chiswick, W.4 | 74 & 97 |
| Champion Elec. Corporation. Champion Works, Newhaven, Sussex | 71 |
| COLE LTD., E. K. Ekco Works, Southend-on-Sea, Essex | 100 |
| COLLARO LTD. Ripple Works, Bye-Pass Road, Barking, Essex | 35 |
| CO-OPERATIVE WHOLESALE SOCIETY LTD. Publicity Department, 99 Leman Street, London, F.1 | 6 |
| COSMOCORD LTD. 700 Great Cambridge Road, Enfield, Middlesex | 234 |
| COSSOR LTD., A. C. Cossor House, Highbury Grove, N.5 | 90 |
| Decca Record Co. Ltd. 1/3 Brixton Road, London, S.W.9 | 48 |
| DOMAIN PRODUCTS LTD. Domain Works, Barnaby Street, N.W.1 | 13 |
| DUBILIER CONDENSER CO. (1925) LTD. Ducon Works, Victoria Road, North Acton, W.3 | 98 |
| DYNATRON RADIO LTD. Perfecta Works, Ray Lea Road, Maidenhead, Berks | 112 |
| Econasign Co. Ltd. 92 Victoria Street, London, S.W.1 | 20 |
| EDISON SWAN ELECTRIC CO. LTD. 155 Charing Cross Road, W.C.2 | 51 |
| ELECTRICAL TRADES UNION. Hayes Court, West Common Road, Bromley, Kent | 202 |
| E.M.I. SALES AND SERVICE LTD. Head Office, Hayes, Middlesex | 93 & 104 |
| ELECTRONIC PRECISION EQUIPMENT LTD. Elpreq House, High Street, Wealdstone, Middlesex | 222 |
| ENGLISH ELECTRIC CO. LTD. Queens House, Kingsway, W.C.2 | 52 |
| EVER READY CO. (G.B.) LTD. Hercules Place, Holloway, N.7 | 30 |
| Ferguson Radio Corporation Ltd. 105 Judd Street, London, W.C.1 | 57 |
| FERRANTI LTD. Hollinwood, Lancs. | 49 |
| Garrard Engineering and Manufacturing Co. Ltd. Newcastle Street, Swindon, Wilts. | 103 |
| GENERAL ELECTRIC CO. LTD. Magnet House, Kingsway, W.C.2 | 89 |
| GOODMANS INDUSTRIES LTD. Axiom Works, Wembley, Middlesex | 37 |
| GRAMOPHONE CO. LTD. Head Office, Hayes, Middlesex | 92 |
| Hobday Bros. Ltd. 21/27 Great Eastern Street, E.C.2 | 96 |
| HUNT (CAPACITORS) LTD., A. H. Bendon Valley, Garratt Lane, Wandsworth, S.W.18 | 88 |
| Iliffe and Sons, Ltd. Dorset House, Stamford Street, S.E.1 | 45 |
| IMHOF LTD., ALFRED. 112/116 New Oxford Street, W.C.1 | 211 |
| INVICTA RADIO LTD. Parkhurst Road, Holloway, N.7 | 47 |
| J. B. Manufacturing Co. (Cabinets) Ltd. 86 Palmerston Road, Walthamstow, E.17 | 27 |
| J. G. PUBLICATIONS LTD. 56(a) Rochester Row, S.W.1 | 24 |
| Keith Prowse and Co. Ltd. 159 New Bond Street, London, W.1 | 114 |
| KERRY'S (GREAT BRITAIN) LTD. Warton Road, Stratford, E.15 | 38 |
| KOLSTER-BRANDES LTD. Footscray, Sidcup, Kent | 32 |
| Linguaphone Institute Ltd. Linguaphone House, 207/209 Regent Street, W.1 | 19 |
| LLOYDS BANK LTD. Premises Dept., 71 Lombard Street, E.C.3 | 84 |
| LUGTON AND CO. LTD. 209/212 Tottenham Court Road, W.1 | 204 |
| McMichael Radio Ltd. 190 Strand, London, W.C.2 | 34 |
| MARCONIPHONE CO. LTD. Hayes, Middlesex | 58 |
| MASTERADIO LTD. 10/20 Fitzroy Place, N.W.1 | 46 |
| MIDLAND BANK LTD. Premises Dept., Poultry, E.C.2 | 39 |
| MULLARD LTD. Century House, Shaftesbury Avenue, W.C.2 | 91 |
| MULTICORE SOLDERS LTD. Maylands Avenue, Hemel Hempstead, Herts. | 111 |
| MURPHY RADIO LTD. Welwyn Garden City, Herts. | 31 |

| | Stand No. |
|--|---------------|
| National Provincial Bank Ltd. Premises Dept., 15 Bishopsgate, E.C.2 | 23 |
| NEWNES LTD., GEORGE. Tower House, Southampton Street, W.C.2 | 87 |
| | |
| Odhams Press Ltd. Sales Promotion and Service Dept., 96 Long Acre, London, W.C.2 | 86 |
| | |
| Pamphonic Sales Ltd. 400 Holloway Road, London, N.7 | 108 |
| PETO SCOTT ELECTRICAL INSTRUMENTS LTD. Adlestone Road, Weybridge, Surrey | 77 |
| PETTER RADIO AND ELECTRICAL SUPPLIES. 201/209 Forest Road, Walthamstow, E.17 | 223 |
| PHILCO (OVERSEAS) LTD. Romford Road, Chigwell, Essex | 50 |
| PHILIPS ELECTRICAL LTD. Century House, Shaftesbury Avenue, W.C.2 | 33 |
| PILOT RADIO LTD. 31/37 Park Royal Road, N.W.10 | 56 |
| PLESSEY CO. LTD. Vicarage Lane, Ilford, Essex | 113 |
| PORTOGRAM RADIO ELECTRICAL INDUSTRIES LTD. Priel Works, St. Rule Street, S.W.8 | 36 |
| PYE LIMITED. Radio Works, Cambridge | 76 |
| | |
| Radio Gramophone Dev. Co. Ltd. Eastern Avenue West, Mawneys, Romford, Essex | 94 |
| REGENTONE RADIO AND TELEVISION LTD. Eastern Avenue West, Mawneys, Romford, Essex | 60 |
| REPRODUCERS (ELECTRONIC) LTD. 82 Great Portland Street, W.1 | 233 |
| ROBERTS' RADIO CO. LTD. Creek Road, East Molesey, Surrey | 11 |
| ROLA CELESTION LTD. Ferry Works, Summer Road, Thames Ditton | 8 |
| RUDMAN, DARLINGTON (ELECTRONICS) LTD. Wednesfield, Staffs. | 208 |
| | |
| Simon Sound Service Ltd. 48 George Street, Portman Square, W.1 | 95 |
| SLINGSBY LTD., H. C. 89/97 Kingsway, W.C.2 | 62 |
| SOBELL INDUSTRIES LTD. Langley Park, Slough, Bucks. | 55 |
| STANDARD TELEPHONES AND CABLES LTD. Connaught House, Aldwych, W.C.2 | 81 |
| STANDARD TELEPHONES AND CABLES LTD. (BRIMAR). Footscray, Sidcup, Kent | 9 |
| "THE STAR". 12/22 Bouverie Street, E.C.4 | 221 |
| STELLA RADIO AND TELEVISION CO. LTD. Oxford House, 9/15 Oxford Street, W.1 | 72 |
| | |
| Taylor Electrical Instruments Ltd. 419 Montrose Avenue, Slough Bucks. | 105 |
| TELEGRAPH CONDENSER CO. LTD. Wales Farm Road, North Acton, W.3 | 107 |
| TELEQUIPMENT LTD. 1319A, High Road, Whetstone, N.20 | 28 |
| TELERECTION LTD. Antenna Works, St. Pauls, Cheltenham, Glos. | 220 |
| TELEVISION SOCIETY. 164 Shaftesbury Avenue, W.C.2 | 78 |
| THOMPSON, DIAMOND AND BUTCHER LTD. 34 Farringdon Road, London, E.C.1 | 7 |
| TRADER PUBLISHING CO. LTD. Dorset House, Stamford Street, S.E.1 | 63 |
| TRIX ELECTRICAL CO. LTD. 1/5 Maple Place, Tottenham Court Road, W.1 | 16 |
| TRUVOX LTD. Exhibition Grounds, Wembley, Middlesex | 106 |
| | |
| Ultra Electric Ltd. Western Avenue, Acton, W.3 | 73 |
| UNITED APPEAL FOR THE BLIND. 204/206 Great Portland Street, W.1 | 201 |
| | |
| Valradio Ltd. New Chapel Road, Feltham, Middlesex | 207 |
| VIDOR LTD. West Street, Erith, Kent | 75 |
| | |
| War Office. Directorate of Public Relations, War Office, Whitehall, S.W.1 | 206 |
| WESTINGHOUSE BRAKE AND SIGNAL CO. LTD. 82 York Way, Kings Cross, N.1 | 54 |
| WESTMINSTER BANK LTD. Premises Dept., 51 Threadneedle Street E.C.2 | 10 |
| WHITLEY ELECTRICAL RADIO CO. LTD. 109 Kingsway, W.C.2 | 109 |
| WOLSEY TELEVISION LTD. 75 Gresham Road, Brixton, S.W.9 | 61 |
| WRIGHT AND WEAIRE LTD. 138 Sloane Street, London, S.W.1 | 110 |
| WAVEFORMS LIMITED. Radar Works, Truro Road, N.22 | 26 |
| WHITE IBBOTSON LTD. 205 Station Road, Harrow | 4 |
| | |
| Demonstration Rooms and Offices | |
| COLE LTD., E. K. | D.14 |
| COLLARO LTD. | D.6 |
| CO-OPERATIVE WHOLESALE SOCIETY LTD. | D.28 |
| COSSOR LTD., A. C. | D.13 |
| DECCA RECORD CO. LTD. | D.26 and D.27 |
| EDISON SWAN ELECTRIC CO. LTD. | D.8 |
| E.M.I. SALES AND SERVICE LTD. | D.24 |
| FERGUSON RADIO CORPORATION LTD. | D.3 and D.4 |
| FERRANTI LTD. | D.25 |
| GENERAL ELECTRIC CO. LTD. | D.9 |
| GRAMOPHONE CO. LTD. | D.10 |
| MARCONIPHONE CO. LTD. | D.23 |
| MULLARD LTD. | D.7 and D.11 |
| MULTICORE SOLDERS LTD. | D.16 |
| MURPHY RADIO LTD. | D.1 |
| PETO SCOTT ELECTRICAL INSTRUMENTS LTD. | D.5 |
| PHILIPS ELECTRICAL LTD. | D.21 |
| PLESSEY CO. LTD. | D.19 |
| PYE LIMITED | D.29 |
| TELEGRAPH CONDENSER CO. LTD. | D.12 |
| TRUVOX LTD. | D.17 |
| VIDOR LTD. | D.18 |
| WHITLEY ELECTRICAL RADIO CO. LTD. | D.15 |

PRE-SHOW NEWS

PETTER RADIO and ELECTRICAL SUPPLIES

This firm has specialised in Radio Components and Accessories for the past twenty-five years, and hold stocks to fulfil almost every requirement of the trade. Included on their stand are the following:— Erie Resistors, Volume Controls (all makes), Electrolytics (over 70 different types), Aerials (including Television), all Belling-Lee components, Chokes, Coils, Condensers all types, Dials and Slow Motion Drives, Chassis, Earth Rods, Loudspeaker fabric, Fuses, Gramophone Motors, and Auto Changers, Amplifiers, Microphones, Pick-ups, Knobs, Meters, Signal Generators, Speakers, Spades, Plugs and Sockets, Screws and Nuts, Washers, Soldering Tags, Westinghouse Rectifiers, Sleeving, Solder, Solon Irons, Car suppressors, Toggle Switches, Transformers, B.V.A. Valves, and a host of other items too numerous to mention. *Wholesale only.*

TELERECTION Ltd.

A fully comprehensive range of aerials, to meet the requirements of the most discriminating dealer and viewer alike, in any area of the United Kingdom, is exhibited by Telerection on their Stand No. 7, of almost 1,000 square feet, at the National Radio Show, September 1st to 12th 1953.

From the simple single dipole, with its ancillary equipment, to the absolute fringe aerial or horizontally polarised unit, the accent is on a substantially built and well-designed series to meet localised conditions coupled with a price range of particular interest.

The latest Telerection introduction, the "Paravex", the vertical counterpart developed from their "Paravex" horizontal aerial, which has met with such marked success in both the Pontop Pike and Belfast areas, brings British Television aerial design to a most advanced stage and proves that *British technical knowledge and inventiveness in this direction is unsurpassed anywhere else in the world.* This new aerial has a similar polar diagram in the vertical plane as that of the "Paravex" Horizontal in the horizontal plane and its acceptance angle is also 35° of the central line, with two null points either side which are very sharply defined. Forward gain is exceptional and signal to noise ratio shows a marked improvement on the conventional "H" or "X". This unique aerial has been specifically designed to counteract reflections from the side to the very highest degree, and matching is inherent in the design of the crossarm, thus maintaining the impedance of the aerial at 80 ohms.

The 4-element "Multimus" aerial has established itself as of outstanding design and construction for absolute fringe reception, its adjustable delta matching device enabling impedance to be varied to suit the special circumstances of location and receiver. This aerial operates perfectly with either co-axial or twin balanced feeder and, as with all Telerection aerials, no dissimilar metals are used in manufacture, thus eliminating all possible corrosion due to electrolytic action.

In near-fringe areas, the 3-element "8DBD" is ideal. This aerial also embodies delta matching to ensure maximum interference suppression and greatly improved signal to noise ratio.

For hilly or mountainous districts, the Telerection "Anti-Ghost" aerial has been specially produced to eliminate troublesome reflections. Of "double H" design, this aerial met with immediate success on its introduction at the 1952 Radio Show and now fulfils a consistent demand in both South Wales and Scotland. The standard $\frac{1}{2}$ and $\frac{1}{4}$ wave H Type aerials and single dipoles are designed and produced to the same high standards as the multi-array models. Equal importance is also attached to all Telerection fixings and mountings, each being specifically designed to give maximum serviceability under all conditions. Half-inch aluminium alloy elements are utilised for all aerials. Quality is therefore such that it meets the demand of the most critical and a planned production ensures a price range which is most competitive.

DUBILIER CONDENSER Co. Ltd. (1925)

The DUBILIER Exhibits on Stand No. 98 are classified under the following headings:—

Mica Capacitors
For use in Television, Radio, Radar and Electronic equipment, including moulded mica and silvered mica types.

Paper Capacitors
For all purposes connected with Television, Radio, Radar and Electronic equipment, including high voltage types and those specially designed for tropical applications.

Trimmer Capacitors
Ceramic dielectric.
Electrolytic Capacitors

An extensive range of high and low voltage types to meet every requirement, including the new miniature "Drilitic".

Fixed Resistors
A comprehensive selection suitable for Television, Radio, Radar and Electronic equipment, including the smallest insulated $\frac{1}{2}$ watt resistor type BTS, Power Wire Wound, High Voltage, High Frequency, High Stability and Precision Wire Wound types.

Variable Resistors
Potentiometers, Volume Controls and Tone Controls in non-tropical, tropical and miniature types.

Television and Radio Interference Suppressors
Capacitors and filter units for use with domestic appliances, including 3-pin mains suppressor plugs. Filter units designed for tropical applications. A full range of Suppressor Chokes for industrial applications, including electric lift installations. Miniature capacitors and chokes in kit form specially designed for Television interference suppression.

GOODMANS INDUSTRIES, Ltd.

The main feature of Stand No. 37, which will be of interest to the high fidelity enthusiast is the demonstration theatre that forms the centre section of the Goodmans display. In this theatre the General Public will be able to listen to selected recordings that serve to demonstrate the lead that the Goodmans Axiom and Audiom range of loudspeakers have in the world of good quality and high fidelity reproduction.

A popular theme that Goodmans Industries wish to express at this year's Radio Show is, should you have friends who may be interested in high fidelity reproduction then bring them along to the demonstration theatre. Alternatively, if your friends have a special recording they wish to hear, then bring it along to Stand No. 37 and subject to time available it will be recorded via the Axiom, Audiom range of loudspeakers.

Tickets for the demonstration theatre will be issued from Stand No. 37 during the period of the show, and for those interested, application to Goodmans Industries prior to the exhibition will enable a seat to be reserved at a particular demonstration.

The static display of Stand No. 37 will include:—

Loudspeakers
A range of Permanent Magnet loudspeakers that includes the well known Audiom and Axiom series.

The registered trade name Audiom is applied to the wide range quality loudspeakers such as those that may be installed in high class Radiograms, P.A. Installations or Electronic Organs. Under this heading is the Audiom 60 (12"–15 watt), Audiom 70 (12"–20 watt), Audiom 80 (15"–25 watt) and Audiom 90 (18"–50 watt).

The high fidelity range—designated Axiom—includes the Axioms 150 Mk. II (12"–15 watt), Axiom 22 Mk. II (12"–20 watt), Axiom 101 (8"–6 watt), Axiom 102 (8"–6 watt).

Microphones
A recently developed low impedance moving coil microphone, Type Z/33, will have its debut at the Radio Show and will be on display for the first time.

The Z/33 has four main characteristics; namely the ability to be used as a hand microphone, desk,

pocket attachment (that leaves the hands free for control adjustments), or as a stand microphone by virtue of having a tapped hole ($\frac{1}{2} \times 26$ T.P.I.) that will fit the majority of present day microphone stands.

The microphone can be used for general Public Address work, Sound dubbing on Cine Projectors, or for use with tape recorders. Its superior output and overall sensitivity compares favourably with crystal microphones without the disadvantages usually associated with that type of unit.

The general design of the Z/33 allows provision for an internal transformer for direct to Grid operation. Television (Permanent Magnet) Focusing Units;

A new type of Permanent Magnet Focusing Unit will also be displayed for the first time. This unit, which employs new features in picture focus and shift, is being used by all the leading British Television Manufacturers and is now available to the home constructor.

There are three constructions applicable to this design, Type 12/44, 14/44 and 16/44; all of which utilise the new Ferroxdure magnetic material that has the advantage of high resistivity, enabling the units to be positioned close to the deflector coil without affecting the performance of the set.

Transformers

Amongst the loudspeakers displayed will be a representative range of output transformers which will include the well known H6. The H6 is an outstanding 30 watt unit specially recommended for use with the Axiom 150 Mk. II and 22 Mk. II. This transformer can be wound to customers' specification.

Vibration Generators

A range of Permanent Magnet Vibration Generators will be on show amongst which will be:—

Model V/47 Force factor 0.9lbs/amp.

Model 390A Force factor 4.7lbs/amp.

Max. continuous current rating = 4 amps (with air cooling).

Model 790 Force factor 9.5lbs/amp.

Max. continuous current rating = 4 amps (with air cooling).

Model 8/600 Force factor 60lbs/amp on high impedance.

20lbs/amp on low impedance.

Max. continuous current rating with air cooling on high impedance = 4.2 amps.

On low impedance = 12.6 amps.

These instruments have a widening application in the field of Scientific Instruments for the investigation of Vibration Phenomena.

Public Address Equipment

Under this heading Goodmans Industries will be showing an Omni-directional Sound Diffuser Model CD/77. This unit houses a high flux P.M. 10" loudspeaker and has provision for an internal line transformer.

A smaller version of the CD/77, Type CD/66, has just been developed and will also be on show. This unit houses a high flux P.M. 6" loudspeaker. Also included in this section will be a 15 watt Pressure Unit Type T52.

BOOSEY and HAWKES Ltd.

A tape recorder of unique design is making its first appearance this year on the stand of Boosey and Hawkes Ltd., Electronics Division. It is called the Reporter and, as its name implies it was originally intended for journalists, but its small size and weight and complete independence of electric mains give it a very much wider range of application.

There is a choice of tape speeds—7 $\frac{1}{2}$ " per second for quality recordings (15 minutes spool duration) or 3 $\frac{3}{4}$ " for long-duration speech recordings (30 minutes). In both versions one winding of the spring motor gives a recording time of eight minutes.

The standard model with headphone playback weighs only twelve pounds but there is a de luxe model (thirteen pounds) with a small built-in loudspeaker (available in both 7 $\frac{1}{2}$ " and 3 $\frac{3}{4}$ " versions).

All models use standard torch cells for LT and 67 $\frac{1}{2}$ Volt HT batteries and the actual battery consumption cost is only about 4d an hour.

To do full justice to the inherent high quality of recordings, the tape can be played back on a con-

ventional mains-operated tape recorder; for example, the Boosey and Hawkes *Magnegraph* which is also being exhibited.

WESTINGHOUSE BRAKE and SIGNAL Co. Ltd.

At this year's Radio Show, Westinghouse Brake and Signal Co. Ltd., will once again be showing a large number of Metal Rectifier units, representative of the many thousands of types this company markets.

Prominent in the display will be selenium rectifiers suitable for use in power supply circuits for radio and television, and these will be divided into two general categories. The first will be typical of those already in use in commercial sets, and designed to suit manufacturers requirements, whilst the second will be general types of interest to amateur and professional alike. The latter group includes popular units used in such circuits as "The View-Master," "The Universal" etc.

Also displayed will be the pencil type of extra high tension rectifiers, now familiar from their wide usage in television circuits, where they provide a cheap and reliable EHT supply. These pencil types are made in two ranges, offering maximum outputs of some 8KV at 2 or 8 mA according to type. In addition, a newly developed miniature range will be on view, having comparable performance at lower current ratings, and providing greater ease for wiring into circuit.

Rectifiers specially designed for use in high ambient temperatures, including those developed for Power Amplifier circuits, will be on view, along with the Type Approved units that have met the stringent requirements laid down by the Ministries. Copper-Oxide rectifiers for use with measuring instruments and the complete range of Germanium Crystal Diodes will be displayed, many of the latter being included in a demonstration television receiver showing how metal rectifiers can perform any normal valve-diode function. Two battery chargers and a wide selection of technical literature will complete the display, whilst qualified technicians will be in attendance to advise on the many and varied applications of metal rectification.

MULLARD Ltd.

Of particular interest to the public at the National Radio Show to be held at Earls Court, from September 1st to 12th will be the Information Centres that Mullard Ltd., are providing on Stand 91. Here expert advice on a wide variety of viewing and listening problems will be available free of charge. Mullard Ltd., are providing this service to meet the need for technical advice for the layman and the home constructor which has become apparent at the last few Radio Shows.

There will be three of these Information Centres. One will specialise in helping the prospective buyer in his choice of a set. Here he will be able to judge for himself the comparative merits of the various television picture sizes available and obtain useful guidance on such problems as correct viewing conditions and aerial installations.

Another Information Centre offers advice on the maintenance of receivers. The need for regular valve testing is given special emphasis, and the Mullard Electronic Valve Tester is there to demonstrate the efficient service now available in many radio stores and service departments throughout the country. The Valve Tester will be demonstrated to the Trade in Demonstration Room No. D7. On another part of the stand will be an amusing display designed to show with the aid of distorting mirrors the way in which worn-out valves can affect reproduction.

A third Information Centre is devoted to the problems of the Home Constructor. Several radio and television chassis incorporating Mullard valves and tubes are given prominent display. Information about designs suitable for home construction will be available on request.

Special features on the Mullard Stand will offer visitors a glimpse of the intricate precision work involved in the manufacture of valves and cathode ray tubes. Operators from one of the seven Mullard factories are to be seen assembling the electron gun for television tubes, while the assembly of a modern television valve is depicted in a specially produced filmlet which will be shown continuously.

A major exhibit on Stand 91 will be a selection from the comprehensive Mullard Range of domestic receiving valves and television picture tubes. Mullard "Long-life" picture tubes will be shown, which together with their associated range of "World Series" valves are incorporated in many of this season's television models. Valves for use in mains and battery-operated receivers, car radio, public address equipment, sound-on-film equipment, and hearing aids will also be shown.

THE TELEVISION SOCIETY—Stand No. 220

The Television Society will exhibit their 405-line experimental transmitter which is being installed at the Norwood Technical College later this year for educational purposes and for the use of members wishing to gain experience on ultra-short-wave reception. The vision carrier is 427 Mc/s and the sound carrier 423.5 Mc/s. An adapter for reception on standard television receivers will also be shown.

In addition a number of reprints and booklets on television engineering will be available, with copies of the Society's *Journal*.

Membership of the Society is open to all interested in television engineering, and full particulars can be obtained from the members and staff in attendance.

Hon. Secretary: G. Parr, M.I.E.E., 164 Shaftesbury Avenue, W.C.2.

T.C.C. Co. Ltd.

Although the T.C.C. exhibit on Stand 107 will display many familiar ranges of paper, mica, ceramic, plastic and electrolytic condensers, the emphasis will be on the progress made during the past year, the results of which are summarised here.

In the Paper Dielectric class, the new High Voltage Smoothing Condensers Types 561-3 will be of especial interest to television designers. Their unique construction is exemplified by the absence of metal parts at the high potential end. Improved performance and reliability at high temperatures are the benefits gained by using "Visconol-X" Impregnation for "Metalpack" and "Metalmit" Tubulars, which will now operate at 100°C. without voltage de-rating.

In the Electrolytic class interest will certainly focus on the new range of Sub-Miniature Tubulars, which are believed to be the smallest of their kind ever made.

These condensers are a noteworthy step forward in the design of miniature components for use in hearing aids and with transistors. Higher ratings and improved performance have also been achieved in the new "Picopack" Tubulars to which has been added a new range for operation at 85°C. The Type 928 Chassis Mounting Electrolytic is outstanding in that here for the first time is an 800V electrolytic condenser which can be used instead of a paper condenser at this voltage, in rectifier units.

In the Ceramic class, three new types have been added: the High Voltage Tubulars for use in line timebase circuits for large screen TV receivers, the Small Capacity Close Tolerance Tubulars for top end coupling in band-pass filters, and the Close Controlled Temperature Co-efficient Tubulars set in "Plimoseal" for use in oscillator and IF circuits.

Once again T.C.C. are featuring one of their highly specialised machines, an Automatic Mica Laying Machine. Designed and made at the Acton Factory, this machine will lay-up stacked mica plates of all sizes from 1" x 11/16" to 2 $\frac{1}{2}$ " x 2" at the extraordinary rate of 4500 micas per hour. The number of micas required for each plate is pre-set mechanically, and the largest number that can be laid-up in one plate is 50. These plates are used in the Transmitter Type H.F. Condensers. In order that visitors may follow the sequence of actions more easily, and so appreciate the ingenuity of this machine, the running speed has been reduced to one-fifth of normal.

MULTICORE SOLDERS

On Stand 111 in the centre section of the National Radio and Television Show, Earls Court, in conjunction with Philips Mitcham Works, Multicore Solders will be displaying what is claimed to be the first ever public demonstration of the wiring and soldering of sub-assemblies used in the Philips Projection Television Receiver.

SEE . . .

The "Orpheus" Tape Recorder

to be described in future issues of this magazine, which will be on display at

THE GENERAL ELECTRIC CO.'s DEMONSTRATION STAND, D9.

The "Universal" Large Screen AC/DC Televisor

now being described, which can be seen on the main

MULLARD STAND, 91

The units being constructed by the skilled operatives from Philips works will be returned each evening to Mitcham Works for tests and will be later incorporated in the Philips model 6027A Receiver.

It is estimated that more than 25,000 soldered joints will be made during the run of the Show, using standard factory size 7lb reels of Ersin Multicore.

Seen for the first time at a National Radio Exhibition will be the new Multicore Tape Solder which melts with the aid of an ordinary match.

Of particular interest will be the Ersin Multicore T.L.C. alloy, a special low melting point alloy used for certain defence contracts. The melting point is 145°C., more than 40° below that of the conventional tin/lead alloys and not many degrees above the melting point of the flux which is contained in the three cores. At the reverse end of the scale is Ersin Multicore Comsol alloy incorporating silver, with the comparatively high melting point of 296°C., shown for the first time at a National Radio Exhibition. Other new special types of Ersin Multicore Solder will be exhibited for technical engineers and research chemists of Electronic Manufacturers.

For workshops, and servicing organisations where a larger or more economical quantity of solder is required, the R5018 is recommended. This is a 1lb reel containing approximately 167 feet of 18 s.w.g. 50/50 alloy and retails at 15/-. This pack was specially designed in response to numerous requests from dealers and smaller engineering concerns.

Service Engineers will also be interested in the various Size 1 cartons of Ersin Multicore Solder available in 4 specifications, retailing at 5/- each.

Ersin Liquid Flux, for dipping purposes and other processes where it is not convenient to use Ersin Multicore Solder, is shown in 10oz tins. It is also supplied in 1gall cans and 5gall drums.

Ersin and Arax Solder Slugs and Pellets, rings and preforms, in a wide range of sizes and in standard tin/lead alloys are included on the Multicore Stand. Claimed to be more economical in certain soldering operations, the "shapes" are available with or without flux cores.

Arax Multicore, a cored solder wire with a washable flux residue, is also displayed on the Stand in similar specifications to Ersin Multicore.

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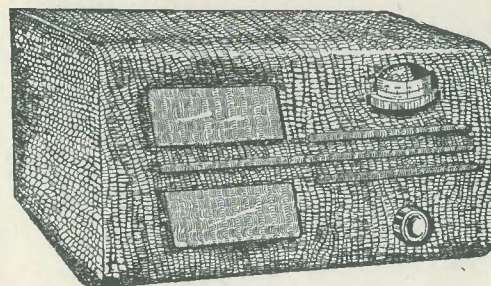
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