A BAND I CONVERTER

PRACTICAL TELEVISION

AND TELEVISION TIMES

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EDITOR
F. J. CAMM

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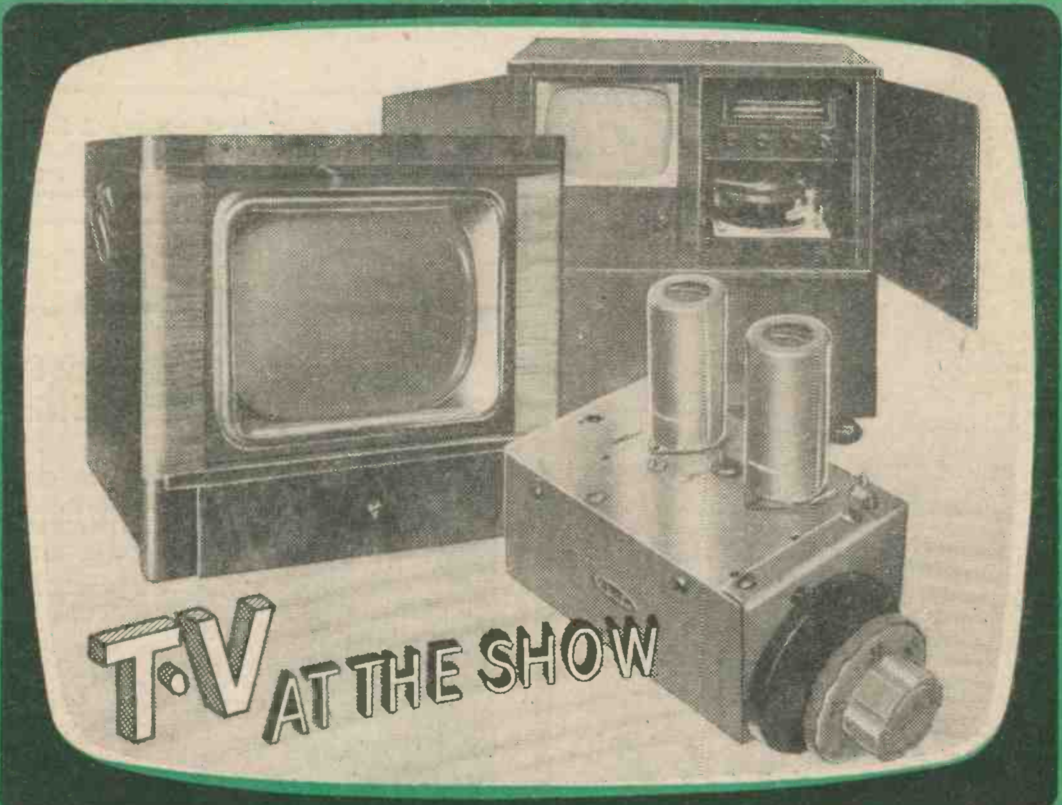

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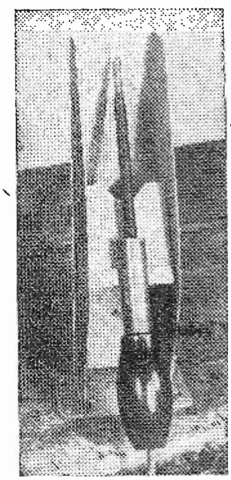

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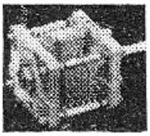

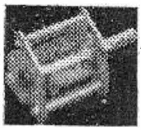

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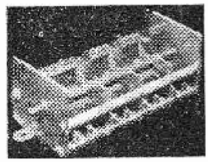

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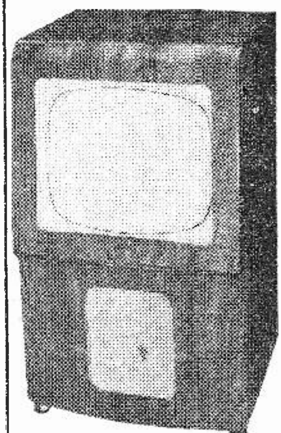

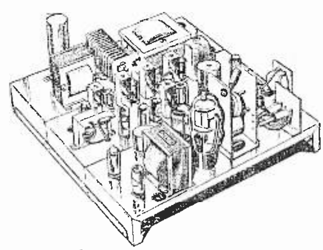

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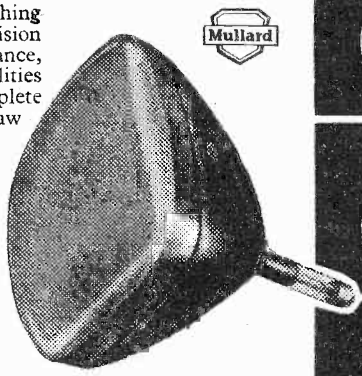

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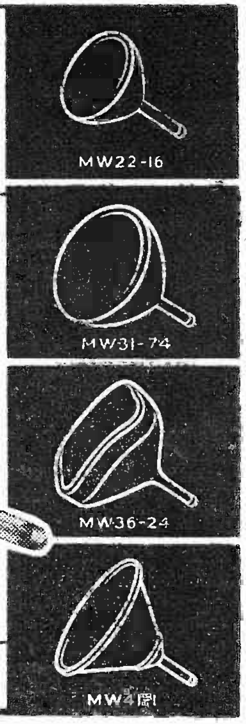
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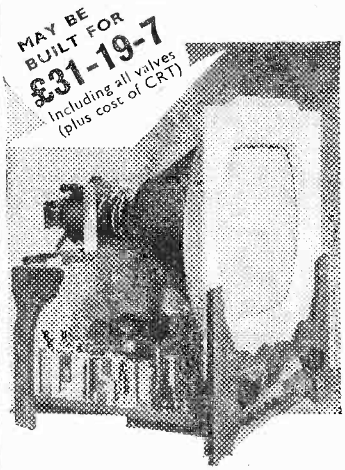
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Vol. 5 No. 53 EVERY MONTH OCTOBER, 1954

Televiews

THE RADIO SHOW

THIS year's Radio Show undoubtedly reflected the change for the better in our National fortunes. There was a buoyant attitude on the part of the visitors, no doubt aided by the relaxation in hire-purchase control. Attendance figures were up and so were home and export orders. The Radio Industry Council has, therefore, every reason to be gratified at the result of the show. We have on previous occasions criticised the catering and seating arrangements, and we are pleased to be able to report that there was some improvement this year.

One criticism which we have repeatedly made and which we must make again this year concerns the numbering of the stands. Numbers were conspicuous in most cases by their absence, and indeed when they were present they were inconspicuous. There were general complaints of the difficulty in locating particular stands. Such stand numbers as were put up did not arrive until the show was two or more days old. At our stand we answered numerous inquiries as to where particular manufacturers were located, and we understand that other stand holders were similarly besieged. It is not sufficient to argue that the pennants suspended above each stand were sufficient to enable the visitor to find his way about. Many stands did not have such pennants. Ours did not. Why is it not possible to have the stand numbers ready on the day of opening and sufficiently large in size for them to be easily recognised? The stand numbers were of miserable and easily overlooked proportions. May we once again suggest that next year it is made compulsory for stand numbers to be placed on the stands before opening day; that they should be at least one foot square and located in the centre of the stand. The visitor upon entering the exhibition buys a catalogue. He gazes through it and decides to inspect the products of three or four companies. This year he had to wander round the whole exhibition hoping to stumble upon those stands by accident. This may seem a minor criticism of an otherwise first-rate, well-organised and faultless exhibition. From the public point of view, however, it is of major importance. May we also suggest that now the interest in radio and television is approaching equality, next year the exhibition be called "The National Radio and TV Show"?

MULTI-CHANNEL RECEIVERS

ONE aspect of TV manufacture which is indicative of future tendencies is the marketing by a number of well-known firms of multi-channel receivers, with turret tuning, in anticipation of the opening up of a number of other TV transmitters, including commercial TV. Some manufacturers' receivers are designed to tune up to 13 channels. Five channels are already in operation and two more are promised to be under way some time next year. Are not manufacturers being a little too anticipatory? The only satisfactory method of designing such multi-channel receivers is by testing against transmissions as they will be, and not against laboratory tests and standards. It is, of course, important that when the new stations come on the air manufacturers should be ready, but we expect that when those stations do commence to function service agents will be kept extremely busy readjusting receivers. It seems to us that a convertor would have filled the bill for the time being.

Otherwise there were no outstanding developments in TV receivers, with the possible exception of the experimental 3D pictures demonstrated by one manufacturer who, at a previous Radio Show, demonstrated experimental colour TV. There is no evidence that either will be available to the public for some years to come, although they did demonstrate the possibilities of the future, and from that point of view were worth while in that they indicate to the non-technical public what is going on in the technical laboratories.—F. J. C.

No. 2.—PYE MODEL D18T AND VARIANTS

By L. Lawry-Johns

THESE models, which were mainly of the 9in. console and table type, employed a valve line-up of EF50s for sound and vision, EF50s for frame oscillator and output, line oscillator and sync separator. EB41s for sync clipping detection and limiting. PL38 line output, PZ30 main rectifier, PY31 booster diode, PL33 sound output.

A later 12in. console model in a period style cabinet with doors will be described at the end of this article.

One of the most common faults on these receivers is a decreased frame scan with a definite fold-over at the bottom of the raster. This is due to the frame output EF50 failing on emission. Increasing the "height" only serves to drive the valve off the straight portion of its characteristic and results in more "fold-over" at the bottom of the screen. If it (the EF50) isn't too "far gone," it may be changed with a valve in another part of the set which can afford a slight loss. However, if it is deemed too far gone, it should be replaced, and most readers will probably desire to use a VR91 ; however, it is rare that an ex-Service valve of this type will give a full scan. If a VR91 is to be used, however, it may be placed in some less critical part of the receiver and this valve, preferably with two black stripes across the top, placed in as the frame output. Several valves may have to be tried to achieve a perfect scan. If sync (line and frame) trouble is experienced, and is not due to the sync separator, the condenser, marked as C.56 in Fig. 2, should be examined. A loss of capacity here introduces some unexpected results, for although this is the booster reservoir electrolytic, it is connected in association with the line output, frame hold and brilliance control. Remember that the positive end goes to chassis.

Blown Fuses

Our old friend the PZ30 is a frequent cause of blown fuses. These valves often develop an internal short which not only does this, but can also burn out its anode surge limiting resistors. These should always be examined when a shorted valve is replaced ; they are easily located under the PZ30 valve base and can be seen in the power supply diagram, Fig. 1. They are both mounted on the same former and, as the PZ30 is in two halves, only one could burn out, leaving half of the valve to carry on working. This it may well do but the symptoms are obvious. A small blurred picture is most often evident, but sometimes the indication is only of a lack of height and width, the picture keeping a fair focus due to the H.T. drop not being so great. If at any time one of these surge limiters is found to be open-circuited, the PZ30 must be tested before the set is tried again with a new resistor.

Lack of E.H.T.

Whilst on the subject of these resistors, it may be mentioned that they are wire-wound, on a circular former and are coloured blue. There is room for a separate small wire-wound to be shunted across whichever may be open-circuited. If the line time-base is working happily, but no E.H.T. voltage is present on the tube anode, the EY51 E.H.T. rectifier may be located in the line output transformer can which has a removable side with screw fixing. The fact that the heater of the EY51 is intact is no evidence

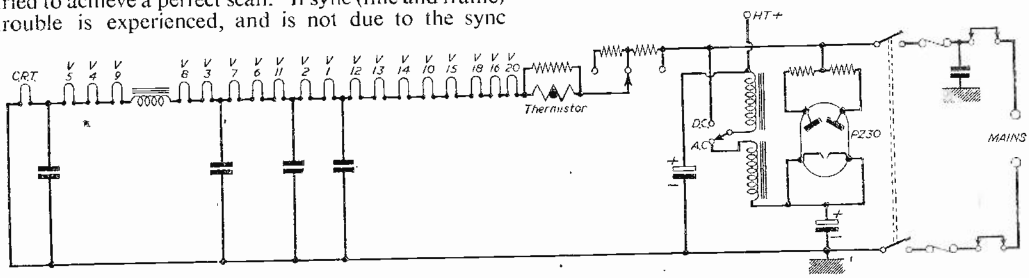


Fig. 1.—Wiring of the heater chain. The surge-limiting resistors to the anodes of the PZ30 should be noted—also the contacts that come before the fuses.

that this valve is not responsible, it may be down on emission or may have an internal short. In the event of a replacement not producing the required E.H.T., switch off, remove the tube connecting clip from the anode cap of the tube and suspend it safely away from any nearby metal parts. Switch on again and if there is now a good spark from an insulated screwdriver touching the clip, it may be assumed that the tube has an internal short or heavy leak which is overloading the E.H.T. supply.

Note that the EY51 has been replaced to rule out the possibility of its being unable to cope with the ordinary current demands of the tube. If, however, there is still no E.H.T., test the anode end (single wire) of the EY51 with the screwdriver for spark. If there is none present, the set should be switched off and a measurement made for continuity from here (anode of EY51) to the top cap of the PL38. No reading will indicate an open circuit over-wind. In most cases this will already have made itself known by sparking inside the winding. A break in the winding is often in a position where it can be repaired and the purchase of a new transformer is avoided. When working on the E.H.T. part of the circuit, remember to see that there are no sharp ends of solder. If a reading is obtained, it should be 300 ohms through the total winding, or 260 ohms from the cap of the PL38 to the other end.

Accessibility

When working on this chassis, it is an advantage to work with the back cover removed ; this can only be done by using a suitable plug to take the place of that fitted on the back cover. A couple of large wander plugs may be used but do not use screwdrivers, as these may touch something other than the contact springs and blow the house fuses. The set fuses are " later " in the circuit than the contact springs of the safety socket. A fault which can be misleading makes itself evident by the screen blacking out with occasional flashes of a bar of defocused white across it. These flashes occur mostly when the chassis is moved, and tapping the sliders at the rear will locate the source of trouble, the " brilliance " control. If the set is operated with this control at its minimum and enough " contrast " is available, a picture can be resolved, but this is begging the question and the control should be replaced. It is a 10 KΩ wire-wound potentiometer. It should not be necessary to point out that the brilliance is at the back and the " contrast " is on the front control.

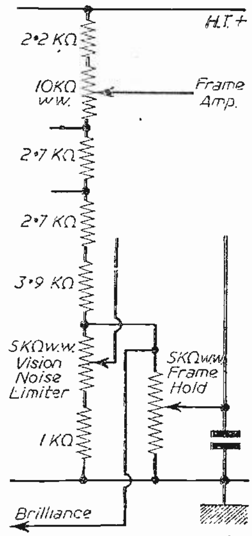


Fig. 4. — Potentiometer chain from H.T.+ to chassis.

Intermittent

If intermittent reception of sound or vision is experienced, the blame can usually be attributed to bad connections on the base of an EF50 holder, especially if the valves have recently been disturbed. The cure is to remove the valve, turn the chassis up and pinch together the relevant socket spring contacts. A pair of slim-nosed tweezers are of value to do this. Later models of the 12in. type referred to at the

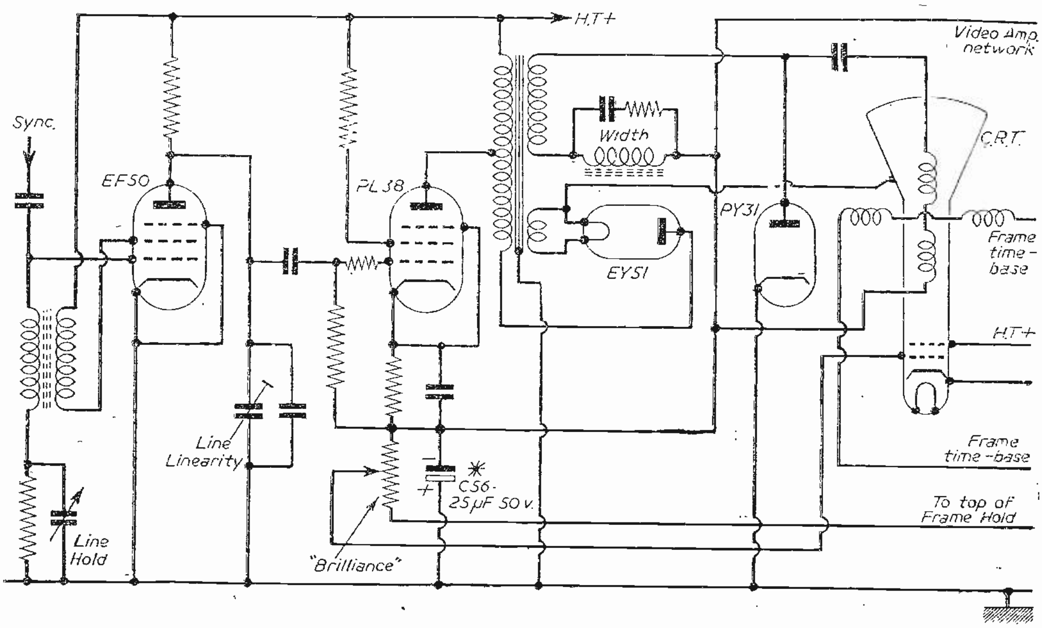


Fig. 2.—Circuit of the line timebase. Note that C56 is not only concerned with the line timebase boosting. C56 is located under the chassis in the centre of a triangle made by the valves V15, 16 and 18.

beginning of this article are fitted with a metal rectifier, rotary controls at the rear, and edge type controls which "peep" through the top of the flange above the tube.

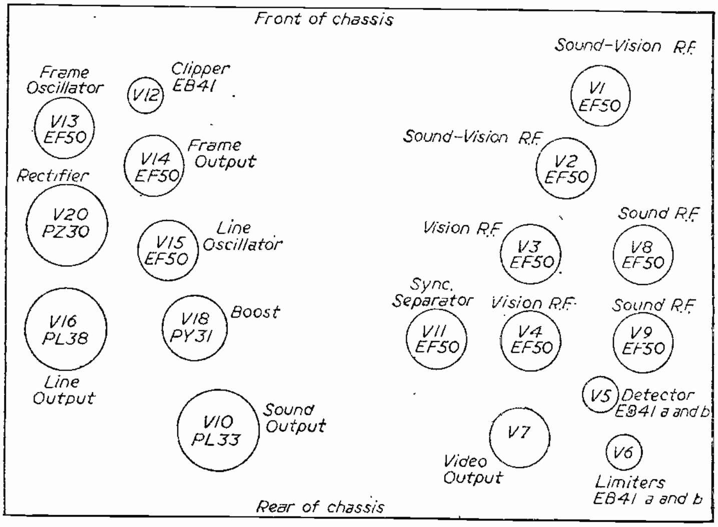


Fig. 3.—Top view showing valve line-up—with chassis horizontal.

These have also a "Metrosil" in the supply to the first anode of the tube. A "Metrosil" appears to be a small metal rectifier, but is actually a resistor of special type which is used, in this case, for boost purposes. (See September issue.) Do not try to measure the voltage on the tube side of this device; a reading of about 20 volts will be obtained on a normal meter, which is about 200 volts down. If the alloy screen which covers the later parts of the vision and sound circuits under the chassis is removed, it must be replaced with care as instability, or no signals, may result if this cover is not replaced properly! Ensure that the leads and covered components are not caught under the edges.

Vision and Sound Defects

If this plate has not been disturbed absence of signals is nearly always due to one of the first two EF50 valves at the front end failing on emission. Absence of sound should be traced to the EF50s on the right side looking from the rear, and vision defects only should be located on the strip to the left of these, Fig. 3. In Fig. 4 will be found the chain of resistors and controls, extending from H.T. positive to chassis. The values given should help in identifying them. The resistors are $\frac{1}{4}$ or $\frac{1}{2}$ watt carbon and the controls are wire-wound sliders.

The next article will concern the Bush TV 22 and 24 table models and their relatives in the console type.

Marconi Services Equipment

AT this year's Radio and Television Exhibition Marconi equipment was shown by both the Royal Navy and the Army and some of it was on public view for the first time.

One of the main features of the Army exhibit was a prophetic "Glimpse into the Future," where visitors were able to watch, on television monitor screens, the progress of an airborne strike against a nest of enemy tanks, as it might be televised from a helicopter hovering over a battle area.

To simulate this a large relief map, measuring 22ft. by 12ft., was constructed to form a realistic panorama of rugged foothills and open country, with a model airfield, roads, trees, a monastery and a village with its church and, not inappropriately, a cemetery. The tanks lurked in the foothills, under close observation of a helicopter, which had supposedly not only called up a squadron of fighter-bombers, but was also televising the entire action to H.Q.

The actual televising was handled by a new Marconi Industrial TV camera, sited high above the models and viewed the scene below with the same effect as it would if installed at a suitable vantage point under conditions of actual warfare.

Underwater Equipment

Marconi equipment likewise played a prominent part on the stand of the Royal Navy, where a realistic demonstration of underwater television was seen. Here again, the exhibit reproduced as nearly as possible the actual working conditions which would obtain during an exploration of the sea-bed. The Marconi-Siebe, Gorman camera used was, in fact, the one which was flown to Elba last March for the search for the crashed Comet.

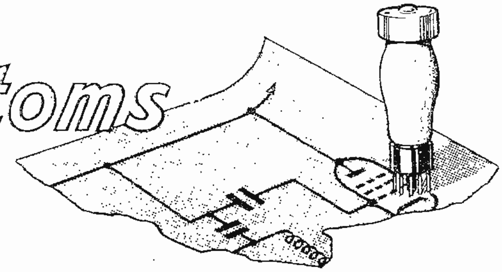
A large tank of water on the ground floor containing a model wreck, model divers and various species of fish gave a realistic representation of a typical underseas scene. Into this the underwater television camera was lowered.

A particularly interesting feature of this exhibit was that the camera with its periscope eye was entirely remotely controlled from the main Royal Navy stand in the Gallery above, where a control desk was installed, together with monitor screens.

Another section of the Royal Navy stand was devoted to a complete working replica of a modern Naval WT/RT Shore installation, manned by officers and ratings.

The Marconi television installation in the R.I.C. Exhibition Studios comprised the complete equipment both for the main (2-camera) studio and for the single-camera continuity studio, together with complete vision master-control equipment. The latter handled all incoming vision signals from seven different sources, monitored the programme and corrected any possible defects in signal level before passing the signals to the Exhibition distribution equipment whence it was distributed to the stands for demonstration purposes by the exhibitors.

Fault Symptoms



THE CAUSES OF COMMON FAULTS, AND METHODS OF CORRECTION

By Gordon J. King, A.M.I.P.R.E.

(*Continued from page* 166, *September issue.*)

BEFORE we continue it will be instructive to get this point clear and settled once and for all, for it is surprising—as revealed by our Query Service—the number of experimenters who appear unaware of the errors of their tests. Fig. 64 shows a potential divider comprising R1 and R2 connected between the H.T. line (300 volts positive) and chassis (negative) of a television receiver. The 30-ohm box also connected across the H.T. line is not an actual resistor, but simply represents the total impedance of the H.T. network.

Now let us connect a 100 *ohm per volt* testmeter—set up for 300 *volts full-scale deflection*—between points A and C. In its present condition the meter possesses a terminal resistance of 30,000 ohms (300 volts times 100 ohms per volt). So connected the meter will, therefore, take an extra 10 mA. (300 volts/30,000 ohms, or 1 volt/100 ohms—100 ohms per volt) from the H.T. source. There is little doubt that this additional current will be forthcoming without the H.T. line voltage falling by any appreciable degree, for 30,000 ohms across 30 ohms represents a small ratio. We can, therefore, be almost certain, provided the meter is accurate, that a reading of 300 volts will be obtained. The same will, of course, apply if a 20,000 ohms per volt meter is employed. Then the total current drawn by the meter will be 1/20,000 or 50 microamps only.

Now let us connect the 100 ohm per volt meter—still set up for 300 volts—to point B; or, in other words, let us use this meter to measure the potential across the 1 megohm resistor R2. In effect, then, the measured potential is that developed across R2 in parallel with the resistance of the meter (Rm)—30,000 ohms, which works out to something like 29,130 ohms—(R2 × Rm/R2 + Rm). The current in the circuit comprising resistance of magnitude Rt (for instance, R1 + (R2 × Rm/R2 + Rm) is, therefore, 300 volts divided by 1,029,130 ohms, or 0.2915 mA. Thus, the potential developed across the combination R2 + Rm/R2 × Rm, which is the effective measured potential, can be worked out to something like 8.4 volts!

From this simple illustration of a simple potential divider formed by two 1-megohm resistors it is clear to see that the actual potential at point B, when undisturbed by the meter, is 150 *volts*. A fantastic voltage error is thus recorded by a meter of low or medium sensitivity.

A 20,000 ohm per volt meter connected to the same point in the circuit will register something like 136 volts. This is not so bad, of course, but even so the desirability of making corrective calculations when dealing with high resistance circuits is clearly revealed.

Now to get back to the symptom of uncontrollable brilliance and Fig. 64. We shall almost certainly discover that a potential positive relative to chassis does exist at the picture-tube grid. There is, of course, the possibility that the brightness control itself is open-circuit at the earthy end, in which case the grid will remain at a steady potential irrespective of brightness control setting.

In certain sets a resistor of fairly high value is included in the brightness control circuit at the point marked X on the diagram. If, therefore, the grid potential is unaffected by the brightness control this resistor should also be suspected for open-circuit. If, in a receiver employing such a resistor, a leak (collapse in insulation) develops in the picture-tube between the first anode and the grid—this sometimes

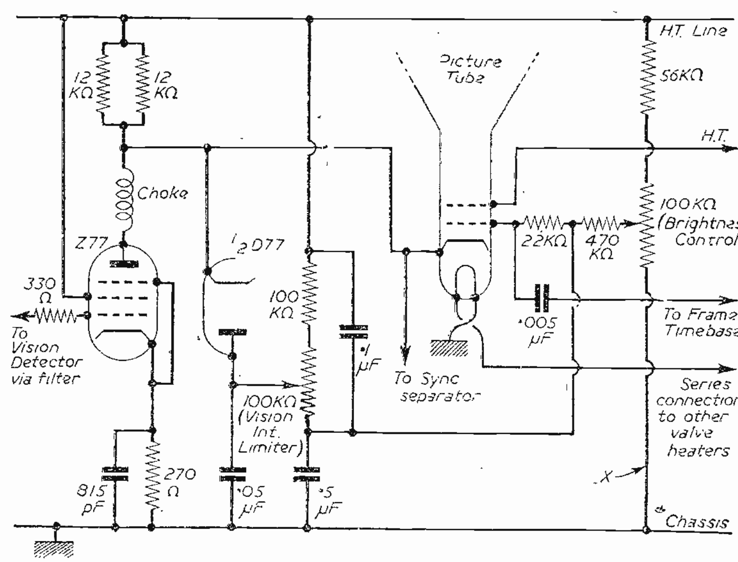


Fig. 63.—Circuit showing the video amplifier, vision interference limiter, and tube control circuits in the G.E.C. 6641 series receiver.

occurs—the grid is held positive, even at minimum brightness setting, and the same symptom results. A small degree of grid/first-anode leakage may not provoke uncontrollable brilliance, but may just prevent the brightness control from extinguishing screen illumination completely. A grid potential

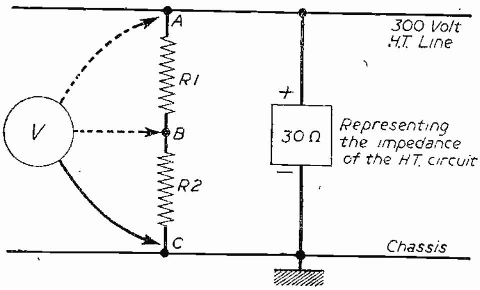


Fig. 64.—Illustrating the effect of voltage measurements across a load.

test may have little assistance in establishing this fault, since the resistor in the earthy side of the control will give rise to a positive potential even when the control is turned right down.

If a tube fault of this nature is suspected it can frequently be proved by measuring the potential at the grid electrode after first removing the connecting leads. This is when a high resistance meter is essential, for generally the grid/first-anode leakage path—if present—represents an extremely high resistance value, and, in any case, the resistance of the first-anode circuit is in itself very high.

These tests will soon make decisive whether the grid circuit is at fault, and, as a rough guide, it often follows that a picture is faintly discernible on the very bright screen only if the uncontrollable brilliance is the result of a defect somewhere in the grid network.

Conversely, therefore, an uncontrollably bright screen with no sign of modulation should lead one to suspect trouble in the cathode circuit. There is, of course, one exception here, and that is in cases where the grid of the tube is modulated directly from the video amplifier. Most directly viewed sets use so-called cathode modulation these days, however, and, although we are basically considering this type of circuit, the general mode of fault analysis will suffice for these cases (see also "No Raster," PRACTICAL TELEVISION, July, 1952).

After having established that the symptom is not the result of a fault in the grid circuit we shall be almost certain to find that the potential at the cathode is zero or, at least, much less positive than normal. Further investigation will probably show that this is due to a short to chassis on the tube cathode circuit. The circuit at Fig. 63 shows one side of the tube heater connected to chassis; clearly, then, an insulation collapse between tube heater and cathode within the tube will provoke the symptom.

A tube defect of this nature is a frequent cause of uncontrollable brilliance, as most of us are aware. In the circuit under discussion the valve heaters—as well as the tube heater—are connected in series; and in conjunction with a suitable dropping resistor the combination is connected across the mains supply. In receivers of this kind one side of the tube heater is invariably connected directly to the receiver chassis. This facilitates H.T. and heater design problems, for it then becomes feasible to connect one side of the mains supply directly to the chassis—it is always advisable to ensure that this is the neutral side.

To save the immediate expense of a new tube, and particularly if the faulty one has good emission and the screen is in no way impaired, the tube heater can often be energised by means of a special isolating transformer. The isolating feature of the transformer disunites the tube cathode-heater (the two electrodes now being considered at the same potential) from the chassis or H.T. negative.

From the D.C. aspect all is now well since the tube grid/cathode-heater potential reverts to normal, and a correct control of picture brightness can be obtained. It is, however, of extreme importance to consider also the problem from the video frequency aspect. Under normal operating conditions very little capacitance exists between picture-tube cathode and receiver chassis, for apart from the circuit design the design of the tube also contributes in this respect. The inclusion of a transformer tends to enlarge considerably this capacitance, and special care must be taken to ensure that it is maintained at a low figure. This is necessary in order to avoid serious attenuation of the higher frequency portion of the picture intelligence; for clearly, not a great deal of capacitance is needed to create a relatively low impedance by-pass route for the picture signals at the 2 to 3 Mc/s end of the spectrum.

Poor picture quality originating from this cause can be avoided by employing an isolating transformer possessing low inter-winding and winding to core capacitances. With the series heater arrangement a transformer having a primary winding suitable

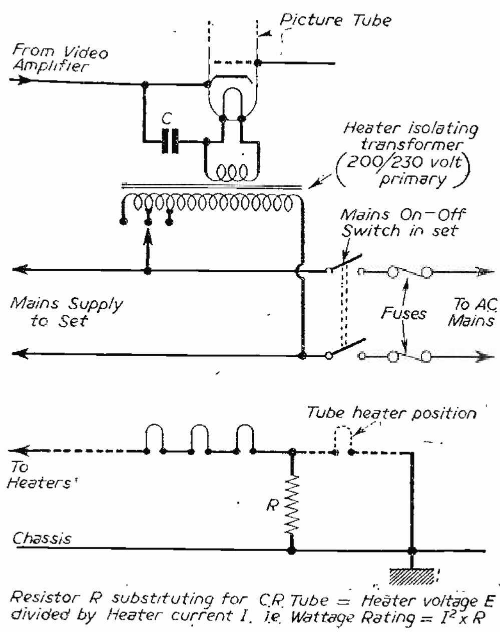


Fig. 65.—Diagram showing the method of connecting a heater isolating transformer in an A.C./D.C. type receiver.

for the mains supply in use is demanded. An A.C./D.C. receiver of this kind which is working from a D.C. mains supply cannot, of course, be adapted in this way. Adjustment to the heater line to compensate for the exclusion of the tube heater can be made by substituting by a wire-wound resistor as indicated in Fig. 65. The resistance value can be readily computed from Ohm's law, and care must be taken to ensure that the component used is capable of handling the power normally consumed by the tube heater.

To facilitate switching, the primary of the transformer should be connected to the receiver side of the on/off mains switch as shown in the illustration. Capacitor C (about 0.1 microfarad) connected between heater and cathode simply stabilises the circuit from the video frequency aspect, and minimises picture quality variation that might otherwise occur should the heater to cathode short be of an intermittent nature.

The circuit at Fig. 66 illustrates the method of connecting a 1-to-1 ratio isolating transformer to a set that makes use of a winding on the mains transformer to energise the tube heater (a transformer of this type must not be used in the previously considered type of circuit). Some sets have a separate winding for this purpose, while others make use of the normal valve heater line. Where a separate winding is used it is not always connected to the receiver chassis, for we have already seen, for instance, that in the Cossor 916 series the winding—and thus the tube heater—is connected to a positive potential as a method of achieving a low heater to cathode potential.

The Factor of Impaired Picture Quality

In receivers where the tube heater winding is left floating a heater to cathode short in the tube will not be revealed by the symptom of uncontrollable brilliance. Here the inherent high capacitances of the mains transformer will absorb most of the high-frequency content of the picture signal and poor picture definition will be well in evidence. In a lot of cases a tube defect of this nature is intermittent, and can be stopped and started by *gently* tapping the neck of the tube—this, in fact, represents a reliable test for quickly establishing an intermittent heater to cathode short.

Owing to the intermittency of the fault under normal operating conditions the resulting picture of poor definition often appears to be pulled to the left-hand side of the screen, and it is not always the whole of the picture which suffers this disturbance, for it frequently happens that a horizontal band of picture becomes displaced to the left of the screen. This slightly displaced picture section appears blurred and lacking in definition and flickers across the main picture at intermittent intervals.

It is worthy to note here that isolating transformers possessing a useful range of secondary voltages are now readily available to the experimenter; 1-to-1 ratio transformers can also be obtained from most radio dealers. Should it be required to overrun the tube heater to achieve a brighter picture from a tube which, apart from having a heater to cathode short, may also be low in emission, an isolating transformer providing a boost voltage can be used (see "Dim Picture" previously covered in this series).

The writer has found it desirable to use a 1-to-1 ratio transformer where possible for this type would appear to possess less inherent capacitances as compared with the 200/250 volt primary kind, and thereby ensures that the very maximum of definition is obtained from a defective tube.

Another fault that often deprives the picture-tube cathode of a positive potential is a heater to cathode short in the vision interference limiter diode. It will be seen in the circuit of Fig. 63 that the cathode of this diode is in direct contact with the tube cathode; therefore, apart from short-circuiting the video

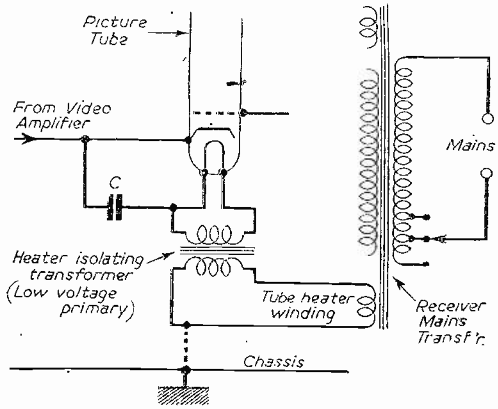


Fig. 66.—The method of connecting a 1 : 1 ratio isolating transformer in certain sets of the A.C. type.

amplifier anode voltage by reason of the valve-tube heater chain, a heater to cathode short in the diode will also tend to inject a 50 c.p.s. voltage into the picture-tube cathode circuit. This is because the diode heater is positioned in a relatively high A.C. potential section of the series chain, and not at the chassis end as with the tube heater.

In most cases of this fault the resulting symptom of uncontrollable brilliance will be accompanied by a shading of the raster from top to bottom; essentially, this takes the form of a hum-bar superimposed on the bright raster. It should be mentioned, however, that a slight evidence of hum may accompany the symptom when it is due to a tube defect, and this is especially true if the heater to cathode short occurs towards the high potential side of the heater, or if, as opposed to a total short between the two electodes, the insulation property diminishes or becomes impaired in any way.

During the normal course of investigating the symptom of uncontrollable brilliance it must always be borne in mind that a defect in the video amplifier valve feed circuit could possibly be responsible; mainly, of course, if the fault reduces, or removes completely the anode voltage from the valve, or if a fault occurs in the circuit coupling the video amplifier valve anode to the cathode of the tube. An associated resistor becoming high in value or open circuit is the chief offender in this respect.

(To be continued.)

A GATED A.G.C. SYSTEM

DETAILS OF A NOVEL CIRCUIT FOR PROVIDING A.G.C.

By K. Cummins

MUCH attention has been focused recently on the use of gated systems for vision automatic gain control. It is a well-known fact that the rectification of the composite video signal will not give a true indication of the signal level, and tends to bring all the pictures to the same brightness level.

Two methods of gating the A.G.C. system are available. The " back porch " of the line sync pulse represents the true signal amplitude, and so do the 10 blank lines in the post-frame pulse suppression period.

Sampling the line pulses has the disadvantage that phase differences, due to ghost images and reflections, will upset the accurate operation of the system.

Phase shifting, however, is negligible at frame frequency, and for this reason frame gating has been employed in this circuit.

Three valves are shown in the diagram, but two, the controlled I.F. stage V1 and the sync separator pentode V3, will usually be included in most televisor designs. Only the gating valve V2 will be required.

Operation

The operation of the circuit is as follows: The I.F. amplifier V1 is biased to cut-off by the resistor network to H.T.+, arranged in its cathode circuit. Thus, to obtain full gain, the A.G.C. line must be driven positive with respect to the chassis.

The A.G.C. line is connected to the cathode of the gating valve V2. The anode of V2 is connected to the rectifying circuit shown. It is essential that the sawtooth waveform at the frame output anode has a negative sense, i.e., has a positive fly-back pulse. The positive fly-back pulses are rectified by the RM2 metal rectifier, and applied to the gating valve anode. The 0.01 µF capacity from the anode to earth sustains the positive potential for the duration of the post-frame pulse blackout.

Thus the valve conducts only during the blackout period.

Let us now turn to the sync separator, V3. As is usual with this type of circuit, the grid is driven with negative video, and builds up a negative bias by grid-current flow. The value of this bias will represent the signal strength during the 10 blank lines mentioned.

The contrast control is fitted in the cathode circuit of the sync separator. Increasing the resistance will cause the whole grid-cathode circuit to rise in potential positively above earth. The sync separator grid is connected to the gating valve grid via a 2.2MΩ. resistor.

Now consider what happens when the contrast is turned up (resistance *in* circuit). The potential of the sync separator grid rises, together with that of the gating valve grid.

The gating valve then conducts heavily when the positive pulses are applied to its anode, and so its cathode drives positive. A series of large positive peaks are available at the gating valve cathode. As these are all in the same sense, rectification is not required, only smoothing, to obtain a steady D.C. potential. The positive potential so produced " opens " the I.F. amplifier.

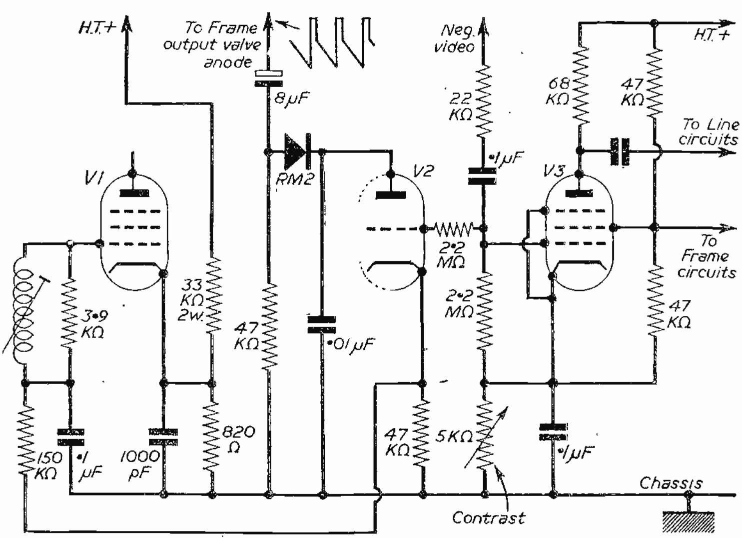
If the signal strength increases, negative bias builds up across the grid resistor of the sync separator in an opposite sense to that positive voltage produced across the contrast control. Thus, during the sampling period, V2 is rendered less conductive, less positive A.G.C. bias is available, and the gain of V1 is reduced. Of course, this applies conversely if the picture fades.

It may be seen that the setting of the contrast control adjusts the level at which the A.G.C. system operates, and hence the overall gain of the receiver.

The effectiveness of the circuit may easily be checked. During some aeroplane flutter, short the gating valve grid to the sync separator cathode.

The loss of A.G.C. will then be very apparent. In the author's receiver, flutter which caused the tube alternately to black out and overload was reduced to a slight flicker.

To check the effectiveness of the gating system, connect V2 anode to HT+. V2 will then be continuously conducting. The A.G.C. will tend to " level out " all scenes, and the black level will change with the scenes. Incidentally, this shows that V2 is actually a cathode-follower, with H.T. only applied during the blanking period. The 2.2MΩ resistor connecting the gating valve grid to the sync separator is important. Under very low signal conditions, V2 may be inclined to draw grid current



Theoretical circuit of the A.G.C. scheme.

while its anode is cut off. The 2.2MΩ resistor prevents this having any serious effect on the sync separator.

Note that the large values in the A.G.C. line (0.1 μF. and 150 K) are essential to provide adequate "smoothing" of the V2 cathode pulses. Too low a value of condenser, for example, will result in high contrast at the top of the picture, and low at the bottom, with a uniform gradation in between.

Actually, the number of components required is quite small, together with some re-arrangements in the existing circuit. The valves used originally were V1, V3, SP61, V2 ½ 12AT7, but almost any R.F. TV pentodes could be used for V1 and V3. A high-slope triode should be used for V2.

The Bandwidth Problem

HOW VALVES AFFECT QUALITY

THE newcomer to television is often puzzled by the fact that valve types which he knows to give good results in other applications are not used in television. Thus, an enthusiast who has built many quality amplifiers is surprised to find that valves like the EF37A do not seem to be used.

"Why," he will say, "when these valves give such a good distortionless performance in Hi-Fi amplifiers are their advantages not used in television?" The answer is, of course, that such valves were intended for purposes other than television. Consequently, their characteristics are not suitable for television. Let us examine a simple video amplifier stage and see why this is.

Below the basic amplifier circuit is shown. The output voltage for an input swing on the control grid of one volt peak to peak depends on the mutual conductance of the valve and the value of its anode load resistor R. The actual value is given by the product of the mutual conductance (in milli-amps per volt) and the value of R (in thousands of ohms). A common value for R in a video amplifier is between 3 KΩ and 10 KΩ. For our example let us assume a value for R of 5 KΩ. Using an EF37A, this will give us a gain of 1.8 times 5 (mA/V times anode load in KΩ) which is equal to 9. Using an EF91, still with the same anode load, we get a gain of 7.6 times 5, which is 38. This increase in gain by using an EF91 is not the whole story however. To see the full advantages we must now consider the stray capacitances. For our purpose, the most important one is the anode to earth capacitance of the valve.

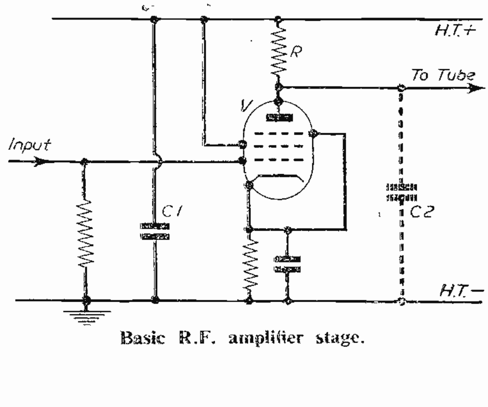
With an EF37A in a good layout, the value of C2 in Fig. 1 will be about 18 pF, of which 8.5 pF will be due to the EF37A itself, about 7 pF due to the picture tube and its holder, and the rest due to the wiring. The value of C1 is always chosen to be a very low impedance at all the frequencies handled: a common arrangement is a 64 μF with a 0.1 μF in parallel. Because of this we can say with truth that the upper end of R is short-circuited to earth *as far as signal currents in the amplifier are concerned.* But this leads us right to the big catch: C2 is in parallel with R as far as signals are concerned. This means that as the frequency handled by V rises, the gain provided will fall. At 10 kc/s, the reactance of C2 will be about 1 MΩ and will not noticeably shunt R. The gain of the stage will be nine times as arrived at earlier. At 100 kc/s, the value of C2's reactance will have become about 100 KΩ and can still be ignored. When the input frequency is 1 Mc/s the reactance of C2 will be about 10 KΩ and can no longer be ignored. At about 2 Mc/s, the reactance of C2 will equal 5 KΩ—the value of R. As a result of this, the effective anode load of V falls to 70 per cent. of its value at low frequencies. (It does not fall to 50 per cent. as might be thought at first sight because of the phase difference between the current in the capacitor and that in the resistor.) Thus we see that our EF37A stage would give a gain of nine times up to about 200 kc/s and would then start to show signs of loss of gain which continue the higher the frequency, at 2 Mc/s the gain being 70 per cent. (3 db down) of its peak value.

Another Example

Let us now take the same stage with an EF91 valve. In a good layout, the value of C2 would be at least 6.5 pF less than in our previous example. A representative value would be about 11 pF of which only 2 pF is in the valve. At 10 kc/s, the gain will be 38 as previously calculated. At 100 kc/s, the reactance of C2 will be about 80 KΩ and its shunting effect on R can be ignored. Indeed the frequency has to be almost 3 Mc/s before the reactance of C2 falls to 5 KΩ. From this we see that a stage using an EF91 will give more gain and more bandwidth than one using an EF37A. Now there is a bartering facility between gain and bandwidth which it is as well to remember.

Suppose that a gain of nine times was all that was required in the circuit of Fig. 1: We know that an EF37A will provide this gain and be 3 db down at about 2 Mc/s. To get a gain of nine times with an EF91 an anode load of about 1.2 KΩ is required. If we have such a value of anode load resistor and an anode stray capacitance of 11 pF as before, the frequency has to be almost 13 Mc/s before the gain falls to 70 per cent. of its design value.

The previous examples have shown that for a wide bandwidth the valve used should have a high value of mutual conductance and at the same time have low output capacitance. They have also shown that for any valve there is fixed product given by multiplying stage gain and bandwidth. These examples



Basic R.F. amplifier stage.

have not considered the amount of output voltage required. Returning to the stage using an EF91 with an anode load resistance of 5 $K\Omega$: This would be suitable for use in a television receiver as the video frequency amplifier at least as far as frequency response is concerned. An anode current swing of 15 mA is within the rating of the valve. So we should be able to get a maximum output voltage swing of at least 75 volts. This is more than adequate to meet all needs for video-amplifier uses.

If we consider the EF37A arrangement with an anode load resistor of 5 $K\Omega$: it is rather poorer as far as frequency response is concerned. Further, an anode current swing of more than 6 mA is not likely to be possible. So from this stage we should be able to get an output voltage swing of only 30 volts, which is rather less than adequate in that it allows no margin for loss of gain or output voltage swing as the valve ages.

Scope Difficulties

So far we have only thought of modulating a cathode ray tube on either its grid or its cathode. Turning now to the feeding of the plates of a tube, we see that the difficulties are even more acute. Not only is a much greater output voltage swing required, but the stray capacitance is higher because of the deflector plate. As an example let us take a VCR138. These tubes seem to need about 250 volts swing on the more sensitive of the pairs of plates when the anode voltage of the tube is 2 kV. It is usually best to deflect electrostatic tubes with a push-pull circuit to avoid astigmatism. If this course is taken, each of the valves has to supply an output swing of 125 volts. The capacitance of any plate to earth is about 30 pF. As a result of this the total stray capacitance across the anode load is increased. With a good layout using an EF91, the value of C2 in Fig. 1 will be about 35 pF. To get an output swing of 125 volts with a current swing of 15 mA, we need an anode load of just over 8 $K\Omega$. Suppose we use a value of 8.2 $K\Omega$, because it is a preferred value: the gain will fall to 70 per cent. of maximum when the reactance of 35 pF equals 8.2 $K\Omega$. This happens at a frequency just above 550 kc/s. So we see that if the amplifier is to be able to fill the screen, it cannot have a bandwidth much above 550 kc/s—unless we change the valve for one capable of a greater anode current swing and having no more stray capacitance.

From the foregoing, the reader will have seen the need to choose a valve for a wide-band amplifier which has a high ratio of mutual conductance to anode capacitance. In addition, the valve should be capable of sufficient anode current swing to produce the required output across the value of load resistor dictated by frequency response considerations. Whether compensation is used or not does not materially affect a comparison between valve types, because compensation will improve the performance of each valve by the same percentage. Compensation might in a border-line case be just sufficient to improve the performance of a low current valve to allow its use rather than one using rather more current. However, this is not likely to happen often, and in any case does not affect the basic fact of each valve's own gain times bandwidth product. Consequently, compensation has been ignored in the foregoing consideration. S. C. MURISON.

Cheaper Industrial Television

PRODUCTION is announced by Marconi's Wireless Telegraph Co., Ltd., of a new Industrial Television Equipment which is smaller, lighter and cheaper than any other at present available in this country.

Industrialists have long foreseen that the use of closed circuit television in their offices, plants and workshops could have immense potentialities for time and labour-saving, provided that the price was reasonable. The new Marconi Industrial Television Equipment, which sells in the region of £500, at last makes the vision a practical reality.

The power consumption of the equipment is as low as 100 watts—no more than that of the larger size of domestic electric lamp. Plugged to any power socket it will operate for 10 hours for the cost of one unit of electricity.

The new camera measures only 5¼in. x 4in. x 11⅝in. Some idea of the miniaturisation achieved may be gauged from a comparison of weights with an average studio camera. The latter averages about 140 lbs. The Marconi Industrial TV camera weighs 4½ *lbs. only*.

Of equal importance is its simplicity of operation. The camera itself houses only the tube, three valves and associated circuitry, so that the likelihood of faults is reduced to a minimum. After initial setting-up it works unattended, simple control being effected from the remote control point, and requires no more skill than is involved in the operation of an ordinary television set.

The new Marconi Industrial Television camera does not, of course, in any sense replace the standard television broadcast camera. It is essentially a tool for the industrial and commercial fields; a time and money saver which may well change the pattern of many of the present production techniques.

The camera, or cameras, are merely set up to view a desired scene. The pictures are fed by a cable to a control unit and thence to a monitor screen, or screens, up to a distance of 2,000 ft. away.

Continuous Use

In this way, for example, a continuous watch may be kept, from a central control office, on various instruments located in widely separated points of a factory. Boiler-gauges, thermometers, revolution counters and power control-board meters may now all be monitored from one place, with consequent economy of man-power. Production lines can likewise be co-ordinated and, by means of the overall picture obtained, incipient bottlenecks foreseen and avoided. The checking of water-levels and flow-meters in hydro-electric projects can similarly be carried out.

Many industrial processes which have hitherto been too dangerous to view at close quarters may now be subjected to minute scrutiny. Innumerable applications suggest themselves; tests-to-destruction, the study of the combustion conditions in a boiler, or even assessment of the amount of smoke coming from a factory chimney can now all be viewed from the security of an office.

A Converter for Band I

A SELF-POWERED A.C./D.C. UNIT

By R. T. Parsons

WITH the commencement of the BBC television service from various low-power stations covering small areas throughout the country two alternatives are available if the new local station is to be received. If the existing receiver is a one-channel T.R.F. circuit it means altering a whole string of coils in both vision and sound receivers, or, alternatively, building a converter for the new channel in use. A converter has the advantage of leaving the main receiver untouched so that at any time it may be used on its original frequency alignment.

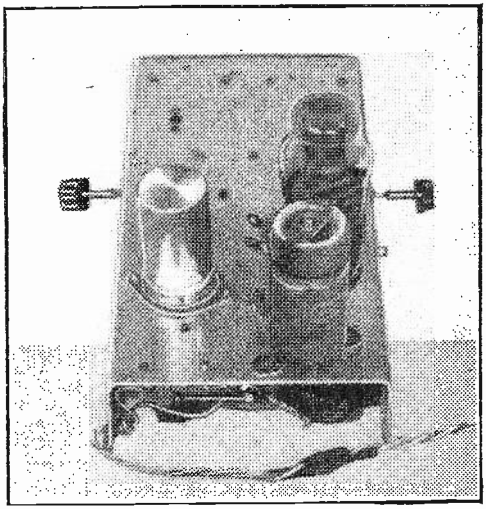
The following data relate to a converter which has been made in the Brighton area.

Valve Line-up

R.F. stage. E.F.50. Mixer germanium diode GEX00 (general purpose diode). Twin oscillators, 955 acorns and the rectifier a U31.

Circuit Design

There are two options regarding choice of oscillator frequencies. A single oscillator can be used at 11.75 Mc/s, or twin oscillators working on 94.75 Mc/s, and 101.75 Mc/s, for sound and vision respectively. The writer decided to ignore the low oscillator system because of the risk of fourth harmonic patterns on the 45 Mc/s circuits of the main receiver due to its bandwidth. It was therefore decided to design a somewhat unconventional type of converter, using twin V.H.F. oscillators and making use of a germanium GEX00 mixer as well as the small 955 acorns which are specially designed for V.H.F. circuits.



The completed unit.

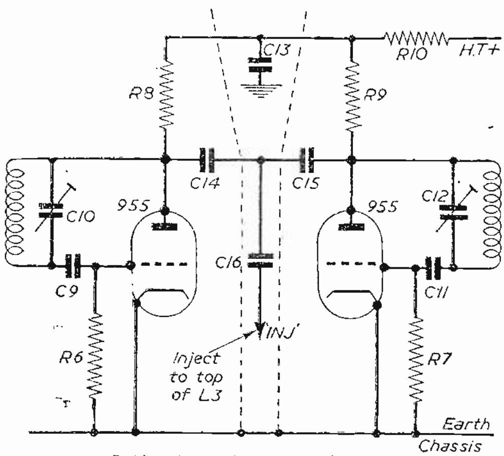


Fig. 1.—Circuit of twin oscillators. The broken line indicates the screen between the two oscillators.

Circuit Description

R.F. stage. Little need be said of this as it is a conventional R.F. stage capacity fed to the mixer. (See text for component values.) The coil has two windings, aerial two turns, and grid six turns wound in close proximity with individual turns separated by $^{1}/_{64}$in. The former is $\frac{1}{2}$in. diameter and the wire 24 gauge enamelled.

The Mixer Stage

Here a GEX00 germanium diode was used with marked success. The stage is screened into two sections, as shown in photo and circuit. One compartment contains the input coil, tuned to channel three in the writer's case, together with associated components and circuitry. The other compartment houses only the output coil, tuned in this case to channel one, and the condenser feeding it from the mixer stage. The mixer stage input coil L3 is similar to the R.F. coil except that it has no coupling winding and consists only of six turns spaced as the R.F. coil. The circuit is self-explanatory, and little trouble will be experienced once alignment has been made. It is pointed out that it is to the top of this coil L3 that the injection from the twin oscillators is made.

The Mixer Output Coil

Here we have two windings again wound as for the R.F. coil, but the larger winding to consist of nine turns with a two-turn output coupling coil to the main receiver. *Note:* The input coupling coil and the output coupling coil are tied down to chassis and earth line through .001 μF condensers, and it is *most important* that reliable mica condensers be used in these positions to isolate the aerial and the main receiver from the mains supply to the converter. These precautions *must* be observed as the equipment is *universal mains* operation. Also *no earth may be* *affixed to the equipment direct* under any circumstances. As the chassis may be live in some conditions the whole assembly *must* be housed in a wooden cabinet of some description and the oscillator adjusting controls be fitted with knobs of reliable insulating properties.

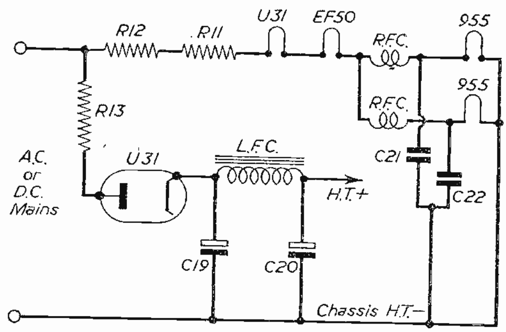


Fig. 2.—Universal power pack built into unit.

The Twin Oscillators

The oscillator circuits are identical in every way except for final alignment and also symmetrical layout of components is achieved by inserting one 955 acorn into its holder upside down. Refer to photo and the vision oscillator acorn will be seen upside down top left of picture.

The Circuit

This is a conventional Colpitts, and the coils are tuned by small condensers, screwdriver-adjusted type, to set the band and then final frequency adjustment is made with the iron-dust cores which have been extended into the standard ¼in. spindle to take small knobs. The coils are each of five turns space wound of 18 s.w.g. tinned copper and are wound on Denco formers and fixed to the sides of the chassis. The heater arrangement is that these two acorns are in parallel, as they are rated at only .15 A., and they come last in the heater chain. One side of their heaters is therefore joined to the chassis line. An R.F. choke of appropriate size is in series with each 955 filament lead on the high side, and a by-pass condenser of .0005 μF is used to chassis. The chokes can be one quarter wavelength of wire, 24 s.w.g. enamelled copper, wound on ¼in. diameter ebonite rod. A length around 30in. of wire will be suitable. It should be noted that condensers C9 and C11 must be reliable to protect the valves from the application of H.T. to the grids. The H.T. supply is kept to the minimum to reduce unwanted radiation consistent with good mixing, and it is found that the main 100 KΩ resistance and the individual 8.2 KΩ resistances in each valve anode circuit reduced the applied H.T. to 33 volts, and each valve passed just over 1 mA. Each oscillator must be completely screened from its neighbour and any power leads passing through the other stages must also be completely screened. The feeds from each oscillator, C14 and C15, are in their respective oscillator compartments, but C16, to which these two connect for injection into the mixer, is housed in the mixer stage, connection being made through grommets in the compartment screens.

Power Pack and Heater Chain Wiring

The power pack is a conventional A.C./D.C. half-wave circuit with normal smoothing, except that a small ex-Service choke is used to economise in space. The circuit here is self explanatory. The heater chain is from mains to mains dropper .3 amp., thence to Brimistor .3 amp, then on to the EF50 and the two 955 acorns and to chassis. The entire circuit is contained on the one chassis, which measures 10in. x 5in. x 2in. The bottom and sides of the chassis *must* be completely enclosed by a metal screen to complete the screening of the unit.

Setting up for Operation

The R.F. and mixer stages are fairly simple to align and should be so adjusted as to give good results on both sound and vision. To set up the oscillators the writer used a calibrated super-regen. receiver and set the two oscillators to 94.75 and 101.75 Mc/s by this, and it was sufficiently accurate to provide both vision and sound when the unit was put on test, although, of course, final adjustments had to be made to get the best results. When setting up the oscillators the vision should be obtained first and then the sound brought in, but at no time should the vision be allowed to disappear, and each time the sound oscillator pulls the vision the vision oscillator must be readjusted to get a perfect picture. A position will be found eventually where both vision and sound are received satisfactorily. However, the main require-

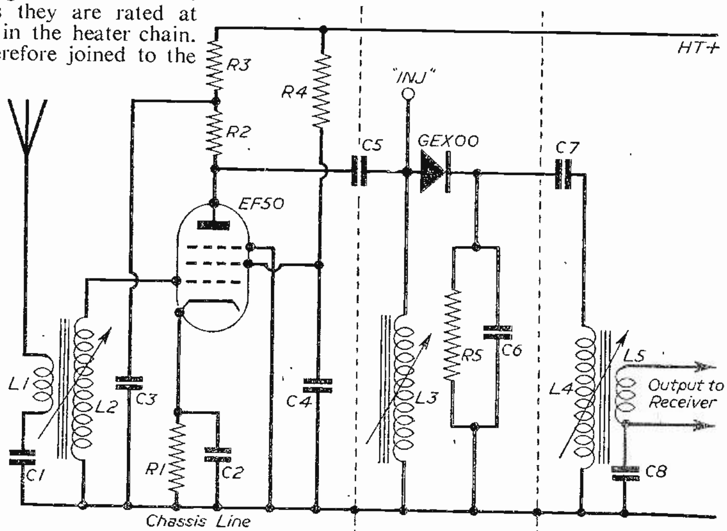


Fig. 3.—Complete circuit of the converter. "Inj" at top of L3 is connected on oscillator circuit.

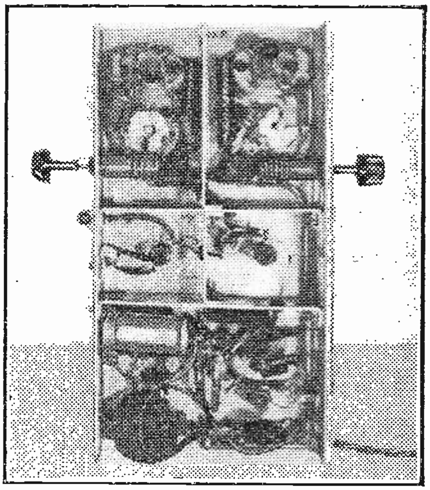
ment is patience—the writer spent the best part of an hour before the unit was aligned to his satisfaction.

Patterns

The writer has been asked about patterns on the screen from two oscillators, as this seems to frighten many hardened TV constructors. Patterns will be evident if the unit is incorrectly aligned, and also it is possible to produce a dotted line raster which gives a delightful " matt " effect to the picture, but once correct alignment is obtained there is little trouble in this direction.

Stability

It will be noted that no stabilising system, has been employed on this circuit and it has not proved necessary. The vision oscillator coil core can be sealed once correct alignment has been obtained, but for minor adjustment it is found better not to seal the sound oscillator core trimmer as there is slight drift here whilst the set is warming up and the effect is felt for about two minutes after first switching on. A slight adjustment of the sound oscillator core at the start of the programme will put everything in order and a final retrim after the first five minutes and then everything remains stable for unlimited periods. The writer believes that the slight pattern experienced at the start of a viewing session is due to the fact that there may be somewhat more than 7 Mc/s between the twin oscillators, and therefore the sixth harmonic of the beat between the two oscillators would fall nearer to the main receiver's vision acceptance than would normally happen when the oscillators had settled on their frequencies of 94.75 and 101.75 Mc/s, when the 7 Mc/s beat would produce a sixth harmonic at 42 Mc/s, which is quite harmless so far as the main receiver is concerned.



A view of the underside of the unit.

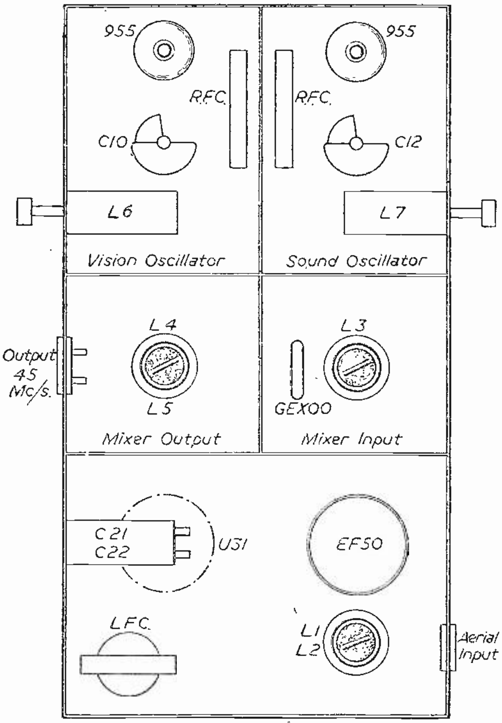


Fig. 3.—Layout of the parts—compare with the illustration above.

Super-het Receivers

Where the converter is to be used with a super-het receiver care must be taken to ensure that harmonics of the local oscillator in the main receiver do not fall near the two frequencies used for the converter's oscillators.

LIST OF COMPONENTS

C1—.001 μF	C2—.001 μF
C3—.001 μF	C4—.001 μF
C5—.0005 μF	C6—5 pF
C7—.0001 μF	C8—.001 μF
C9—18 pF	C10—Max. 10 pF
C11—18 pF	C12—Max. 10 pF
C13—.0005 μF	C14, 15, 16—5 pF
C17, 18—.0005 μF	C19—32 μF
C20—24 μF	C21, 22—.0005 μF
R1—150 Ω	R2—8.2 k Ω
R3—10 k Ω	R4—68 k Ω
R5—10 k Ω	R6, R7—47 k Ω
R8, R9—8.2 k Ω	R10—100 k Ω

R11—Brimistor .3 A rating
R12—Mains dropper .3 amp.
R13—Anode limiter 100 Ω 3 watt.

L1—2 turns	L2—6 turns
L3—6 turns	L4—9 turns
L5—2 turns	

L6 and L7—5 turns each space wound on Denco formers with iron cores adjustable. Low-frequency smoothing choke, ex-R.A.F. midget, resistance approx. 1,000 Ω

VALVES

1—U31 1—EF50
2—955 : 1 GEX00 germanium
Mains resistance needed for 240 volts is 670 Ω

NOTE.—It must be realised that there is risk of two heaters breaking if one 955 breaks down, due to their being in parallel (.15 amp. each valve), but this was considered worth facing to enable one side of each heater to be tied to chassis rather than to wire them in series and shunt them.

A 1-VALVE PRE-AMPLIFIER

CONSTRUCTIONAL DETAILS OF A SELF-CONTAINED PRE-AMPLIFIER

By B. L. Morley

THIS pre-amplifier has been designed especially for those who wish to build such a unit for their own television receiver. It can be used with any A.C.-operated television receiver whether it is home constructed or commercially built, and forms an entirely separate unit on its own, with its own power supply.

The circuit has been so arranged that it can be used with either balanced twin or coaxial cable, only a very slight modification being required to change from the one to the other.

It is a one-valve amplifier using a modern miniature valve (Fig. 1). A 6AM6 has been specified, as this valve is obtainable very cheaply on the surplus market. This valve gives a high gain combined with stability and there should be no difficulty in getting the amplifier to work satisfactorily.

The original circuit used an EF54, which is an excellent valve in itself, but is prone to trouble due to poor contact with the valveholder. When these valves are used it is necessary to clean the pins with emery cloth and to use valve retaining springs which are not always available. After a number of field trials the valve was abandoned in favour of the 6AM6 which does not suffer so much from this defect.

If a "surplus" valve is used it is wisest to check the pins and if they appear even slightly dirty they should be cleaned.

The amplifier gives a gain of about 10 db. and is suitable for locations up to about 80 miles from the high-powered transmitters. Beyond this distance something further is required and it is hoped to produce a two-valve version in the near future.

Use (and Abuse) of Pre-amplifiers

Before giving the constructional details a few words about the use (and abuse) of pre-amplifiers may not be out of place.

A pre-amplifier will increase the strength of the signal to a marked degree; it will also increase the "noise" so that its usefulness is limited.

The noise manifests itself on the screen as "snow." The picture appears as though everything is taking place in a minor (or sometimes, major) snowstorm.

When this occurs the useful limit of direct amplification is about reached and it is preferable to improve the aerial system before attempting to increase the amplification.

If your picture already suffers from snow effects then a pre-amplifier will not always effect a cure. Quite often the reverse is the case, the pre-amplifier bringing in more noise than useful signal.

Aerials

It is not possible to lay down any hard-and-fast rule about aerials. Experience has shown that generally, with the high-powered transmitters, an "H" or "X" aerial is quite satisfactory up to about 60 miles from the station. Beyond this distance an aerial of greater gain should be used.

It is not intended to enter the great aerial controversy here; suffice it to say that a commercially produced high-gain aerial *does* give a greater gain. It has been carefully designed and due attention has been paid to correct matching.

The amateur, however, does not always obtain the best from his home-constructed array, and it is worth while to experiment with the matching arrangements to ensure optimum results.

Bearing these points in mind, it is recommended that, wherever possible, an improvement in the aerial system be attempted before fitting a pre-amplifier.

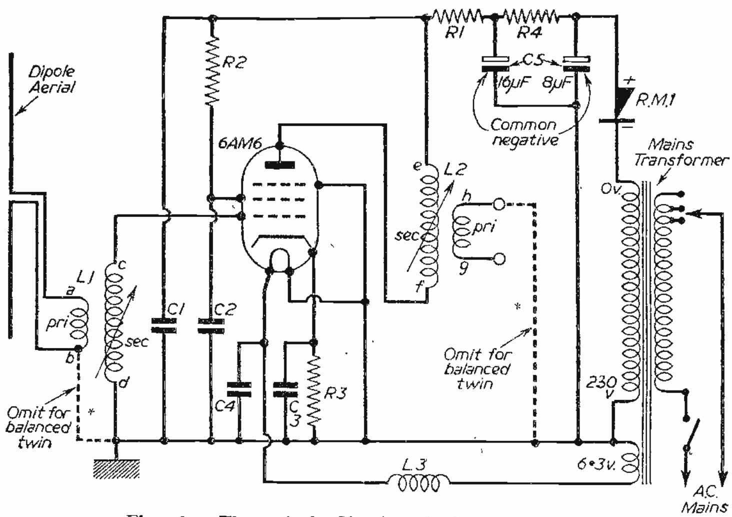


Fig. 1.—Theoretical Circuit of the Pre-amplifier.

R1=4.7 K Ω, R2=1.8 K Ω, R3=180 Ω — ½ watt
R4=1 K Ω 1 watt.
L1, L2= ⅜ dia. coil forms with iron-dust cores.
T1=230-0-230 v. 20 mA, 6.3 v. 2 A 5 v. 2 A., or 230-0-230 v. 20 mA 6.3 v. 3 A.
RM1=Selenium rectifier, 250 v. 50 mA.
C1, C2, C3, C4=500 pF.
C5=8+16 μF 350 v. wkg.

SUNDRIES

1 B7G valveholder.
1 6AM6 valve.
2 earthing tags.
1 three-point tag strip.
2 two-point tag strips.
1 on-off switch.
* Omit for balanced twin.

Construction

The construction of the pre-amplifier has been simplified so that even the beginner can tackle it with confidence.

The chassis has been made purposely roomy to make for ease of construction. It can be made from sheet aluminium (about 22 gauge) to the dimensions given in Fig. 2. A ready-made chassis may be purchased, if desired, so long as it is approximately the same size.

Dimensions of a bought chassis can be plus or minus 1in. in width and breadth to the measurements given.

Cutting the hole for the valveholder should present no difficulty, and if a special hole cutter is not available then the hole can be drilled around its circumference with a series of small holes, the jagged edge being afterwards smoothed off with a half-round file.

It is advisable to drill a hole through the top of the chassis opposite the cores of the coils so that they can be adjusted from the top. The holes should be $\frac{3}{8}$in. diameter.

For the sake of economy the aerial socket can be one of the popular "surplus" Pye type, which are very inexpensive.

Where balanced twin feeder is used to feed the television receiver, then coupling coils (ab and gh) must not be earthed, and the aerial socket must be insulated from the chassis.

The wire marked * should be omitted for balanced twin, but inserted for coaxial cable. The outer of the aerial socket should be connected to the chassis where coaxial cable is used.

Mains Transformer

In the prototype the mains transformer used was obtained from the Radio Supply Co. It is not strictly necessary to use this transformer as one having approximate outputs can be used.

The main point to remember is that the transformer should give a minimum of 230 volts at 20 mA. and 6.3 volts at 1 amp.

Note that as half-wave rectification is used it is not necessary to have a centre-tapped H.T. winding. Nor is it necessary to have a separate winding for a rectifier valve as a metal rectifier is used.

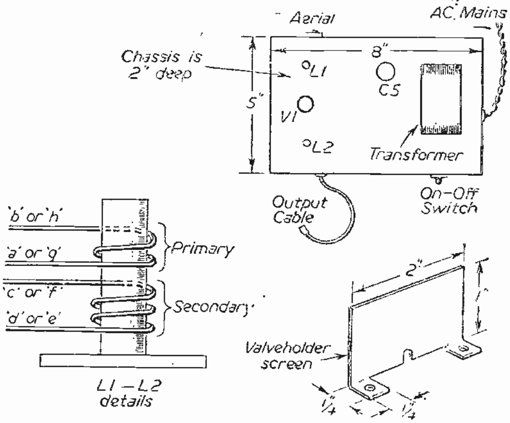


Fig. 2.—Details of the chassis, coils and valveholder screen.

Heater Choke

The heater choke L3 is of approximately 22 s.w.g. enamelled wire. Sixteen turns are wound on a ¼in. diameter former (such as a pencil) and then released. It will be found that the coil will spring to a wider diameter and it can then be soldered in position being held by the wiring itself.

Wiring

All wires should be kept as short and direct as possible, and the components R3, C3, C4, L3, C2, R2

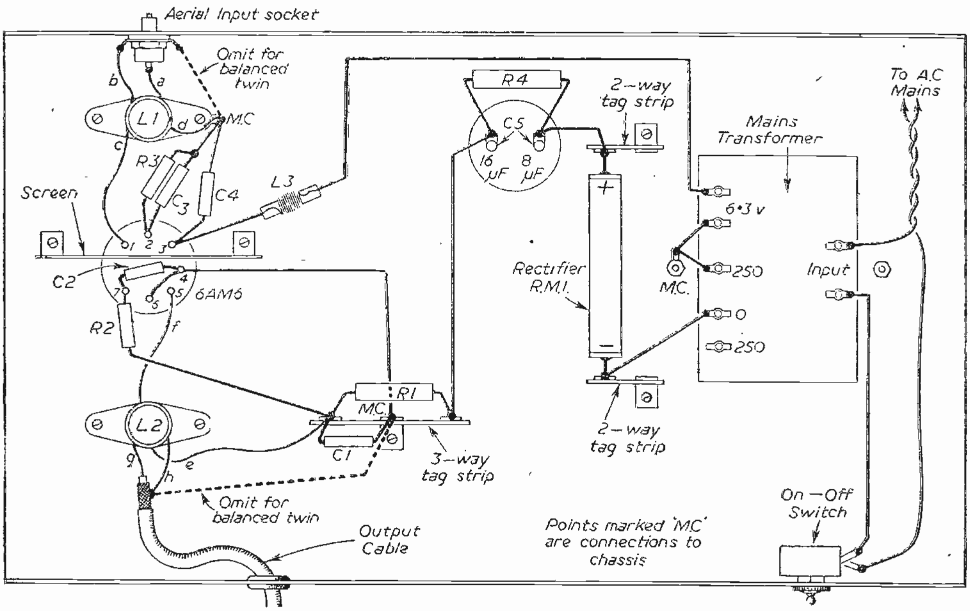


Fig. 3.—Practical layout and wiring diagram.

are mounted as close to the valve tags as possible, keeping the wires very short. Fig. 3 gives the wiring diagram.

Winding the Coils

The coils are very easy to wind. Twenty-two s.w.g. enamelled wire can be used, or a smaller gauge up to a minimum of 32 s.w.g. (Fig. 2).

First wind on the secondary clockwise and then wind on the primary. For L1 the "c" wire of the secondary must come opposite the "a" wire of the primary and for L2 the "f" wire of the secondary must come opposite the "h" wire of the primary.

The number of turns required for each coil is given in the table.

COIL TURNS—L1 & L2

Channel	Primary	Secondary
1	2	8
2	2	7
3	2	6
4	1½	5
5	1½	4

Alignment

When the wiring is completed check it carefully with the diagram. Now switch on the pre-amplifier and also the television receiver. (If desired the on/off switch on the pre-amplifier can be omitted and the mains input taken from the televisor side of the on/off switch on the televisor. Both pre-amp and televisor will thereby be controlled by the single switch.)

The contrast control on the televisor should be turned to maximum and the brightness control left operated at its normal position.

Connect the aerial to the pre-amplifier and the output of the pre-amplifier to the televisor aerial socket.

Adjust L1 and L2 to mid-position and then adjust L2 until the picture is received at maximum brightness.

It may be necessary to reduce the contrast control to avoid overloading the tube.

The aerial coil (L1) should now be adjusted for maximum picture brightness.

Now reduce the brilliance control until the white parts of the picture are just visible and readjust L1 and L2 for maximum brightness. This is the best position for gain on vision signals.

You may find that this final setting will not give sufficient sound. In this case readjust the cores by screwing them in a little until the optimum balance between sound and vision is obtained.

Should you find that you have plenty of signal to spare then the cores L1 and L2 can be readjusted on Test Card "C" to obtain the maximum quality.

Straight Receivers

With straight receivers the coils L1 and L2 should be adjusted for maximum brightness and then readjusted on Test Card "C" for optimum quality.

Should instability manifest itself, the vision (or sound) sections going into oscillation, a 4.7 KΩ can be connected across the larger windings of each coil.

MAGNETIC MEMORY

A NETWORK of fine wires and tiny beads of a new magnetic material, capable of "remembering" 1,024 basic units of information, was shown to guests at a Mullard private demonstration room at the National Radio Show. This device, known as a magnetic matrix store, is used as the "memory" of "electronic brains"—the giant computing machines that perform calculations at amazing speeds. It is possible to feed a basic item of information—known to computer engineers as a "bit"—into the "memory" in a few millionths of a second or take it out again at the same speed. By using a number of these magnetic matrix stores many thousands of "bits" of information can be stored in a very small space for use by the machine, and any one of them selected automatically.

This memory system, which has great advantages over earlier systems, has been made possible by the special properties of Ferroxcube D1, made by Mullard, Ltd. Tiny beads of Ferroxcube D1, less than a tenth of an inch in diameter, are threaded on networks of wires. Current pulses which flow through the wires can magnetise a bead in one of two ways. One way signifies that the answer to a question is "yes," the other way "no." Any piece of information such as a number or a word can be broken down into a series of such answers and stored in the matrix memory. Further current pulses are used to interrogate the memory and extract the information as required.

Operation

The actual mode of operation of the memory device is as follows: The matrix consists of a network of wires, insulated from one another, looking rather like the grid lines of a map. At each intersection the wires pass through a tiny ring of Ferroxcube D1 less than a tenth of an inch in diameter. To feed information into any one ring of Ferroxcube a current pulse of half the amplitude needed to saturate the ring is passed into each of the two wires which intersect at the particular ring in question. Thus at this one ring the total current is sufficient to saturate the Ferroxcube, while any other ring on each wire receives only half the saturation current, and due to the rectangular hysteresis loop the magnetic state of the ring is sensibly unchanged.

One state, which may be called positive remanence, is used to insert a figure "1" into the ring. The state of negative remanence signifies the presence of a figure "0." Thus any number of binary digits within the capacity of the store can be inserted into the matrix.

To read out the information stored in any one ring a negative current pulse is applied to each of the wires intersecting at that ring. If the ring is in a state of negative remanence negligible change of state can occur. If, however, the ring is in a state of positive remanence (i.e., it carries a figure "1") the arrival of two simultaneous negative pulses is sufficient to switch it suddenly from positive remanence to negative remanence. When this happens a large and sudden change of flux occurs in the ring. This change of flux is sufficient to induce a voltage pulse in a third wire which is threaded through all the cores in the matrix. This is the "Read Out" wire, and it plays no other part in the operation of the matrix.

THE PROJECTOR

An impressive cabinet, originally designed for T.V. but slight modification makes it into an unusual, but most dignified, radiogram or amplifier. Size 23in. wide, 22in. deep, 37½ in. high. Price £8/15/-, or £2/18/4 deposit. Carriage and ins. £1.

THE SIMPLEX

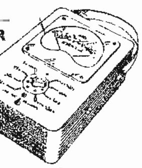
for £5 deposit

Constructors please send for detailed Price List. H.P. Terms available. Deposit £5. Balance over 12 months.

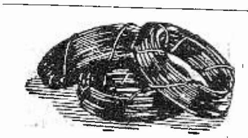
VARIABLE POWER RESISTORS

Mounted on substantial framework—overall dimensions approximately 11in. x 3½in. x 6¼in. high—25 amps. .4 ohms. Quite suitable for rewinding for other values. Power rating exceeds 250 watts. Adjustment is by twisting protruding knob which is the only part that needs to show in front of panel. Price 17/6—carriage and packing 2/- extra.

MULTI-METER KIT



The Multi-meter illustrated measures D.C. volts, D.C. m/amps and ohms. It has a sensitivity of 500 ohms per volt and is equally suitable for the keen experimenter, service engineer or student. All the essential parts including 2in. moving coil meter, selected resistors, wire for shunts, 8-point range selector, calibrated scale, stick on range indicator and full instructions for making are available as a kit, price 15/- plus 9d. post and packing.

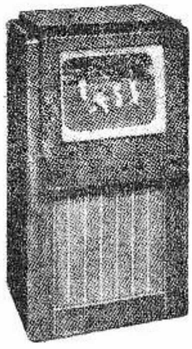


CONNECTING WIRE SNIP

P.V.C. insulated 23 s.w.g. copper wire in 100ft. coils, 2/9 each. Colours available: Black, Brown, Red, Orange, Pink, Yellow, White, Transparent. 4 coils for 10/-.

SOMWEAVE

This really lovely loudspeaker fabric we offer at approximately a third of to-day's cost. It is 12in. wide and our price is 12/- per yard or panels 12in. x 12in., 1/9 each. This is also very suitable for covering plain wooden cases, for portable radio amplifiers, etc.



A FEW REMAIN

This cabinet is offered below cost. It is suitable for a televisor using Tube sizes varying from 12in. to 17in., its overall dimensions being 3ft. 5in. high, 1ft. 4in. deep, 1ft. 10in. wide. It is complete with plywood back and "Bowler Hat." Originally made for a very expensive Televisor, and really good quality. Unrepeatable. Offered at £6/19/6, carr. and packing 12/6.

Note.—These are cut for 12in. Tubes, but the holes for the controls are not drilled.

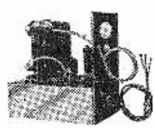
THIS MONTH'S SNIP

Unit for breaking down—offered at only a little over the price of the Aladdin Coil Formers it contains. Note.—All parts can easily be removed as they are all bolted together. The unit contains :—

- 6 Aladdin ⅜in. Coil Formers with dust cores.
- 6 Metal cans for above coil formers.
- 1 4-position 12-pole switch.
- 6 Miniature R.F. chokes.
- 2 25 mf. 25 v. electrolytics.
- 30 Paper tubular condensers .002 to .1 mostly for 450 v.
- 56 Carbon resistors values from ¼ watt to 2 watt.
- 2 Medium size R.F. chokes.
- 7 Moulded octal valve holders.
- 1 Moulded diode valve holder.
- 20 Mica condensers (moulded, silver and ceramic).
- 7 Insulated top caps for valves.
- 4 Components Strips (1 40-way, 1 11-way, 1 5-way and 1 3-way).
- 1 Very useful chassis size 18 x 5 x 3½. Plus dozens of nuts, bolts, screws, washers, and other useful items such as ¼in. spindle extenders, etc., etc.

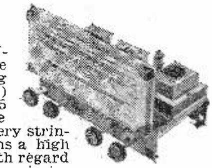
Price only 7/6—post and packing 2/6.

THE ELPREQ E.H.T. GENERATOR



This is a made up unit working on the blocking oscillator/overwound amplifying stage principle. It is of moderate power consumption (6.3 volt .8 amp. filament and approx. 59 mA. H.T.) and contains three BVA valves. Output obtainable ranges from 6 kV. to 9 kV. with normal H.T. rail input but somewhat higher outputs can be obtained with higher H.T. supply. Valve rectification is employed in the output stage. The dimensions are 6¼ x 4¾ x 7in. Price 69/6—post, packing, etc., 5/-.

COMBINED RADIO WITH YOUR T.V.
THE CLEVELAND "ORGANTONE"



The Cleveland "ORGANTONE" is a 5-valve, 3-wave band superhet covering long wave (1,020-1,875 metres) medium wave (187.5-545.5 metres) and short wave (16-50 metres). Built to a very stringent specification, it attains a high level of performance both with regard to sensitivity and fidelity. Osram all-glass miniature valves are employed throughout and low loss iron cored coils in both aerial and oscillator sections together with permeability tuned I.F.'s account for an excellent signal to noise ratio. Full A.V.C. is applied to both frequency changer and I.F. stages, and particular care has been taken to ensure freedom from frequency drift.

The output stage utilises variable negative feedback for tone control, and, but for standard pentode correction, no cut in the ordinary sense is applied. A gram. position is provided on the wave change switch and reproduction of records is particularly good. An amply proportioned power transformer with a primary tapped for 110-280 volts gives complete isolation from the mains. Chassis size is 12in. x 7in. x 7in.—scale size is 10½in. x 4½in.

This receiver has been tested in particularly difficult areas and its stability and noise rejection have produced exceptional results. It is an instrument which could fairly be described as a custom-built chassis. Price £11/10/- or £3/16/8 deposit—carriage, etc., 7/6. A circuit diagram and photograph available, price 2/-, post free.

ELECTRONIC PRECISION EQUIPMENT
42-46 WINDMILL HILL, RUISLIP, MIDDLESEX. • 152-3 FLEET ST. LONDON E.C.4
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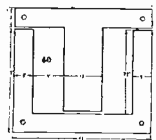
MULLARD AMPLIFIER

A High Quality Amplifier designed by Mullard engineers. Robust, high fidelity, with a power output exceeding 10 watts and a harmonic distortion less than .4% at 10 watts. Its frequency response is extremely wide and level being almost flat from 10 to 20,000 c.p.s.—three controls are provided and the whole unit is very suitable for use with the Collaro Studio and most other good pickups. The total cost of the amplifier is around £10. For 30/- extra a unit completely made up and tested will be supplied. Carriage in either case is 10/- extra. Data will be provided with all orders for components. Send for the "Mullard Amplifier Shopping List."

TRANSFORMER LAMINATIONS



Ideal for making up experimental and special purpose jobs. Dimensions as drawing. Price 1/6 per lb. or 1/6 per dozen pairs (approximately 48 required for 1in. stack)—(size 2¼in. x 2¼in. approx.) Suitable for output transformers, etc.—price 6d. per dozen pairs.

MAKING A CONVECTOR HEATER ?

250 watt elements ideal for use with home-built convectors, towel rails, airers, etc. Price only 2/6 each—post and packing 6d.

METER FOR BATTERY CHARGER, etc.

2in. square bakelite cased meter, reading 0-5 amps. Price 9/6—post and packing 9d.

HEAVY DUTY CHOKE

300 milliamp—7 Henry—50 ohm D.C. size, approximately, 4½in. x 4½in. x 3in. New, not Government surplus—price 10/-—plus 2/- post and packing.

UNIVERSAL METER

2 milliamps moving coil meter square bakelite case flush mounting. Complete with sheet of printed scales, covering most ranges of volts, milliamps, amps. Price 9/6—post and packing 9d.

VALVE FOR V.H.F.

Type C.V.64 and C.V.186 Magnetrons unused and guaranteed. Price £2/10/- — post and insurance 10/-.

HEAVY DUTY MAINS TRANSFORMER

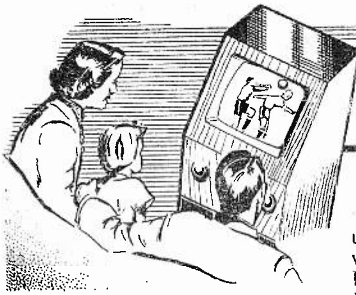
400-0-400 at 200 mA with two 4-volt L.T. windings, both rated at 6 amps. A really massive job made for services equipment—limited quantity 19/6 each.

CHARGER TRANSFORMERS

0-9-15 v. with tapped primary—suitable for 6- and 12-v. batteries. Charging rate up to 6 amps. Amply rated—price 21/6—post and packing 2/6.

1in. MICROMETER

Exceptional purchase enables us to offer a 1in. precision micrometer at the very low price of 10/-. A micrometer is an essential part of an engineer's equipment. You, no doubt, will have found the need for one on many occasions in the past for measuring wire gauge, etc. If you act quickly you can acquire one now at the remarkably low price of 10/-, post free.



UNDERNEATH THE DIPOLE

By Iconos

THIRD PROGRAMME TV

THE marriage of electronics and the entertainment business has progressed quite a lot since those carefree days of the first 2LO concerts from Marconi House. Somebody once described the programmes as being like a bridal dress—something old, something new, something borrowed—but nothing blue. The tradition lingers on in all BBC programmes, sound and TV, excepting perhaps in the Third. The stupendous task of finding good new material for programmes must be infinitely more difficult for TV than for sound radio. Fortunately, the planners and producers at Lime Grove are drawn principally from one or other branch of show business—stage, concert party, films or theatre. Let us hope that TV will be preserved from the patronising manner in which "culture" is presented on the Third Programme, together with all-too-regular doses of one-way traffic "culture relations" with the U.S.S.R. I mention this because I detect a flavour of "Third-itis" creeping into TV now and again.

Away with dull uplifting documentaries until an alternative TV programme is available!

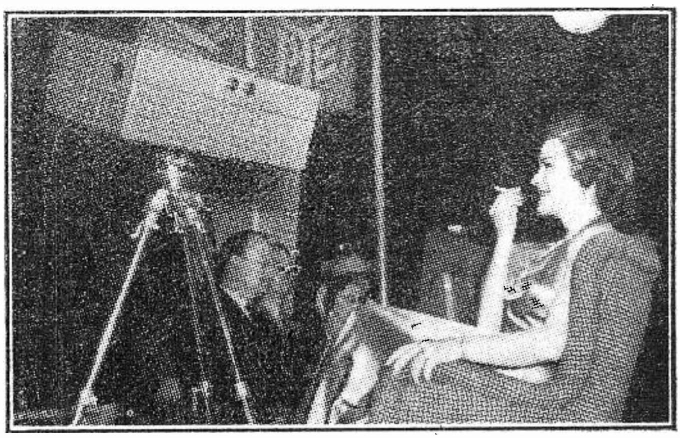
SHORT STORY

THE development of short plays or short stories on TV has not been particularly impressive up to now. Perhaps the small screens, necessity for close-ups, and other technical demands have placed limitations upon the producers. These restrictions were overcome most successfully in "The Mossbach Collection," adapted by Jon Manchip White from Stefan Zweig's short story of life in Germany during the post-war inflationary period. Described as "a dramatic incident," this little story of a blind collector whose valuable prints had been sold, unknown to him, to provide food, was most movingly played by Hugo Shuster, Nelly Arno, Carl Jaffe and Margot van der Burgh.

A short play lasting only half an hour allows the producer little time in which to develop characterisation as well as to tell a story and to build up to a strong final situation. Chloe Gibson did succeed in doing this, and with most skilful use of camera angles and cutting from shot to shot at precisely the right moment, gave emphasis and punctuation to the well-written dialogue. Here was a perfect example of what the Wardour Street gentry call a "tear Jerker"—but it was played with restraint, and the sentiment was never false. I wouldn't be at all surprised if it resulted in at least two million handkerchiefs being produced to wipe away tears induced by the last five minutes of this little play. It is worth while remembering the name of the producer, Chloe Gibson, and adding it to the growing list of TV producers and directors who turn out smooth and polished productions. "The Mossbach Collection" more than makes up for her "Shadow on The Glen" of a few nights earlier, when thick accents made dialogue unintelligible. An elementary fault committed by many screen, stage and film directors who know every word of a script, is to allow their actors to overdo dialect, foreign accents and broken English. The percentage of German accent in "The Mossbach Collection" was exactly right. Miss Gibson had learned her lesson.

THE TWICKENHAM STUDIOS

ALMOST every week I am hearing about new enterprises formed to make films for American television, which also hope to get into shape for making films for sponsors on the I.T.A. Barns, ballrooms, garages and cellars have been fixed up as temporary studios by enthusiasts whose optimism has not yet been tempered by experience. The market is hardening for TV films, and a professional polish is now expected by the American importers who, a year or so ago, were willing to buy up even the most amateurish productions. The Fairbanks organisation has made many first-class subjects—but they were made under professional film studio conditions by experienced technicians. Another more recent enterprise which is tackling the TV film in a professional manner



The Pye 3-D camera in front of announcer Miss Avis Scott, at Earls Court. Visitors may be seen viewing the receivers through polarised spectacles.

is Trinity Films Ltd., which has leased the old Twickenham Studio. This studio, which has been out of production for some years, has a good stage 116ft. by 62ft., well-appointed cutting rooms, theatre, workshops and offices, together with a 500kw mercury arc rectifier for supplying direct current for the lights. It is fortunate that when it turned over from being a cinema film studio into an engineering works, the power distribution and ancillary plant was not disposed of by auction, as has happened at other film studios. I have heard of copper bus-bars, motor convertor sets, switch-gear and the like being ripped out and smashed up by junk merchants, who have bought them for a song at an auction. At Twickenham, only the portable equipment was removed: cameras, booms, dollies, lights. All were replaced by an energetic manager in the space of three or four weeks.

THE XX PLAN

IN making films of any kind, time is the most expensive factor. A fully equipped and staffed studio can cost anything from £100 to £1,000 a day to run, quite apart from the heavy costs of the actors, film stock and processing. Continuous working in a one-stage studio presents a problem for set building and dressing, which has to keep pace with fast shooting schedules to enable two or three half-hour subjects to be turned out in a week. High Definition Films at Highbury Studios use television technique and record the picture on film. At Twickenham, direct film photography is used, and two large "X" shaped composite sets are built on the stage beneath permanent lighting. Each "X" enables four separate settings to be prepared back to back under the same bank of lights. The sets are constructed so that small alterations to doors and windows can be made with interchangeable panels. As one set is being photographed, in one division of the "X," another is being furnished. Action can continue through doors from one set to another if required. Major constructional work is rarely required, the interchangeable unit system enabling swift changes to be made on a kind of Meccano plan. In this way, excellent results are said to have been obtained on a series entitled "Fabian of the Yard." Sound is recorded on the RCA system, using photographic sound track methods. Exterior shots are obtained by a second camera unit, usually working without sound, which is added afterwards. The daily target is seven to ten minutes of finished picture per day. I should think that this rate of production calls for a team of script writers in order to maintain the pace.

3-D ON TV

SOONER or later it had to come! The news that Pye demonstrated 3-D television at the Radio Exhibition must have drawn many additional customers to this year's show. I have always felt that 3-D would have greater appeal on TV than at the cinema, if it could be accomplished in a simple manner. Somehow, polarised spectacles are more acceptable in the home than in public theatres. Probably this is due to the fact that it is not always comfortable viewing from the seats at certain angles, and the simultaneous operation of two projectors calls for a degree of skill not always available. I suppose that sooner or later, sterophonic sound will follow on TV. If projection type receivers were general in homes, there would be no practical difficulty in obtaining wide pictures of the shape seen in CinemaScope, providing there was enough picture illumination. Horizontal compression would be easily effected in transmission and a corresponding expansion made at the receiving end. A compression ratio of 2 : 1 would be sufficient to give a projection picture with an aspect of 2.66 : 1 which compares with the normal TV format of 1.33 : 1. In other words, the picture shape could be 8 by 3 instead of 4 by 3. I have already seen a TV scene, compressed and recorded in this manner on cine film, projected with a CinemaScope-type objective. It was quite effective. However, I don't think television has quite reached the stage of requiring a new shape "gimmick" to retain our interest.

SEASIDE TV

MANY viewers on holiday have been thankful for the chance of seeing television on the sets installed at hotels and boarding houses. Wintry weather has kept them in their armchairs, crowded around sets which are, in many cases, poorly maintained. On holiday at a north-east coast resort, I noted that the enterprising management of my hotel had installed a big-screen back projection set of good make. However, the sampling of it proved to be a disillusion. The picture was flat and grey, with a most objectionable hot-spot—and viewing at any angle excepting from dead centre was almost an impossibility. By contrast, the 16mm. film projection at the same hotel was bright and clear, with excellent sound. However, I decided to have a holiday from synthetic entertainment and enjoyed the change of seeing real flesh-and-blood performers in the local concert party and repertory shows.

B.I.R.E. PRESIDENT FOR 1954-55

THE Council of the British Institution of Radio Engineers announces that Rear-Admiral Sir Philip Clarke, K.B.E., C.B., D.S.O., is to be the next president of the institution.

Educated at the Royal Naval Colleges, Osborne and Dartmouth, Rear-Admiral Sir Philip Clarke commenced regular service in 1914. After the first world war, and further study at Christ's College, Cambridge University, Admiral Clarke served overseas as torpedo officer and on appointment as commander in 1932 joined the staff of the Tactical School. Following appointments with the Home Fleet and the South American Squadron he was promoted to captain on December 31st, 1938.

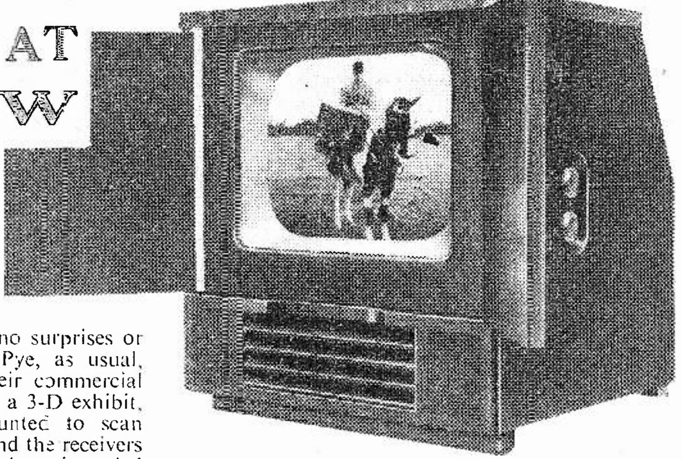
As Commodore and Senior Naval Officer, Red Sea and Aden, he was mentioned in despatches and in 1941 was appointed Deputy Director and subsequently Director of the Anti-submarine Warfare Division.

From 1943 to 1946 Admiral Clarke was in command of H.M.S. *Glasgow*, being awarded the Distinguished Service Order on December 28th, 1943. He was again mentioned in despatches for his work in the Normandy landings.

Whilst Director of Manning at the Admiralty he was promoted to rear-admiral, subsequently serving on the Eastham Manpower Committee and then as Admiral Superintendent, Malta. He was appointed to his present post of Director of the Naval Electrical Department in 1951.

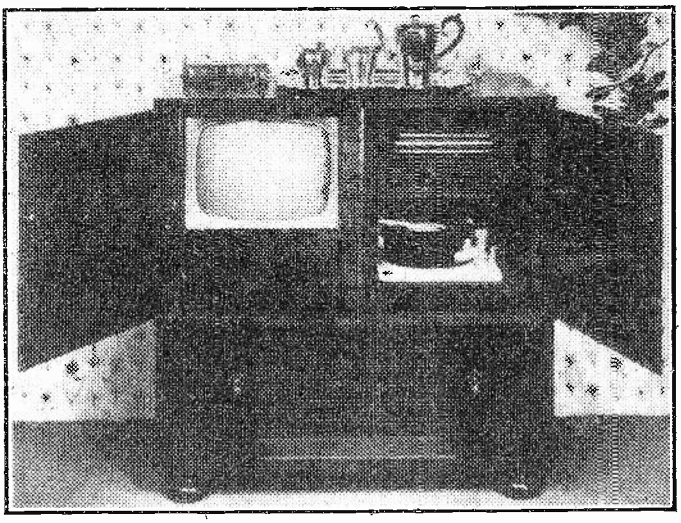
TELEVISION AT THE SHOW

A REVIEW OF SOME OF THE EXHIBITS AND SPECIAL ITEMS



A Pam table receiver with protecting doors.

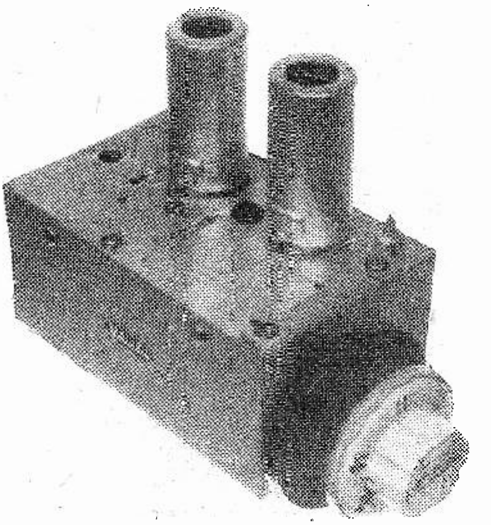
THIS year's exhibition produced no surprises or new developments, although Pye, as usual, made a feature of one of their commercial developments. This took the form of a 3-D exhibit, a specially-made camera being mounted to scan nearby objects through twin lenses, and the receivers producing two side-by-side images which are intended for viewing through polaroid spectacles (see page 213). This development is, of course, not intended for general broadcast use, but is a natural extension of the commercial use of television for viewing certain apparatus under conditions where it is either impossible or dangerous to approach close, such, for instance, as nuclear fission experiments. The use of ordinary TV in commerce for supervision of various sections of a factory, or for inspection of books and records in a central filing department has, of course, left the laboratory stage and is in use in quite a number of business houses, and this 3-D development will no doubt find a place in many factories or businesses. There appeared to be no exhibit of colour TV which, in view of the demonstration some months ago we felt might have found a place. All the remaining exhibits appeared to be on more or less standard lines, and it is obviously impossible in the space at our disposal to do more than mention a few of the many items exhibited which may be taken as typical of the general trend of design.



A good example of a combined TV and radiogram. This is Sobell's Model TRG175.

Commercial TV

The forthcoming commercial pictures will, as most readers know, be in Band III and frequencies have been allocated to London and the North. Many receivers were on show with Turret Tuners, that is, a rotatable coil unit in which coils are fitted to cover the five channels on Band I (for the BBC transmissions) and others in Band III. In many cases the tuner appeared to be the standard Plessey product, and is not available to the home-constructor. There were, however, two types of tuner which are illustrated on the following pages. The first (on page 216) is by Valradio and although primarily intended for incorporation by manufacturers into new receivers, is available for converting existing receivers. The circuit incorporates a cascode R.F. amplifier (type PCC84) with a PCF80 as a frequency-changer. The tuner covers the frequency from 40 to 100 Mc/s in four steps and from 170 to 225 Mc/s in two steps. Tuning is continuous over each step and is achieved by a combination of iron-dust cores and brass slugs, ganged and sliding axially within the coils. The I.F. from this tuner is 34 to 40 Mc/s. In the other unit illustrated, by Pam, a similar input valve is employed but this is followed by an ECC81. The unit in this case is in a box into which the aerial is plugged and an output lead is taken to the receiver. It is stated that this may be any type of post-war model, either T.R.F. or superhet, and it functions by changing any one Band III signal into any Band I signal frequency.



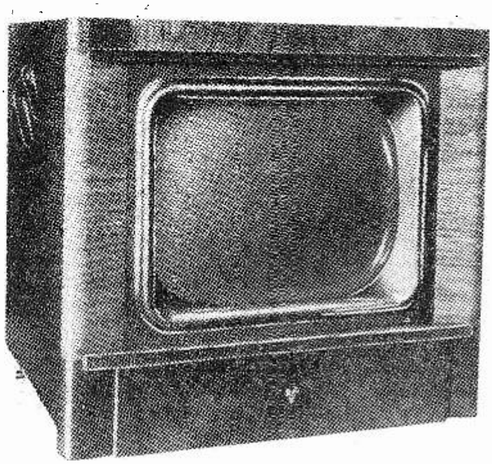
A multi-channel tuner by Valradio.

Interaction

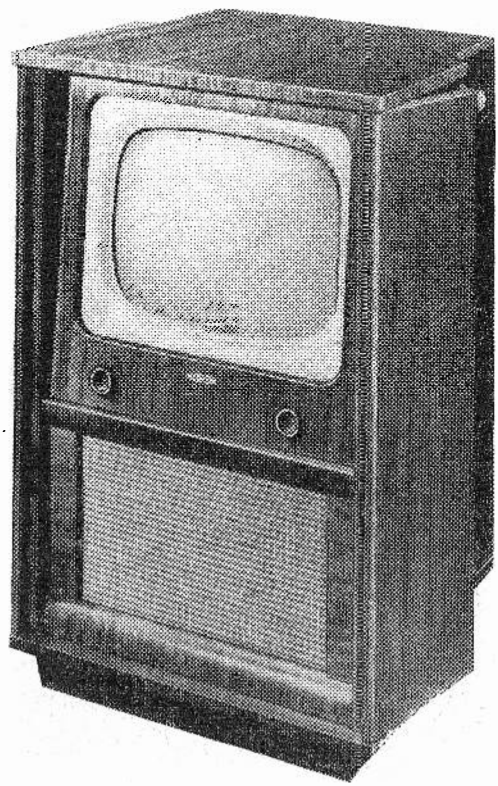
Whilst it is a fairly simple matter to design a converter of the types referred to, there may be quite a number of difficulties in the actual conditions of use when the alternative programmes come on the air. In many receivers, especially those operated close to the main BBC stations, there will undoubtedly be direct pick-up of the signal on some of the wiring of the receiver, and this will result in a pattern superimposed on the screen. The unused aerial for Band I will also have to be suitably terminated if it is to be kept from radiating the local BBC signal. In some cases the length of the lead from aerial to receiver may be such that if it is shorted or not suitably terminated, it will carry standing-waves which also will produce a pattern on the screen. Interaction or feedback between the two oscillators may also take place in certain conditions, and therefore the final form which a converter should take is not a simple matter to decide, and actual conditions on the air may have to be experienced before final judgment is given.

Aerials

In connection with the commercial programmes the question of aerial design comes up and new aerials will have to be used. Whether these may be placed inside or outside the house will again depend upon the proximity of the transmitter. Pam were demonstrating their converter with the aid of a folded dipole with reflector and director, the actual material being strip metal to offer a large surface area. A novel type of aerial was shown by J Beam Aerials, and this took the form of a " skeleton slot " aerial. The slot type of aerial for Band I is now very well known and takes the form of a rectangular slot cut in a length of wire netting. It is mounted with the slot horizontal, for a vertically-polarised transmission. It has been found that the material surrounding the slot may be cut away and only the rectangular form or slot edging left, and results are still satisfactory. It is in this form that the J " Skeleton Slot " is produced—the feeders being taken from the centre of the two longer sides. It is claimed that it will cover the whole of Band III (from 170 Mc/s to 215 Mc/s), is small enough to be mounted on an existing support for a Band I aerial, has a narrow frontal lobe with sharp side nulls to eliminate ghost images and gives a gain of 7 db. over a dipole. The price of this aerial is 45s.



Vidor Model CN 4216—a 12in. model costing 56 gns.



Peto Scott Model 1715C has protective doors and a 17in. screen.

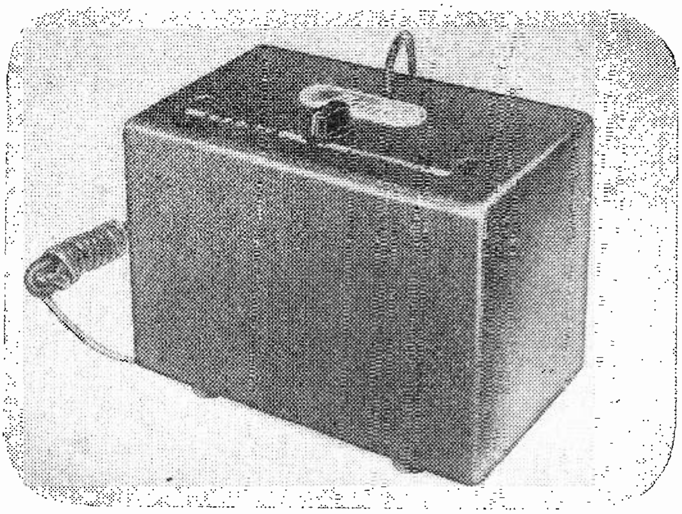
Projection

So far as the actual receivers were concerned there appeared to be an increase in the number of projection receivers on view. A newcomer to this field was H.M.V., the difference between this and previous other receivers being the use of a 3¾in. projection tube. Most, if not all, other models use the 2in. tube, but it is claimed that the larger tube produces a brighter image and thus the resultant picture is brighter than existing models. In addition the screen used for viewing is curved to avoid de-focusing at the edges, and this, in conjunction with the fact that a higher E.H.T. is used, results in the overcoming of many of the objections which have been raised in the past about projection receivers. The throw of this particular model is 9ft., and the screen is 4ft. by 3ft. The receiver employs 23 valves and is tunable to any channel on Band I or III. The price is 175 guineas. Another firm which specialises in the projection type of equipment is Nera of England and their models range from a 30in. domestic receiver to a 4ft. by 3ft. model for clubs and similar localities. One interesting model is designed so that it may be mounted on the ceiling thus making available the floor-space which is normally occupied by the main cabinet.

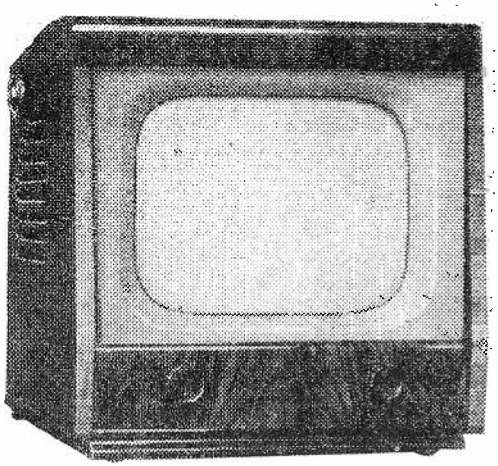
A new domestic model produced by Valradio gives a picture 34in. by 25½in. and the screen is curved to produce a properly focused "Double-D" picture. It is claimed that this enables 20 per cent. greater brilliance to be obtained, and it incorporates a five-channel tuner.

Ordinary Models

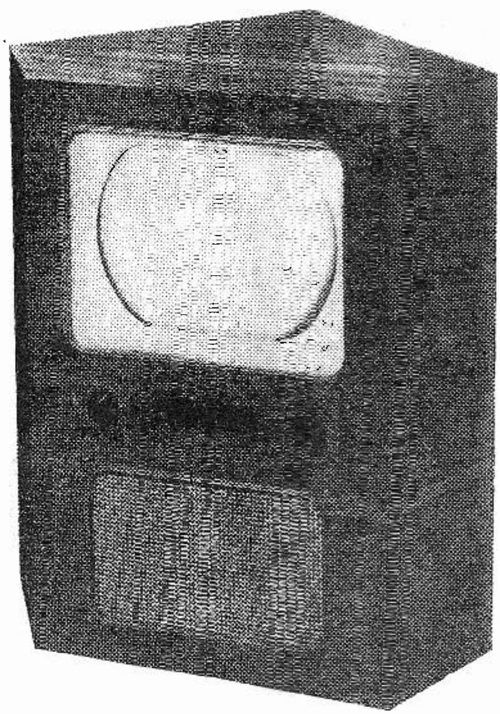
Amongst the remaining domestic receivers the predominance of the 14in. screen was noticeable. Last year, it will be remembered the 9in. screen was represented by only one make of receiver, and this year the average size appeared to be either 14in. or 17in. A general inspection showed that the rectangular type of tube is more usual, mainly owing to the need to keep cabinets of the table model within reasonable size, and there were quite a number of 21in. tubes on view. The choice appeared about equal between



A Band III and Band I converter by Pam Radio. The makers claim that it may be used with any post-war receiver.



Pilot TV 84/12. 14in. table with 12 position 13-channel turret tuner on upper left-hand side of cabinet.



This Ambassador receiver has a cabinet designed for fitting into the corner of the room.

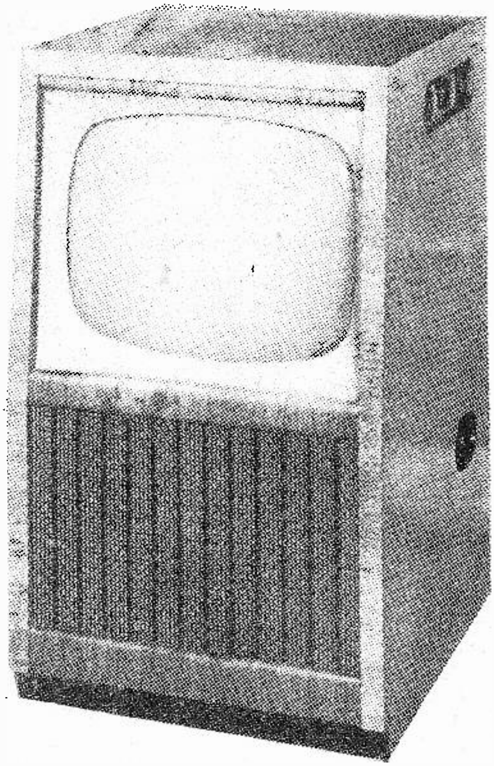
aluminised and non-aluminised types, and English Electric this year were showing a rectangular aluminised tube. There were few "Double-D" screens, the majority being the normal rectangular standard shape, and the only real departure in general screen appearance was again the Ferguson "halo" surround, in which the actual mask is made to glow faintly to reduce eye-strain.

Representative of the table models was the Vidor, seen at the foot of page 216. This has no front controls, but a 12in. screen. The Pilot, Model TV84/12, seen on page 217 is a 14in. table model with fly-back suppression, aluminised tube, and filter screen. This, and all the other models in the 84 and 87 range, has a 16-valve circuit and five-channel chassis. A 13-channel turret tuner is available, and may be fitted to the 84 or 87 range of receivers at a cost of six guineas. As distinct from the normal table models there is the Pam shown on page 215 which has doors to screen the tube when not in use.

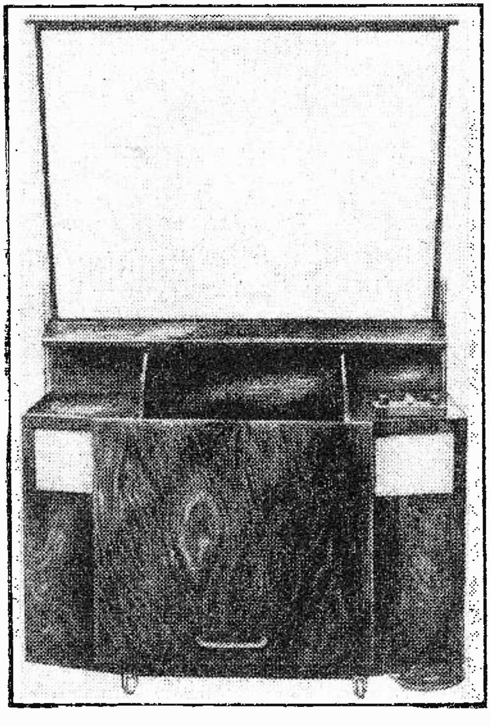
Combined radiogram-television receivers are represented by the Sobell on page 215. This incorporates not only the auto-changer and broadcast receiver with a standard television receiver, but also record storage space in the form of two large cupboards.

Other console models are designed to fit into a corner of the room to take up less space, and of these one may cite the Ambassador model shown on page 217, in which an added attraction is the fitting of the principal pre-set controls between the two main controls on the front of the cabinet.

Console cabinets take a number of forms, and many have had the cabinet designed to take full advantage of the high quality of reproduction which is possible



This Bush receiver, Model T36 will receive either Band I or Band III signals.



A projection model by Nera of England.

on the television frequencies. It was noticeable, however, that few manufacturers made a feature of this aspect and in quite a number of cases very small speakers were fitted. The question of controls raises many problems, and some manufacturers had them placed on the side, whilst others appeared to have no controls of any kind, the main knobs being of the horizontal edge-wise variety to render them inconspicuous. From the servicing aspect controls present a problem. If the main controls only are on the front of the cabinet lining up is rendered difficult unless one has an assistant or a large mirror. On the other hand, placing the pre-set controls in the front of the cabinet as in the Ambassador just mentioned, or in certain H.M.V. models, provides the non-technical user with some temptation to try and improve things, with the result that a service engineer may have eventually to be called n to make readjustments.

F.M.

The forthcoming frequency-modulation sound transmissions offer an added facility and Ekco have made provision for receiving these in a combined TV and V.H.F. receiver. This is Model TC209 and is for A.C./D.C. operation, and has protecting doors to the cabinet. Flywheel sync, turret tuner, automatic picture control and all modern features are incorporated in this model, together with the well-known Ekco spot-wobble. This model is priced at 110 guineas.

MODULATION OF THE C.R.T

THIS ARTICLE DISCUSSES THE PROS AND CONS OF GRID VERSUS CATHODE MODULATION

By "Erg"

THE modern practice with coupling circuits between the C.R.T. and the video output valve is to employ direct coupling which does not block the D.C. component of the video signal. The anode of the video valve is connected directly to the grid or cathode of the C.R.T.

By this method the D.C. component is retained. It is important that the C.R.T. should receive the video signal with the D.C. component as it is this which sets the brightness level of the scene. Without it the picture tends to assume a mean brightness; very bright scenes appear darker than they should, and dark scenes, brighter.

It is possible to employ A.C. coupling and still retain the advantages of the direct coupling by "faking" in the D.C. component by the use of a diode. Such methods, however, introduce unnecessary complications and increase the overall costs; direct couplings are therefore preferable.

Direct coupling has two main problems, one being the safety of the tube, and the other being that of the quality of the picture.

There are two methods which can be employed; one is to couple the video anode directly to the grid of the tube and the other is to couple the video anode directly to the cathode of the tube. In some circuits both methods are employed, the cathode and grid of the tube being fed with video signals which are opposite in phase; a form of push-pull modulation is thereby attained.

Grid Coupling—Disadvantages

Fig. 1 gives a skeleton circuit of a grid fed directly-coupled C.R.T. The C.R.T. requires a certain amount of negative bias on the grid and this means that the grid must be negative with respect to the cathode. If we make the cathode positive with respect to the grid we shall have the same result as making the grid negative to the cathode.

The cathode is made positive by applying a positive potential from the potential divider R2, R3 and R4. R3 is made variable so that the voltage on the cathode can be controlled. Varying the cathode voltage will vary the potential of the cathode with respect to the grid; in other words, although the actual voltage of the grid remains constant it will be at a varying negative potential to the cathode: the beam current through the tube will therefore be varied by operation of R3 and this control will act as brilliance control.

It will be seen from Fig. 1 that the grid is at a positive potential with respect to earth as it is coupled directly to the anode of the video output valve. To make it negative with respect to the cathode, the cathode will have to be at a higher positive potential.

As an example, supposing the tube requires a negative bias of 50 volts and that the anode voltage of the video valve is 220 volts positive, then the positive potential on the cathode will have to be 50 volts greater than that on the grid, i.e., 220+50=270 volts.

There may be some difficulty in obtaining this voltage, especially in the case of A.C./D.C. receivers.

It is possible to overcome the defect by arranging a signal potential divider in the output circuit of the video valve. The method of doing this is shown in Fig. 2, which is identical to Fig. 1, but with the potential divider circuit R5, R6 and C1 added. The grid is therefore run at a lower positive potential enabling the cathode of the tube also to be run at a lower potential.

Failure of the Video Valve

A second important defect of the system is that the brilliance control is set so that normal brilliance is obtained with the video valve drawing anode current. As the valve draws current there will be a voltage drop across R1 and hence the anode potential of the valve will be lower than that of the H.T. rail. If now the valve should fail (heater broken, etc.), then it will cease to draw current and the anode voltage will rise to the H.T. rail voltage. It follows that the grid of the tube will rise to a high positive potential of the same value and a very heavy beam current will flow through the tube with the grave possibility of damaging it.

The effect is offset to some extent by the potential divider system as given in Fig. 2, but there will still be a voltage rise which may cause damage if the video valve should fail.

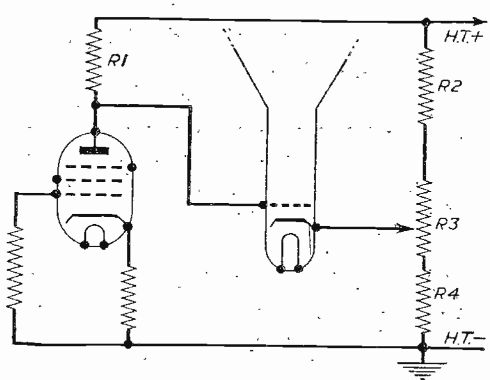


Fig. 1.—Basic circuit for a grid-modulated tube.

H.T. Rail Surges

A third defect is the possibility of damage to the tube on first switching on. Where metal or directly heated rectifiers are employed for the H.T. supply the full H.T. voltage surges along the H.T. rail immediately the receiver is switched on. This voltage will be felt on the anode of the video valve (and hence the grid of the C.R.T.) until such time as the video valve draws current.

The answer to this problem is to use either an indirectly heated rectifier for the H.T. supply so that application of the H.T. is delayed until the video valve warms up, or to arrange that the E.H.T. is delayed. The latter is automatically accomplished if the line flyback E.H.T. system is used, as delay will occur until the line output valve has warmed up.

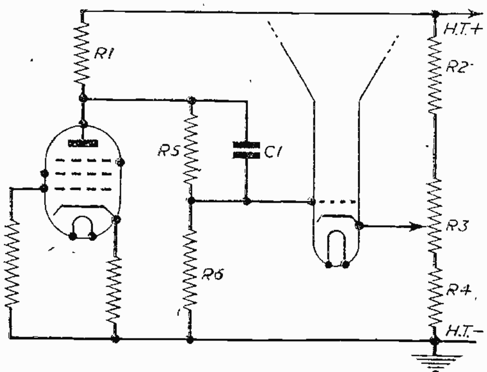


Fig. 2.—Grid modulation with signal potential divider.

Video Valve Defects

A fourth defect of the system is in the video valve itself. If the grid of the tube is modulated, then the bright parts of the picture signal should make the grid more positive so that more beam current flows and the screen brightens. This means that the output of the video valve must be positive going on whites. As a reversal of phase takes place in the valve then the input to it must be negative on whites. Now the video signal comprises sync pulses for the first 30 per cent. of modulation and the remaining is the picture signal (varying shades of brightness). The signal is therefore very negative going on the grid of the video valve.

As quite a large amplitude of signal is fed into the video valve the valve will have to be biased very lightly. If this is not done then the peak whites will drive the valve beyond the cut-off point, the practical effect being a severe degrading of the whites of the picture.

The video valve, then, must be very lightly biased and when no signal is being received it will therefore draw a very heavy current, which may reduce its life. In circuits using negative signal input to the valve it is wise temporarily to increase the bias on the valve when extensive experiments are being carried out on the timebase or sound circuits.

It will be noted that with a negative input to the video valve the sync pulses occupy 30 per cent. of the total input and must be included and amplified along with the picture signal. More economic working can be obtained if the sync pulses are taken from the pre-video valve stages using the valve solely for the picture signal.

Grid Modulation—Advantages

Having looked at the black side let us now turn our attention to some of the undoubted advantages of this form of modulation.

Perhaps one of the most obvious advantages is that with grid modulation no form of interference limiter is required, as limitation takes place automatically in the video valve. As the input is negative on whites the heavy whites caused by car ignition drive the video valve beyond the cut-off portion of its curve; the spots are thereby very effectively suppressed.

Secondly, as the sync pulses occupy the first 30 per cent. of the input waveform to the valve they are adequately amplified, a useful feature where strong sync pulses are required to trigger the time bases.

Thirdly, as the video valve requires only a very light bias and hence a low value of bias resistor, difficulties due to feedback in the cathode circuit are avoided.

A fourth and rather important advantage from the home-constructor's point of view is that there is no difficulty in using tubes which have a cathode-heater short-circuit. A special low capacity transformer is not required in the C.R.T. heater circuit, and ordinary heater transformers can be employed.

Cathode Modulation—Disadvantages

When the cathode of the tube is modulated then the whites must drive the cathode in the negative direction; this makes the grid more positive with respect to the cathode and hence the beam current increases and the screen becomes brighter.

The basic circuit is shown in Fig. 3, and it will be seen that the cathode of the tube is now connected where the grid of the tube was in Fig. 1. As we require a higher positive potential on the cathode than on the grid then there is no difficulty in supplying the necessary positive potential to the grid which at all times is lower than the video anode potential and the H.T. rail.

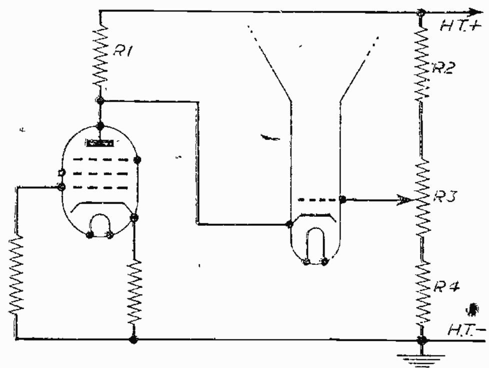


Fig. 3.—Basic circuit for cathode modulation.

As an example, if the tube requires a bias of 50-volts and the positive potential on the anode of the video valve is 220-volt then the grid will require a positive potential of 220 − 50 = 170-volt. This is obtained from the potential divider R2, 3 and 4, and R3 is made variable as before to form a brightness control.

(*Continued on page 223*)

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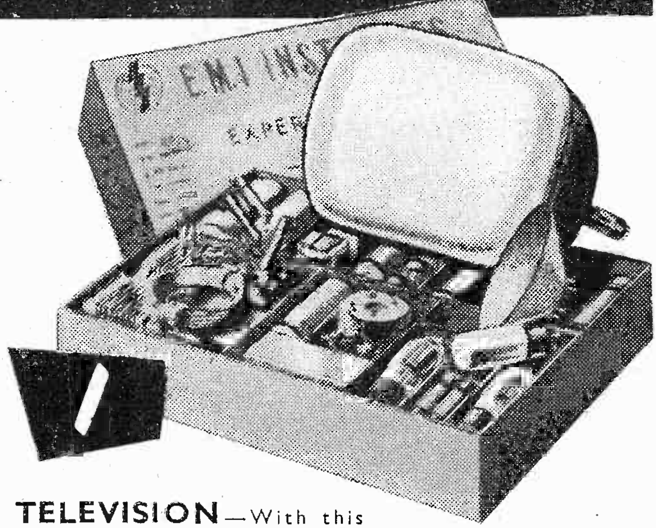

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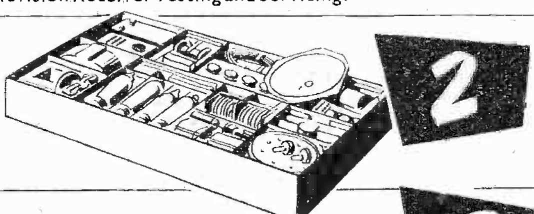

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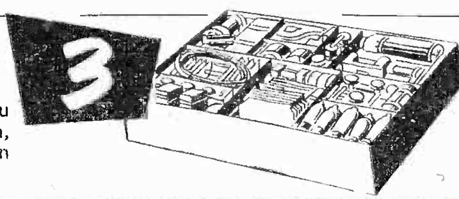

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As the signal must drive the cathode of the C.R.T. in the negative direction then the output of the video valve must be negative, and due to the phase reversal in the valve the input to the grid will have to be positive going on whites.

If the grid of the valve has to be driven heavily in the positive direction it is obvious that the bias of the valve must be very heavy to prevent the valve drawing grid current.

From this it will be seen that the video valve will work at a much easier rating than is possible in the case of the grid modulated tube. No-signal conditions leave the valve drawing minimum current.

Heavy biasing of the valve requires a large value of bias resistor and this introduces complications in preventing distortion due to the feedback across the resistor. The time constant of the cathode circuit has a marked effect on the quality of the picture.

Another bad effect is that as peak white is represented by a positive potential on the grid of the valve, the pulses due to car ignition interference drive the valve heavily in the positive direction with the result that the valve is driven into grid current far beyond the normal white level. The pulses appear whiter than white, so to speak, and are very much over-emphasised.

In some cases synchronising signals suffer when cathode modulation is employed. It will be remembered that the sync signal occupies the first 30 per cent. of the waveform ; if the video valve is overbiased the beginning of the sync pulses will be cut off.

So far as the home constructor is concerned the system suffers from another serious defect. As the signal is tied to the cathode a cathode-heater short-circuit in the C.R.T. will cause serious distortion of the signal even though the heater of the tube occupies a separate winding on the transformer, or uses a separate transformer entirely.

Apart from the capacity between primary and secondary windings (and hence to earth), there is also some capacity to earth by the core. The practical result is as though a condenser were connected across the cathode of the C.R.T. and earth.

In such cases it is necessary to use a separate heater transformer designed for low capacitance.

Cathode Modulation—Advantages

Perhaps the most important advantage with cathode modulation is the safety factor.

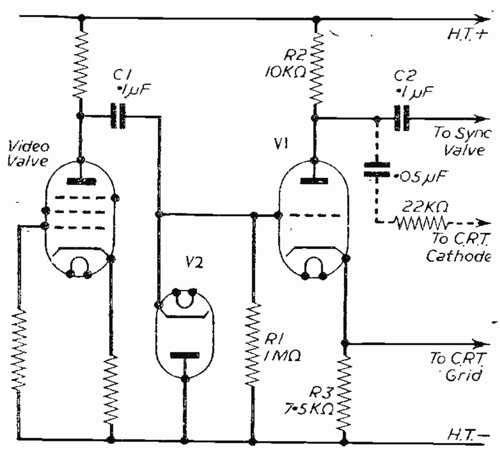

Fig. 4.—A phase splitter circuit.

Should a directly-heated or metal rectifier be used, full H.T. potential will be available on the H.T. rail immediately upon switching on, and this voltage will be felt by the cathode until the video valve warms up. No harm results because the more positive the cathode the more negative the grid in relation to it and the beam is therefore effectively suppressed.

In the same way, if the video valve fails then it will not draw current and there will be a rise in positive potential at the anode, and hence an increase in positive potential on the cathode of the C.R.T. The grid is made more negative under such circumstances rather than more positive as in the case of grid modulation.

Another important point is that as the video valve can be biased back almost to current cut-off it works at a much easier rating and its life is prolonged. Greater use can be made of the valve by increasing grid and anode potentials and hence greater gain can be obtained.

With grid modulation the peak white drives the video valve towards current cut-off ; with cathode modulation peak white drives the video valve towards current saturation and it will be observed that, generally speaking, the high lights are brighter when cathode modulation is employed.

Summary

There is very little observable difference in the quality of the picture between either modes of operation, though the cathode method seems to give a crisper picture.

In view of the fact that C.R.T.s are inclined to develop cathode-heater short-circuits the writer rather favours the idea of grid modulation—especially where it is intended to experiment with the circuit. The main disadvantage (the risk to the tube through valve failure) can be overcome by employing a phase splitter such as is used in many popular circuits employing ex-government tubes such as the VCR97.

The method is equally applicable to magnetic tubes, and for those who would like to experiment a suggested circuit is given in Fig. 4.

The output from the video valve is fed via the coupling condenser C1 to the grid of the phase splitter valve V1. This valve can be any triode such as a 6J5 or pentode operated as a triode. It is heavily biased and draws very little current.

R3 is the bias resistor and connection is taken directly from the cathode to the grid of the C.R.T. ; the C.R.T. grid is therefore practically at earth potential and as the cathode is biased positively as in Figs. 1 and 2, failure of V1 merely results in the grid of the tube being made more negative with respect to its cathode, as there is then no potential drop across R3.

Sync pulses are taken from the anode of V1 the pulses being in same phase as the picture signals on the cathode, i.e., they are positive going and can be used directly to operate a sync separator using the common heavily biased pentode.

V2 is a simple diode valve such as an EA50 or a germanium crystal and is used to restore the D.C. component of the signal. As the grid of the C.R.T. is directly coupled to V1 there is no need for restoration here, but restoration must be made at the grid of V1 as the all-important component has been blocked by the coupling condenser.

Thoughts About TV Critics

A BBC PRODUCER CRITICISES THE POSITION OF THE CRITIC

By "Q"

I USED to delight in the early Charlie Chaplin films. The more custard pies that were thrown, the more pleased I was. Then a dreadful thing happened. The critics of the time discovered that Charlie was not just a comic but a symbol of social importance. Significantly, he ceased to be Charlie and became Charles. And I, seeking the symbolism for which I had been told to look, no longer laughed. This memory is prompted by the realisation of what TV critics are doing to viewers to-day. There is a tendency amongst some of the less responsible of them to induce the feeling that the item we enjoyed so much last night was, in fact, something in the nature of a national disaster. The viewers' confidence in their own judgments is undermined because they reason with themselves that a national newspaper would not employ a man as critic unless he could speak with a voice of unquestionable authority. This, on the face of it, is absurd.

The Specialised Critics

Inevitably, comparison must be made with other kinds of newspaper critics: those for music and drama. (I will omit book critics because they are obviously supermen who can read and pronounce judgment on anything up to 20 books a week.) The music and drama critics follow a long and distinguished tradition, and the essence of their work is that they are specialists in their particular fields and so able to offer expert guidance and opinions to members of the public with similar interests. Although, mercifully, it is still common practice that critic A will say a play is bad and critic B that it is good, a critic whose judgment is found to be consistently faulty will in time have to look for another job.

Let me repeat that music and drama critics are specialists and, except in the case of an exceptionally gifted person, the drama critic would not dare to pass an opinion on the merits of a musical performance, and vice versa.

Uninformed Opinions

No such integrity hampers the television critic, who cheerfully passes opinions not only on music and drama but upon everything that appears on the screen. They cannot be specialists in all these subjects, as their professional brothers are in theirs, and therefore their opinions cannot be of great value. Viewers should be reluctant to change their opinions because the television critic happens to hold a contrary view.

We have questioned the authority of critics to pass informed opinions. What is more objectionable is the manner in which these uninformed opinions are frequently passed. This writer holds the opinion that when a young man writes satire it is a confession of failure; unable to create, he destroys. The same attitude of mind prevails in some newspapers, not only about television but about everything. An example is when a reporter interviews a celebrity, accepts his hospitality and then criticises the amount or quality of the drinks offered. This attitude of denigration must be fostered as a good policy by the newspapers concerned, who probably excuse themselves by saying that the public lap it up and make their sales increase. If this be true, shame on the newspapers and on the section of the public that encourages them in their policy.

Certain it is that many television critics, consciously or unconsciously, adopt an attitude of criticism that is mainly destructive. Some express their views with the vehemence of a virago which is as silly as it is unnecessary, and could be disregarded but for the proven fact that constant reiteration affects the judgment of viewers and convinces them that they are having a shabby deal from the BBC.

In an attempt to be fair it is necessary to examine the kind of lives television critics have to lead. Do you recall your own early days of careless rapture when you watched every programme that came on to your brand new set? Then, as the honeymoon ended, do you remember how you became selective and, by experience, discovered the types of programmes you liked and gave up watching each and every item and went back partially to the life you led before—reading books and going to the cinema. Now, as experienced viewers, how would you feel if you were compelled by your job to watch every programme?

That is what television critics are supposed to do, except when the repetition of the Sunday play gives them an excuse to escape from the tyranny of the screen. Is it to be wondered if what they sometimes write conveys an impression of having been written by a man who is TV punch-drunk?

The Remedy

The remedy lies in the hands of those who employ critics. Far too much space and attention is being given to television and not enough to radio. There are not enough experts to deal authoritatively with every kind of programme now being transmitted and, unless an opinion can be given an authority equal to that of musical and dramatic criticisms, it should not be given at all. Television has now become part of the texture of our national life and is destined to grow in stature. It requires criticism to help its development but only responsible, authoritative criticism will be of any value. The newspapers should appoint more and more critics, each with special qualifications to make his views worthy of our consideration.

If an immediate palliative is required it is suggested that the present television critics should work on a shift system, working week and week about, sharing their job with another reporter. One condition should be that the new boy be told that, unlike the drama critic who shared the first night of the new play with a few hundred people only, his criticisms will in turn be criticised by millions of viewers who shared his first night with him.

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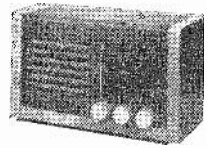

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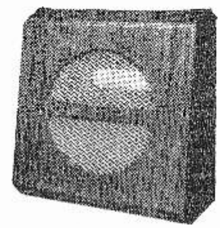

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ELAC	4in.	Square type 4/02, 2 to 3 ohm	13/9
GOODMANS	5in.	Round type	14/9
PLESSEY	5in.	Latest type	13/6
GOODMANS	6½in.	Round type	15/11
LECTRONA	6½in.	With transformer	18/-
PLESSEY	6½in.	Round type, 2 to 3 ohm	14/11
ELAC	6½in.	Type 6/19, 2 to 3 ohm	15/6
TRUVOX	6½in.	Wafer, only 1⅝in. deep, 2 to 3 ohm	20/-
R. & A.	8in.	Lightweight, 2 to 3 ohm	16/11
PLESSEY	6½in.	Mains Energised	17/6
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LECTRONA	8in.	PM 2 to 3 ohms	16/6
ELAC	8in.	PM 2 to 3 ohms	17/6
ELAC	10in.	Units, 2 to 3 ohms	22/6
PLESSEY	10in.	Lightweight	19/6
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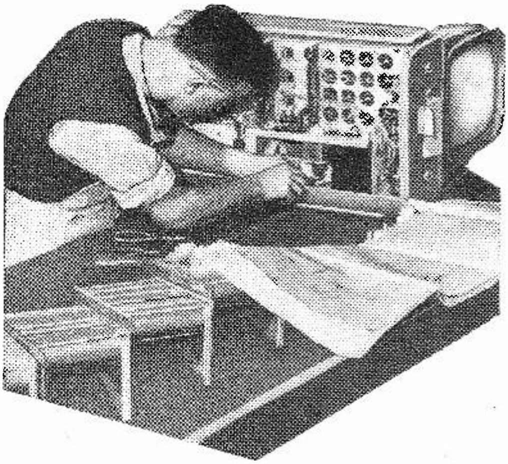
PAGES FROM A TELEVISION ENGINEER'S NOTEBOOK

21.—ALIGNMENT AIDS FOR TV



ONE of the bugbears of the home-constructed television receiver (or for the ordinary broadcast receiver for that matter) is the problem of alignment. It is true that very good alignment can be made using the Test Card C and actual picture transmissions as a guide, but to the experimentally minded constructor, who is constantly modifying his circuitry and trying out other systems, the assistance of a piece of test gear to show him exactly "where he is" at any particular moment must be considered almost indispensable.

The main instrument to come to mind is the signal generator, but this is not always the most useful piece of equipment, especially where circuit alignment on wide-band apparatus is concerned. It is much better to have gear which can show immediately the state of the response curve, and detect any changes in its shape, amplitude, frequency disposition, etc., as soon as they occur, rather than the laborious process of point-plotting the response curve as detector output against spot-frequency inputs, necessary with a straight signal generator.

Visual alignment, of course, means the use of an oscilloscope and a frequency-modulated oscillator (or "wobbulator"), but neither of these devices is beyond the capacity of the home-constructor to make, and in their way, are simpler to build than a first-class signal generator.

There are several methods of building a suitable frequency-modulated oscillator to cover the television bands (Band 1 is now being considered), and the following notes should enable the practical constructor to make his own without difficulty.

Basic Principles

The principle of operation of visual alignment systems is well known, but a few words will be said for the benefit of those who may be vague on the matter. In Fig. 1, an oscillator which is capable of being swept over the frequency band 42 to 48 Mc/s is shown connected to a television receiver normally tuned to receive Alexandra Palace. The D.C. output at the detector of the set is connected to the Y-plates of a C.R. tube, while the X-plates are connected in the usual way to a sawtooth source providing a linear timebase. This sawtooth voltage is also fed back, and is synchronised to the frequency-modulated oscillator, the manner of doing this being ignored for the moment. Consider, then, the action of events: the spot begins to move across the screen from left to right, and simultaneously the frequency of the oscillator begins to increase from 42 Mc/s towards 48 Mc/s. By the time the spot has reached the right-hand side of the screen, the frequency has just reached 48 Mc/s, and as the rapid flyback of the spot to the left occurs, the frequency reverts immediately to 42 Mc/s, after which the cycle repeats. The base line drawn on the tube screen, therefore, is one of frequency, representing a frequency change of 6 Mc/s within which lies the tuning range of the televisor under test.

Now, as the input frequency to this receiver changes so will the detector output voltage, being a maximum at the peaks of the response curve, and falling to a minimum at the extremes of the passband. The vertical deflection of the spot will therefore be proportional to the detector output voltage at any particular frequency, with the result that a picture of the actual response curve will be traced out continuously on the screen. Any alteration to the tuning of the receiver will consequently be seen immediately by the operator as a change in the shape of the response curve, with a result that alignment is rapid and relatively simply.

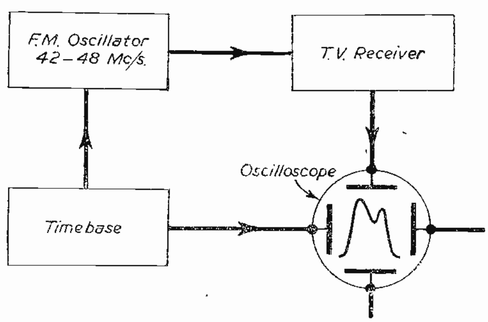


Fig. 1.—Basic set-up for displaying a TV response curve on an oscilloscope.

There are, of course, several pitfalls to avoid in the use of a wobbulator in this way, otherwise the response curve as seen will be quite different from the actual one, but the system is by no means difficult to master.

Covering the TV Band

As described above, the wobbulator would be of use only on T.R.F. receivers tuned to the London frequency around 45 Mc/s; if a set came in for an of the other frequencies now in use, or if an I.F. strip of, say, 13 Mc/s needed alignment, the gear would be of little value. To make the instrument capable of use on all these frequencies, a further modification is called for.

Suppose that a frequency range of from 5 Mc/s to 70 Mc/s is required. This range will cover all the present I.F. and R.F. in use. In addition, wherever the tuning is set, the frequency is to be swept over 6 Mc/s, that is, plus-or-minus 3 Mc/s either side of the centre frequency chosen. The instrument then becomes usable over the whole of the present television frequencies.

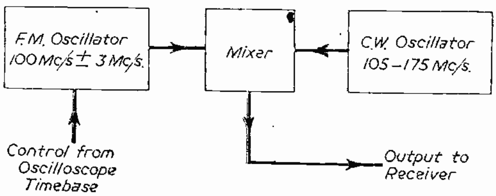


Fig. 2.—A modification enabling the whole TV band to be covered.

To do this requires a system somewhat as shown in block form in Fig. 2. Here the frequency-modulated oscillator works at 100 Mc/s and is "wobbled" by the sawtooth control voltage from the oscilloscope timebase over a range of 3 Mc/s either side of this, that is, the F.M. oscillator works over the range 97 to 103 Mc/s, in sympathy with the input sawtooth. This output is applied to a mixer stage, the other input to which is a C.W. signal, capable of being manually tuned throughout the range 105 to 170 Mc/s. The mixed output will therefore range from 5 Mc/s to 70 Mc/s (the difference signal), with a 6 Mc/s wobbulation at any point. If the C.W. oscillator is under the control of the operator, therefore, he may set this to suit any I.F. or R.F. used on the set under test. The other mixer output is the sum of the inputs, that is the range 205 to 270 Mc/s, but this is of no consequence.

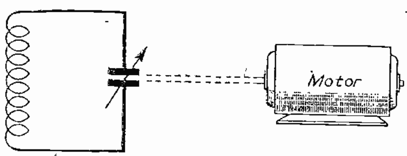


Fig. 3.—A motor-driven condenser system.

Method of Frequency Modulation

There are two methods of frequency-modulating a C.W. oscillation; mechanical and electronic. The mechanical systems consist basically of a tuned circuit, in which either the condenser or the inductance is varied by mechanical means; usually, a small condenser is driven by a motor in continuous rotation, thus sweeping the oscillator over the required range of frequency.

In the electronic system the method is entirely valve controlled, no moving parts being employed. A valve is made to simulate either a condenser or an inductance by a suitable set-up in its phase conditions; control of its mutual conductance by means of the input sawtooth then enables the oscillator to be controlled over the necessary frequency sweep range.

At lower frequencies, such as the normal broadcast bands and the usual I.F. in the region of 465 kc/s, such electronic wobbulation is reasonably simple to achieve, as a sweep range of some 10 to 20 kc/s normally suffices. For the television frequencies, however, and for the larger sweep requirements of at least 6 Mc/s, such a system is by no means straightforward, and the mechanical methods are probably better for the home constructor to build. Electronic sweeping can be done, of course, and very wide ranges can be covered, but the equipment tends to become complicated and large numbers of valves are used, factors against the limited means of the home constructor.

The reason for the comparatively high frequencies of Fig. 2 should now be apparent; a change of 6 Mc/s in a 100 Mc/s oscillator is easily achieved with a very simple mechanical system, and the ease of control over the entire television band makes it a practical proposition to the experimenter. The main difficulty is that of synchronisation between the timebase sweep and the change in frequency, especially if the former is linear.

Mechanical Methods

It is usual to arrange the control of the timebase to come under the mechanical control of the device which is operating the tuned circuit change; a switch can be arranged to close periodically and trigger the timebase sweep, which is then automatically synchronised to the frequency change. An alternative is the use of a continuously rotating potentiometer to generate the timebase sweep, but this system is not to be recommended. The best method, if it can be arranged, is to let the timebase run at its normal free rate, and use this to control the mechanical system. The timebase repetition is not then tied down to that of the mechanical device, and can be varied over a range.

Consider Fig. 3 where a condenser is continuously rotated to tune the resonant circuit through the desired range. This condenser will be of the semi-circular plate variety, and it will move from a

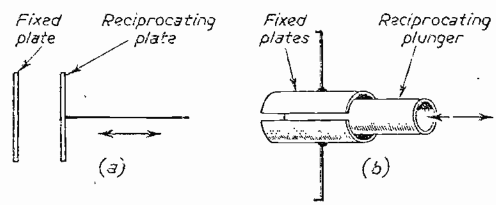


Fig. 4.—Variable capacities operated by reciprocating plates.

minimum capacity to a maximum over 180 deg. of its revolution, the other 180 deg. reversing this. For each complete revolution, then, the frequency sweep decreases to a minimum and then rises to a maximum. It does not do this linearly, however, for the capacity change itself is linear with rotation, making the frequency follow a square law. Half the sweep, being a reversed repetition of the other half, is not strictly needed, and the tube trace will have to be blanked out over this half period to avoid confusion.

The alternative to the rotating condenser is the reciprocating condenser; here a plate is fixed with another plate being moved to and fro before it, see Fig. 4 (a).

(To be continued.)

TELENEWS

Television Licences

THE following statement shows the approximate number of television licences issued during the year ended July, 1954. The grand total of sound and television licences was 13,477,263.

Region	*Number*
London Postal ...	967,951
Home Counties ...	371,734
Midland	661,791
North Eastern... ...	468,208
North Western ...	488,872
South Western ...	152,084
Wales and Border Counties	174,558
Total England and Wales	3,285,198
Scotland	158,343
Northern Ireland ...	13,187
Grand Total ...	3,456,728

Test Transmissions

THE extra hour of test transmissions from noon till 1 p.m., consisting of test card "C" accompanied by recorded music, will continue for four months.

The additional testing time began on September 1.

Commercial Costs

ACCORDING to *Television Digest* of America, to buy one full hour of time during the evening hours when viewing is heaviest on all the 382 commercial television stations in operation in the United States, as of July 15, would cost 194,875 dollars.

This gives an average of about 510 dollars for time alone, not including talent, production, interconnections and other costs.

Two-unit Camera

PYE LIMITED have installed a minature TV camera in a specially constructed hut on the stern of the whaling factory ship "Balaena." This camera is to be used to relay pictures, on a closed circuit, over 750ft. of cable to a monitor on the bridge. The control of manoeuvres from the bridge has always been difficult as there is an approximate distance of 500ft. between the bridge and the forecastle and two vast funnels obstructing the view of anyone wishing to see between them. As both whales and ships tie up at the stern, the difficulty of controlling operations will be considerably eased by the use of television.

Hessary Tor

THE BBC has at last been granted permission by the Ministry of Agriculture to build a television station at North Hessary Tor, Dartmoor, after many protests had been received by nature-lovers who believe that a TV mast would mar the beauty of the countryside.

The new aerial will serve Devon and Cornwall and construction is expected to begin as soon as possible.

Interference from Amateurs

VIEWERS who have been troubled by interference from radio amateurs are now able to fit a modifier to their receivers which eliminates the nuisance and costs no more than a few shillings.

Previously, the responsibility of getting rid of interference laid with the "ham" who had either to do so or not transmit. Now, that is as from October 1, it is up to the TV owner whether he views in comfort or not.

Jubilee of the Valve

NOVEMBER 16th will mark the end of the fiftieth year of the valve, for it was on that date in 1904 that Sir Ambrose Fleming took out the fundamental thermionic valve patent, number 24850, entitled "Improvements in Instruments for Detecting and Measuring Alternating Electric Currents."

The I.E.E. are arranging an exhibition of apparatus and equipment used over the period and three lectures on the development of the valve will be given by Sir Edward Appleton, Professor G. W. O. Howe and Dr. J. Thomson. These lectures are to be delivered on November 16 and the proceedings will be opened by the Lord President of the Council, the Marquess of Salisbury.

Conservative Party Conference

THE BBC Television Service will present three half-hour reports on the 1954 Conservative Party Conference on the evenings of October 7th, 8th and 9th. These programmes, which will be introduced from a special studio adjacent to the Conference Hall at Blackpool, will include a tele-

Among the many interesting features at the National Radio Show was a demonstration of television being used on the battlefield by the Army.

recorded report on the day's proceedings. It is also hoped to interview at Blackpool some of the personalities taking part in each day's debate.

"In Town To-night"

ON September 18th "In Town To-night" began its second series of simultaneous broadcasts in the Home Service and Television.

The programme will be 21 years old in November and producer Peter Duncan is to continue his policy of keeping it up to the minute in news content and hopes to include as many interesting people from the Commonwealth as possible.

Rowridge Station

THE BBC has announced the appointment of Mr. E. P. B. Metcalfe as engineer-in-chief of the TV station now nearing completion at Rowridge, Isle of Wight, which is due to come into operation on November 12th.

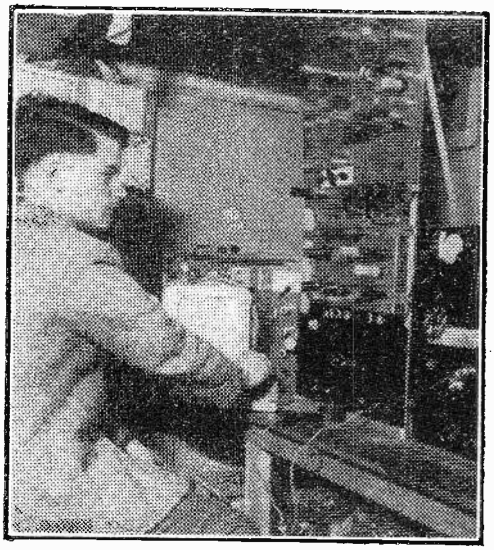
Mr. Metcalfe has been with the BBC since 1936 and for the past 15 months has held the position of engineer-in-chief at the temporary TV station at Brighton, which will close down when Rowridge opens.

Colour Tubes Cheaper

LATEST reports from America indicate a steep reduction in the price of colour television receivers.

The 12½-in. screen model produced by the Radio Corporation of America dropped from £350 to £175 in one day. Customers who had bought their sets before the reduction were refunded the extra £175.

It is understood that the price cut was to clear the shops and stockrooms to make way for the larger-size tube models.



Jeremy Royle in the control room of his own private TV station. The monitor screen in front of him shows the signals before they are finally transmitted and affords an opportunity for correction.

Trade's Code of Honour

A LIST of "gentlemen's rules and regulations" has been drawn up by the Radio and Television Retailers' Association and the British Radio Equipment Manufacturers' Association and circulated to dealers and service engineers throughout the country.

Among the list of "offences" to be avoided are: offering free replacement of tubes, valves, etc., outside the guarantee period.

Not charging for outside or loft aerial erection; offering hire purchase or credit facilities without a reasonable charge.

Bing Crosby Successes

FOLLOWING the televising of snippets from the better-known films of Rita Hayworth and Doris Day, the BBC announces that Graham Woodford, who compiled the two programmes, is planning a similar feature on Bing Crosby's Paramount hits for transmission just before Christmas.

Show Goes North

THE R.I.C. plans to hold a radio and television exhibition, the second Northern Radio Show since the war, at the Manchester City Hall next May. The probable dates are May 3rd to 14th.

Mr. R. P. Browne, secretary of the R.I.C., said: "The immediate success of the show at Earls Court and the great interest shown by dealers from the north has encouraged us to hold an exhibition in Manchester Since the last Northern Radio Show in 1952 there have been considerable advances in the industry and in broadcasting, and the show will be held on the eve of commercial television."

Contracting the Stars

IT is learned that the BBC intends offering long-term contracts to stars who have earned a large following through their appearances on TV. The main clause of such contracts is, of course, that the star cannot accept offers of engagement from commercial bodies and must appear only on BBC programmes.

About 20 such contracts are to be offered. Gilbert Harding and Wilfred Pickles have already signed on the dotted line.

"Wrong Forecasts" Protest

MR. F. BOTTOM, Rhyl Publicity Manager, has sent a protest to the BBC about the transmitting of incorrect weather forecasts.

They can have a very bad effect on business at sea-side resorts, he says, particularly before a week-end when holidaymakers are wondering where to go. He claims that the BBC occasionally broadcast that fine weather will prevail in certain areas only. Trippers flock to these places and enjoy the sun, yet other areas where rain had been forecast has just as much a share of the sun but no visitors.

The Editor will be pleased to consider articles of a practical nature suitable for publication in "Practical Television." Such articles should be written on one side of the paper only, and should contain the name and address of the sender. Whilst the Editor does not hold himself responsible for manuscripts, every effort will be made to return them if a stamped and addressed envelope is enclosed. All correspondence intended for the Editor should be addressed to: The Editor, "Practical Television," George Newnes, Ltd., Tower House, Southampton Street, Strand, W.C.2.

Owing to the rapid progress in the design of radio apparatus and to our efforts to keep our readers in touch with the latest developments, we give no warranty that apparatus described in our columns is not the subject of letters patent.

Your problems solved

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 239 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

MAGNET DETERIORIATION

The picture on my Pye LV51 12in. TV appears to be moving to the left (as one views). I have tried adjusting the picture centring magnets, but this makes no difference. Can you help me, please?—H. G. Matterface (Welling).

Your remarks indicate that the field strength of the picture centring magnets may have deteriorated somewhat and that magnet replacement may be demanded. Before contemplating this change, however, we would advise that you check the insulation of the 25 microfarad electrolytic capacitor included in series with the line deflecting coils.

CONVERTER RESULTS

I have a Philips 9in. screen set, but this is tuned to Alexandra Palace. I constructed the converter contained in your issue of February, 1951, Volume 1, No. 9, and this has given me very good sound reception from Sutton Coldfield. Do you think that you could let me have the circuit for a converter for the vision unit? Having done half the job I should very much like to finish it.—Herbert H. Smith (Nottingham).

We would point out that the "London/Birmingham Converter" described in our February, 1951, issue of PRACTICAL TELEVISION is designed to embrace both the vision and the sound channels.

FRAME FAULT—"ARGUS"

I have built the "Argus" and have struck trouble as follows:—Picture very good but the bottom half is superimposed on the top half.

Sound stops at EB34, but I can get it through the cathode by removing condenser from diode 2 and connecting to cathode.—A. R. Collyer (Uxbridge).

Receipt of a double raster indicates that the frame circuit is running at much too high a speed. Check C43, R49 and VR5.

The optimum value for C43 is 0.005 μF.

If the sound channel is heard on one side of the EB34 and not the other suspect a faulty R23. This resistor is best checked by substitution.

"SIMPLEX" TROUBLES

I have built the "Simplex" television set which has the following faults:—

1. The only illumination I can obtain on the screen is a beam of light which is S in shape.

2. The contrast control has no effect on this beam.

3. When the brilliance is advanced to maximum this beam flies off at the top of the screen.

All the other controls are working perfectly.

I have an idea that the tube (VCR517) is perhaps the wrong type, or perhaps a wrong connection on the vision side is causing this trouble.

I have not tried the set with an aerial yet, as according to data in "Practical Television" I should get an illuminated screen with a raster.—B. Liddington (N.W.11).

With no aerial connected you should be able to get a raster on the screen by operation of the brilliance and focus controls. The raster is an oblong shape composed of a large number of fine horizontal lines. The width control in conjunction with the linearity control affects the overall width, and the height control the height.

V11 provides the height and V12 amplified by V13 the width. Therefore if the "S" shape is in the vertical plane then V12 and/or 13 are not functioning.

A rough check can be made by using a loudspeaker in series with a condenser of about 0.1 μF to listen for the horizontal pulses. If one lead of the speaker is connected to chassis and the other to one side of the condenser then a wire taken from the other side of the condenser can act as a test lead. Connect the test lead on to the anode of V12 and by operation of VR7 you should be able to hear a high-pitched whistle. If nothing is heard then this valve stage is faulty and must be examined. If the whistle is heard check its progress through to the grids and anode of V13 and then, by disconnecting the E.H.T. condensers, you can trace it through to the C.R.T. By this means you will find at which point the circuit fails.

To steady the raster a condenser of 0.03 μF 2.5 kV. can be connected between chassis and pin 8 of the C.R.T.

FAULTY OSCILLATOR

I would be very grateful if you would help me to trace the following faults on my Philips TV set 1100/15 which is now two years old.

1. Every time I switch the set on I get a raster with the diagonal lines but no picture or sound, but on touching the anode of V1 or V2 with meter prod as when taking voltage measurements, I get the picture and sound and they remain until set is again switched off. Also if I touch control grid of V2 I lose both picture and sound, but again on touching anodes as above picture and sound return.

2. About 3in. from the bottom of screen the legs of

people and things seem to be notched like a saw. I have tried changing valves over but without any success.—W. Sullivan (Bargoed).

It is not good policy to interchange valves within a receiver, for such practice can readily impair the general alignment due to valves being interchanged in the R.F./I.F. stages that may possess slightly different characteristics—although of the same type.

The symptom mentioned is probably caused by an intermittent defect in the local oscillator section. In this respect check the frequency changer valve (EF80), and also the resistors, and particularly the capacitors associated with the oscillator coil and screen grid electrode of this valve.

POOR INTERLACE

I have built an "Argus" TV according to the blueprint and have good sound, vision. I cannot get proper interlace, getting lines across the picture tube running slowly. Should the focus and brilliance controls work clockwise ? I cannot black out tube which is O.K. in ex-service set I have. When the focus control is full-on clockwise I get definition in picture ; if I turn this control down the tube gets brilliant. I have tried different values of pot. for focus and brilliance, but these give either too much or too little ; altered values in E.H.T. network. There is a slight hum in the mains transformer which gets hotter than normal.—G. Harris (Bristol 5).

To control the brilliance try increasing R67 up to 270 K. or even 470 K. If this does not effect a cure then you have a leakage in the E.H.T. network which must be found.

When you are able to black out the raster then the brilliance control should be set so that the flyback lines are not seen when the picture is being received.

To obtain correct locking of the vision check C43 (should be 0.005 μF) and if top foldover is experienced reduce C44 to 0.002 μF.

USING MORE E.H.T.

I would be grateful if you could give me some advice on this problem. I bought a second-hand tube for my set, which is a Defiant TR.947. The set uses a C.R.M.92 tube, but the tube I have bought, a C.R.M.92A, needs another 1,000 volts E.H.T. for normal working. Could you please give me details of obtaining the extra voltage without discarding the present E.H.T. system in the set, which uses mains transformer with a U.22 rectifier?—P. Barker (Morden).

Unfortunately, owing to limited scanning power available in your set, it is not readily possible to use an increased E.H.T. potential. To do so would almost certainly result in insufficient horizontal and vertical scan amplitude.

There is very little service data available on your model, though, apart from the manufacturer's, you may be able to acquire a Service Sheet from one of the firms advertising in this connection in PRACTICAL TELEVISION.

MOVING RASTER

On advancing the brilliance control my raster climbs up the face of the tube and disappears at the top. I have replaced my height control but this has made no difference.

On approaching my TV from the vision unit side the screen becomes brighter, when walking away it goes dull. The same thing happens when I pass my hand over it.

I have checked and replaced V11, C24, R24 and VR6. I have also tried doubling the value of C24, but the fold-over still exists.

The vision and sound signals are still very strong in the earphones.—R. Guy (Manchester).

Movement of the raster associated with movement of the brilliance control usually indicates that a faulty coupling condenser exists. Check C29, 30 and 31. In some cases a condenser of 0.03 μF 2.5 kV connected between pin 8 of the C.R.T. and chassis will steady the raster.

The normal position of the brilliance control is that with the aerial disconnected the brilliance should be set so that the raster is barely visible. Now with the aerial connected the contrast is advanced until a pattern appears on the screen.

"SIMPLEX" FAULTY

I have recently completed the building of your "Simplex" receiver and it has given many hours of enjoyment. I have had no previous experience in the building of TV receivers and I was frankly amazed at the results.

However, I would be grateful if you could help me to clear up the following points.

(a) Frame non-linearity (not too serious).

(b) Picture shakes on low notes in spite of all attempts at tuning out with rejector coil.

(c) A recent fault which has developed, viz., a slow wave moves vertically down the picture.—Ian D. Gooch (Coatbridge).

(a) A small degree of non-linearity of the frame scan is to be expected on the "Simplex" receiver, as is present on most commercial sets. This condition may, however, be aggravated to a point where non-linearity is unacceptable by a defect in V11, or if the value of the associated parts is far removed from the accepted tolerance.

(b) Apart from a mistuned rejector circuit, poor general alignment can aggravate the effect of sound interference on vision. Note whether the effect disappears when the sound volume control is turned right off ; if it does, microphony in V11 should be suspected—test by tapping the valve whilst observing the effect on the picture.

(c) This effect is symptomatic of mains ripple that is not synchronised to the frame timebase ; it often occurs if any television set is working from a power supply other than that connected to the general grid system—such as home generating plants. Should this not apply in your case check (a) the mains smoothing, and (b) V11 and the frame timebase circuits generally.

BEGINNER'S TIMEBASE

I am building the above timebase. There is a general shortage of .1 μF 2,500-volt condensers. I have secured two .1 μF 3,000 volt for condensers C20 and C21, but cannot secure 2,500-volt condensers for C9, C10, C8 and C11. Will it be in order to use four .1 μF 1,500-volt condensers in positions C8, C9, C10 and C11 ? I shall be glad if you would let me know. I have also four .03 μF 2,500-volt condensers but I fear their capacity is too low.—Peter Cowan (Fife).

C9 and C8 can be 0.01 μF 2.5 kV. which are obtainable, but C10 and C11 must be 0.1 μF minimum. 1.5 kV. condensers can be used if four of them are connected in quadrature (in parallel-series formation).

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CORRESPONDENCE

The Editor does not necessarily agree with the opinions expressed by his correspondents. All letters must be accompanied by the name and address of the sender (not necessarily for publication).

"H" VERSUS MULTI-ELEMENT ARRAY

SIR,—Mr. West's reluctance to accept the theory that a very low noise pre-amplifier is rendered ineffective by external noise (except in very exceptional circumstances) is understandable. However, this is the case, as has been shown by many workers on the subject. The article "The Noise Performance of Television Receivers," *Electronic Engineering*, April 1954, is recommended for reading. In this article the subject of pre-amplifiers has been discussed in detail, and the conclusion was drawn that only where an exceptionally long feeder has to be used is the use of a low noise pre-amplifier advantageous.

In the example given by Mr. West, of a receiver with a mixer as the first stage, this will, of course, result in a very bad signal-to-noise ratio due to the extremely high level of local oscillator noise. I have already stated that the first stage must be reasonable.

As for the aerial, one should not be too impressed by the nicely shaped radiation patterns published by some manufacturers of multi-element arrays. Such patterns are obtained when the aerial is tested at one frequency only. At other frequencies in the television band the patterns will be seen to approximate more closely to a circle. This is because of the wide band that has to be catered for in relation to the centre frequency. Obviously the spacings of the elements can be correct at one frequency only, that is, to say, spacings of 0.15λ and 0.1λ will be such at one frequency only, namely, at the frequency at which one will obtain these very favourable polar diagrams. In the case of an "H" aerial the spacing is much less critical.—M. R. HARKNETT (Southsea).

TV INTERFERENCE

SIR,—It would appear from your correspondents that nobody ever takes the trouble to read the conditions printed in the Schedule on the back of a Receiving Licence.

Para. 3 of the Sound Licence and Para. 4 of the TV Licence state :

"The apparatus shall be so maintained that it does not cause interference with any other wireless telegraphy."

Surely this applies equally to interference from the timebases of a TV set as it does to the radiations of an oscillating receiver and the last four words of the paragraph apply as much to amateur reception as the reception of broadcasting.

If the terms of this paragraph are enforced, then the owner of an offending TV set can be made to switch off until the interference is suppressed.

If the Post Office fail in their duty to enforce their own terms for granting a licence, then I see no reason at this point why legal action cannot be taken and an injunction be obtained to restrict the use of the offending set until such time as the set is made interference free.

Perhaps some of your more legal-minded readers may like to take the matter up.—JOHN W. ROBINSON (G5UP) (High Westhouse).

THE "SIMPLEX" AERIAL

SIR,—In your August, 1954, issue, there is an article entitled "Making an Aerial for the Simplex Receiver."

In this is a description of how to make a "Double V aerial" complete with diagrams. We would point out that this design of aerial was originated by ourselves and is protected by our Patent No. 666285. It is, in fact, our well-known "Antex" aerial.

While we have no objection to your readers making up these aerials for their own use, we feel that mention should be made that this construction is a patented one. We would, in fact, take action against anybody making these aerials for commercial use. We trust that you will print due acknowledgment of our patent in your next issue.—ANTIFERENCE LTD. (Aylesbury).

AN IMPROVED TV AERIAL

SIR,—Mr. Hobley's article on the aerial arouses interest, and no doubt a more presentable picture is obtained than might be the case with many a thin rod aerial, multi-element or otherwise.

Mr. Hobley's aerial is, of course, a broad band dipole. The broad bandwidth of frequencies to which it is sensitive on account of its large diameter makes the presentation of a sharply defined picture possible. Full use is made of the high frequency components in the video waveform, which covers the range 0 to 2.75 Mc/s approximately. For receiving BBC vestigial side band transmissions an ideal aerial should be equally sensitive (i.e., have an even response within, say, 3 db) from the vision carrier frequency down to the sound carrier frequency, these being 3.5 Mc/s apart.

Many thin rod aerials do not meet this requirement, more especially multi-element arrays, which by the addition of parasitic elements achieve greater directional properties and greater gain at the centre frequency at the expense of bandwidth. This partly accounts for their only slightly improved apparent "pick up" (to quote Mr. Hobley). We should not become confused, however, into attributing this cause directly to the metallic surface area of aerial exposed.—G. L. JEPSON (Portsmouth).

VALVES AT UHF

SIR,—Regarding the above article in the August issue I should like to correct an error in the caption to Fig. 2. The travelling wave tube shown in the illustration is of English Electric manufacture, and is not the type used in the Manchester-Edinburgh link.—S. SIMPSON (Chelmsford).

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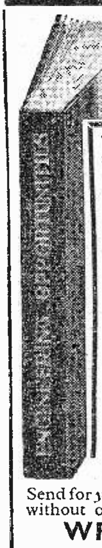

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5Y3	7/6	8D2	2/6	AP4	7/6	PL81	10/6
5Z4	8/6	9D2	3/-	B36	10/6	PL82	10/-
6AB7	6/-	10F1	10/6	BL63	7/6	PM2	3/6
6AC7	6/6	10P13	10/6	CBL1	17/6	PM12	4/-
6AK5	7/6	11D3	6/-	CY1	12/6	PM12M	7/6
6AM6	6/6	12A6	6/6	DL93	8/-	PY80	11/-
6AQ5	9/-	12AH7	12/6	EA50	1/6	PY82	8/6
6AT6	8/-	12AT7	7/-	EB34	1/6	QP230	8/-
6BA6	7/-	12AX7	7/-	EB91	6/-	QS70	10/6
6BE6	7/-	12AU7	10/-	EBC33	7/6	QV04	10/6
6BJ6	7/6	12BE6	6/6	EC91	7/-	RM4	12/-
6BW6	7/6	12C8	7/6	ECC33	9/-	SP4	7/6
6C4	7/6	12H6	3/-	ECC35	9/-	SP61	2/6
6C5g	5/-	12J5	6/-	ECC81	9/-	S130	7/6
6C6	6/6	12K8	8/6	ECH35	12/-	SP41	2/6
6CH6	6/6	12SJ7	7/-	ECH42	10/-	TP22	8/6
6D6	6/6	12SK7	6/6	EF36	4/6	UAF42	12/6
6F1	10/6	12SQ7	8/6	EF39	6/6	UBL21	12/6
6F7	6/-	12SR7	7/6	EF50E	5/-	UF41	10/6
6F12	6/6	12Z3	8/6	EF50A	8/-	UR3C	10/6
6F33	9/6	13D1	8/-	EF54	6/-	UU6	10/6
6H6g	2/6	14B6	10/6	EF80	10/6	UU8	16/6
6J5g	5/-	14H7	10/6	EL2	12/6	UY41	9/-
6J6	8/-	14R7	10/6	EL32	6/6	U403	10/6
6J7g	5/-	15D2	4/-	EF91	6/6	VP2	8/6
6K6g	7/-	19H1	10/-	EF92	5/6	VP2B	10/6
6K7g	5/-	25L6	8/6	EL38	20/-	VP4	8/6
6K8g	8/-	25Y5	8/6	EL91	6/6	VP23	6/6
6L7g	7/6	30	7/6	EM34	10/6	VP41	7/6
6N7g	7/6	35L6	8/-	EY91	7/6	VR53	5/-
6Q7g	8/6	42	8/-	FC2	10/6	VR150	8/6
6R7g	8/-	42Mpt	15/-	FC13	9/-	X24	10/6
6SA7	8/-	43	8/6	H30	7/6	X66	7/6
6SJ7	7/6	50L6	8/-	H63	7/6	Y63	7/6

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