PRACTICAL TELEVISION, SEPTEMBER-OCTOBER, 1950

SERVICING TELEVISION RECEIVERS

PRACTICAL TELEVISION

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EDITOR F. J. CAMM

& "TELEVISION TIMES"

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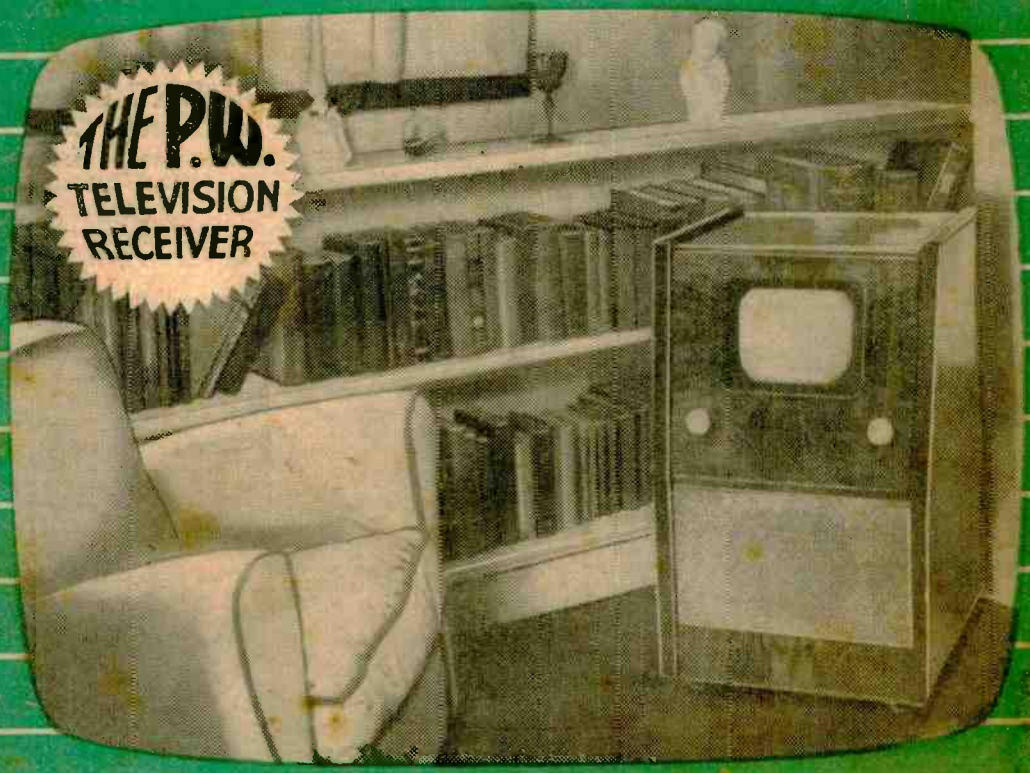

IN THIS ISSUE

PRACTICAL TELEVISION
& "TELEVISION TIMES"

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Televiews

First Continental O.B.

THE tests of the television link equipment installed between Calais and London have been so successful that on August 27th for the first time in history viewers were able to see television pictures from across the Channel. The Channel was spanned by microwave television links which carried the programmes, in a series of hops, from Dover to the roof of London University building, where it was transmitted by land line to Alexandra Palace and retransmitted to London and Midland Regional televiewers. There is historical significance in the short Channel crossing between Dover and Calais. Heliographs were set up by the Romans at Dover and it was in 1931, using principles having close resemblance to those of the heliograph, that the first microwave radio telephone link was demonstrated. The broadcast on the twenty-seventh was the fructification of intensive work and research by B.B.C. engineers and by the British Radio manufacturers who supplied the equipment for linking Calais and London. Hitherto, the working range for the mobile television units has been about 20 miles. This equipment was too cumbersome to be used in a confined space. The rapid developments of the past year in television radio links have produced lightweight equipment which can be taken to the scene of action and set up immediately. Several of these units can be used in tandem, the picture being transmitted from one to another in a series of hops, thus permitting much greater distances to be covered. These microwave radio links enormously extend the scope of television outside broadcasting, by increasing the distance over which television picture signals can be sent. Experimental work only started last year and two sets of equipment were used successfully for televising the boat race this year. In May of this year the first outside broadcast from the coast was successfully achieved using one very high frequency and two microwave links between Southend and London. More recently the test match was televised from Nottingham by means of microwave links. The Calais-London broadcast was more difficult of achievement because the distance was greater—about 90 miles and the stretch over the sea introduces special problems in television transmission. It has been found that the strength of the signal received at Dover fluctuates with changes in the weather and the tides and was also affected by the passage of ships through the Straits. Many experiments were conducted before the ideal site was found.

There were three intermediate stations along the route to London in addition to the terminal stations at Calais and Dover. A microwave link was used for the first lap across the Straits of Dover, with the transmitter 200ft. above ground in the tower of the Town Hall at Calais and the receiver on a mast at Dover. Another microwave link carried the signals from Dover over the 26 miles to Warren Street, near Lenham. The next stage from Warren Street to Harvel, about 18 miles, was accomplished with a V.H.F. link. From Harvel, which is near Wrotham, the signals carried the last lap to London, where the receiving equipment had been installed on the London University Senate House in Bloomsbury. From there the signals went by cable to Alexandra Palace, having travelled a distance of 95 miles in four stages.

The portable microwave television link, such as that produced for the purpose by Standard Telephones and Cables, Ltd., is a frequency modulated S.H.F. system employing carriers of the order of 4,000 megacycles, and operating between points within visual range of each other and not normally more than 30 miles apart. For transmissions over longer distances one or more repeaters may be used. These comprise, without modification, a standard receiver for demodulating incoming signals and a transmitter for re-modulating the resulting video signals and passing them on in the desired direction at a frequency shifted from that of the previous link of 40 megacycles to prevent mutual interference.

The complete mains-operated transmitters and receivers are transportable, being broken down into a number of portable units. Except in the case of semi-permanent receiving terminals, equipment is designed for use in a motor van. The 4ft. paraboloid transmitter and/or receiver assembly may be mounted on a spigot on the roof so that no equipment need be removed from the van for short and unobstructed radio linkages. Where transmission paths are not clear of buildings and leafy trees, it is necessary to find a more elevated or suitable vantage point for the paraboloids.—F. J. C.

Building the P.W. TELEVISION RECEIVER—3

Wiring and Mounting the Tag Boards : Coil Details

THE receiver is wired in two ways—certain components being fixed to the chassis and wired, and others being mounted on tag boards and interconnecting wires run from these to the chassis items. As with any receiver, it is essential that no leads are omitted or wrongly run, and therefore a careful check is necessary, and no doubt the most efficient way of wiring a receiver of this type is to take the theoretical circuit and as wires are put in position the equivalent wire on the theoretical circuit should be cancelled through with a coloured pencil. In view of the particular method of wiring this receiver it will be found very difficult to make alterations in certain positions, so extra care should be taken. First of all, solder a vertical screen to each of six EF50 valveholders, soldering pins 5 and 9 to one side of the screen, and the spigot to the other side. If you have obtained the silver-plated valveholders you can clean a small space on opposite sides (near pins 4 and 8) to which points marked MC may be soldered, or, alternatively, a soldering tag may be positioned over the screw-fixing hole and the various connections made to the tags. They may be held temporarily by a bolt which may then be removed whilst the valveholder is placed in position. On each of these valveholder assemblies wire up the resistors and condensers as seen in the wiring diagram. Arrange them neatly up against each side of the vertical plate, but make sure there are no short-circuits, and cut the wire ends of the components back to be as short as possible, leaving the ends no longer than is necessary to go between one point and another. The screens may be marked V1, etc., so that they may be identified afterwards, and they may be put on one side for the time being.

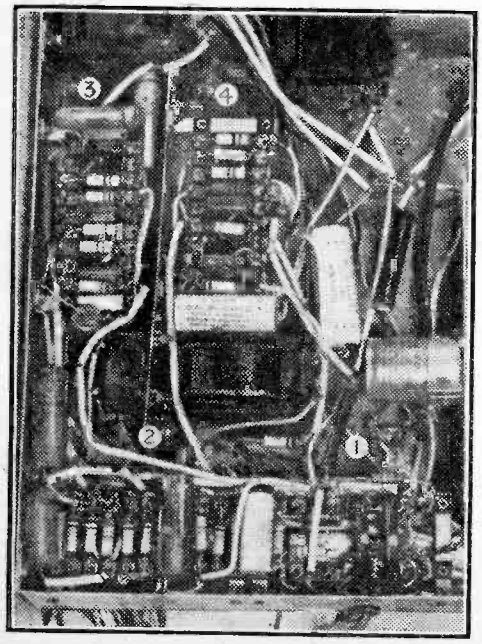


Fig. 1.—A corner of the chassis showing the tag boards —numbered 1 to 4. Wiring for these boards will be found on the facing page.

Mounting Order

Next mount on the chassis all remaining valveholders, the small tag boards, the two output feed chokes, and the brackets carrying the two front controls. Fit a soldering tag beneath one of the screws holding the bracket which carries the volume control. Mount condenser C48 on its appropriate screening strip and the two oscillator transformers on each side of the time-base screen, making sure that they are on the right side as shown by the turned-over mounting edges.

Put in all the leads shown in the wiring diagram (Fig. 6) on the time-base side and any other leads on this diagram which are available, but do not touch the sound and vision sections yet. Note that the screened lead which runs from the volume control out to the power pack plug is anchored by being cut at the lower tag board so that the strain will not result in the wire being moved and thus introduce a short-circuit. The two sections of screening braid should be bonded at the tag point. By this means both ends of the screened leads are earthed.

The Coils

The next stage is to prepare the coils, if they have not been purchased ready-made, and to assemble the small tag boards. Full details of the coils are given in Fig. 7 and the wire used is No. 28 D.C.C. When wound the wire should be held in position with some form of cement, such as Denco, Belsol, etc. Small tag-rings are available from the makers of the coil formers and these clip on the reduced top of the coil former and are provided with four small soldering tags. The ends of the leads may be soldered to these, and the rings fit sufficiently tightly to enable fair tension to be put on the wire, but the cement is desirable to prevent the turns moving at some later date and necessitating retrimming.

The small video choke may be supported in the wiring, but for safety it is recommended that a short strip of $\frac{1}{4}$in. by $\frac{1}{16}$in. brass be let into the lower edge and provided with a tapped hole through which a bolt may be passed to clamp the coil to the side runner of the chassis. An old Wearite "P"-type coil may be dismantled and will provide the necessary former and tags. The two ends of the winding may then be brought up to the upper edge, as shown in the wiring diagram, Fig. 6.

Tag Boards

Figs. 2 to 5 show the four tag boards, and the components shown on them should be soldered to the tags, again cutting down the wire ends to the necessary minimum. Note that C55 on Board 3 is mounted on the *underside* of the board, as also are C49 and C51 on Board 4. On Board 1 C23 and 24 are also on the underside, whilst on Board 2 C40 is mounted on top of the two

resistors R47 and 48. Make the interconnecting leads on each board where indicated, but do not yet attach leads running off to the arrowed points.

Wiring

You are now in a position to complete the wiring. First, run the heater leads to the separate sections of the sound and vision receivers, taking a wire from V1 round past the contrast control to the rear chassis runner, and one from V6 to about the same position. Similarly, run a lead from V9 round to about the same position, these last two leads running out toward the rear runner and then being bent toward the centre of the runner. The valveholders may now be dropped down into their positions in the sound and vision sections, making certain that you get the right holders in the right positions, and see that the screens attached to the valveholders do not come into contact with any bared leads. Standard insulated sleeving should, of course, be slipped over all leads to guard against short-circuits. Next drop the coil holders over the bolts which have been left projecting as described in last month's issue, and fit the necessary lock-nuts to both coil formers and valveholders. Complete the wiring to these two sections and make a careful check. As the earth bonding relies upon actual contact between the valveholders and the chassis the adjacent surfaces should be thoroughly cleaned and the lock-nuts well tightened. If a soldering tag has been used on the valveholders, make all other MC connections to the tags so that a common earthing point, in good contact with the chassis, is available at each MC point. When this has been completed the two separating screens should be attached and the short length of screened (coaxial) lead attached through C10 to V3 and fed through the hole in the screen to the tag strip for subsequent connection to the input coil of the sound section. Cut the ends of C10 as short as possible and attach one end direct to the grid valve-socket of V3 and leave the smallest possible piece of lead showing

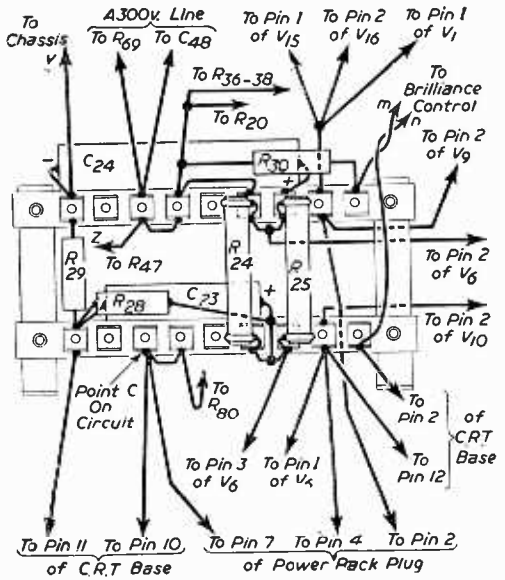


Fig. 2.—Tag board No. 1, which is the main power distribution point.

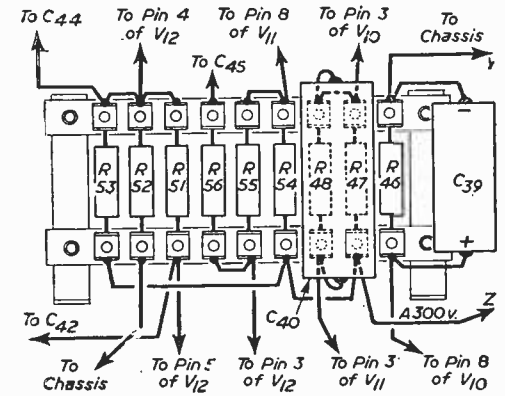


Fig. 3.—Tag board No. 2, which feeds the sync-circuits.

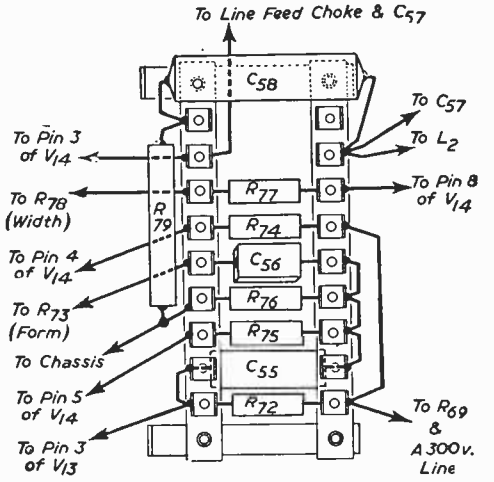


Fig. 4.—Tag board No. 3, which feeds the line time-base.

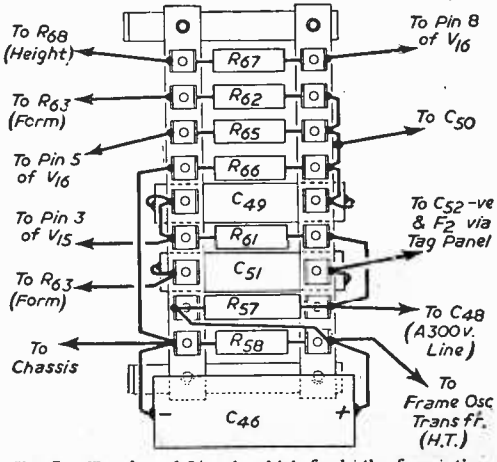


Fig. 5.—Tag board No. 4, which feeds the frame time-base.

from the short length of coaxial at each end. Excessive radiation from this lead may lead to instability.

Tag Board Connections

The leads from the components to the points on the tag boards are best attached to the chassis components and left rather long and projecting upwards. Taking tag boards Nos. 1 and 2, place them in position roughly and snip off excessive lengths of the leads. Measure off suitable lengths of insulated sleeving, drop them down on the leads and, feeding them up as required, bolt both tag boards in position, noting that an earthing tag is attached at the outside bolts for these two boards, one being shown as the anchoring point for the lead to pin 1 on the C.R.T. base, and the other taking the lead from R52 on tag board 2. The inner upper connecting points on these two boards (marked "To Chassis Y") are joined together and connected to the

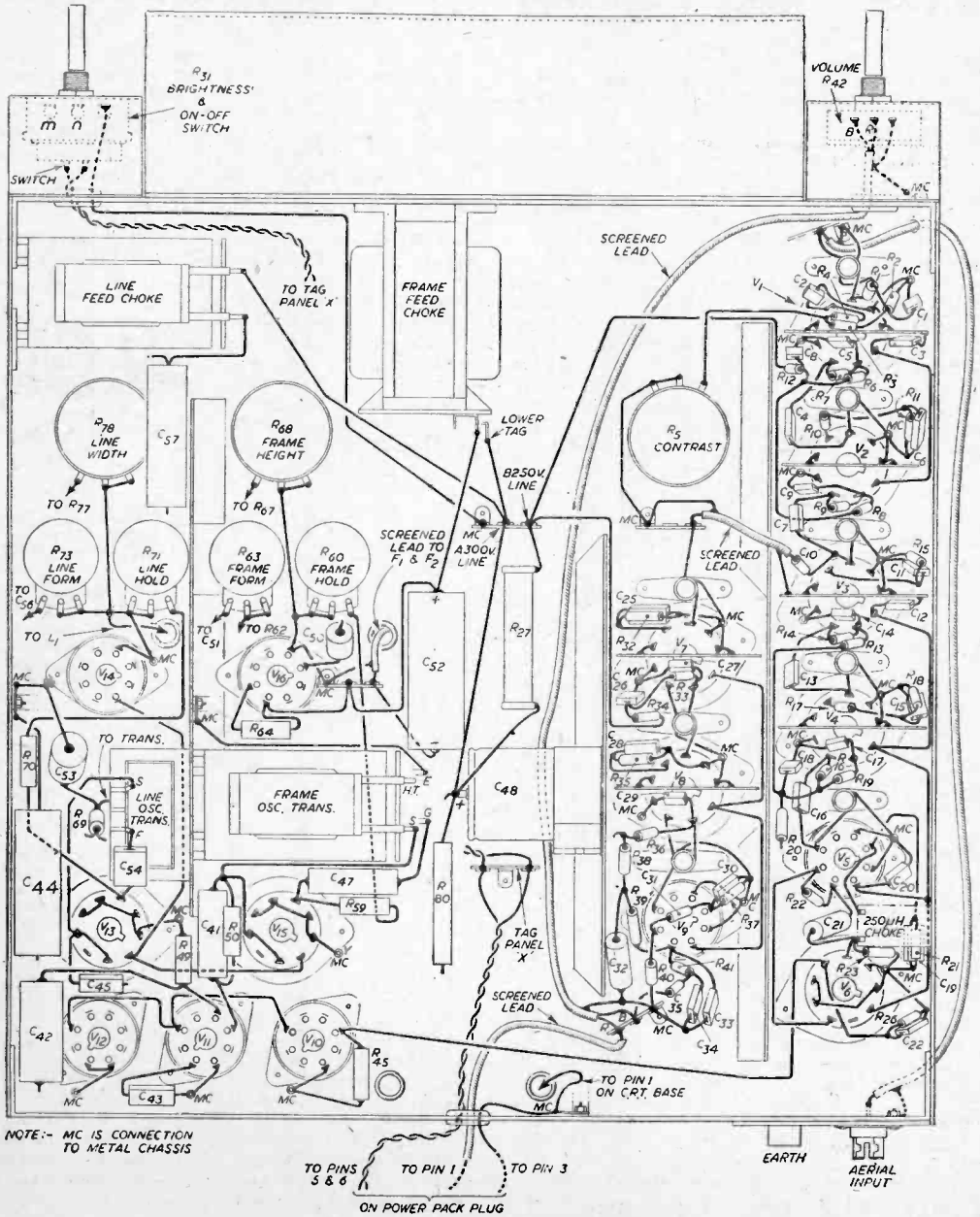


Fig. 6.—Main chassis wiring details.

earthing point on holder V15, immediately below them.

Next mount tag boards 3 and 4 on the metal screen carrying the two oscillator transformers, noting that board No. 4 is attached on the frame side and No. 3 on the line side (that is, the side nearest the side chassis runner). Put this screen gently into position, bringing up the various connecting wires, and slip lengths of insulated sleeving down as before. Note very carefully the connections to the two ends of C57 and also the two leads from R69. The other connections are more or less straightforward, but the usual care should be exercised to avoid short-circuits and mistaken connections.

Deflection Coil Leads

The leads which are taken up to the scanning coils are taken through rubber grommets, and for the line, ordinary flex (5 amp. type) may be used. One lead is taken to the chassis line and the other is brought down from tag board 3 (from C58). The frame leads consist of a few inches of ordinary single screened flex, the inner wire being taken to the small tag strip and C52, and the braiding being connected to the earthed tag on the tag strip.

Precautions

Points where it is possible to go wrong and give rise to difficulty are the respective positions of the two leads inside the screened flex from the volume control. They are lettered R and B (indicating red and black leads), and it should be noted that the red lead is joined to the centre terminal on the control and to the outside tag on the tag strip. Similarly, the two essential points on the brightness control have been marked " m " and " n " and the respective positions of these should be noted on tag board 1. The twisted flex from the switch portion of this control (to tag panel " X " and on to the power pack plug) is not critical as it carries the incoming A.C. supply and the wires may be twisted at junction points without any ill effects.

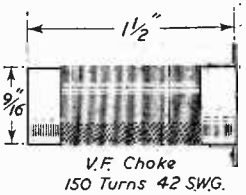
When making all wiring endeavour where possible to keep H.T.— and low potential leads down near the surface of the chassis, whilst leads carrying H.F. or H.T. potentials should be kept as high from the chassis as possible. It will be found that the various essential items (C48, for instance, and the tag board 1) have been chosen to assist this end.

Earth

Note that the socket marked earth on the rear runner has no connection to it. It is merely a plain socket which makes direct contact with the small mounting strip and is thus in direct contact with the whole of the metal work and provides a separate earth connection instead of relying upon the outer shell of the coaxial aerial socket. This will be discussed when dealing with the setting up of the receiver.

Before passing on to the power unit the wiring should be very carefully checked, preferably with a meter and voltage source, checking from point to point and at the same time trying all screened leads to make quite certain that the screening has not come into contact with the inner screened wire.

(To be continued.)



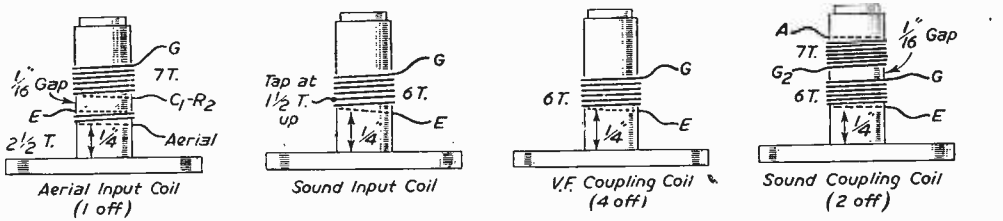


Fig. 7.—Details of the coils and the video corrector choke. The wire used for the coils is No. 28 D.C.C.

Television Demonstrations

DURING the Radio Show 90 television receivers were operating on manufacturers' stands and 85 were working side by side in the Hall of Television. Including the half-dozen sets for official use, there were 181 television receivers in operation in the exhibition. The programmes were of three kinds—B.B.C. transmissions over the air, including those originating in their studio in the exhibition, performances and rehearsals in the same studio but relayed on a closed circuit, and films televised by Radio Industry engineers using the latest type of film scanner.

Sutton Coldfield Field Strength

FROM the experience gained at the last Olympia Exhibition it was obvious that the field strength of Sutton Coldfield was too high

NOTES

to admit the possibility of operating the internal closed circuit of the Exhibition on the same frequency as Sutton Coldfield without serious interference. For this reason it was decided to operate on Alexandra Palace frequencies—41.5 megacycles for sound and 45 megacycles for vision.

Show Facts and Figures

THERE were 90 exhibitors, including the R.A.F., G.P.O., B.B.C., and the Press. It occupied an area about two-thirds the size of Radiolympia and was the seventeenth National Radio Exhibition. The show was opened by the Lord Mayor of Birmingham. It was organised by the Radio Industry Council on behalf of the British Radio Equipment Manufacturers' Association.

Outside Broadcasts

MANY viewers will recall the " glamour days " of sound radio, when the B.B.C. made the first broadcasts from express trains, from aeroplanes, from the coal-face of a coal mine and other unusual places. The soothing tones of Beatrice Harrison's 'cello coaxed the nightingale into song in Oxted Woods for the benefit of the microphone ; and sports commentaries at the Derby and other open-air events were a thrilling novelty. TV has now reached the same stage of development, with outside events, catching the imagination of the growing viewing public, whether relayed direct or recorded on film for retransmission later in the day.

Practical Time-Bases—2

Popular Time-bases Explained, and Some Tested Circuits for the Experimenter

By ERIC LOWDON

AS C has yet only a small voltage developed across it, then it follows that nearly all of the H.T. voltage will appear across R, and, therefore, the cathode of V1, which is connected to the junction of C and R, will be near the H.T. positive line.

At the same time V2 which is working at zero bias is conducting heavily, and, therefore, its anode, together with the grid of V1, is near earth. Thus V1 grid is very negative with respect to its cathode and the valve is at cut-off.

As C charges up the voltage across it increases, and so then must the voltage across R decrease. V1 cathode, therefore, falls towards earth, and, of course, approaches the potential of its grid. When the two electrodes are nearly at the same potential V1 begins to conduct, and the consequent voltage drop across R2 appears as a negative going pulse on the suppressor of V2, so making this valve less conducting.

In consequence the anode of V2 begins to rise toward the H.T. positive line, and this rise is communicated as a positive going pulse directly to the grid of V1, which is thereby made to conduct still more heavily. This, in turn, makes V1 anode fall still nearer to earth, and the suppressor of V2 more negative and the valve, therefore, still less conducting. This, in turn, drives V1 grid even more positive, and so on until V1 is conducting heavily and V2 is driven to cut-off.

This switchover, of course, takes place very rapidly and C discharges very quickly through V1. As C discharges the voltage across it becomes less, V1 cathode again rises towards the positive line, and therefore becomes less negative with respect to its grid.

The current through V1 begins to fall off, causing V1 anode and V2 suppressor to become more positive, and V2 begins to draw current once more. V2 anode thus falls towards earth again, and V1 grid is driven further in a negative direction which cuts down still more the current in this valve, and so on, until V1 is again cut off and V2 is fully conducting. The circuit is then set for the next cycle.

The setting of R3 determines the value of bias applied to V1, and therefore the point at which V1 will conduct. This is the amplitude or, if you like, the "sweep length" control. R2 determines the size of the trigger pulse that is applied to V2 suppressor, and if it is too low the time-base will not operate. On the other hand, as it is in the discharge circuit for C, too high a value will cause the condenser to take a longer time to discharge, and will therefore increase the flyback time, which is undesirable. It is necessary to compromise, and R2 is usually made variable so that it can be adjusted for the best results.

In practice, R is nearly always replaced by a linearising pentode, the action of which has already been discussed. The circuit shown in Fig. 8 will give good results from about 5 cycles per second up to 200,000 cycles per second.

V1 is the linearising pentode, V2 the discharge valve, and V3 the triggering valve. The condensers required for the various overlapping frequency ranges are selected by S1. R2 is the fine frequency control, R5 the trigger control, R7 the amplitude control, and synchronising voltage can be injected into the grid of V3 via R10.

Incidentally, it is not always appreciated, even by those who are familiar with this circuit, that the charging condensers will work just as well if connected from the cathode of V1 to earth instead of to the H.T. line. The only difference in the action of the circuit when this is done is that C will now *charge up rapidly* through V2 and *discharge slowly* through V1 (Fig. 8). In other words, the sweep is now obtained from the discharge of the condenser and the flyback from the charging action.

This arrangement has the obvious advantage that it

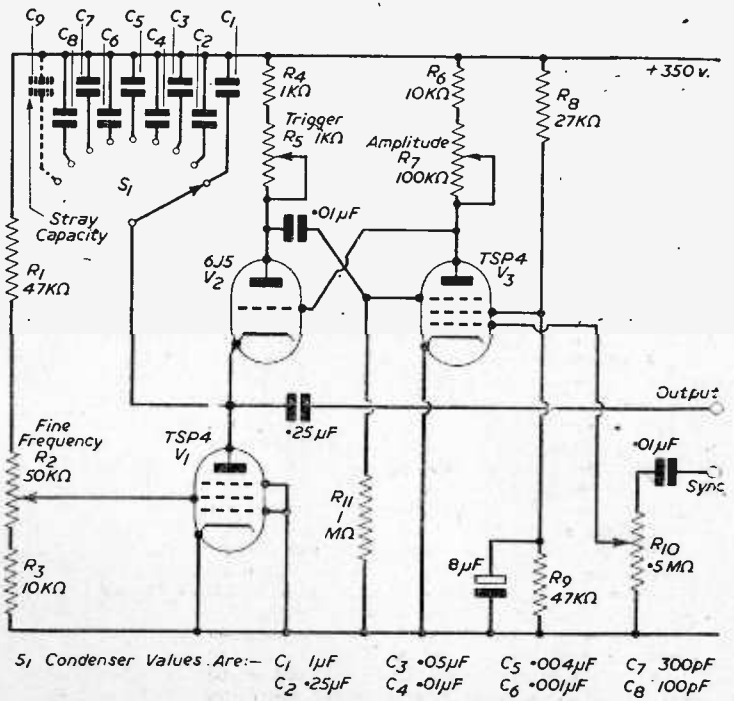


Fig. 8.—A practical Puckle time-base.

is much easier to wire the numerous condensers into the chassis, as one side of each condenser is earthed.

The Transitron-Miller Time-base

This single valve time-base was developed during the war for radar equipments, and is still used extensively for this purpose. It is economical in components, as can be seen from the basic circuit shown in Fig. 9, and it can be designed to cover a very wide frequency range together with very good linearity.

To be sure, it has certain limitations at very high and very low frequencies which can be overcome, however, by adding refinements to the circuit. Though, even in its simplest form it will do useful work, and merits consideration from anyone looking for a cheap and efficient time-base.

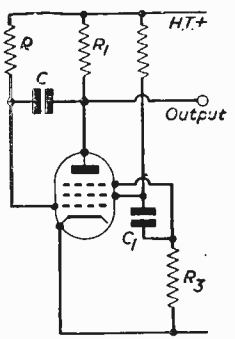


Fig. 9.—Basic circuit of Transitron-Miller time-base.

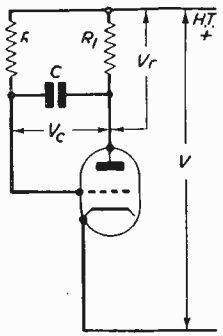


Fig. 10.—Miller integrator section of the time-base circuit.

As its double-barrelled name implies, it is really a combination of two circuits (1) the transitron oscillator, and (2) the Miller integrator.

The last named is responsible for the linear discharge of condenser C, and the transitron portion supplies the triggering effect which causes the condenser to charge up at the end of each sweep.

We will first of all deal with the Miller integrator part of the circuit (Fig. 10), so called because it relies for its action on the Miller effect. As most readers will know, it is this effect which causes the input capacitance to be equal to the grid-anode capacitance multiplied by (1 + A), where A is the gain of the valve.

At first glance, the valve appears to be connected in a rather alarming manner with the grid taken right up to the H.T. line through R. Anyone could be forgiven for thinking that a very heavy and destructive grid current is bound to flow. This would, in fact, be the case if C was not connected between grid and anode. A little thought will show that as the grid is driven heavily positive, so then will the current increase heavily through the valve, and the anode will fall negatively. This negative fall will be communicated back to the grid via C, and the valve will be driven back towards cut-off and no grid current will flow.

Another way of looking at it which may, perhaps, give a better picture of the action, is to assume first of all that C is already charged up to the full H.T. potential, and that the valve is drawing some current.

Under these conditions we have three voltages to consider. Firstly, the H.T. supply voltage which we will call V. Secondly, the voltage across C which can be called Vc; at the moment, as we have just stated, this is equal to the H.T. supply voltage V and, of course, as C is connected between anode and grid, then Vc will be also the grid-anode voltage, grid being negative. Thirdly, we have the voltage drop across R1 due to the valve current, and this we will call Vr.

Initially, then, we have the grid negative to the anode by a voltage Vc which is equal to the full H.T. voltage V, and also the anode is negative to the H.T. line by a voltage Vr, the drop across the anode resistor. Therefore, the grid must be negative to the H.T. line by an amount Vc + Vr.

It will be seen, however, that the cathode is negative to the H.T. line by the full H.T. voltage V, and therefore the grid must be negative to the cathode by the voltage Vr. Thus there can be no grid current.

Now let us see if we can work out how the circuit manages to discharge the condenser linearly.

C commences to discharge, the discharge path being through R and the valve anode-to-cathode current. Vc is therefore decreasing, which means, of course, that the grid is becoming more positive, or, if you like, less negative, with respect to the cathode. This follows, because Vc + Vr is now smaller than it was and therefore the grid bias, which we said was equal to (Vc + Vr) − V, must also be smaller because V is constant.

But because the grid is less negative, the current through the valve will increase and this in turn will cause Vr to increase. Thus, as Vr is increasing and Vc is decreasing there will be a tendency for the total voltage Vc + Vr to remain constant.

That is to say, the grid is still negative to the H.T. line by the same amount as before. Further, as the resistor R, through which the condenser is discharging, is connected between the grid and the H.T. line, then the voltage across R is equal to the constant voltage Vc + Vr.

A constant voltage across R means a constant discharge current through it from the condenser, and this, as we saw when dealing with the thyratron time-base, is the requirement for a linear fall of volts across the condenser. We thus have a perfect linearising device.

By this time the discerning reader will have seen a snag to this explanation. "But," he will point out, "if the total volts Vc + Vr remain constant, then the

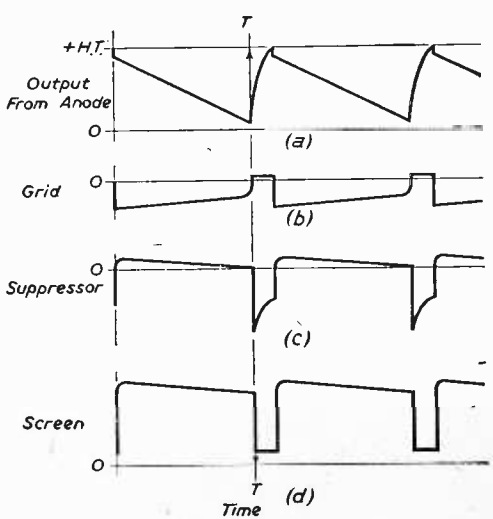


Fig. 11.—Showing the wave forms.

grid-cathode volts must also remain constant. There will therefore be no change of current through the valve, no increased volts drop across R, and, in fact, C is not discharging at all."

This is, of course, quite correct, and in practice the total volts Vc+Vr do not remain perfectly constant. There is a small change and therefore a slight departure from linearity. However, it will be appreciated that although the grid-cathode volts cannot obviously remain constant, if the amplification is high then only a very small change of grid volts is necessary to cause a large increase in Vr and therefore Vc+Vr does remain very nearly constant. This is in fact one of the most efficient linearising devices.

Action of Complete Circuit

Now turn again to Fig. 9 and work out the action of the complete circuit. A pentode is used here and we have two more grids—the suppressor and screen—to play with.

The inter-connections between these two grids form the transitron part of the circuit and the action is based on the fact that the suppressor can, by altering its potential, be made to divert current from the anode into the screen, and vice versa, while at the same time keeping the cathode current substantially constant.

It is convenient to start the operational cycle as we did before, with C fully charged and the valve anode drawing current. In this condition, then, the suppressor is at earth potential and the screen volts are at maximum —that is to say, screen current at minimum.

The condenser C begins to discharge linearly and the grid volts become slightly less negative, thus increasing both anode and screen currents. The screen and anode volts therefore begin to fall.

This action continues, the grid becoming still less negative and the anode and screen potential falling still further, until eventually the anode reaches a point where its voltage is insufficient to hold the electrons coming to it through the suppressor grid. They are therefore attracted back to the screen, and a sudden increase in screen current results together with a sudden drop in screen volts.

This rapid fall in volts is communicated to the suppressor grid through C1 and has the effect of cutting down the anode current still more with a consequent further increase in screen current.

The effect is cumulative, and this triggering action rapidly reduces the anode current to zero and therefore returns the anode potential to that of H.T. positive.

Suppose we freeze the action at that instant just before the anode returns to H.T., and take a look at the conditions on the various electrodes (Time T in Fig. 11).

The condenser is discharged, the anode volts have reached their lowest point, the suppressor has been driven very much negative, and the screen volts have reached a very low value. The control grid has been driven sufficiently positive to draw current. Let us now start the action again from this point.

The anode potential shoots up to the H.T. line. This is the fly-back stroke and during this time the condenser charges up again through R1 and the grid current. The exponential character of the fly-back is clearly shown in Fig. 11(a) and this shape is due, of course, to the charging condenser.

During this time the condenser C1 is discharging through R3. In fact, the action of the circuit is now suspended until the discharge of C1 brings the suppressor back to a potential such that anode current can begin to flow once more.

The increase in anode current means a decrease in screen current, and therefore an increase in screen volts. This increase is applied through C1 to the suppressor thus causing the suppressor volts to rise even more rapidly and the anode current to increase still more. Again the effect is cumulative, and the trigger effect causes the suppressor and screen to shoot in a positive direction.

C is now fully charged and the valve electrodes have again reached their original potentials and the cycle can begin again.

Sweep Frequency

The sweep frequency is controlled by C and R, and the fly-back time, which should, of course, be as short as possible, is determined by the values of C1 and R3.

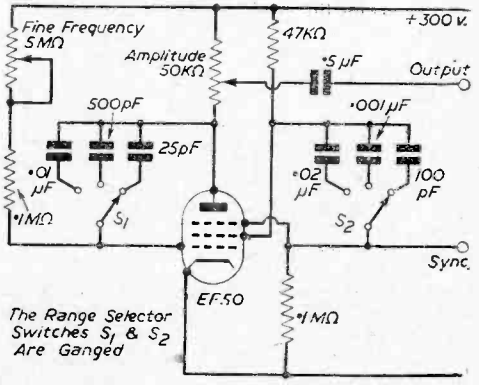


Fig. 12.—A practical Transitron-Miller time-base.

As we mentioned earlier this circuit though possessing excellent linearity in the medium and high frequencies, suffers from certain defects at very low and very high frequencies. These are principally, loss of linearity at low frequencies and too low a ratio of fly-back time to sweep time at the high frequencies.

These points have, however, been dealt with already in *Practical Wireless* in an excellent article by E. N. Bradley (December, 1949) and the reader in search of a good practical time-base to cover a wide range of frequencies can do no better than study the article.

If very low frequencies are not required or extreme linearity at the low frequency end of the band is not essential, then the circuit shown in Fig. 12 will make a cheap and efficient time-base. With the component values shown, the frequency coverage is from 20 cycles to 200 kilocycles in three ranges, and the pulse at the screen is suitable for fly-back suppression.

R.E.C.M.F. Exhibition, 1951

THE Eighth Annual Private Exhibition of British Components, Valves and Test Gear for the Radio, Television, Electronic and Telecommunication industries, will be held in the Great Hall, Grosvenor House, Park Lane, London, W.1, during the period Tuesday, April 10th, to Thursday, April 12th, 1951.

Admission will be by invitation only. Further details will be issued in due course by the organisers, the Radio and Electronic Component Manufacturers' Federation, 22, Surrey Street, Strand, London, W.C.2.

X-Rays on Alexandra Palace

No. 2.—Back-Rooms and the Boys and Girls—By the Marquis of Donegall

THERE are more things in Alexandra Palace than are dreamed of in the philosophy of most viewers. People, too !

Let us set out to make a tour of the " back-rooms " and the Boys and Girls.

Right at the end of that famous corridor, we come to the Small Props Room, but " Buddy "—William Elsdon—is away on holiday. However, " Jimmy "—J. T. Sullivan—is there in a cubby-hole surrounded by everything from whisky bottles with faked labels to Chinese gods for the mantelpiece.

An alchemist is at work—one of Jimmy's colleagues—mixing (just drinkable) concoctions into bottles to represent anything from gin to port. Anything goes, we gather, from lime juice to ginger wine, provided the right photogenic colour is arrived at. Red ink is barred.

Jimmy says that his worst headache was a side of beef on a Saturday morning and a radiogram of a specified type on a Sunday. However, he and Dockmaster Roy King, together with four assistants on the props side, got them. So they did a ram's head, a pram of Continental type—lower than ours. Steak is toasted bread. They only mutiny when asked if they can substitute fakes for all the genuine advertisements in the interior of an Underground !

Then we pass a studio where the cameras are being set up for the afternoon transmission. Senior cameraman that we happen to find is F. G. Cresswell, who lives at Potter's Bar. (We find that most of our victims live within sight of the Alexandra Palace masts.) Mr. Cresswell's hobbies are soccer and swimming, which latter he performs at the Wood Green and Hornsey (open-air) Baths. For a busman's holiday, he goes in for photography.

There are four senior cameramen at Alexandra Palace. They do a 47½-hour week which works out at seven days' duty per fortnight. They may be on during any public holiday, but these are made up in days off at other times.

" We may have our Christmas Day in August ! " was Cresswell's way of putting it.

Senior cameramen are responsible for training the youngsters and operate No. 1 camera, which takes the majority of the transmissions. They are also, of course, responsible for discipline. Cresswell, who is fair, looks incredibly young to have been with the B.B.C. Television since 1936.

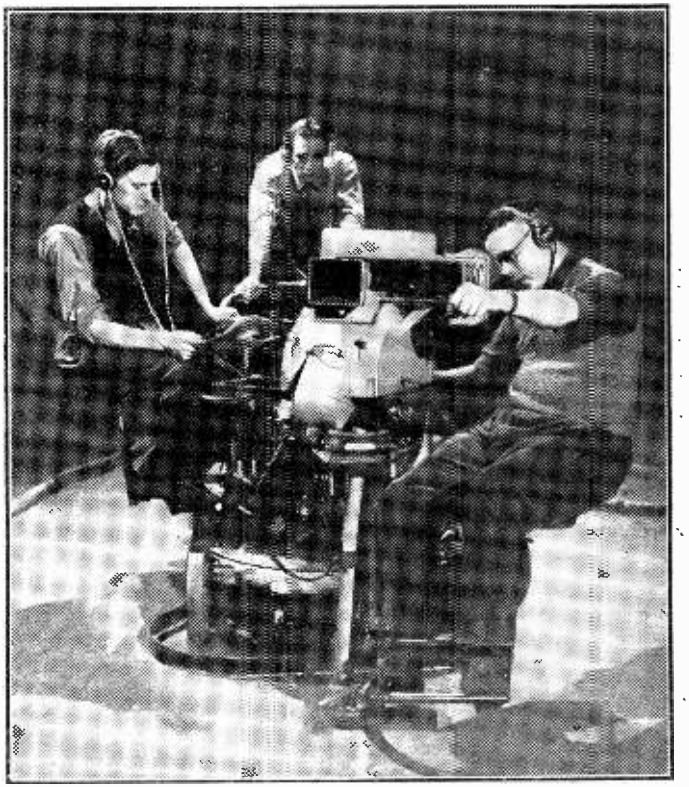
Now we come to one of the nine very charming young ladies. Before the war the B.B.C. employed no girls on the engineering side. Audrey Starrett, tall brunette, was conscripted into the B.B.C. in 1944, with no previous experience, as a Recording Technical Assistant.

Before A.P reorganised in 1946 she had become a Vision-mixer—mixing from the Preview screen to the Transmission screen at the direction of the Producer in the Production Gallery. She also has a bank of four turn-tables for effects, and logs all faults, visual or aural. I forgot to ask her whether she does all this simultaneously. Audrey comes from Liverpool and lives in Finchley. The worst thing that ever happened to her was that a sudden gust of wind blew away her cues and she put down the wrong pick-up on one of her turntables. The result was that two comedians went all through the same not very good joke all over again.

Central Control Room

" But it wasn't quite as bad as what happened in Canada, once," she tells us. " There was a religious ceremony. The boys just left the record to play and went off to the pub for ten minutes. When they came back they found that the pick-up had stuck in a groove and that the words, ' For Christ's sake,' had been repeated over the air for some six minutes."

So we leave Miss Starrett in the Production Gallery



Cameraman No. 1, Cyril Wilkinson, with his two assistants.

and pass logically to the Central Control Room and its associated Central Apparatus Room. These two enable the various vision and sound sources to be selected and distributed to the transmitters.

The Central Apparatus Room contains equipment that enables changes from one vision source to another to be made without loss of synchronization. It also contains the equivalent sound equipment and the master-timing generators.

The Central Control Room is really the remote-control position for the Central Apparatus Room. Here we see the Central Vision and Sound Mixer operators—e.g., change over from outside broadcasts to studio programme.

In the Central Control Room, now known as "Vision Racks," we find Mr. T. B. McCrirrack, from Galashiels, who has been with B.B.C. Maintenance since 1943 and Television since last December. During the war he was instructing on radar in the R.A.F. In part of his spare time McCrirrack builds radio sets, but he has not yet built a television set.

We gather that part of the job is to "shade the pictures properly on the Preview screen" and that this takes about seven seconds before the picture is ready to go on to the transmission viewer. To put it in my way, McCrirrack does electrically what a newspaper retouching artist does before a photograph is ready for the photographic process department.

With him he has two colleagues on the shift. No. 1 is responsible for the shading of the transmitted picture. No. 2 does the same for the Preview screen and No. 3 adjusts the contrasts. There are about 16 experts on "Racks," and they also do maintenance.

Matching Sound

Before leaving we run into Mr. C. Everest, whose job it is to make the sound match the picture. To take an absurd example, it would make a monkey of the whole programme if a man calling from a hill half a mile away made the same amount of noise as the man seen in close-up. Both, however, have to be audible, and that, broadly speaking, with a thousand much more complicated variations, is Mr. Everest's headache. I have been told that when B.B.C. Sound experts have come to Alexandra Palace and realised the difference between the problems of Sound Broadcasting and Television Sound, they go away very quickly and take subtle measures to see that they are not transferred to A.P. !

Skipping lightly round a wall of enclosed machinery Mr. R. C. Chaston makes us at home in the Central Apparatus Room and shows his oscilloscope, which measures the pulses fed from the master-pulse bay and the levels of the programme returning from the studio; 20,250 master-pulses per second, which, of course, means 10,125 line pulses per second.

There are six experts altogether on this Vision rota who work on the A Racks and B Racks. They also alternate on the Outside Broadcast receiver at Highgate and the L.T. Room down below us. These changes are made fortnightly to keep the experts in touch with new developments in the several branches.

Chaston lives at Epsom. A man of many hobbies: photography, motor-cycling, swimming and tennis.

We now have to go downstairs to walk round to the other branch of Alexandra Palace, in which semi-blitzed abomination of near-desolation Mr Peter Bax, the Design Manager, manages to find an office. But on the way down we meet Mrs. Coles, Comptroller of Lift. "Time marches on," says Mrs. Coles, having done as many miles "going up" as she has "going down" in the last 14 years.

Apart from being in far the best position to assess what really goes on, Mrs. Coles is an avid reader. Factually, at 10 a.m., Mrs. Coles was on page 85 of a Western. At 12 noon, she was on page 200, and at 4 p.m. she was on page 60 of a thriller.

Now Peter Bax (Design Manager) we find to be a man of infinite humour. But you will have to get him to tell you the stories of his fog adventures on the Chug-Chug Steam-puffer that runs from Highgate to Alexandra Palace. It should be shown to all American tourists as a memorial to George Stephenson. Mr. Bax introduces us to one or two of his craftsmen. For instance, there is George Barnes, the general property maker, who thinks nothing of making a wood-carving or a Greek temple.

Then we meet Bill Pickett, who used to go up the 800 feet of the mast at Daventry in the routine job of keeping the monster smartly painted. By a curious coincidence, we find him in the process of making a flower 5ft. 6ins. high which will wilt completely in three seconds.

"This is easy," says Bill. "Three months ago they wanted a similar one to do the same thing, and that did take a bit of working out."

(The secret? The stem of the flower is a rubber tube with an iron rod inside it. Wilting is produced by removing the iron rod.)

(To be continued.)

Peter Bax, head of Television Design, with Mrs. Hearnshaw, head of Wardrobe Department. This is Banquo's suit of armour for "Macbeth."

TELEVISION PRINCIPLES AND PRACTICE

6.—Interlacing—Frequency Bands—Television Systems

By F. J. CAMM

FOR best results consideration must be given to what may be termed *the viewing point* when looking in. If a photograph is enlarged unduly it will lose its sharp definition; the grain effect of the photographic emulsion will show and the picture will appear blurred. The front seats of a cinema are not the best for viewing a picture. A certain *viewing distance* is necessary in order that the picture, whether television or cinema, can be viewed in its correct perspective. Obviously, the more lines which are employed in the scanning system, the closer may the picture be viewed without the lines becoming apparent. Therefore, a viewing position must be chosen where the lines, so to speak, disappear. This can be proved to be that distance from centre to centre of two contiguous lines which subtend an angle of about two minutes or one-thirtieth

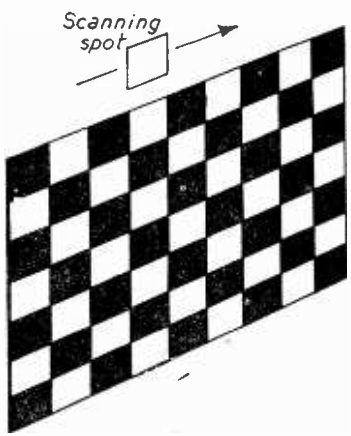


Fig. 23.—Example of rapid changes from black to white giving rise to ripple and distortion of vertical lines.

of a degree at the eye point. If viewing takes place at a shorter distance the lines will be visible and a greater distance will reduce the amount of detail which is visible to the eye.

We have already seen that in order to comply with the principle of persistence of vision, which gives the appearance of moving pictures, the television screen must be scanned a regular number of times every second. If the frequency of this scanning is not sufficiently high flicker will result similar to some of the early cinematograph pictures. As is well known, with the cinematograph about 24 frames per second, sometimes many more, are projected on to the screen. This does not entirely avoid flicker. The purpose of the shutter system in the cinematograph is twofold—to cut off the light between frames and to obscure the middle period of each frame. In the result there are two distinct light projections for each frame, giving the illusion of 48 frames per second.

Frame Ripple

A repetition frequency of about 48 frames per second is also necessary with television if flicker is to be reduced to the minimum. This repetition frequency is also necessary to avoid as far as possible frame-ripple caused by stray fields created by the power circuits of the receiver and associated apparatus. If the frame frequency is not an exact sub-multiple of the mains frequency this trouble is likely to occur, manifesting itself in the form of irritating ripples upon the viewing screen. If a frame frequency, in the case of 50-cycle mains, of about 25 is employed ripple is considerably reduced. On 50-cycle power systems it is theoretically necessary to employ at least 50 frames per second to reduce flicker and mains ripple. This is indeed a high frame frequency calling for a wide frequency band during transmission and from this point of view alone it is undesirable.

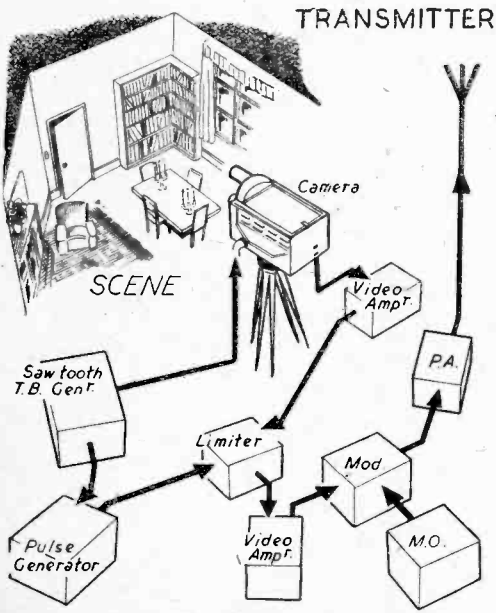
Reason for Interlacing

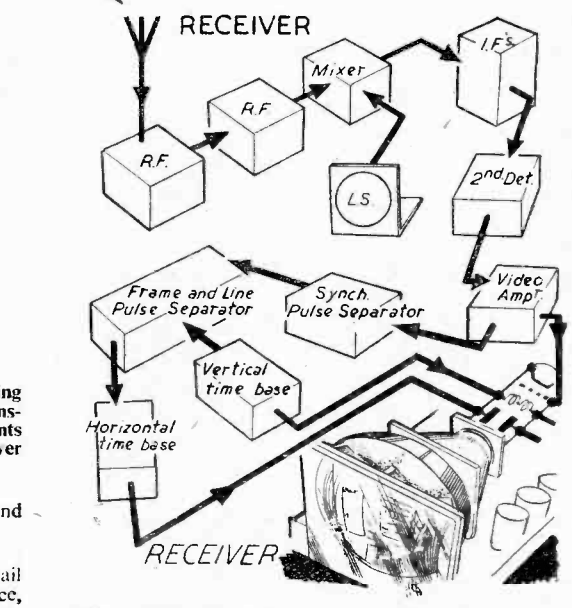
This is the reason why interlaced scanning is employed. It overcomes the difficulty of the high-frequency band necessary with 50 frames per second but retains the advantages of it. In interlaced scanning the picture is scanned 50 times per second but only alternate lines are traced per scanning period. In the 405-line system at present employed the odd numbered lines are scanned first and then the even numbered lines, the latter being placed, so to speak, in the gaps between the odd lines. It follows that each 202½ piece of the picture is transmitted in one-fiftieth of a second, building up a complete picture every one-twenty-fifth of a second. It is impossible to say why the odd figure of 405 was chosen, but no doubt it provided the best compromise, giving reasonable quality and reducing the transmitting problems which follow when a higher number of lines are used. A disadvantage of interlaced scanning is that it can give rise to a peculiar kind of distortion which is absent with simpler systems. In scanning scenes involving very rapid motion minute changes will occur in the picture between the period of the half frames resulting in a slight wavy or zig-zag appearance of the vertical lines. It is not, however, a serious disadvantage; the advantages more than outweigh it.

Frequency Bands

Television picture signals are radiated in the usual manner by modulating the carrier wave with the video frequency. There is, however, an important difference between picture and sound transmission. In order to transmit a picture with a great amount of detail a much wider band of frequencies is required than is necessary

for the transmission of sound. Trouble in this connection is chiefly experienced with contrasting pictures having areas changing suddenly from black to white, as for example, in the case of a draughts-board. If in the latter case the width of the scanning line corresponds to the height of these contrasting tones, the defect will be at a maximum, because as the scanning spot traverses such a pattern, there are sudden changes in the output current of the television camera varying from minimum to maximum. As has been pointed out in previous articles in this journal, one cycle of this current represents the scanning of two squares, and if the number of lines in Fig. 23 is L and the ratio of width to height or the aspect ratio is R, the total number of squares is given





Figs. 24 and 25.—(Left) Block diagram of transmitting system showing chain of events from scanning to transmission. (Right) Block diagram showing chain of events from reception of sound and video signals by the receiver aerial, through the receiver to the tube.

by $N = L^2R$. For a repetition of π pictures per second the frequency band will be :

$$f = \tfrac{1}{2}L^2\pi R \text{ cycles per second.}$$

From this formula it will be found that greater detail results in the horizontal direction than vertically. Hence, by making the frequency band approximately equal to two-thirds of the full frequency band detail in both directions is balanced up. The actual frequency band required for an aspect ratio R

$$= 0.67\tfrac{1}{2}L^2\pi R$$

$$= 0.34L^2\pi R \text{ cycles per second.}$$

It will be seen from this that with a picture ratio of five to four and with a definition of 400 lines at 25 frames per second, we should obtain a frequency band of 1,700,000 cycles per second and, adding 50 per cent. for the synchronising pulses, a figure in the region of 2,000,000 cycles will be obtained, and hence a total side-band width of about 4,000,000 cycles ! This eliminates the possibility of using the medium wavelengths for transmitting high-definition television programmes. For example, the carrier frequency itself must be high so that the side-band width does not form a large percentage of it. This means that the tuned circuits of the transmitter will handle the modulated carrier without serious cutting of the outer side-band.

Receiving and Transmitting Systems

A block diagram of a television transmitting system is shown in Fig. 24, from which will be observed the following. First the image is scanned by the television camera, producing a series of varying currents which are the counterparts of the changes in light intensity along the scanning line. These varying currents are fed to a video-frequency amplifier the output from which is passed to a limiter and pulse generating system. The purpose of the limiter is to obviate the overloading of later stages and to limit the peak amplitudes of the combined signal and synchronising pulses to about 50 per cent. more than black. The triggering impulses are provided by the pulse generator, and it also superimposes the synchronising pulses to the signal currents, proceeding from the first video amplifier. Further amplification takes place after the limiter stage and the currents are then used to modulate the carrier wave generated by the oscillator. The modulated carrier is passed on to the aerial arrays by means of a radio frequency power amplifier.

Fig. 25 shows a block diagram of a receiver. The aerial system picks up the signals from the transmitter and they are passed through a series of radio-frequency stages which are heavily damped in order to handle the necessary frequency band. The output is mixed with that of a local oscillator, and the intermediate frequency which results is then amplified by a series of IF stages of from 8 to 10 megacycles. The I.F. stages are sometimes stagger-tuned. By this is meant that each stage is tuned a megacycle or so above and below the actual I.F. to obtain the desired response over the wide range being handled.

(To be continued.)

Frills Rush In . . . !

A Reply to the Criticisms of TV by Monica Dickens in a Recent Issue of "Woman's Own"

By F. J. CAMM

FRILLS rush in where technicians fear to tread ! In that lively weekly journal *Woman's Own* Miss Monica Dickens was accorded space for an attack on television which must have annoyed her female readers and aroused condescending smiles amongst the males. Her arguments are so specious and lacking in acumen, coming from one descended from such an illustrious forebear, that one is tempted at first to dismiss them with contumely. In view, however, of the enormous and influential circulation of this leading feminine journal we have a duty to the trade to set Miss Monica Dickens upon the paths of rectitude from which she has in her technical juvenescence strayed. Let us first of all outline her objections to television. She has been to Sweden where she says the people in the evening have to make do with wireless or the cinema, to sit at home and play cards, read, knit, sew or talk, and she thinks that the Swedish people are more fortunate than the British because they are without television. With italicised emphasis she says "I *don't* like television. I haven't got a set, and I wouldn't have one if it were given to me." Miss Dickens need have no fear of her ostracism of television being disturbed, as a result of her paragraph, by her house being surrounded by supplicatory manufacturers anxious to ingratiate themselves by presenting her with TV sets. The demand for these receivers, from enlightened householders and particularly the women, is such that their stocks are low. Let us repeat some of her reasons for this artificial dislike, erected like an Aunt Sally so that she could knock it down. She thinks, "it's a terrible extravagance to spend all that money on a glorified toy when you can't afford new shoes for the children which is what does happen in a great many families." This must be a piece of Dickensian imagination and I challenge Miss Dickens to produce evidence that people in this country deny their children shoes in order to purchase television receivers. It just is not true. "Another thing I have against TV is that I think it's the biggest time waster ever invented. With the wireless you can at least get on with something else while you are listening, mending, *or doing your nails* (our italics), or housework." Notice that Miss Dickens puts housework last. Apparently women must do their nails at all costs, a habit I loathe as much as Miss Dickens loathes television. If women have time enough to do their nails they could more profitably employ it by looking-in to a TV programme instead of staring vacuously at their digital extremities.

"But television, like an imperious queen, claims your undivided attention. There is a fatal fascination about that active screen." Not for Miss Dickens ; but I like that simile about an imperious queen ! How long did it take Miss Dickens to think that one up ?

"You may turn on the set as you pass by sweeping the floor just to see what's on. Its a film. He takes her in his arms. He is going to kiss her—no she moves away. you must wait to see what he does . . . until finally you have put down your broom and sat down to dream and moon the time away over some second-rate and elderly film and the house stays dirty. If they ever start having TV programmes all day long we might become a nation not of housewives but of sluts ! I don't say we *would*, but we might." Miss Dickens hints at a fault, hesitates dislike, willing to wound, and yet afraid to strike. What she really means is that she has so little belief in her sex that she thinks television will convert housewives into sluts. I have no doubt that by this time she has had some quite rude letters from readers of that influential women's journal, who have purchased the many soaps which do the washing for them, labour-saving washing machines, and electrical gadgets of all sorts which further save the housewives' time and provide the leisure required for looking in. Otherwise, these labour-saving powders and machines have failed.

If Miss Dickens has her way there would be no motor cars, nor any of the other links with the intelligent present and the primordial past. As well to argue that *Women's Own* with a circulation approaching two millions is converting housewives into sluts ! It would not take much alteration of one of her paragraphs quoted above to make this apply :

"As you pass by sweeping the floor *Woman's Own* arrives. You take a peep to see what is in it. It's a serial. He takes her in his arms. He's going to kiss her You must read on to see what he does . . . until finally you have put down your broom and sat down to read and moon the time away over some. . . ." But no ! The serial stories in *Woman's Own*, I am sure, are not second rate and elderly !

Miss Dickens goes on to say that children may become a generation which cannot read a book, or play games out of doors or amuse themselves with carpentry or trains or butterflies. Watching a television programme is surely more enlightening than fiddling with alar insects. In America, she says, they are getting really scared of television. Doctors say that children's health is affected because they spend too much time indoors. Well, doctors may say it, but there are no statistics to support it. Doctors have always been wrong anyway. Doctors said, in the early days of the motor car, that the human frame could not possibly withstand a speed of 60 miles an hour ! "Sociologists are saying that although TV may keep people at home it is changing the pattern of family life." Yes, for the better. By means of TV people are learning how the other half lives. They are learning more about literature, art and music than in twiddling their thumbs, painting their nails, plucking their eyebrows, plastering their face with mud packs and generally aping aboriginal Zulus.

What *does* Miss Dickens want ? It was complained of the motor-car, the bicycle and the cinema that they took people *away* from their homes and destroyed family life. When radio, and before it the gramophone, were introduced, there were complaints from theatres that they kept people *in*, an argument also used in connection with television. The run of the average play at a theatre is about two and a half hours and if you add travelling

(*Continued on page* 280)

Building a Pattern Generator

A Useful Accessory for Television Servicing

By A. M. ST. CLAIR

FOR the television-service man, a pattern generator is an indispensable piece of apparatus, but often too expensive. For the experimenter, a commercial model often proves too expensive. The model described is capable of producing a pattern of vertical bands for testing the characteristics of line scan, horizontal bands for testing frame-scan operation, and is generally useful for checking focus, video amplifier response, definition, etc. It can be constructed from parts available from the "junk-box," and is in no way critical in construction or use.

Square Waveform

The principle employed is that of feeding to the video amplifier a square-wave having a frequency several times that of the line- (or frame-) scan repetition frequency, and feeding a portion of the same voltage, suitably "shaped," to the appropriate sync point. Suppose a square wave is applied having a frequency six times the line frequency ($6 \times 405 \times 25 = 60{,}750$ c/s), a pattern of six white and six black bands appears on the screen, vertically, since every line is divided into six "on" and six "off" lengths. Similarly, a frequency of six times frame frequency will give six black and six white horizontal bands. Any non-linearity in the scan waveform will be shown by a crowding of the bands to one side (or top or bottom, in the case of frame scan); poor video-amplifier characteristics give "fuzzy" edges to the lines; "ringing" in the video stages causes the lines to have narrow "satellite" bands on one or both edges, and so on. It will be found that tests for linearity of scan are best undertaken with a large number of lines on the screen, while amplifier faults show best with fewer bands, of wider extent. There are few faults in a vision receiver which, with a little experience, cannot be traced by the aid of the instrument.

The Circuit

The basic part is a two-valve relaxation square-wave generator. This is followed by a clipper stage, and by an output valve at whose cathode appears the square-wave signal, and from whose anode, via a suitable network, is drawn a sync pulse. The frequency range is from about 30 c/s to well above 200 kc/s. The three switches are a three-bank single-pole, four-way wave-change type. They effect the frequency range control, while the 25 kΩ potentiometer is the frequency control. The 1 kΩ potentiometer in the common cathode lead of V_2 and V_3 is the squaring control. The output wave from "A" should be examined by means of a C.R.O., while adjusting this control, until the best square shape is obtained. At "A" we get a square wave of variable amplitude, and at "B" a sync pulse, likewise variable. In operation, set up on C_2, and take output from "A" to the video amplifier under test. Take output from "B"

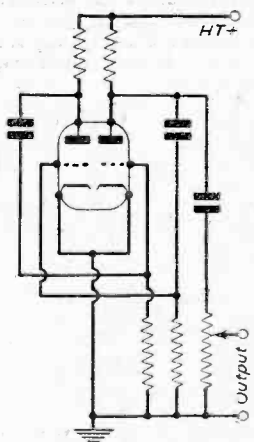


Fig. 2.—A simpler version of a square-wave oscillator utilising a double triode valve of the 6SN7 type.

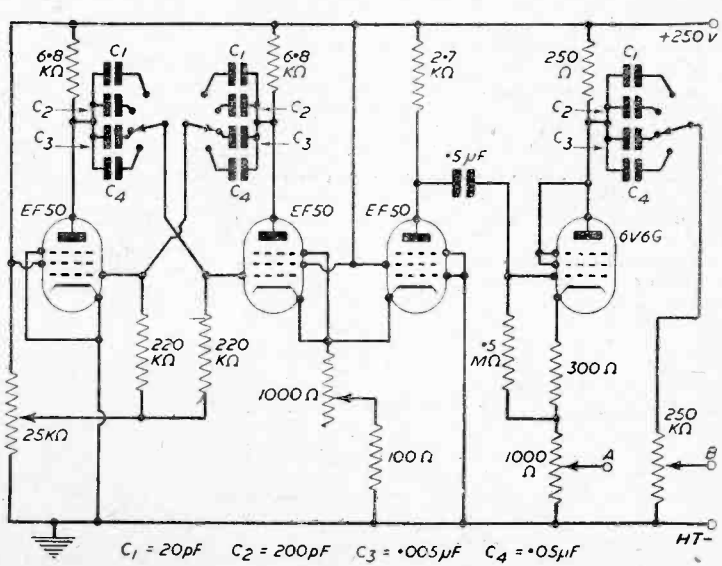


Fig. 1.—Theoretical circuit of the instrument described here.

to the line sync circuit and switch on the Pattern Generator and T.V. receiver. Adjustment of the frequency control will give varying numbers of vertical bands. Any given pattern should be completely stable and observable. Try also on C.1. Then test with C3+C4, and "B" connected to frame scan sync, when the horizontal band pattern will appear.

Not Ethical

The values suggested are not to be regarded as highly critical. While preserving the time-constant components reasonably near the given values (the C1, 2, 3, 4 and the 220 k. Ω grid leaks), experiment with the other parts, giving varying amplitudes of square-wave and sync pulse, may modify the performance to suit different requirements. However, to keep the square wave fairly true, the first two anode loads should be kept low, while the 0.5μF coupling condenser cannot be reduced without introducing distortion. For more or less rough-and-ready work, a simpler version of square-wave oscillator could be used, say, a double-triode connected as in Fig. 2 A 6SN7 with anode loads of 5 k. Ω, and grid condenser of 250 pF, grid leaks of ¼ megohm, the output circuit being a 4 μF condenser and a 2 MΩ potentiometer, can be coaxed to give a fair approximation to a square wave.

Limitations

Applying bias by means of individual cathode resistors would help. In this case, sync and square wave are taken from the same output, sync via a small condenser, say .0005 μF. Such a set-up will test for time-base linearity, but is useless for any other tests, other than that of determining outside transmission hours whether or not a T.V. receiver is working. It is thought that the trouble of building the more elaborate apparatus will be amply repaid.

Modulating the VCR97

Adapting the ex-Government Tube for Cathode Modulation

MOST experimenters who are building their own television receivers, using ex-Government radar equipment employing the VCR97 or VCR517 electrostatic cathode-ray tubes will, no doubt, apply the picture-signal modulation to the grid of the cathode-ray tube as in the popular phase-splitter circuit of Fig. 1. In this circuit the triode valve is coupled via the condenser C to the anode output of the video amplifier valve, which is not shown in the diagram. The phase-splitter circuit has many advantages which make it useful in television receivers. The unbypassed cathode resistance R1 is made very large (often several thousand ohms), and in consequence there is heavy negative feedback giving only a low-stage gain (about 1.8 overall) accompanied, however, by very linear operation, large signal-handling ability, and a high input impedance. Furthermore, if the resistances R1 and R2 are made equal, the output voltages, cathode to earth and anode to earth are almost equal, and are opposite in phase—that is to say, when the signal voltage at one is increasing the voltage at the other is decreasing. Finally, the output impedance of the valve between cathode and earth is very low, and in consequence the cathode will be a very suitable point to which the grid of the cathode-ray tube may be connected. To understand the importance of having a low-impedance connection for the cathode-ray tube grid, one must consider the effect of making the connection. The input grid circuit of the cathode-ray tube represents a small condenser of about 25 pF capacitance, whilst the tube holder and the connecting lead between the phase-splitter and the tube grid may add another 10 pF., depending on the length of the lead; a total of about 35 pF. Now, this capacitance is in parallel with the cathode load of the phase-splitter so that at high-signal frequencies the actual cathode output is less than what it is at low frequencies, due to the shunting effect of the 35 pF. capacitance. Owing, however, to the low output impedance of the cathode follower, this shunting effect would not be seen unless the picture contained much higher frequencies than it does at present.

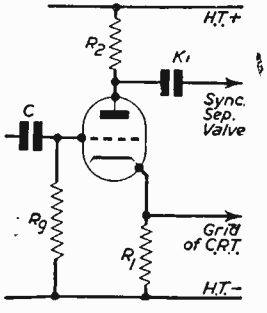


Fig. 1.—The most popular method of feeding the VCR97 as used in many ex-Service conversions.

Positive Picture

Now, in order to modulate the grid of the cathode-ray tube, we require a picture in the positive sense, that is to

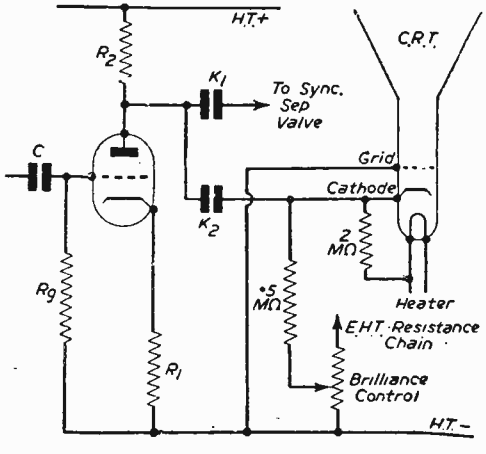


Fig. 2.—In this circuit the signal and sync pulses are taken from the anode of the video valve, and the cathode of the tube is modulated.

say, the peaks of the signal representing the white parts must cause the grid to go less negative, thereby increasing the beam current and consequently the brightness of the picture. To obtain a signal in the positive sense at the cathode of the phase-splitter valve, using the circuit of Fig. 1, it is only necessary to connect the demodulation diode in the correct sense, that is, with its anode to the grid of the video valve.

If the above circuit arrangement is adopted and equal resistances are used in the cathode and anode circuits of the phase-splitter valve, it will be realised that the signal is produced in the anode circuit of the phase-splitter, but in the negative sense due to the phase reversal in the valve. Now, a signal in the negative

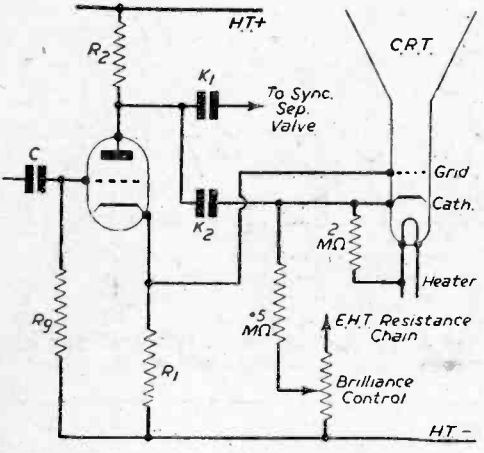


Fig. 3.—Final circuit recommended by the Author.

sense is very suitable for sync separation, so the anode output of the valve is connected via an H.T. blocking condenser K1 to the grid of the sync separator valve.

It will be obvious that this signal at the anode could also be used to modulate the cathode-ray tube; but owing to the fact that it is in the negative sense it could not be applied to the grid because it would produce a negative image. To obtain a positive image this signal would have to be applied to the cathode of the tube whilst the tube grid was connected direct to chassis. Then on peak white the cathode of the tube would be driven most negative with regard to the grid, which would mean, in effect, that the grid had been driven positive with respect to the cathode. Now, the cathode of the C.R.T. is connected to a point in the E.H.T. supply about 100 or more volts positive to chassis, via the brilliance control (assuming negative earthing of the C.R.T. supply); therefore, when trying cathode modulation, we must adopt the circuit of Fig. 2 where the condenser K2 is inserted to block the H.T. potential from the anode of the valve. If we are to avoid hum modulation on the picture, the cathode of the C.R.T. must still be connected to its heater circuit, and this is done by means of the 2 MΩ coupling resistance which is used to reduce the effect of the heater circuit capacitance on the anode load of the phase-splitter. Similarly, a 500,000 ohms resistance is introduced into the lead of the brilliance control to reduce the shunting effect of the latter on the anode load, at the lower end of its travel.

Unfortunately, the introduction of the condenser K2 blocks the low-frequency components of the picture unless K2 is made very large—a proceeding which may cause loss of high-frequency response due to the self-capacitance to chassis of a bulky condenser. In spite of this the cathode method of modulation should be tried and it will be seen, most probably, that the picture is quite satisfactory, although the background will be lacking in detail and smudgy (due to low-frequency loss and phase shift), the extent to which these effects are present depending somewhat on the values of the components used in the H.T. smoothing equipment.

If grid modulation is already being used, then when testing out this cathode modulation the experimenter must remember that the grid of the C.R.T. should be connected to chassis, taking care not to short-circuit the cathode resistance of the phase-splitter valve in so doing. The lead to the cathode of the C.R.T. should be kept as short as possible and away from the chassis to avoid capacitance effects resulting in high-frequency loss, because the output impedance of the anode circuit of the phase-splitter is not low, as it is in the cathode circuit.

Probably the best result of all is obtained, however, when both methods of modulation are employed at once, as shown in the circuit of Fig. 3. The VCR97 and VCR517 cathode-ray tubes are comparatively insensitive and the extra drive obtained by this method (which resembles "push-pull") is of value. The writer has been using this circuit for over one year now, and has found it to be very satisfactory. No trouble should be experienced in getting it to work, and the results are well worth while. Greater depth of modulation is clearly obtained, and it is possible to turn the brilliance much higher without the fly-back lines appearing, and there is no loss of definition. There may be a slight loss of output and waveform on the sync pulse, but this has been so small as to cause no inconvenience, and may be minimised by using a physically small condenser for K2 (.1 μF 500 volts working), and mounting it away from the chassis.

When experimenting with this "double modulation" circuit, it will be well worth while adjusting the values of the cathode and anode resistances of the phase-splitter valve to find the combination which will give the best response, commencing with about 6,000 ohms for R1 and 10,000 ohms for R2.

Colour Code for Television Aerials

A UNIFORM scheme of catalogue suffix numbers for television aerials to indicate clearly the channel for which an aerial is suitable has been agreed upon by the manufacturers.

The channel number will also be marked clearly on aerial packages. Some manufacturers will use a colour code, as shown below:

Channel number	Location	Frequencies Mc/s		Catalogue suffix	Optional colour code
		Vision	Sound		
1	London	45.00	41.50	/1	Yellow
2	North England	51.75	48.25	/2	Light blue
3		56.75	53.25	/3	Red
4	Midlands	61.75	58.25	/4	Green
5		66.75	63.25	/5	Dark blue

The scheme has been initiated by the Aerials Panel of the Radio and Electronic Component Manufacturers' Federation in the hope that it will simplify storekeeping and records, not only for manufacturers but for wholesalers and retailers. The scheme commenced on September 1, 1950, the changeover will be gradual.

Television for Australian Premier

MR. R. G. MENZIES, the Australian Premier, took full advantage of the opportunity of seeing television daily while he was in this country.

In his suite at the Savoy he had a 15in. receiver with radio in his private room and a 12in. console model in his conference room. Both sets were supplied by E. K. Cole Ltd.

Electronic Flash on Picture Page

INTERVIEWED in the Television Picture Page programme some time ago, Mr. G. A. Gilbert, M.B.E., B.Sc., of Mullard Electronic Products Limited, and Mr. K. H. Gaseltine, F.R.P.S., A.I.B.P., of Ilford Limited, emphasised the growing importance of electronic flash photography in various branches of industry and research.

During the interview, viewers were shown a selection of pictures included in a special exhibition of electronic flash photography.

After mentioning the development of electronic flash tubes during the war for the study of projectiles in flight, Mr. Gilbert went on to say that the wide range of tubes now being manufactured in this country were the finest in the world.

Broadcast Receiving Licences

STATEMENT showing the approximate numbers of licences issued during the year ended 31st July, 1950.

Region	*Number*
London Postal	2,320,000
Home Counties	1,633,000
Midland	1,719,000
North Eastern	1,885,000
North Western	1,595,000
South Western	1,055,000
Welsh and Border Counties	727,000
Total England and Wales	10,934,000
Scotland	1,122,000
Northern Ireland ..	205,000
Grand Total	12,261,000

The above total included 423,550 television licences.

Television viewers are reminded that they need a television licence costing £2 (which also covers sound broadcast reception) as soon as they instal their television sets, and it is not sufficient to wait until their 20s. (sound) licences expire. They can claim a rebate at the rate of 1s. 8d. per month on unexpired 20s. licences at the post office at the same time as they buy their £2 television licences.

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 wireless 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.

Television Sports Advisory Committee

THE Postmaster-General has appointed Mr. John Lewis, M.P., to be a member of the Television Sports Advisory Committee.

As this is a committee set up to advise the Minister, Mr. John Lewis has ceased to act as his Parliamentary Private Secretary.

Mr. Richard Winterbottom, M.P. (Brightside) has been appointed Parliamentary Private Secretary to the Postmaster-General.

College TV

AMERICA'S WOI-TV at Iowa State College became first educational television station when it began operation in February. The station marks a step forward in the 27-year-old development of educational broadcasting which has made Iowa State College a leader in the field with the most modern and best-equipped broadcast facilities of any college in the country.

WOI-TV broadcasts programmes for schools in the afternoons and

Members of the Aluminium Development Association staff watching the television programme "Shop at Home," the first number of which dealt with aluminium. The receiver is a TS114 loaned and installed by E. K. Cole, Ltd.

general programmes in the evenings each weekday. The station serves an area of more than 55 miles in radius with a population of about 600,000 people in six major Iowa cities.

Stereoscopic Pictures

THREE-dimensional television pictures have been developed by both RCA and by the Argonne National Laboratory in co-operation with Du Mont. The two systems are very similar, both using a twin lens arrangement with the lenses separated about the same distance as between the human eyes.

The RCA system uses two CR tubes side-by-side in the camera and two tubes at the receiver. The Du Mont camera has only one camera tube and the images are placed side-by-side in the space normally occupied by one image. The Du Mont receiver requires only one ordinary picture tube.

In both cases, complementary polaroid filters are placed in front of the two adjacent images and the observer wears a pair of polarised spectacles so that he sees the right-eye image only with his right eye and the left-eye image with his left eye.

Philips Projection Television

THE latest Philips projection television receiver, Model 600A, was recently demonstrated to a large gathering of dealers from the Birmingham area at the company's showroom at Dale End, Birmingham 4. Mr. Thorne, the radio sales manager of Philips Electrical, Ltd., said that the new receiver really did produce what is usually regarded as a picture which, being projected on to a flat large screen, could be compared with normal framed pictures.

"Hall of Television"

THE Hall of Television, in which all types of receivers were seen in operation, was an important feature of the seventeenth National Radio Exhibition at Birmingham. The television programmes were "piped-lined round the exhibition from a glass-walled room in which were the Radio Industry Council's engineers and announcers."

"Radio Show"

THE Birmingham Exhibition did not lend itself to a portmanteau word like Radiolympia. It was known as the Radio Show, and apparently the older name is to be dropped. "This informal name has the advantage of being applicable to the National Radio Exhibition when it is held during the next three years at Earl's Court, and wherever else it may go," said an official at the exhibition.

Ferranti Receiver

A 12in. tube television receiver combined with a medium- and long-wave band radio and giving a flat picture 10⅝in. by 8 in. was exhibited by Ferranti. It used an American-style shallow mask to give the widest viewing angle. The controls on the front of the set can be concealed by a hinged flap.

Five-Channel Reception

NEW models by Bush Radio, Ltd., and E. K. Cole, Ltd., are designed for five-channel reception, making them adjustable for London, Birmingham, or any of the television stations yet to be built.

Hale Projector

A PROJECTION television receiver by the Hale Electric Co., Ltd., gives a picture 18in. by 13½in. The superhet. circuit uses 23 valves, and models are available for both London and Birmingham.

Aerials

AMONG the range of aerials exhibited by Telerection, Ltd. was a television multi-array claimed to give a high performance. A simple mechanical adjustment allows it to be matched to any television set irrespective of feeder and input impedance.

Model Television Factory

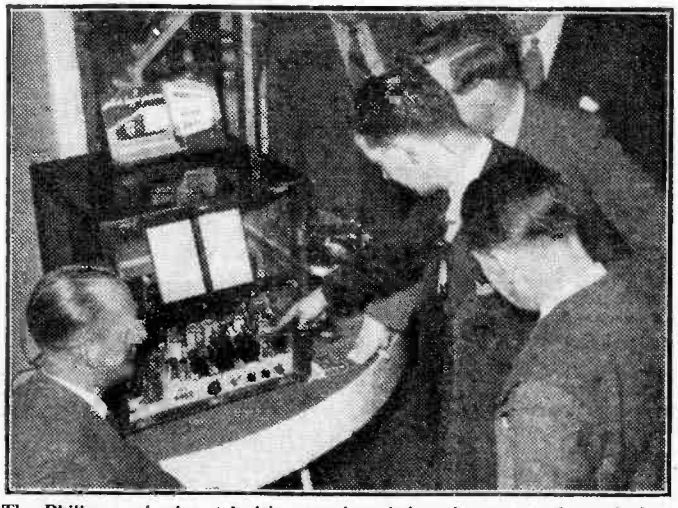
A MODEL television factory formed the stand of Multicore Solders, Ltd. It represented a cross-section of a typical television assembly line.

School Television Research Centre

A SCHOOLS' television research centre is to be established at Stratford Green Secondary Boys' School, Walter Lane, E.15. The venture at this stage is a private one. The aims are to study the physical conditions in which television can best be used as a visual aid in schools, to test current production models, to act as a proving ground for prototype equipment, to measure the value of programmes and to create a cadre of teachers with a knowledge of television.

Advisory Committee on Interference

THE Institution of Electrical Engineers has nominated 45 persons to constitute the panel provided for by Section 9, Sub-section 2 of the Wireless Telegraphy Act, 1949. From this panel the Postmaster-General has appointed an advisory committee of 17 members which he will consult before making regulations for prescribing the requirements to be complied with in the case of the ignition systems of internal combustion engines; and an advisory committee of 18 members which he will consult before prescribing requirements to be complied with in the case of refrigeration apparatus.



The Philips projection television receiver being demonstrated to dealers from the Birmingham area.

Wavetrap for Television Interference

A Unit to Remove Amateur Transmitter Radiation Troubles

By "ELECTRON"

"TELEVISION time" has, in many cases, come to mean "switching-off time" for radio amateurs. For the radiations, even from a low-power transmitter, cause havoc within the immediate neighbourhood. One of the chief troubles seems to be third harmonic reception of 14 Mc/s signals, but the writer feels that in many cases the interference could be lessened if more attention were paid to the aerial system, which too often radiates harmonics at almost the same intensity as at the fundamental! Other spurious oscillations do not help, but this is not the place to start talks on aerial and transmitter efficiency. Let us assume that everything is in order but that the transmissions are causing local interference.

Alternatives

There are two alternatives (a) to shut down during TV transmission times and (b) to fit a wavetrap of some description at the transmitter end or the TV receiver end. The last, if effective, is, of course, the best answer and scores of amateurs have done this with very good results. In some cases, however, wavetraps seem to be of no avail.

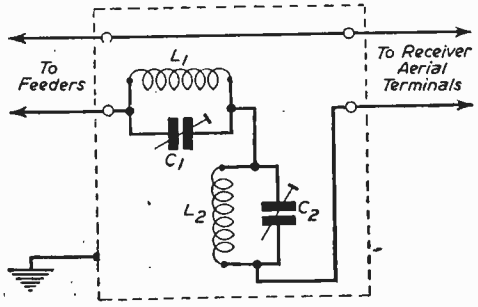


Fig. 1.—Circuit of the Wavetrap.

This article is directed towards the latter section, since the type of suppressor about to be described is extremely effective. It is also directed to those viewers who are experiencing interference from amateur and other sources (except for car ignition radiations) since the wavetrap is fitted at the receiver end.

The circuit of Fig. 1 shows the components—two coils and two variable trimmer capacitors in an earthed box. The choice of coil-capacitor values will depend on the frequency of the undesired interference, but the table of Fig. 2 gives details to cover most possible ranges. Although simple enough in itself, there are one or two very important points to note as regards construction and installation.

Mounting

As shown in the circuit. the wavetrap consists of identical tuned circuit L1/C1 and L2/C2. These should actually be mounted as shown in the drawing; that is to say, the two coils must be fixed at right angles to one another. They should also be placed about 3in. away from each other, certainly not less, otherwise the rejection may not be so effective.

For maximum effect the wavetrap should be mounted as near to the receiver as possible and the metal casing taken to a good earthing point. Adjusting the trap is simplicity itself. Should the rough frequency of the offending transmission be known suitable coils can be installed; if not, then a certain amount of trial and error is unfortunately necessary. However, C1 is first adjusted until the interference level is at minimum and then C2 adjusted similarly. In most cases this will completely eliminate the trouble—at the worst it will considerably reduce it—and, as a matter of interest, this type of filter has been found to be several times as effective as a normal type of wavetrap.

Where the frequency is unknown, L2/C2 circuit can be shorted out and alternative coils tried in the L1 position until one is found which can definitely produce a "dip" in the interference. In cases where interference is being received from two sources (not so uncommon as it may sound) the unit can be used to counter the effect of both. Merely use L1/C1 to reduce one source and L2/C2 for the other. Naturally, this will not give such a good result for either of the interference transmissions, but at least it can simultaneously cut down the effect of the two radiations at the same time.

Frequency	S W G	No. of turns	Spaced to	Dia. of Former	Capacitor Value
1.5—5 mc/s	24	34	1½in.	1½in.	350pF
5—9 mc/s	24	28	1¼in.	¾in.	150pF
9—20 mc/s	24	11	½in.	¾in.	150pF
20—42 mc/s	18	5	½in.	¾in.	150pF

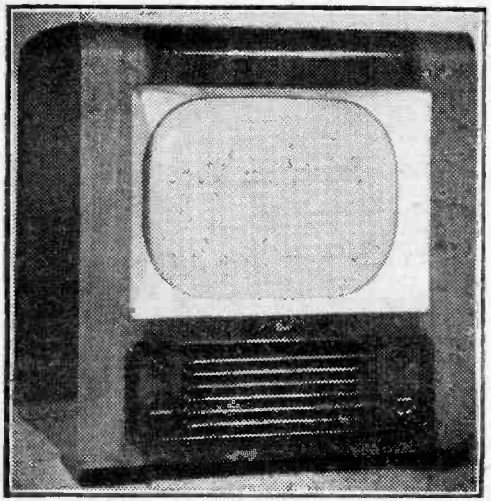
Components

The capacitors can be of the trimmer type with screwdriver slot adjustment; this will be an advantage and the adjustment can be made with a trimming tool or a short-shanked screwdriver with insulated handle to avoid "hand capacity" effects. The complete unit can be made up of spare parts from the junk box and, if the offending frequency is known, the whole job done in a very short time.

TV at the H

The Seventeenth National Radio Exhibition was h September 16th, in a part of the British Industry's No less than 181 television receivers were in operati television receivers broke all previous records. The Palace and Sutton Coldfield.

We were unable, owing to the withdrawal of overti industry in London, to include the following report o radio exhibits are reviewed in our companion jo



The Bush Radio table television receiver, type TV24. with a 12in. tube.

Aerialite, Ltd.

ALL the television aerials are now proofed against "humming." They are treated against corrosion inside and outside of tubes, and each aerial carries a £200 lightning insurance.

The range shown included simple units from 16s. 6d. to £13, the latter being Model 64—a four-element aerial with dipole for use in outer fringe areas. In addition there were coaxial cables, plugs, sockets and connector boxes.

Polar diagrams are published for various models of Aerialite television aerials.

Castle Works, Stalybridge, Cheshire. [Stand No. 76]

Antiference, Ltd.

A FULLY comprehensive range of aerials was seen here, with models for all possible requirements. New products included the "Antex" which has been redesigned mechanically; a light-weight single dipole and a flexible room aerial. It embodies a new junction unit which is of high grade bakelite, reinforced by aluminium die-castings and is a great improvement mechanically over the original "Antex" insulator. All electrical connections are fully enclosed and weatherproof. A special feature is the provision of rod sealing glands which ensure both a watertight seal and complete freedom from movement due to vibration once the rod element is screwed into the junction unit. The "Antex" Mark 2, is fitted with ½in. diameter annodised aluminium alloy rods which provide an even better performance than the original model. Four models are available, two with 5ft. cranked masts for chimney or wall mounting; one for mounting to a wooden mast of any height, and the other is complete with a 10ft. aluminium alloy mast and chimney lashing equipment.

In addition there are a "two-way" dipole aerial, and a room aerial, a simple flexible aerial for internal mounting in strong signal areas.

67, Bryanston Street, London, W.1. [Stand No. 18]

A. J. Balcombe, Ltd.

AMONG the new television receivers shown here were a 12in. table set for London and Birmingham areas, in a new bow-fronted cabinet. The set consists of a new circuit which is actually an adaptation of the original successful Midlands superhet.

52-58, Tabernacle Street, London, E.C.2. [Stand No. 54]

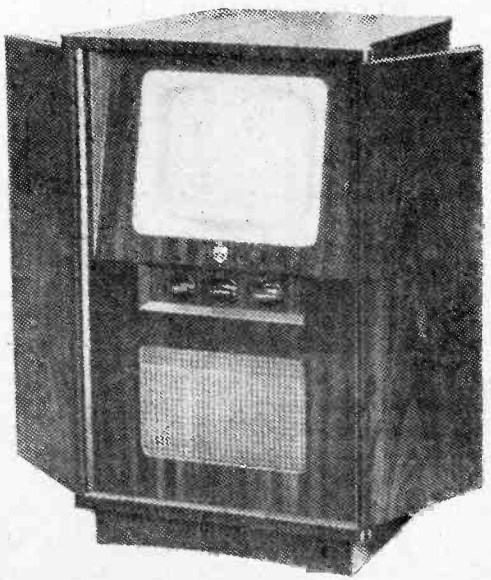
Burndept, Ltd.

RECEIVERS under the Vidor trade mark were shown on Stand No. 47, in the main aisle of the exhibition, and included a comprehensive range of television and radio receivers as well as radio batteries to fit every make of battery receiver on the market.

The main attraction in the field of television was the new 1951 model. This is a 12in. console receiver, housed in a most attractive walnut veneer cabinet. The design permits a larger picture than up to now achieved with tubes of a similar size. The hermetic sealing of the view face of the cathode ray tube prevents the collection of dust on the screen thereby reducing service charges to an absolute minimum. To allow for ease of movement concealed castors are fitted to the cabinet.

All controls are in the front of the receiver, the secondary controls being behind a panel between the two main controls to facilitate the ease of focusing.

This receiver is made in four models to cover all existing television stations:



Ekcovision model TC140 exhibited by E. K. Cole, Ltd.

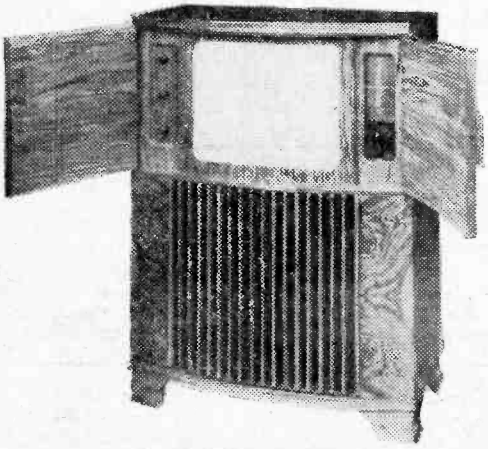
Radio Show

ld from Wednesday, September 6th to Saturday, Fair building, at Castle Bromwich, Birmingham. on daily, and the number of exhibitors showing pening ceremony was televised from Alexandra

me working imposed by a section of the printing the television exhibits in our previous issue. The nal "Practical Wireless."—Editor.

CN.4206 for reception in the London service area.
CN.4207 for reception in the Sutton Coldfield area.
CN.4208 for reception of the London transmission at long range.
CN.4209 for reception of the Sutton Coldfield transmission at long range.

The other new television receiver on show was Model CN.4210, a console two-station television receiver, covering transmission from Sutton Coldfield and Holme Moss, the nearly completed station in Yorkshire. Its handsome walnut cabinet is fitted with two full length doors to conceal the screen thereby making the set a



Decca model 131 T.V.

beautiful piece of furniture to be a decorative addition to any room.

An entirely new development in the Vidor Large Screen projection television was seen in Model CN.4205. This two-door console model shows a picture measuring 16in. x 12in. of utmost clarity.

The outstanding design of the cabinet makes it possible to service the set on the front without complicated dismantling operations. Also all controls are on the front, all secondary preset controls being covered by a hinged panel.

West Street, Erith, Kent. **[Stand No. 47]**

Bush Radio Ltd.

BUSH television will include table receivers with 9in. and 12in. tubes, a console (12in.) and a combined television (12in.) all-wave radio and radiogramophone.

A Burndept 12in. console model bearing the Vidor Trade Mark.

The most recent release is a table television receiver, type TV.24, with a 12in. tube, priced at 56 guineas (tax paid). All television receivers are adjustable to work on any one of the B.B.C. T/V. frequencies.

Power Road, London, W.4. **[Stand No. 48]**

Champion Electric Corporation

HERE were the Albany, the Berkeley and the Luxor receivers, the latter claiming to be an example of the combination of British cabinet craftsmanship and artistry with the latest in radio and television technique, where a breakaway from the traditional style of radio cabinet has been made.

It incorporates a built-in radio and cocktail cabinet, as well as an auto-changer equipment. The total cost of this instrument is £195 0s. 2d. It employs a 14-valve superhet circuit and a 12-in. tube.

16, Berkeley Street, London, W.1. **[Stand No. 73]**

E. K. Cole, Ltd.

THE receivers shown on this stand included Model T141, a table model 12-in. tube receiver, at 55 gns. inc.; Model TC138, a console vision receiver with 12-in. tube, at 62 gns. inc.; Model TRC139, a 12-in. tube console vision receiver combined with pre-set radio, at 72 gns. inc.; Model TC140, a console receiver with 12-in. aluminised tube in well-styled cabinet with doors, price 80 gns. inc., and Model TSC113, a 15-in.

tube console with radio in cabinet specially designed by Wells Coates F.R.I.D.I. This costs 145 gns. inc.

Ekco Works, Southend-on-Sea. [Stand No. 53]

Co-operative Wholesale Society, Ltd.

THE "Defiant" receivers shown included Model TR947 for A.C. mains, a 22-valve table model in figured walnut. A 9-in. Mazda C.R.T. is used, giving pictures 7½in. by 6in.

Model TR949, for A.C. mains, is a 15-valve compact table model in semi-matt walnut finish. It also has a 9-in. Mazda C.R.T.

Model TR1247, for A.C. mains, is a 22-valve console model with recessed speaker design. A 12-in. Mazda C.R.T. gives pictures 10in. by 8in. The walnut cabinet is 41in. high, 22in. wide, 17⅞in. deep.

Model TR1248 is similar but incorporates an all-wave radio.

Model TR1250, also for A.C., is a 15-valve console model in polished walnut. It also uses a 12-in. tube.

1, Balloon Street, Manchester 4. [Stand No. 61]

Cossor, A. C., Ltd.

COSSOR television receivers giving brilliant pictures of the utmost detail were shown in a variety of models, including console instruments with radio combined. These receivers are fitted with Cossor cathode ray tubes with a unique electronic filter—the Cossor patented "Ion Trap"—which protects the fluorescent screen from heavy ion bombardment. A full complement of valves in the high-gain superhet circuit ensures really effective interference suppression and maintains a remarkably good performance even in remote fringe areas.

Table Model 916, at 49 gns. tax paid, in Sapele mahogany cabinet, gives the largest possible direct-viewing pictures on a 10-in. tube and will be found ideal for comfortable family viewing under normal room lighting. Model 917 is a console version at 60 gns. tax paid, and is housed in a two-tone walnut cabinet with concealed castors. To provide for those who seek a combination of radio and television in one cabinet a console of very similar general appearance was shown, but by raising a section of the lid an all-wave radio receiver is brought into view (Model 918).

In addition to the above, other Cossor television consoles were shown and included two models in which 12-in. tubes are employed, giving correspondingly larger pictures. One model is for television only (Model 919), and an alternative version combines the two functions of television and radio (Model 920).

The Cossor direct-writing electro-cardiograph Model 1314 is also displayed.

Cossor House, Highbury Grove, N.5. [Stand No. 52]

Decca Radio and Television

THE Kensington and the Knightsbridge were outstanding in the Decca exhibit, at prices from £573 upwards. Projection pictures are included in some of these models, together with all-wave radios and F.M. circuits. The Knightsbridge is built round the Decola cabinet, and so, in addition to the best in sound reproduction, they also provide a 12¾in. by 15in. picture on a fine-grain screen. Model 131, at 189 gns., is a large-screen (16in. by 12in.), three-waveband radio combined receiver for which a remote control unit is available by means of which contrast and focus may be adjusted without leaving the viewing chair.

1-3, Brixton Road, London, S.W.9.

[Stand Nos. 22, 37 and 40]

Dynatron Radio, Ltd.

ON this stand was featured the improved "Falcon" television console, Model TV24A. This is a still further improved model of the original Falcon television receiver with even better picture clarity. It will work satisfactorily where other television receivers have failed. The picture detail is outstandingly superior. Despite increased costs in some instances the list price has been reduced to 110 guineas from 125 guineas, giving a new total price, including purchase tax, of £141 3s. 4d.

The television and radio receivers have been combined in the following combination radiogramophone and television models:

The "Ether Consort" is a new combined television radiogramophone, Model B314. Using the new radio chassis from the "Ether Princess" comprising Tuner T49 and Amplifier LF44. Television Chassis TV24A and Record Changer; in a handsome walnut cabinet with sliding doors. Price from £397 4s. 5d.

The "Ether Sovereign" is a combined television radiogramophone in Queen Anne style cabinet, Model K349QD. Facilities for long-playing records at small extra charge, dependent upon requirements. £574 17s. 8d., inc. tax.

An "Ether Sovereign" combined television radiogramophone in modern style cabinet, Model K349MD. The improved chassis installed in the three-section style cabinet, now costs £470 3s. 4d., inc. tax.

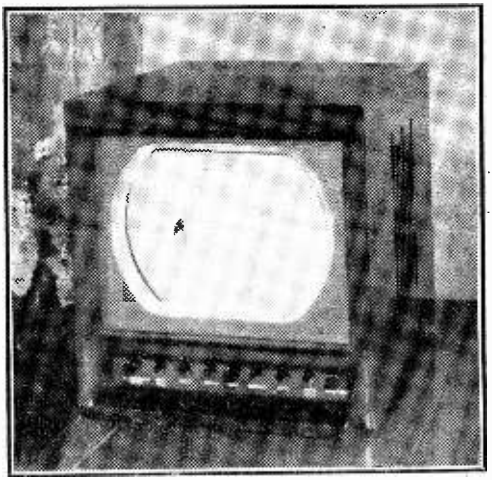
Perfecta Works, Ray Lea Road. [Stand No. 69]

The English Electric Co., Ltd.

THE English Electric Company stand featured their Model 1550 television receiver, which was seen in action.

This model, which was introduced at the end of 1949, has a 120-square-inch screen, and is equipped with a synchrophase device which enables it to be used in those parts of the fringe areas where reception would otherwise be impossible. On the company's stand at this exhibition the synchrophase device was specially featured.

On the stand there were also demonstrated television test instruments made by Marconi Instruments, Ltd., and so arranged that they can be grouped as a complete assembly for overall testing. The grouping system does



An attractive table model by Ferranti, Ltd.

not immobilise otherwise portable instruments, nor need all the individual types be acquired at the same time. Starting with only two or three, further units can be added as required.

Marconi Instruments, Ltd., one of the English Electric Group, demonstrated this equipment in use on an "English Electric" television receiver dismantled to show the chassis and components.

Queens House, Kingsway, London, W.C.2.
[Stand No. 35]

Electronic Products, Ltd.

THE Model MTS501, shown on Stand 74, is a television console with a 12in. cathode ray tube. The picture produced on the screen is so bright, sharply defined and steady that it can be viewed comfortably in normal room lighting. The quality of sound reproduction is excellent. The selected walnut cabinet is well-designed on modern and attractive lines.

Stand No. 74 was also devoted to a display and demonstration of valves, tubes and components of interest to equipment manufacturers. The wide range of products included valves for domestic receivers, car radio and audio-amplifiers; valves and C.R. tubes for television receivers; sub-miniature valves for hearing aids, and the very latest photocells for sound-on-film equipment. Of particular importance among these exhibits was a new range of novel base receiving valves specially designed for television.

A wide variety of Mullard radio and television components was also exhibited. Important among these was a range of "Ticonal" permanent magnets; Ferroxcube high-permeability low-loss ferrite; and Varite negative temperature coefficient resistors.

Mullard projection television components were also demonstrated on this stand. These components, as readers know, comprise an optical system, deflection and focusing coils, and compact E.H.T. unit and the Mullard MW6-2 projection tube.

Century House, Shaftesbury Avenue, W.C.2.
[Stand Nos. 64 and 74]

Ferranti, Ltd.

THE television range which was shown gave a choice of table and console receivers for the Midland and London areas, and included models incorporating a radio receiver with built-in aerials. A projection television receiver, Model T.1605, which gives a large flat brilliant picture 14in. by 10½in. in size, was also on view.

With the exception of the projection television receiver, all models have the 12in. Ferranti cathode-ray tube, which is free from ion spot burn, and because of its moulded construction gives a substantially flat brilliant picture approximately 10½in. by 8in. The models are highly sensitive and suitable for use at any part of the television service areas, making the use of an external aerial amplifier unnecessary. All controls are conveniently placed at the cabinet front, considerably simplifying operation. In the table model T.1405 the controls are concealed by a hinged flap when not in use, and in the console model T.1205 the picture screen and controls can also be concealed by a flap which retracts into the top of the cabinet and can be used, if necessary, to shield the picture from unwanted direct lighting. The combined television and radio console model T.1505 has doors to conceal screen and controls when not in use, and its radio receiver has built-in aerials.

Hollinwood, Lancs. **[Stand No. 55]**

The Ambassador TV2 corner console model. It has a 12in. tube. (R. N. Fitton, Ltd.)

R. N. Fitton, Ltd.

UNDER the "Ambassador" trade-mark, Model T.V.2 was probably the most interesting exhibit on this stand. In this a 15-valve superhet circuit is used with efficient noise suppression on both sound and vision. The tube is a 12in. Mazda giving a picture approximately 10¼in. by 7¾. Patent Ambassador circuitry ensures rock-steady pictures. Electrical interference cannot cause frame slip or pulling on line as is so often found in other circuits. Three main controls at the front of the receiver regulate sound volume, picture contrast and brilliance. The 8in. loudspeaker gives realistic reproduction of sound. The range of the receiver is up to approximately 80 miles from a transmitter. At distances beyond 60 miles, however, reception is subject to favourable location. The receiver will operate only on A.C. mains. The price is £72 inc.

Radio Works, Hutchinson Lane, Brighouse, Yorks.
[Stand No. 68]

Hale Electric Co., Ltd.

TWO consoles and a projection set were to be seen here. Model ECV. 1523 gives a picture size of 9in. by 6¾in. and is available for either the London or Birmingham reception areas. It employs a superhet chassis, having maximum sensitivity with good picture definition and offers first-class television reception in the average size room, at a reasonable price. Retail price, 46 gns., plus tax.

Model ECV. 1524 is housed in a de-luxe console cabinet, giving a picture size of 10in. by 8in. and also employs a superhet chassis. A television receiver in which all the latest refinements have been incorporated, which gives a large, clear picture and ample gain even in the fringe areas of either London or Birmingham transmitters. Retail price, 72 gns., tax paid.

The latest development by this firm consists of a projection televisor employing a superheterodyne circuit with a total of 23 Mullard valves. It is available for both London and Midland reception areas, and is housed in a handsome console cabinet, fitted with doors which, when opened disclose a screen giving a picture measuring 18in. by 13 $\frac{7}{16}$ in.

Radio Works, Talbot Road, W.13. **[Stand No. 60]**

Invicta Radio, Ltd.

THE two main exhibits here were Models T.105 and T.111. Model T.105 is a table model of the popular type fitted with a 9in. cathode ray tube. The vision receiver incorporates a tuned radio frequency circuit with interference limiting and video frequency amplifier. The time base circuit has a positive interlace filter with grid blocking type line and frame scan oscillators. For reception of sound a T.R.F. circuit is also used with differential interference limitation. The cabinet is of highly polished walnut and the price is £55 5s. 9d., tax paid.

Model T.111 is similar to the T.105, but uses a 12in. cathode ray tube giving a picture area of approximately 80 sq. in. Price, £63 18s. 8d., tax paid.

Radio Works, Parkhurst Road, N.7. **[Stand No. 46]**

B. Kimber, Allen and Co.

A FULL range of television aerials were on show, from the flexible dipole to the multi-array. Prices from 12s. 6d. to 182s. 6d. Whilst every consideration has been given to ensure maximum technical efficiency, the riggers' problems have received particular attention, and special care has been given to ease of assembly and erection. The patented moisture protective methods employed protecting the vital contacts, have reduced maintenance to the barest minimum. Several new and interesting improvements were to be noted, including the push-lock element and the new chimney fixing which does away with lashings and can be fixed permanently in a few minutes. A comprehensive installation service covers the whole television area.

Myron Works, London, S.E.13. **[Stand No. 99]**

Kolster-Brandes. Ltd.

THE K-B models which were on show included Table Model EV.30. This is a 21-valve A.C. sound and vision receiver, with a 12-in. Brimar cathode ray tube. High gloss mahogany or walnut cabinet. Available for Birmingham or London frequencies.

Table Model FV.30 is a 12-in. de-luxe edition of EV.30, similar in all main essentials but with highly efficient variable picture definition control and new design high-gloss walnut cabinet. For London, Birmingham and Holme Moss frequencies.

Console Model EV.40 is a 12-in. console edition of Model EV.30 sound and vision only, with large speaker and high-gloss walnut cabinet on casters. London and Birmingham frequencies.

Console Model FV.40 is a 12-in. sound and vision receiver. It is a console version of Model FV.30 including variable definition control. High-gloss walnut cabinet with doors and casters. London, Birmingham and Holme Moss frequencies.

Console Model FT.50 is a radio and television receiver with 12-in tube, chassis similar to Model FV.40 with variable definition control. Three-wave band, 5-valve radio superhet, lush high-gloss walnut cabinet with large doors and casters. London, Birmingham and Holme Moss frequencies.

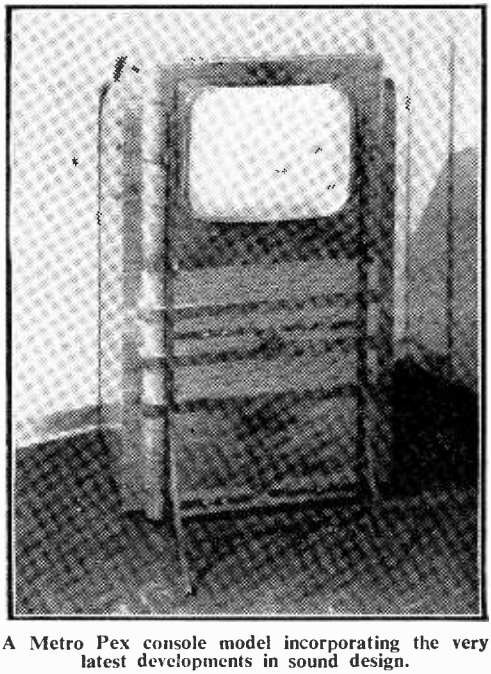
Footscray, Sidcup Kent. **[Stand No. 36]**

Masteradio, Ltd.

THE receivers shown on this stand included Model T.851—a 12-in. table model television receiver, incorporating a 2 wave-band, 4-valve radio set which uses the TV aerial, and Model T.852—a 12-in. table model television receiver without radio. Both these models use a superhet circuit, and are designed to receive all the five B.B.C. TV channels by a simple screw adjustment. Also incorporated is a picture enlarger improving central detail.

Model PT.50 is a projection television set with a screen size of 16in. by 12in. The screen is non-directional, and can be viewed from all angles without distortion.

Fitzroy Place, London, N.W.1. **[Stand No. 28]**



A Metro Pex console model incorporating the very latest developments in sound design.

Metro Pex, Ltd.

AS manufacturers of television lenses, the products of this company were of special interest. Since last year's Radiolympia, where " Magnavista " lenses created so much public attention, many new and attractive models have been added to the already comprehensive range. It is well-known that this lens when fitted over the receiver screen gives high magnification to the picture, outstanding clarity, and a wide angle of view. Exhibits included specially designed lenses and accessories for radar development, lenses for incorporation into television receivers (export), industrial lenses and full ranges of standard and filter type lenses for current receivers. Separate filters were shown for use on 9in., 10in., 12in. and 15in. receivers.

Perhaps the most noteworthy additions to the range are the console and table stand models, type Nos. C1X, C2, A3, incorporating the very latest developments in stand design. They are hand forged in wrought iron, finished in polychromatic bronze, and are available for 9in., 10in. and 12in. receivers.

(*Continued on page* 271)

(*Continued from page* 268)

Also on show were the new Trolley table models, introduced to solve the problem of where to put the television set. They are simply-designed tubular steel tables with telescopic and swivel lens adjustment, fitted with large wheels for easy movement ; available for 9in., 10in. and 12in. table receivers.

38, Great Portland Street, W.1. **[Stand No. 78]**

Midland Auto Components (Prop. E. & H. P. Smith Ltd.)

SOLE distributors of " Televoice " television receivers, Model T.R.12 was displayed and was also seen working in the communal television demonstration section.

This is a 14 valve superhet chassis fitted with 12in. Mazda cathode ray tube (picture 10in. x 8in.), 10in. loudspeaker and Mazda valves. Cabinet is in pleasing walnut veneer 36½in. x 18½in. x 16½in. on castors. Price £73 9s. 2d. (including Purchase Tax).

58, Cambridge Street, Birmingham, 1. **[Stand No. 24]**

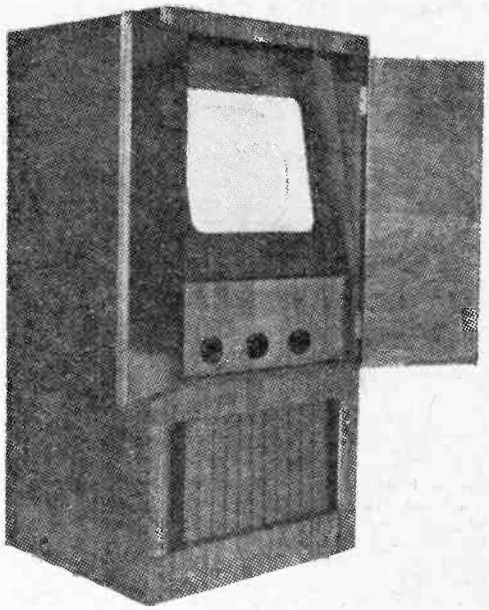
Mullard Electronic Products Ltd.

THIS firm exhibited on two stands. On the larger of these, Stand No. 64, Mullard presented their latest range of radio and television receivers. A section of this stand was also devoted to a comprehensive display of radio valves and television tubes suitable for all types of receivers.

Important among the range of Mullard exhibits was a new television receiver, Model MTS501.

Century House, Shaftesbury Avenue, W.C.2. Stand No. 64.

The Mullard model MTS501.



A console model by Peto-Scott.

Murphy Radio, Ltd.

ALL Murphy television models shown on this Stand were of the superhet type and are available with suitable tuning arrangements for either London, Sutton Coldfield or Holme Moss.

Model V.150 is a table model receiver with a 12in. tube, two R.F. stages, interference limiters for sound and picture, a walnut cabinet, and the price is £54, tax paid.

Model VU.150 is an A.C./D.C. version and costs £54, tax paid.

Model V.180C. is a console receiver with 12in. tube, two R.F. stages, interference limiters for sound and picture, focus adjustment compensated for mains voltage fluctuations, and is supplied in a figured walnut cabinet on castors. Price £75, tax paid.

Model V.178C. is a luxury model console for those who want the best in 12in. tube pictures. It has an aluminised tube giving very high brightness with excellent contrast ; adjustable sound and vision limiters; focus compensated for mains voltage variations, an attractive walnut cabinet fitted with doors, and the price is £104, tax paid.

In Model V.176C. the makers claim television at its best. Features are a 15in. aluminised tube ; good regulation high E.H.T. supply giving very bright pictures with excellent contrast. A wide band amplifier for the best possible definition. Compensated focus and many other refinements. Special acoustic arrangements for realistic sound reproduction. Extremely attractive walnut finished cabinet. Price £148, tax paid.

Welwyn Garden City, Herts. **[Stand No. 44]**

Peto Scott Electrical Instruments, Ltd.

RECEIVER model TV.124 has been designed by the Peto Scott Laboratories with a view to ensuring that the quality of the receiver, both in performance and workmanship, should be of the best commercial standards. A picture of exceptional quality, brilliance and

stability is obtained from the 16-valve chassis which includes several special circuits using the latest techniques.

The input is designed for an 80-ohm unbalanced coaxial cable feeding into a band-passed R.F. transformer. A single R.F. stage precedes a triode-pentode valve used as a high stability oscillator and mixer respectively. A vision I.F. frequency of 13.4 mc/s is used in the two-stage band-pass coupled amplifier.

The H.T. supply is obtained from an auto transformer and half-wave rectifier, and focusing is effected by a permanent magnet and adjustments are provided for centring the raster in the mask and fine focusing.

From a service point of view the chassis is particularly clean in layout and is extremely light and easily handled. The chassis and tube supplies and similarly the mains transformer are connected by plug and socket only.

Addlestone Road, Weybridge, Surrey. [Stand No. 84]

Philips Electrical, Ltd.

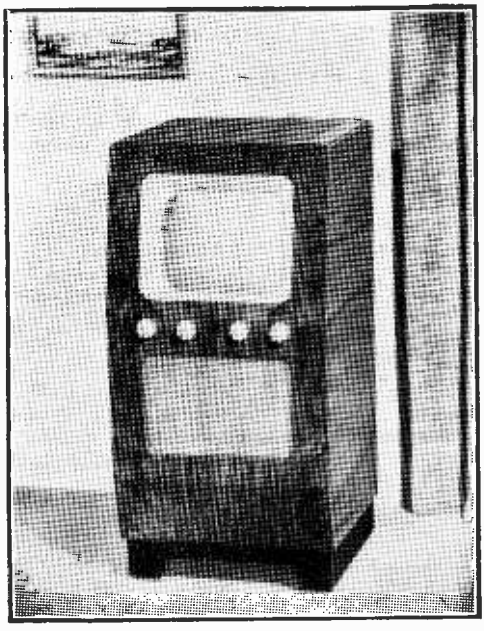
THE full range of Philips television receivers were exhibited, comprising direct viewing and projection models. The direct viewing receivers include two table models, the 385U with the 9in. tube, the 492U with the 12in. tube, and a 12in. console model 485U. Two of these receivers were demonstrated in the Television Avenue.

Of particular interest was the demonstration on Stand No. 42 of Philips projection television. Two models were exhibited, the table receiver 600A—which is supplied with or without stand—and the new console model, 704A.

The outstanding advantage of these new receivers is that they allow the picture to be viewed comfortably by a large group, thus greatly enhancing the entertainment and social value of television. The screens have been specially developed to give the maximum horizontal angle of view from the front. This has been achieved by lenticular rulings on the back face of the screen. The flat screen also obviates high speed reflections of sources of light so that the picture may be viewed in normal room lighting, with no glare or any appreciable loss of contrast.

The introduction of the 600A table model really brings projection television within the reach of the home. It combines the important features of popular price, compactness, bigger screen and wide-angle viewing, and is the ideal set for family viewing. It gives clear, soft-toned pictures on a flat screen measuring 13¾in. x 10¼in.

Century House, Shaftesbury Avenue, W.C.2. [Stands Nos. 42 and 45]



Pilot model CV34 with 12in. tube.

Pilot Radio, Ltd.

ON the Pilot Radio stand were a comprehensive range of television and radio receivers, including a new 12in. table television receiver.

This was Model TM54. The chassis carries a 14-valve circuit, and interference suppressors are fitted on vision and sound. This model is a five-channel receiver and can be installed in either of the existing television areas or in the proposed new television areas, where it can be immediately adjusted for reception in the appropriate locality. Cabinet in dark walnut veneer with contrasting mahogany mouldings. Picture of high definition, bright and steady, A.C. mains operation 210/230/250 volts. One important feature is that this receiver gives a larger picture than hitherto obtained on the 12in. receivers. By technical changes, and the introduction of a new design Pilot Tube Mask, the makers have obtained a picture 10 per cent. larger than has previously been produced using a standard 12in. cathode-ray tube.

Model C.V.35 is a television console with 12in. tube, specially designed for the Midlands area. The 19-valve circuit has interference suppressors for vision and sound. Cabinet in polished walnut is mounted on hidden castors. A.C. mains operation 200/250 volts. Price, £72, tax paid. It is also available at the same price for London.

Park Royal Road, N.W.10. [Stand No. 56]

Pye, Ltd.

THE main attraction on the Pye stand was, of course, the new black screen receivers. As most readers know, these are standard sets in which the plain glass or Perspex front has been replaced by a tinted material. The effect is twofold. Firstly, with ordinary glass any outside light in the room passes through the glass with some reflection and is again reflected from the glass front of the tube. In the tinted material the majority of such front light is prevented from passing through to the tube face and consequently not so much effect is noticed. Secondly, the black parts of a picture are merely the unlighted areas of the tube face, and as the normal colour of this is white the blacks are lightened by any front light or reflection. The tinted material thus "heightens" the darkness of the black parts of the picture and gives a more contrasted picture, although, of course, the gain or brilliancy control has to be advanced more than usual. Two models were shown, the table set at 39 gns. and the console at 45 gns., both tax paid. Model BV21C is a large cabinet with double front doors to mask the screen, etc., and has a 12in. aluminised tube. The price is 76 gns. tax paid.

Radio Works, Cambridge. [Stands Nos. 8 and 49]

Radio Gramophone Development Co., Ltd.

MODEL 1700 is a new R.G.D. television receiver. It has a 17-valve circuit and the special feature of a 12in. cathode-ray tube which gives crisp, bright pictures,

(*Continued on page* 275)

(*Continued from page* 272)

completely free of curvature distortion. It has only two main controls, the sound volume control being combined with the mains switch and contrast. A 10in. permanent magnet loudspeaker of low external field is used, and to prevent distortion caused by outside interference, built-in suppressors are fitted for both sound and vision. The cabinet is of selected figured walnut, and is fitted with concealed castors. A front panel is easily removed for cleaning the face of the tube. An expanded metal grille conceals the loudspeaker. Dimensions are 43½in. high, 20¼in. wide, by 15⅞in. deep.

Model 2751P is a projection television console which gives a sharply focused 16 by 12in. picture on a flat, square-cornered screen. On the sound side there is provision to receive four broadcast programmes and gramophone entertainment from a separate pick-up source.

Pale Meadow Print Works, Bridgnorth, Shropshire.
[Stand No. 50]

Romac Radio Corporation Ltd.

ALL Romac receivers utilise the latest type of aluminised 12in. tube, thus giving adequate brilliance for daylight viewing.

Six receivers were shown and are available for immediate delivery. They can be converted for reception of any B.B.C. Television station by exchanging three plug-in type of R.F. coils on Model 180 and four on Model 190. Receivers now supplied to fringe areas which will eventually come within the service area of a new station will be supplied with a second set of R.F. coils tuned to the new station.

The Hyde, N.W.9. **[Stand No. 88]**

Scophony-Baird Ltd.

THE receivers exhibited and demonstrated here included the Townsman ; a no-aerial Television Console ; 12in. cathode-ray tube, A.C. mains. In walnut cabinet, 40in. high, 24¾in. wide, 20¼in. deep, mounted on rubber castors. This receiver was the centre of attraction at last year's Radiolympia and is claimed to be still holding its position as the best value in Television to-day.

The Townsman with Radio is a no-aerial Television-Radio Console ; 12in. cathode-ray tube, 3 station radio, pre-selector tuned, A.C. mains. In walnut cabinet mounted on rubber castors.

The Countryman is a long-range Television Console for use in fringe areas. 12in. cathode-ray tube, A.C. mains. Walnut cabinet fitted with rubber castors.

The Everyman is a Table model, 9in. cathode-ray tube, A.C. mains. Walnut cabinet, height 12⅞in., width 12¾in., depth 17¼in.

Model T165 Portable is a no-aerial table model portable. 50 sq. in. picture. Figured walnut cabinet with plastic insert front.

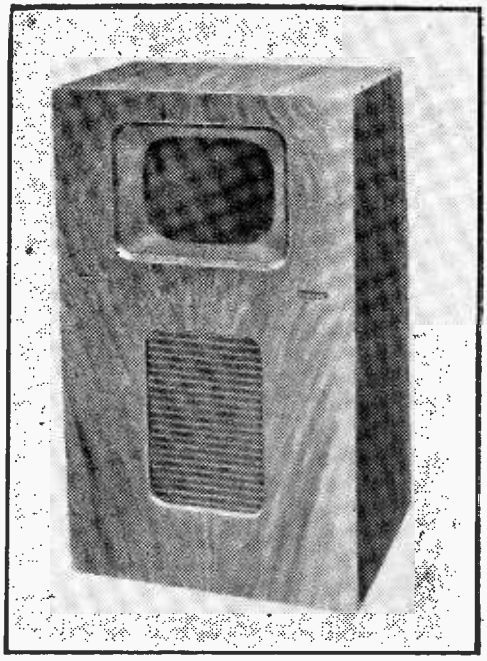
Lancelot Road, Wembley, Middlesex. **[Stand No. 39]**

Sobell Industries Limited

AMONG the models shown on this stand were Model T90. This receiver is designed to operate over the whole range of the new Television bands, extending from 41½ megacycles to 66.75 megacycles. It comprises 19 valves employing a 9in. " Mazda " electromagnetic tube, producing an effective picture of 48 sq. in. This is done by employing a mask of different shape from that normally employed, thus utilising the majority of the screen available from a 9in. tube. The receiver employs the lower side band operation in order to cover the five predicted bands, and although this creates difficulties in obtaining a sufficient band width for good definition, this has been achieved on the T90 which is a superhet receiver, with an effective vision band width of 2¾ megacycles.

Other models were the T120, a 12in. Console at 76 guineas ; T89 a 9in. Console at 63 guineas, and T107 a combined Radio and Television at 110 guineas.

Langley Park, Slough, Bucks. **[Stand No. 63]**



One of the main attractions on the Pye stand was the black screen receivers.

Whiteley Electrical Radio Co. Ltd.

APART from the many interesting W.B. items seen on this stand the Viewmaster undoubtedly was the centre of interest. This popular home-constructor receiver is, of course, made up on a chassis and with other components which are produced by the Whiteley Electrical people, and the working model could be compared with other receivers in the Exhibition. Constructional envelopes were on sale on the stand and appeared to enjoy a very wide market.

Victoria Street, Mansfield, Notts. **[Stand No. 62]**

Wolsey Television Ltd.

THREE new features were seen at the Show as follows :—

1. The Wolsey " Umbrella " fitting. This is slid over the upper half of the dipole and prevents water running down into the junction box.

2. The Wolsey broadside array, the first aerial on the market to give more than 10 dBs forward gain for use at extreme range.

3. The Hudson Mobile Radiotelephone for use in taxicabs and car hire services for which Wolsey Television are the sole agents.

75, Gresham Road, Brixton, London, S.W.9.
[Stand No. 102]

Two-valve Pre-amplifier

For £1 You Can Build a Unit Covering Five Selected Transmissions by Switching

By R. F. SCARISBRICK

THE amplifier here described is converted from the well-known RF24 ex-service unit, which can be purchased for about 12s. 6d. brand new, complete with valves. The additional cost of conversion amounts to only a few shillings and provides a high-gain two valve pre-amplifier which can be used on any of five selected TV frequencies at will, the change-over being effected by the 5-position switch already incorporated in the RF24 unit. It will prove particularly useful to enthusiasts situated in the outer fringe areas of two or more transmitters, and to television dealers for demonstration and comparison of different commercial receivers.

The RF24 unit uses three VR65 (SP61) valves, V3 being the oscillator. In the conversion this valve is not used, but the associated tuning and switch circuits are modified to provide the tuned anode and coupling of V2. To assist the constructor the circuit, before and after modification, is shown in Figs. 1 and 2 respectively. For the sake of clarity, the switching arrangements and trimmers have been omitted.

Sub-Chassis Modification

In the first stage, the chief modification is the inclusion of a 5K potentiometer in the cathode circuit to provide a gain control. This refinement is not essential, but is desirable to avoid any possibility of overloading the first stage of the receiver proper. The potentiometer must be of the small type, not exceeding 1⅜in. in diameter, and is mounted by removing the large handle from the front panel and enlarging to the required size the upper screw hole which secures the handle. It is advisable to use a wire-wound type to assist in keeping the signal/noise ratio as high as possible. For the same reason the anode resistors R2 and R3 and bias resistor R7 should be replaced by wire-wound types. R6 may be removed, the cathode pin of V1 being taken direct to R7. The connecting lead of VR1 should be of single-screened wire, as shown in Fig. 3a.

The cathode circuit of V2 is altered as shown in Fig. 3b, C9 being disconnected from L5 and earthed on pin 5 of the valveholder. The junction of R13 and R14 is also removed from L5 and may be either left free or anchored on the unused valve pin 7. Substitute the 100 ohm resistor R7 (removed from V1) for R14 (1KΩ). The coil L4 and R10 (10KΩ) must be removed, a 2.4KΩ anode load resistor being wired between the anode pin No. 3 and the junction of R9 and R11. The 2.4KΩ resistor (R16) in the anode circuit of V3 may be used for this, as V3 is not used. The disconnected end of coupling condenser C8 should now be connected to the anode pin 3. The 100KΩ resistor R11 is replaced by the 10KΩ (R10) just removed.

As V3 is not used, it is advisable to remove all the associated components underneath this section of the

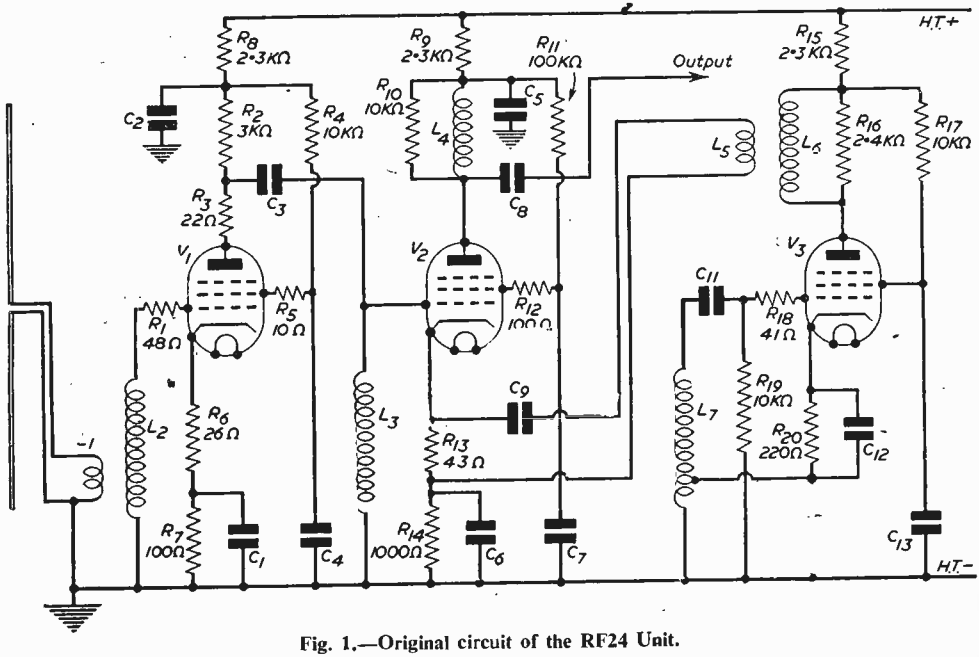


Fig. 1.—Original circuit of the RF24 Unit.

chassis, and this should be done next, leaving only the valve heater lead, the H.T. feed through the rubber grommet, and the short length of co-axial. At the same time, disconnect the lead between cathode resistor R20 and the coil L7 (above the chassis) and remove L7. The free end of the length of co-axial will be taken up through the chassis after the tuning circuits have been modified.

The bakelite connecting block is not required and should be removed. It can be replaced, if desired, by a small piece of paxolin, fitted with three rubber grommets to accommodate the heater, H.T., and co-axial output leads. In the interests of neatness, the writer also removed the two spring-loaded spigots, which can be done by drilling out the four spot-welds on each bracket.

It will be noticed that each valve has one heater connection returned to chassis. These must be disconnected and an insulated lead substituted to link the valves, otherwise there would be a risk of short-circuiting the heater winding if the heater feed was connected wrong way round. The earth return of C6 and R14 must be transferred from the valve pin 8 to the adjacent chassis earthing tag. The capacitators across each pair of heater pins are not altered. So far as the sub-chassis is concerned it remains only to connect a twin flexible lead to the V3 heater pins for the 6.3V heater supply, and a further twin lead for the H.T. positive (250 volts to 300 volts) and common negative.

Modifying the Coils

Tuning of the stages is effected by fixed capacities and pre-set air-dielectric trimmers in parallel with the coils, the appropriate trimmers being selected by the five-position switch. To modify the circuits it is first necessary to rewind the coils. Disconnect and remove the former of L1 and L2. Unwind both windings until only one-and-a-half turns of the coupling coil remain, and secure the end of this coil by a loop through one of the holes in the former. Now rewind L2 to four-and-

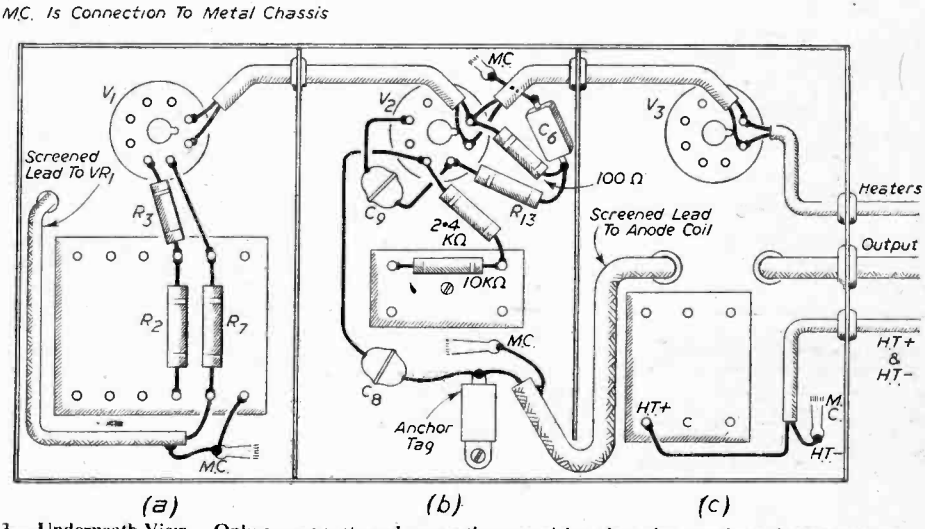


Fig. 3.—Underneath View. Only components and connections requiring alteration are shown in the drawing.

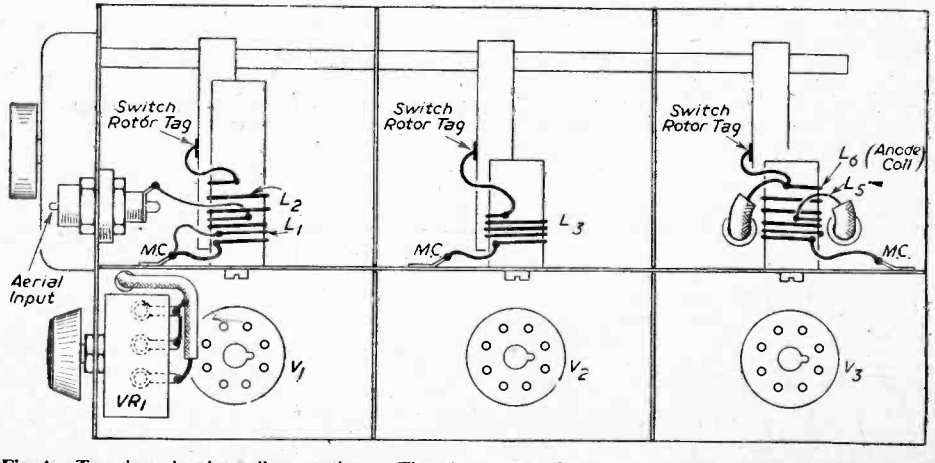


Fig. 4.—Top view, showing coil connections. The trimmers and fixed condenser have been omitted for clarity.

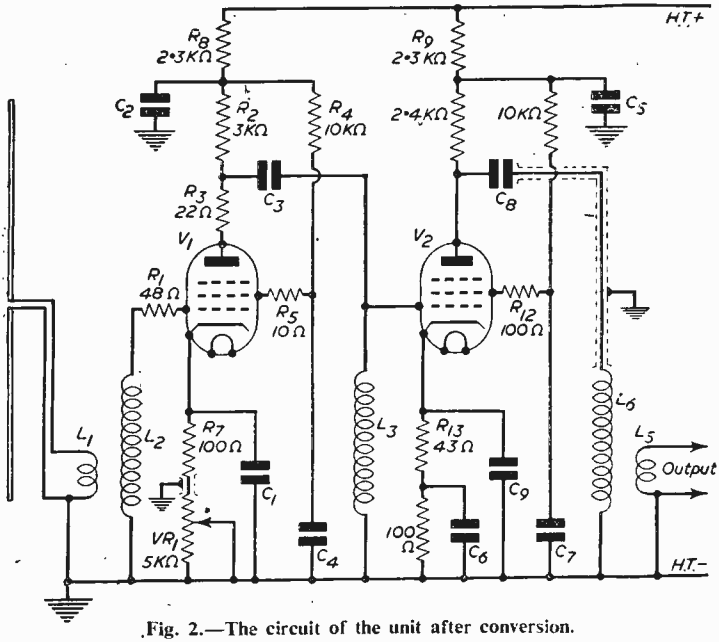


Fig. 2.—The circuit of the unit after conversion.

A signal generator is essential for lining up, together with a suitable receiver. The best procedure is to commence by setting each of the variable trimmers to an approximate half-way mark. The highest selected frequency should be adjusted first, using switch position 5, with position 4 for the next highest, etc. Apply the S.G. to the grid of V2, adjust the generator to resonance, and note the resulting frequency. Simple trial and error will indicate whether the existing parallel fixed capacity needs to be increased or decreased, and this can be effected with the cover of the unit removed. Final adjustment is, of course, made on the trimmers and must be carried out with the screening cover in position to obviate hand capacity and instability. Having adjusted the V2 stage, transfer the S.G. to the grid of V1 and proceed as before. Adjustment for the other frequencies follows the same procedure, but the receiver with which the pre-amplifier is used must, of course, be suitable for the frequency under adjustment. Should it be found that, on the highest selected frequency, a trimmer will not "peak" even when screwed right out, remove half a turn from the appropriate coil.

a-half turns and secure it, leaving 2in. for connection. Replace the former and connect as before.

Next remove L3 and reduce the winding to four turns. Before replacing, cut off 1in. of the unused portion of the former with a hacksaw. This section of former, which is used to wind the V2 anode coil, should be drilled and tapped 4BA at one end to take a mounting screw. Wind on four turns, with the coupling coil of one-and-a-half turns interwound at one end in the same manner as L1 and L2. Mount this in place of the oscillator coil L7 previously removed, one end of the larger winding being connected to the switch rotor tag and the other end to the chassis tag. If facilities are not available for drilling and tapping, a simpler mounting method is to suspend the coil directly by short stiff connections between the two points. The screened lead to the V3 top cap must be disconnected from the switch rotor tag.

The free end of the short co-axial lead under the chassis can now be taken up through the ¼in. chassis hole and is connected to the switch rotor tag, the screening being bonded to the adjacent chassis tag. A co-axial output lead of suitable length for connection to the receiver is now fitted, being brought through the centre hole in the small paxolin plate and thence upwards through the grommet hole which was previously used for the V3 cathode return. Bond the co-axial screen to the chassis tag, together with the "earthy" end of the coupling coil, the other end of the latter being shortened to ½in. and soldered to the inner conductor.

It is necessary, of course, to alter the values of the parallel fixed capacities of each stage to cover the desired frequencies. In the writer's case the unit was modified to cover both sound and vision frequencies of the London and Birmingham transmitters. Northern or Midlands enthusiasts, however, may prefer to adapt it to the Birmingham transmissions and/or the new Manchester station.

FRILLS RUSH IN . . .!

(*Continued from page* 255).

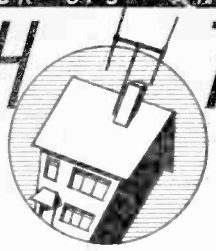
time in the total time occupied would be at least four hours. By looking in to a television play television saves at least two hours, and becomes a further time-saving device!

Towards the end of her article Miss Dickens displays herself as an *ingenue*: "The greatest danger of all, of course, and the thing that scares me most about television is that it might spread to the telephone system and then it's good-bye to the last shreds of our domestic privacy. Notice how you are the next time you answer the telephone at home. You may be . . . just out of the bath wearing nothing but a towel. How would you like to be televised like that? You may want to tell some white lie about being ill. . . . No chance of that when the other person can see as well as hear you." I suggest to Miss Monica Dickens that her fear of *telephonovision* would be immediately dispelled if she went along to Alexandra Palace and saw the apparatus required for even a modest two-way receiving and transmitting system. The equipment would occupy a fair-sized mansion.

Now, Miss Dickens. How about writing some nice talky, talky stuff to your feminine readers about how to polish their nails while sweeping the floor, how to work 12 hours a day in the home and thus avoid being a slut, and how to employ the time saved by labour-saving devices, by such interesting occupations as sewing the buttons on Johnny's shirt; leaving TV and similar technical topics to trained people like the present writer? For myself, if television only stops women from that eternal twiddling of knitting needles it will have justified its scientific introduction into the home.—F. J. C.

TELEVISION PICK-UPS AND REFLECTIONS

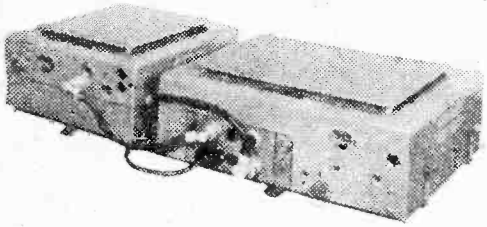
UNDERNEATH THE DIPOLE

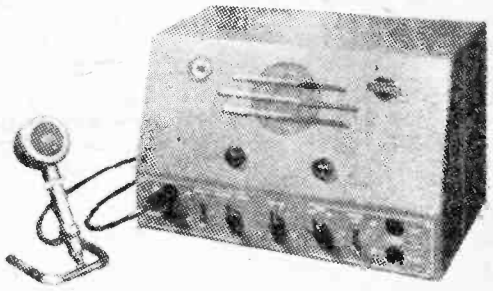


By Iconos

THE CALAIS-DOVER LINK

THE credit for making television broadcasts from across the Channel a reality goes to a group of engineers drawn from three departments of the B.B.C. Engineering Division—the Planning and Installation and the Designs Departments, and the Television Outside Broadcasts section of the Operations and Maintenance Department. This group of engineers has been led by Mr. A. N. Thomas, assistant head of the Planning and Installation Department, and Mr. T. H. Bridgewater, the engineer-in-charge of Television Outside Broadcasts, aided by Mr. W. D. Richardson, the Assistant Engineer-in-Charge of Television Outside Broadcasts, Mr. W. N. Anderson, who is a specialist in microwave techniques, and Mr. K. C. Quinton, of the Designs Department. The equipment for linking Calais and London has been supplied by four British companies—Standard Telephones and Cables, Ltd., Marconi's Wireless Telegraph Company, Ltd., Pye Ltd., and Mullard Electronic Products Ltd. The broadcast has been arranged with the co-operation of the G.P.O., the Mayor of Calais, the Calais Chamber of Commerce, the French Post Office, and Radiodiffusion Francaise.





(Above) The Mullard contro unit and (right) the Mullard transmitter/receiver and power unit which was used exclusively for the communications side of the cross-Channel B.B.C. TV link.

THE WIMBLEDON LISP

THE evening newsreel transmissions of the highlights of the day's play at Wimbledon have been very effective. Slick work is required, as the sound and picture film have to be developed and printed, edited and titled in time for adding to the evening B.B.C. newsreel. With sound and picture recorded on separate films, this is quite an undertaking, but the B.B.C.'s television film department have short-circuited some of the operations by arranging for a picture camera to record sound on the same film as picture. Thus, commentary and original background noise are recorded straight on to the side of the picture negative, which has to be edited in such a way as to avoid cutting off odd words of the sound commentary. This is a job which has to be done with care, since the sound is twenty frames (or about 14½in.) ahead of the equivalent picture. The actual negative is used, reversed into positive electronically.

One of the disadvantages of this system is that the photographic sound recording has to be made on picture negative film, the emulsion of which is not very suitable for variable area sound tracks. Kodak Plus X panchromatic negative is used, whereas, for variable area sound recording purposes, an orthochromatic emulsion of high contrast is preferable. The use of this wrong film stock, unavoidable in this case, results in "shushing" sibilants and distortion of all frequencies above about 3,000 c.p.s. One of the methods of overcoming this distortion is to use "push-pull" recording, in which two sound tracks, side by side, record traces which are 180 deg. out of phase, and which are scanned by specially divided optical systems for dealing with the twin tracks. The distortion of one of the sound tracks is then completely cancelled out by a similar and opposite distortion, produced on the twin track by its side. Sibilants are cleaned up in a most extraordinary way and only the highest lisp is heard!

So now having praised the B.B.C. for their enterprise in achieving such speed in reporting the tennis at Wimbledon, let us hope that they will remove the Wimbledon lisp!

LIME GROVE STANDARDS

SLOWLY but surely the Lime Grove Studios go into regular service. A B.B.C. television engineer recently stated that the standard equipment now required for each studio stage, to give producers complete operational control to be co-ordinated with other programme sources, seemed to be working out like this:—

(a) Every stage must have its producer's viewing room, overlooking the scene, in which the outputs of several TV cameras can be mixed or switched.

(b) Each stage must have its own little announcing studio and also its own caption transmitter.

(c) There must be a comprehensive system of communications between producers and engineers to the cameramen and others on the set. Monitoring screen should be available for cueing on the stages.

(d) Each stage should, if possible, have its own film transmitter—quite separate from the film transmitters used as a complete programme source.

With these basic requirements satisfied, a stage may be considered fully equipped and suitable for dealing with anything from complicated action TV plays and reviews to Muffin the Mule.

The atmosphere in the producers "hide-out" during the progress of a show is anything but relaxing. Sometimes nerves seem to be at a higher tension than the volts on the plates of the transmitting valves. The tempo of the TV play seems to be slowing a little, with the producer tracking his camera about instead of cutting frequently from one camera to another. Conversely, the musical TV show is speeding up, with intricate cross-switching, interpolated film and commentary, and a multitude of trick devices.

TECHNICAL TRICKS

ALREADY we have seen the negative reversal process used on several musical shows, and on the television newsreel, where it is used for making positives. Normal reversal gives the picture the aspect of a photographic negative, a trick obtained quite simply by cutting out one stage of amplification in the long chain of amplifiers between camera and transmitter. Improvised switching has served until now, but the device may become a "built-in" accessory, ready for instant use by the producer. Another trick accessory now being developed which may become of more general use than the negative reversal is the "travelling matte" system. The object of this process is to enable the images of actors in the foreground to be superimposed upon an entirely separate background, forming a composite whole. In the film studios, this effect is usually obtained by the rear-projection upon a ground glass (or cellulose acetate) screen of the background scene, while the actors pose in front of this screen for the camera. The backgrounds might be passing scenery, as seen from a car or train, or the stationary view of a foreign street scene, a seascape or a view from an aeroplane. If the background is absolutely still, representing, for instance, the view of roofs and the tops of buildings, as seen from a window, a lantern slide is sometimes used. Alternatively, the background is made up with a very large photographic enlargement, which sometimes measures twenty or thirty feet wide and and is prepared by joining together many sectional enlargements of one photographic negative. Yet another method is the more prosaic one of painting the backing on a large sheet of canvas. All of these methods are used from time to time, but the B.B.C. have largely confined their ambitions to the painted background, which is less expensive than the photo-enlargement backing, and occupies less space than the rear-projection method.

THE "TRAVELLING MATTE"

THE B.B.C. have long pinned their faith in the ultimate use of the film "travelling matte" system, which is more complex than any of the orthodox background devices already described, but which appears to be quite suitable for television purposes. The actors, lit with tungsten lights, perform their actions in front of a pale blue back-cloth, separately lit with arc lighting. Two negatives are photographed simultaneously. The resultant foreground filtered negative (a) registers the actors as playing the scene in front of a black background, due to filtering. The background (b) (photographed simultaneously with the foreground negative) shows only a clear silhouette of the actors in front of a solidly black background, and a print from this (c) gives a black silhouette upon a clear background. By using either (b) or (c) as a cover mask during the printing process, the foreground (a) can be superimposed upon any background scene, forming a composite whole. In television the printing process is eliminated. The actors disport themselves in front of a white background, which should be lighter than the lightest tone in the foreground. This will enable one TV camera to give two separate types of output; one normal (so far as foreground figures are concerned); the second, an exceptionally contrasting silhouette picture which may be used as a matte or mask upon the output of a third picture source or a background film. The actors can then be made to look out at a foreign scene and yet remain in the comfort (or "discomfort"!) of the television studio.

A lot of work remains to be done on this development, but when it arrives it will be a real startler. Foreign scenes, elaborate backgrounds and spectacular settings will become everyday affairs, obtainable at small expense. The backroom boys are working along the right lines.

TWO OF EVERYTHING?

WE heard the other day of a viewer who has two television receivers in operation at the same time because it is annoying in the middle of a play if one breaks down. We do hope he does not carry this system throughout his life—two motor-cars, two refrigerators, two wives!

SLOW-MOTION DRIVE

IT is my view that slow-motion drive should be fitted to television control to prevent people whacking up the picture brilliance too suddenly.

ANNOUNCERS AT RADIO SHOW

BERNADETTE HODGSON, Adza Vincent and Robert Mawdesley were chosen by the Radio Industry Council to announce the sound programmes which were heard on 92 loudspeakers in the Radio Show.

IMPRESSIONIST

IN the recent televised floor show "Regency Room," Clifford Stanton gave several amusing impressions of artistes from the usual group of "imitatees," plus a startling reproduction of that well-known theatrical critic, Hannen Swaffer.

Scottish TV Station

WORK is well under way on the Scottish television station. For some time workmen have been busy laying foundations and building a roadway.

They have made steady progress since work began, and by the end of next year viewers in Scotland should see their first television programmes.

Some of the men employed at the site are ex-miners who were thrown idle by the closure of several pits in the area.

The site comprises 35 acres of mossy ground 950ft. above sea-level two and a half miles from Harthill.

The station will be bigger in area than the one opened at Sutton Coldfield, near Birmingham, last December.

Scotland's transmitter will be the most powerful in the world, and is expected to have twice the range of the Birmingham station. It will bring in all big centres of population.

SUPREME RADIO, 746b, Romford Road, Manor Park, E.12 (Tel.: ILF. 1260). Parts for the "P.W." Televisor: Equivalent type Mains Trans., open type, **66/6**; shrouded, **67/6**. Equivalent type Smoothing Choke, **18/6**, fully shrouded. 1,000pf. Midget Mica Cond., **6d.** each, **5/6** doz. P.M. Focus Units, as specified. **15/-** ea. R.F. E.H.T. Unit, by Hazlehurst, as specified, **95/-**. EF50 Valves, new, boxed, **7/6** ea. Retaining Rings for same, **8d.** ea. EF50 Ceramic Valve Holders, **6d.** ea. All other parts in stock at keenest prices. Ask for our lists. Aladdin Coil Formers with cores 8mm, **8d.** ea.; 6mm with cores, **6d.** ea. Co-AX Cable, 80 ohms, **8d.** yd.; also 50 ohm type, **6d.** yd. Aerial Plug and Socket for same, **1/-**. Twin Balanced Feeder, 5 yd., **4/6** doz. yds. Screened Twin B/F, **1/-** yd. **11/-** doz. yds. Fly-back type Line Trans., 5.5kV output, **22/6**; 2.5kV. E.H.T. with 4v 1.5 amp. and 4v 2 amp c.t., **27/6**. Tapped Primary VU111 Valves, new, boxed, **3/-** ea. VCR97 Tubes for Television, **35/-** ea. White Masks for same, **7/6** ea. Black Masks, **3/6** ea. Magnifier for above, **25/-** ea. CV102 Crystal Diodes, **2/6** ea. Equivalent "Viewmaster" Mains Trans. **26/-**. Equivalent set of Resistors for "Viewmaster," **15/9**. ½ watt Resistors. 10 ohms, 22, 27, 47, 82, 120, 180, 330, 390, 820, 1k ohms, 3.9k ohms, 11k ohms, 470k ohms, 1.5 meg and 10 megohms, **1/9** doz., **18/6** gross, or ass. B7G Valve Holders, Amphinol type, **9d.** ea. Remember "Supreme" for "Supreme" bargain Television and Radio Component Parts. Est. 16 yrs. Terms C.W.O. No C.O.D. Send 6d. extra for postage orders under £5. 2½d. S.A.E. all enquiries and list.

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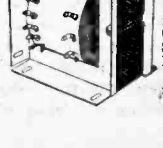

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Servicing Television Receivers—6

How to Locate Faults and Cure them in Commercial and Home-made Equipment

By W. J. DELANEY (G2FMY)

SO far, we have dealt generally with the main faults which might be expected in a television receiver. It should be understood that it is not possible to deal with this type of receiver on the same lines as a normal broadcast receiver, in view of the many different types of circuit which can be employed. Apart from the use of straight or superhet receivers, there are the various special time base circuits, sync separators and so on, and it is not possible to generalise for all of these. The main grounds have, however, been covered, and all that remains is to deal with picture faults and give some indication as to the possible causes of those defects which are generally met with. These are general remarks, and specialised circuits used by individual manufacturers may result in troubles giving rise to similar faults but from a different cause, and therefore each receiver has to be considered from its own individual circuit point of view. Every receiver has its own peculiarities.

Broken Pictures

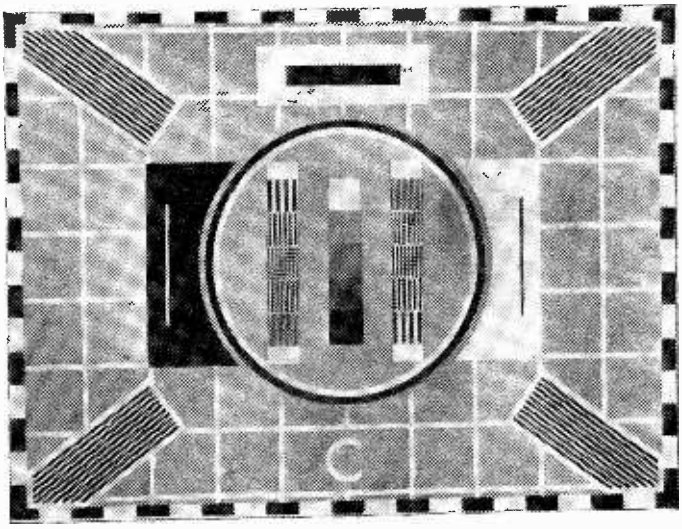
We have seen how the time-bases and sync circuits must be operating properly to give a correct picture shape with full picture delineation. Very often, however, complaints are made that the top of the picture is curved ; that it jumps erratically from side to side ; that slices of the picture slip sideways from time to time ; that the picture is in two halves with a black line across the centre of the screen, and so on. Probably the commonest of these is the split frame. In some cases the horizontal line will stay perfectly still across the very centre of the frame, and in others it will travel slowly backward and forward about a small area, but it will not drop to the bottom or top and give a clean frame. The most likely reason for this is not, as might be expected from what has been said in previous articles, faulty synchronisation, but poor smoothing, or a breakdown in certain components in the frame time-base. The frame frequency is, of course, 50 per second (two interlaced frames at 25 per second), and the normal mains frequency in the country is also 50 c.p.s. In the event of poor smoothing hum frequencies will be present in various stages (at 100 c.p.s. with full-wave rectification), and it may prove that the mains hum impulse in the frame circuit is stronger than the received frame pulse, with the result that it will trigger the time-base perfectly at 50 per second, but in the wrong place, and the weaker frame pulse will be non-effective. Normally, the simplest way of ascertaining whether this is the trouble in a receiver giving the above fault is to connect a large capacity electrolytic condenser of suitable working voltage to the earth line and then, whilst a picture is being received with the line across it, to connect the positive side of the condenser to the H.T. line somewhere in the frame time-base circuit. If poor smoothing is the cause of the trouble the line will immediately jump out of the frame and the picture will hold satisfactorily. It should be remembered that when this form of trouble is experienced the frame fly-back lines will become visible across the picture.

If the connection of the condenser fails to move the frame, the fault will almost certainly be found in the components between the sync separator and the frame oscillator. In other words, it may be said that generally the sync separator may be ruled out of the question if the frame locks solidly out of position.

Line Faults

The frame section is not so troublesome as the line, and it is in the latter that most of the troubles arise. Somewhere in all circuits there is a discrimination circuit, the function of which is to separate frame and line pulses. If the line pulse is affected by that of the frame, due to faulty discrimination, and it fails to hold whilst the frame is being triggered, the top of the picture will take on a curved shape. Obviously, attention to the discriminating circuit is indicated here.

Where the picture breaks into thin horizontal strips (especially where it can be seen that these coincide with white areas on the right-hand edge of the picture), this may be caused by a weak signal, one which is too strong, or faulty D.C. restoration. Picture impulses getting into the time-base will give break-up throughout the picture rather than this particular type of fault, and it is desirable to try first decreasing the contrast or receiver gain control, and if this makes it worse then obviously the signal is too weak and the gain should



Test Card C, which will reveal practically any defect in a television receiver. The finest of the ruled squares will only be resolved when the acceptance of the receiver covers a bandwidth of 3 mc/s.

accordingly be turned up. If, however, neither reduction nor strengthening of the signal affects the horizontal breaks, the D.C. restoring arrangements should be examined.

Picture Proportions

Finally, there are the faults which affect the proportions of the entire picture. If the picture is divided into four equal sections by a cross consisting of a central vertical and horizontal line (the horizontal bars signal generally seen before a transmission commences), each of those four sections should be equal in size. In most receivers the linearity controls will close or open only one side of an area. For instance, the Line Linearity control will generally be found to modify the left-hand side of the picture, giving an opening-out or even a fold-over of the scan. Frame Linearity generally affects the top part of the picture. From these remarks it may be assumed that Line Amplitude affects the right-hand side more than the left, and Frame Amplitude affects the lower more than the upper part of the picture. Therefore, to obtain a correctly proportioned picture it is necessary to adjust these controls together, and, although the artificial bars signal is very useful for this, the normal test card C may be used, all the ruled squares across the body of the picture being perfectly square and of the same size in a properly adjusted set. This card is also of great value in proving other defects. For instance, if the raster is not rectangular, but wedge-shaped, it will probably be found that part of the picture is defocused, showing that the shape is not due to the incorrect working of the time bases but to the deflection coils or focusing magnet having become misaligned.

H.F. Oscillation

Before finishing this short series it is necessary to deal with one fault which is expensive and which can give rise to worry on the part of a service engineer. The whites or light on the picture tube are caused by the received signal, and the stronger the signal the brighter the light. If, due to a fault in the vision receiver, H.F. oscillation takes place, the tube will be flooded with light and the scanning lines will not be visible —the face of the tube glowing all over. In some circuits, reduction of the gain control will not affect this and the glow will not disappear until the set is switched off.

Unfortunately, this effect is also experienced when a C.R. tube is breaking down and in need of replacement. In the latter case, when the set is switched on, before the valves have attained maximum temperature and a picture can be resolved the tube will glow as just described. In some cases the glow will die down as the picture impulses come through, in others the brilliancy control may be effective in controlling it, but in others the set may have to be switched on and off two or three times before it operates normally. Tube replacement is the only remedy.

The simplest way of ascertaining whether H.F. oscillation is the cause of the trouble is to feel the load resistor in the anode circuit of the V.F. stage—after the set has been switched off, of course. If the V.F. stage is oscillating the anode resistor will be hot. Alternatively, the current of the demodulator may be measured and will be excessive if H.F. oscillation is taking place.

Aerial Polar Diagrams

MESSRS. AERIALITE are now supplying a polar diagram with their aerials, and they give the following details on how these diagrams can be studied and utilised in order to give improved reception, and appreciate the advantage and application of certain types of aerials.

With the polar diagram, the radial distance from the centre of the graph to the curve at any point represents the comparative signal strength in voltage in any particular direction chosen. Where an aerial array is non-directive, as in the case of a plain dipole, the distance from the centre of the graph to the plotted curve is uniform and the diagram is, in fact, a circle. Where the array is directional, the curve has a maximum distance from the centre of the graph in some direction (or directions). If the aerial is adjusted so that the aerial faces the transmitter (i.e., the aerial tubes (dipole) are nearer to the transmitter than the reflector), the signal received will be a maximum and interference coming in from a different direction will be reduced.

Where serious interference is experienced from, say, a main road or garage, it is advantageous to rotate the aerial so that the array no longer directly faces the transmitter, but that the minimum point on the polar diagram curve is in line with the direction of the source of the interference. This will mean a slight reduction in signal strength received from the transmitter, but the overall reception will be improved.

Some examples of the value of directivity are given below :

Assume that the aerial is directly facing the transmitter and the polar diagram is rotated so that the zero degree position coincides with this direction. Also assume that interference is coming in from a direction on the 240 deg. line. By measuring the distance between the centre of the diagram to the curve on the zero degree line, a figure of, say, 300 units is obtained. A similar measurement on the 240 deg. line gives, say, 60 units. Thus the aerial will discriminate against unwanted interference on the 240 deg. line by a factor of $\frac{300}{60}$, i.e., a ratio of 5 to 1.

Now the aerial is rotated and the polar diagram is moved so that the distance from the centre of the graph to the curve is only 10 units in the direction of the unwanted interference. The measurement of the distance of the curve from the centre in the direction of the transmitter will now read, say, 200 units. Hence the discrimination has been improved to a ratio of $\frac{200}{10}$ or 20 to 1.

General points to be remembered are that a given curve can be compared instantly to a standard non-directional dipole since the latter is shown as a dotted circular line on each chart.

The front to back ratio is the ratio of the signal strength received along the zero degree line compared with that received along the 180 deg. line. *The acceptance angle* is the angle existing between points of half voltage, i.e., 6 dBs down and can generally be regarded as the angle in which a visible picture can be obtained. The sharper this angle, the more accurately must the aerial be erected.

The *gain figure* of the aerial is important in assessing the amount of signal pick-up in a given field, whereas the front to back ratio is a measure of the interference discriminating properties.

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).

COLOUR TELEVISION

SIR,—I was greatly interested in the article "Colour and Stereoscopic Television" which appeared in the second issue of your journal. It would appear that all successful systems of television in colour are based on the three colour additive principle.

In every case three pictures are transmitted and received in the time interval covered by retentivity of vision, one representing the red light in the original subject, one the blue light, and one the green light. The three pictures have to be combined by elaborate optical apparatus at the receiving end to form one picture in natural colour, and in one or two systems this is a very great disadvantage.

The American C.T.I. system demonstrates the fact that the three required pictures can be transmitted side by side on one cathode-ray tube, and received side by side on one tube. If this is so, what would be the effect if a special glass screen, on which were imprinted a series of transparent lines or bands of the three primary colours, were to be placed over the picture surface of a transmitting tube, and a similar screen placed over the receiving tube? It seems to me quite possible that a system could be introduced on present black and white television in which lines of scanning from top to bottom of the "frame" represent, in repeating order of sequence, the red, green and blue light present in the subject.

A disadvantage would probably be the fact that the coloured lines, viewed closely at the receiving end, would be coarse and too noticeable, but on the other hand, they should merge to give the phenomenon of natural colour when viewed at the correct distance.

Such a system, if successful, would not interfere with the definition of black and white reception.

The principle has been applied photographically with success—why not in television?—G. LAND (Coventry).

SIR,—At the head of the article on colour television in the July issue the question, "Will It Work?" is posed. The answer appears to be "No" if present transmission standards are adhered to.

One defect of the proposed system is the method of separating the two different coloured images. Using the method illustrated, only a small part of the two images could be brought into register and this defect would affect not only the viewer of a coloured receiver, but also the viewer of a black-and-white receiver. However, this fault could be remedied either by using a rotary-coloured filter, or by using a prism beam-splitting system (similar to that in the Technicolor camera) in combination with electronic switching.

An annoying effect of the sequential colour scanning method, which would be invisible on a monochrome screen, is that of "colour fringing." When, for instance, an object such as a ball passes across the screen in a time of, say, one second, its position on the screen during the scanning of one colour is different by one-fiftieth of the screen width from its position during the scanning of the other colour. This gives rise to a colour fringe which on a 10in. screen would be ⅕ in. wide, and quite visible.

The greatest objection to the proposed system can be appreciated if one considers the televising of an object whose colour approximates to one of the chosen filter colours. This will give rise to a strong signal during one frame, but the corresponding part of the signal during the next frame will be nearly zero because the complimentary filter will be in use. Thus the flicker frequency in such parts of the picture will be 25 per second instead of the present 50 per second (obtained by interlacing) and an annoying flicker will result. This flicker will affect those with unmodified monochrome receivers as much as those with colour receivers.

Finally, I think it is very doubtful if people accustomed to first-class three-colour motion pictures would be satisfied with the limited colour range of a two-colour additive system.—R. C. COLECLOUGH (Tottenham, N.17).

THE P.W. TELEVISION RECEIVER

SIR,—I was unfortunate in that I was unable to commence subscribing to your journal until the July issue, so of course, I have missed the opening articles of Mr. F. J. Camm's series on the Principles and Practice of Television as well as the first article on the construction of your television receiver. Would it not be possible to re-print these articles in book-form? I know the difficulties of production and that there is a paper shortage, but valuable information of this sort should not be lost in unobtainable issues. I dare not take the risk of someone purchasing my ordered copy before I arrive for it (this has happened before) so I have to practically wait on the newsagent's doorstep to ensure getting it. What an interest creator your Editor is!—A. J. BILLING (Stratford).

(We have published a booklet on the construction of our television receiver for 3s. 6d., or 3s. 9d. by post. The edition is limited.—Ed.)

BINDING CASES AND INDEXES

SIR,—As your journal is the first practical television journal I want to preserve the issues in a permanent form as bound volumes and in time will form a complete encyclopaedia on the subject. I can get the issues bound locally, but in the course of years it is tedious to have to turn the pages over to find the information one requires. Do you intend to issue binding cases and indexes, as with your companion journals? Very few other journals issue indexes as you do. It is a much appreciated reader service.—H. E. (Leytonstone).

(We shall issue annual binding cases and indexes for this journal each year.—Ed.)

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