SYNC SEPARATION

PRACTICAL TELEVISION

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EDITOR F. J. CAMM

& "TELEVISION TIMES"

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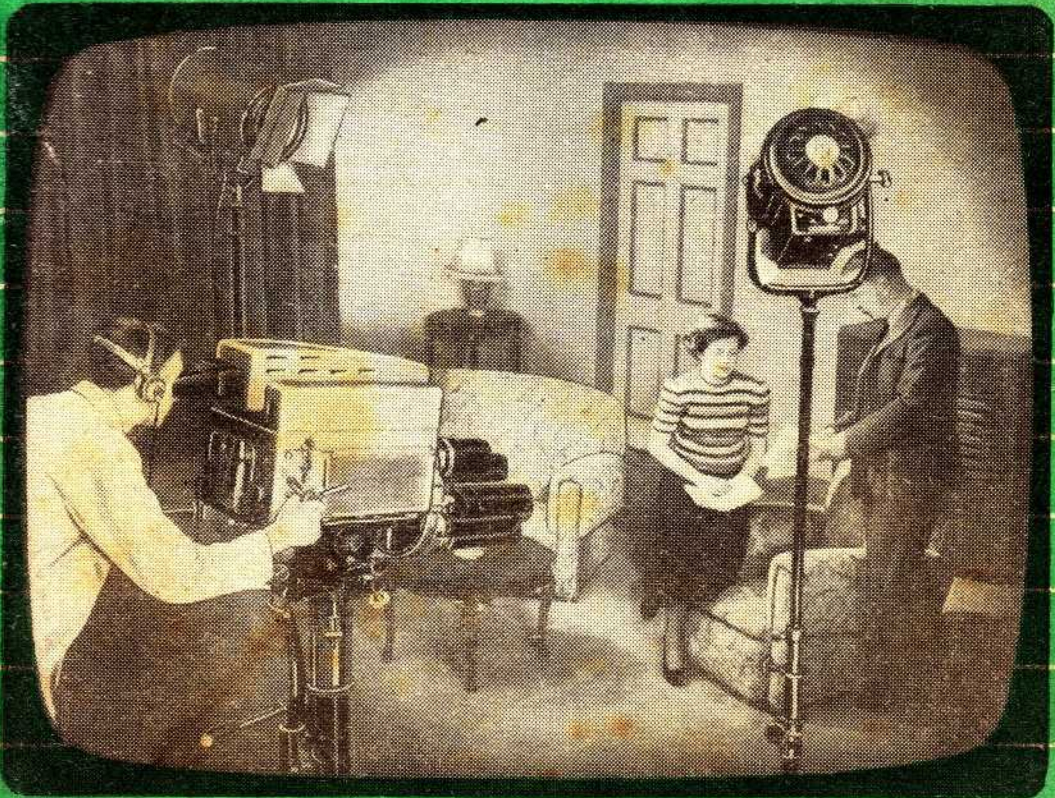

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PRACTICAL TELEVISION
& "TELEVISION TIMES"
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Televiews

ADVICE FROM THE OPTICIANS!

THE Association of Optical Practitioners has issued a pamphlet "in the interests of comfort in viewing" which states that television has created new visual problems and they therefore direct your attention to seven simple rules which they say will ensure that you can enjoy viewing without eyestrain.

With somewhat longer scientific and practical experience of television we can assert that not once in the course of thousands of letters from televiewers have we had one complaint about eyestrain. This would appear to be an attempt to invent a defect and to supply apparatus for it. For, of course, the argument used in the pamphlet would apply to cinemagoers, theatre patrons and many others. The argument seems to be that you should have a pair of glasses for everything you do!

It is worthy of comment in passing that the eyesight of the nation has not improved during the past 50 years. More and more people are wearing spectacles; so it cannot be said that opticians have found cures for eye troubles. At the best they merely provide the counterpart of a crutch for a defective organ.

The tendency of opticians should be to cure bad eyesight instead of providing glasses which do not cure it. Once glasses are taken to, eyesight steadily gets worse, and this needs to be adjusted by fitting glasses of greater magnification or with other correcting lenses.

Here are the simple rules:

"Never view television with the room in darkness; the contrast between the bright screen and the dark room is very tiring for the eyes. Have a comfortable amount of light, either overhead or behind you but not shining directly on the screen.

"Be sure your set is properly installed, with special attention to the aerial.

"Tune your set carefully, readjusting after it has warmed up thoroughly, otherwise the picture may be unsteady and distorted and this strains the eyes.

"Seat yourself comfortably and do not look up at the screen. It is better to have the picture at eye level, or slightly below rather than higher.

"Do not concentrate on the television screen for long periods, as this tends to produce eyestrain. Glance round the room occasionally, as a change of focus rests the eyes.

"It is advisable to sit about 6-10ft. away from the television screen.

"If television makes your eyes ache have them examined and wear glasses if you need them. If you are over 55 you may need special glasses for television."

Perhaps this last recommendation is the gravamen of the matter. We do not know whether spectacles for television would be partly met out of the Health Service, but there should be good business for opticians in the sale of spectacles if the advice is taken!

INCREASED PURCHASE TAX

THE increase in the purchase tax on television receivers from $33\frac{1}{3}$ per cent. to $66\frac{2}{3}$ per cent. has caused manufacturers some concern. It seems wrong to add this further burden just as the television service is developing to the point where it will provide a nation-wide coverage. It is particularly hard on those who have not yet purchased receivers and who are awaiting the erection of their local transmitting station.

There have been protest meetings in the north and representations have been made to the Government. The reduced demand for television receivers in the, as yet, undeveloped television areas will not enable manufacturers to reduce basic prices. In fact, it will cause an increase, and as purchase tax is based upon selling price the real increase is greater than $33\frac{1}{3}$ per cent.

Owing to the shortage of certain raw materials, manufacturers in any case must perforce restrict their output. It is unlikely that the revenue will benefit very much, if at all, from this increased tax, which seems to be designed to reduce the demand rather than produce revenue.

This is a curious policy to adopt in view of the recommendations of the Beveridge Report and the progress which is being made on the transmitting side. Manufacturers had hoped that as demand went up they would be able to reduce their prices. Certainly that cannot happen until at least April next year, when the 1952 Budget is introduced.—F. J. C.

A Compact Televisor–2

A Complete 6in. TV Receiver on a Single Chassis

By E. N. BRADLEY

THE by-pass capacitors C63 and C64, directly between the Y deflector plates and the tube anode, may appear unconventional, but serve to obviate slight cross-talk between the X and Y plates. The capacitor between the "idling" Y plate and the anode is larger in capacitance than its fellow to tie this plate more closely to the steady anode potential. It is possible that in several home-built televisors the inclusion of two such capacitors might clear the picture of any trace of curvature along the line—most VCR97s appear to show a little cross-talk between the X and Y plates—resulting in a trace of the line frequency appearing on the frame deflectors. In bad cases this can show as a quite serious phase shift oval at the base of the raster. The capacitors also by-pass any line frequency induced into the frame deflecting leads between the receiver output socket and the tube. These capacitors are actually mounted between the lugs on the tube base itself.

The Sound Receiver

The sound section employed in this receiver is based on the sound section fitted to the writer's "Portable Televisor" described elsewhere, and is a little unconventional in that it has a regenerative detector. In an ordinary receiver this might well mean that quality would be low, but in the case of the television sound signal a quite high degree of regeneration is permissible. The advantage, of course, in using such a circuit is that each valve or valve section is adding its quota of amplification, so that only a single R.F. stage is needed after the common vision-sound R.F. stage round V1.

The sound signal is taken from the grid coil of V2 by a 1½-turn loop at the base of the coil. This loop, via a twisted feeder, forms part of L6, the first sound tuning coil proper, and this method of taking off the sound signal is found to be distinctly preferable to a capacitive coupling into the vision R.F. strip or to running the sound section separately to the aerial. Adjustments are more easily made and the circuit, once tuned, is very stable.

V10, the first sound R.F. stage proper, feeds into the regenerative detector, via a transformer coupling, the detector being the first section of the double triode V11. The second section is employed as a normal A.F. amplifier and the signal is finally supplied to the output valve V12. Regeneration, and thus volume, are controlled by the potentiometer R53. Note that the sound section tuning coils are peaked a little by small shunt capacitances.

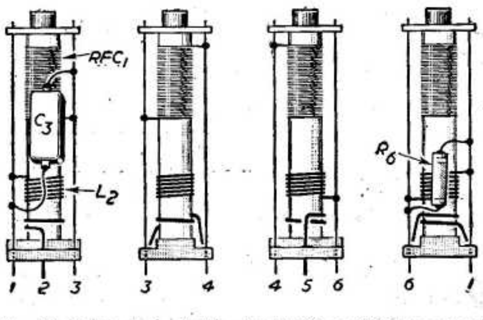


Fig. 3.—Side views of L2 with RFC1 and R6 mounted.

Power Supplies

Real economy is exercised in the power pack where one quite small transformer is employed to supply all the heater and H.T. voltages necessary. A drop-through component, Messrs. Coulphone's Type 351, is easily mounted and handles the load well. It should be stated at this point that the heater winding is a little

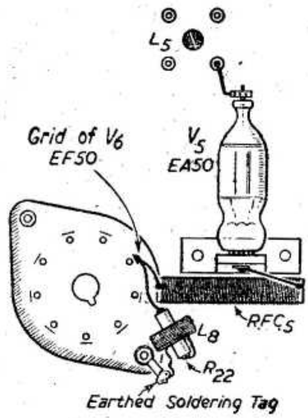


Fig. 4.—This diagram shows how the diode detector should be placed in relation to V6, as described on page 23.

overloaded, but since there have been no signs of overheating during several long test runs the specification would appear to be in order. The heavy shroud over the top of the transformer makes it possible to mount the C.R. tube very close to the power pack—the transformer, moreover, is mounted in a circular cut-out in the chassis so that it can be rotated, and it is oriented for minimum hum on the raster or picture during the first trials.

Rectification is handled by selenium rectifiers both in the H.T. and E.H.T. lines. The transformer is employed in a half-wave circuit, 350 volts to earth being drawn from the H.T. secondary centre-tap and 700 volts across the full secondary. The receiver H.T. is therefore supplied by half the secondary and the full secondary is connected into a Cockroft multiplier made up of Recs. 4 and 5 and C61, C62 of Fig. 1. C62 presents to Rec. 4 both 700 volts A.C. and a steady bias of about 700 volts D.C. provided by Rec. 5 which is connected between the capacitor and earth, so that the final output, taking peak values into account, is between 1,400 and 1,500 volts into the load of the tube and bleeder network. Different tubes and varying bleeder resistor tolerances will give some voltage variation here, but the final output is found adequate, especially with the addition of the "intensifier," shown in Fig. 1 as being connected directly to the tube anode supply point. The intensifier is no more than a ring of wire or foil round the tube just behind the screen, held in place by a strip of adhesive cellophane tape, and protected, in the prototype, by the rubber tube mask. This ring is then connected directly to tag 10 on the tube base by a short length of rubber-covered flex, and gives the effect of several hundred volts extra E.H.T. at the anode, to judge by the reduction of the raster size as the connection is made. It also prevents bulb charge and gives a cleaner, brighter picture which can be viewed with some room lighting. No claims as regards daylight or full room light viewing are made because the VCR97 is not suitable for such conditions no matter what the E.H.T. supplied.

The two E.H.T. rectifiers were obtained at 6s. each as surplus and are coded as SenTerCel K3/40, 1,000 volts at 1 mA. Some constructors may be sufficiently fortunate to find this type at cheap rates, others may prefer to employ rectifiers already to hand. Any selenium (preferred) or metal rectifiers with the same ratings will serve. In the components list the normal SenTerCel codings are given.

The three H.T. rectifiers in series are the new SenTerCel RM3 type, ideal for this sort of construction since they take up so little space and are rated to supply 120 mAs. They are run at lower than full ratings and so handle the load with ease. Three units are needed as each rectifier is rated at 125 volts, so that three in series can deal with 375 volts.

R76 is a surge limiter resistor. In a half-wave circuit there is a heavy reservoir capacitor current and R76 gives a measure of protection against these surges. At the same time a double reservoir capacitor is employed, not so much to provide extra capacitance but to give a parallel path for the reservoir capacitor currents, so easing the load on each capacitor section.

Construction—The Coils

Work on the original televisor showed that the first job to be completed should be the winding of the coils; once these are finished the chassis construction can proceed very quickly. The coil former set as received is ready for winding and assembly.

The set as marketed contains nine formers, cans, etc., whilst the present circuit employs but seven of these, so leaving two spare complete formers. These may be employed for sound rejection circuits, to be described, or could be used in a pre-amplifier should this prove necessary in remote or poor reception areas. In any case it should soon prove possible for any experienced constructor to find a use for these spare formers.

The coil winding data is as follows :—

For Channels 1 and 2 (London, Belfast, Holme Moss, S. Devon).

L1—10 turns 32 s.w.g. d.s.c. tapped at 2¼ turns for aerial.

L2—7 turns 32 s.w.g. d.s.c. 1½ turns 20 s.w.g. enam. at base of former. See below.

L3, L4, L5 } 7 turns 32 s.w.g. d.s.c.

L6—5 turns 32 s.w.g. d.s.c.

L7—7 turns 32 s.w.g. d.s.c. anode coil; 6 turns 32 s.w.g. d.s.c. grid coil.

The vision coils are wound to a pitch of 40 turns per inch—this means that the aerial coil, for example, should have a total length of ¼in. The windings are quite easily put on by hand and a close approximation to the pitch is obtained by winding on two wires side by side, close-wound, then removing one wire after the double coil is fixed by a thin coating of hot paraffin wax. When one wire is removed the other is left as the coil with properly spaced turns. This is by no means essential, however; the original coils were wound directly by hand and gently spaced to the correct pitch and set with wax.

The sound coil L6 is wound to a pitch of 20 turns per inch, so that the five turns occupy a length of ¼in. and are easily wound on. The windings of the transformer, L7, again have a pitch of 40 turns per inch, and the two coils should be separated ¼in. apart.

For channels 3 and 4 (Kirk O'Shotts, S. Hants, Sutton Coldfield and Aberdeen).

L1—8 turns 32 s.w.g. d.s.c. tapped at 1½ turns for aerial.

L2—5 turns 32 s.w.g. d.s.c.; 1½ turns 20 s.w.g. enam. at base of former. See below.

L3, L4, L5—5 turns 32 s.w.g. d.s.c.

L6—4 turns 32 s.w.g. d.s.c.

L7—5 turns 32 s.w.g. d.s.c. anode coil; 4 turns 32 s.w.g. d.s.c. grid coil.

Winding pitches and, for L7, the coil separation, as for the coils above.

The Feed Chokes

For either set of coils, L2, L3, L4 and L5 have feed chokes on the same former as the coil, the choke occupying a winding length of about ¾in. at the top of the former and spaced ¼in. at least from the tuned winding. For each choke 38 s.w.g. d.s.c. wire should be used and 80 turns close-wound put on. If 40 s.w.g. can be employed it will be found possible to put on 100 turns, but it is not necessary to employ this very fine wire and it has been found permissible to use 32-gauge wire and to put on only about 60 turns.

The process of winding the coils should be carried out as follows: First set in place, at the top of the coil former, the paxolin top piece, making sure that the four corner holes are in line with the holes in the base. The side wires are later held in place by these holes. Before winding, check the metal eyelets in the base and ensure that they are clean for soldering.

Then wind on the coil, keeping it near the base of the former and securing each end of the former either by wax or a small slip of cellophane tape. Wind on the choke, or the second tuned winding in the case of L7, also securing its ends. In the case of L2 the 1½-turn sound coupling is also wound on, and in the case of this coil its ends are carried directly through the two side holes in the base to protrude about ½in. By the side holes is meant the two holes numbered 2 and 5.

Tappings are made by drawing out a length of wire and twisting it into a short pigtail—later, care must be taken that the double wire of this pigtail is cleaned down to the coil and both wires soldered together throughout their length.

With the coil windings completed the side wires are slipped into place so that their upper ends just protrude through the upper spacer—the paxolin top piece earlier fitted to the top of the former. The side wires should be a push fit in the metal eyeletted holes in the coil base, and should now be soldered firmly to the eyelets. The side wires, which are to form the connecting points to the coil, should not be bent over below the former, as this might twist the wires between their two supports and break the coil connections to them. With the side wires in place, the coils, chokes, etc., have their ends soldered to the side wires—in Fig. 3 are shown the four side views of L2 to show how the connections are made.

To obtain the shortest possible coil connections to the rest of the circuits the coils should be wound so that the coil and choke ends are taken to the side wires numbered as follows:

L1—Grid coil across Nos. 1 and 6. Grid to No. 1. R1 across Nos. 1 and 6. Aerial tapping to No. 4.

L2—Grid coil across Nos. 1 and 6. Grid to No. 1. R6 across Nos. 1 and 6. C3 across Nos. 1 and 3. Anode choke across Nos. 3 and 4. Anode to No. 3. Sound coupler, through Nos. 2 and 5.

L3, L4, L5—Grid coil across Nos. 1 and 6. Grid and Diode to No. 1. R12, R17, R(X) across Nos. 1 and 6. C8, C13, C18 across Nos. 1 and 3. Anode choke across Nos. 3 and 4. Anode to No. 3.

L6—Grid coil across Nos. 1 and 6. Grid to No. 1. C38 across Nos. 1 and 4. Earth tag 4 to complete C38 circuit. Take one lead from sound coupler on L2 to tag 6 and earth the other lead along with the earthed side of C38.

L7—Grid coil across Nos. 1 and 6. Grid to No. 1. C44 across Nos. 1 and 6. Anode coil across Nos. 3 and 4. Anode to No. 3. C42 across Nos. 3 and 4.

With all windings completed and protected by a coating of wax, which can be melted on by a soldering iron, it remains only to insert the cores into the coil formers. L7, of course, has two cores, one controlled from the top of the former and one from the bottom. The coil cans have their fixing lugs bent up to an angle of 90 deg. by broad-nosed pliers ready for bolting down. The remaining coils are R.F.C.5, between the diode cathode and the grid of V6, and the compensating choke, L8, in the grid-earth circuit of V6. Both may be wound with 32 to 36 s.w.g. d.s.c. copper wire.

R.F.C.5 consists of 100 turns close wound on a ¼in. diameter former 1½in. in length; a ceramic-bodied resistor of about 1 watt rating serves well. The resistance value should not be too low—a megohm is suitable. The wire ends of the resistor then act as leads to which the ends of the choke may be sweated.

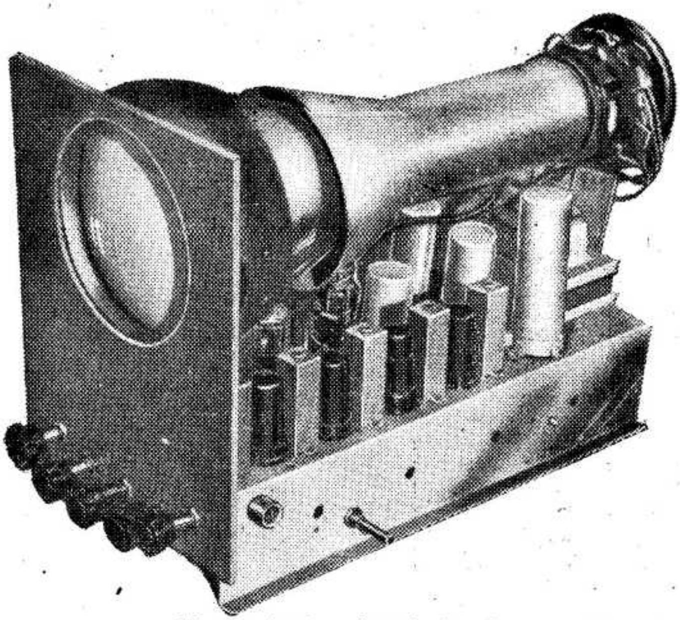
L8 is wound actually on R22. Two small cheeks of thin card are cut from a postcard and temporarily fixed on to R22 by wax, the winding space between the cheeks measuring about ¼in. or perhaps slightly less. Each cheek should be about ½in. in diameter. One hundred and fifty turns of wire are then bank-wound between the cheeks and impregnated with hot wax, the cheeks being removed when the wax is hard. The coil will be found firmly set on the body of the resistor, and it remains only to connect one end of the coil to one end of the resistor, the spare resistor lead being cut off short. The combination is then wired in series between the grid tag of V6 and the nearest earthing point.

Construction—the Chassis

With the coils completed and the chassis drilled and punched the work can proceed at a rapid rate. The main chassis drilling dimensions were shown in Fig. 2, last month.

The circuit is split into three sections each of which runs longitudinally along the chassis top deck. The coils are mounted over groups of seven holes (each hole 3/16in. diameter), except for the L2 position, where a further two holes are needed for the sound coupler leads. The central hole in each group gives access from below to the core, whilst the holes for the coil and choke leads fall at the corners of a ½in. square round the centre. The mounting holes are 1⅛in. apart.

The valveholders for V1-V4 are placed fairly tightly between the coil positions, and the direction of the keyways should be noted carefully from Fig. 2. To discover the exact drilling positions for the valveholder fixing bolts, once the main 1⅛in. holes have been punched out, drop a valveholder on to the chassis top deck,



The completed receiver showing the compact lay-out of components and controls.

its pins through the main V1 hole, and rotate the valveholder till its mounting holes are in line with the holes for the coil mounting tags. Ensure that the holder is central over its hole, then mark the two drilling positions. Repeat for the V2, V3 and V4 holes. The valveholders are actually mounted below the chassis.

All the potentiometer mounting holes should be of ⅜in. diameter, whilst the two holes for the aerial socket and the video output socket should also be ⅜in. in diameter if the specified sockets are employed.

It will be noted that in Fig. 2 no definite drilling points for the diode valveholder are shown, as these depend on the actual holder employed. In the prototype a small bracket holder was used, taken from ex-Service equipment, and this holder supports the diode horizontally about 1/16in. below the chassis top deck. The anode pin of the valve comes very close to the anode contact on L5, whilst R.F.C.5 is carried immediately from the diode cathode tag on the holder to the grid tag on the V6 holder. The short leads thus achieved, and the nearness of the diode to the screen provided by the chassis, play a very considerable part in attaining the stability of the circuit. The arrangement is shown in Fig. 4.

(To be continued)

The Sync Separator

How it Functions and Some Circuits for the Experimenter

By W. J. DELANEY (G2FMY)

CORRESPONDENCE on design details and concerning faults indicates that the sync separator is the cause of the majority of worries so far as the home-constructor is concerned. Much of the trouble seems to arise from the fact that in some receivers there is only a single valve performing this function, whilst other circuits show three or even four valves all used only for the purpose of separating the sync pulses. From this some constructors infer that the single valve cannot do the job properly and thus fail to adjust it and assume that failure to obtain proper working is inherent in such an arrangement. A study of commercial receivers will show, however, that in the majority only one valve is employed, and if this stage does work correctly it satisfies all normal needs.

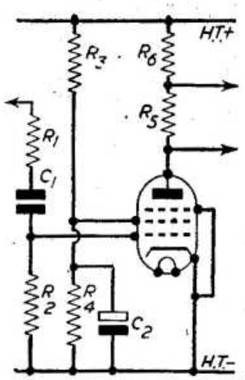


Fig. 1.—Standard single-valve sync separator circuit, depending upon grid current for its action.

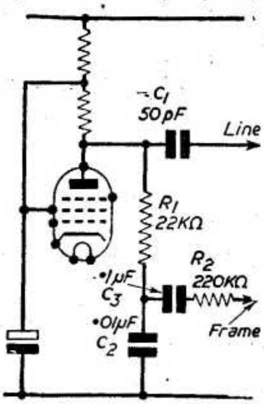


Fig. 3.—Circuit used in a commercial receiver for separating frame and line pulses.

The purpose of the circuit, as its name implies, is the separation of the synchronising pulses, and this covers actually two separate things. Firstly, the separation of the combined line and frame sync pulses from the picture modulation and, second, the separation of the line and frame pulses one from the other. The latter is a fairly simple matter, and it is in the first part of the function that the real difficulty lies.

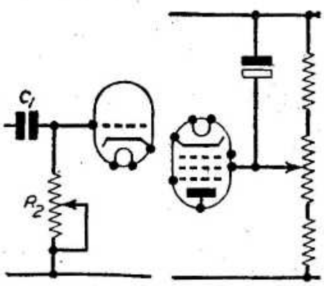
Standard Arrangement

In the video stage there are present the modulation impulses and the relative time bases controls and if these were all applied to the tube it would have little effect, as the normal bias here would take care of the elimination of the sync pulses as these are below the normal "black level." The picture impulses, however, if they got into the time bases would trigger them at all sorts of odd moments and it would be impossible to obtain proper interlacing or even a proper raster build-up. The fact that faulty separation leads to such trouble as line tearing shows the importance of proper picture elimination. Fig. 1 shows the standard arrangement which is employed by most makers and it will be seen to consist of a normal H.F. pentode without bias. There are two critical components in this circuit and one "invisible" critical component. When certain values of signal are applied to the grid of this stage grid current flows, and therefore by proper adjustment of values it is possible to arrange that everything over a certain value is cut off, and this can include not only the picture pulses but also peaks due to noise and interference. The latter is important, as in an area of weak signals where interference is present it may be found that the interference will trigger the time bases and thus break up the interlacing or tear the lines. The first point in adequate separation, therefore, is to arrange for a suitable working point of the valve in use and avoid this stage having any effect on the video stage. Resistor R1 is included for the latter purpose mainly, and it will be found that a value of 10,000 or 12,000 ohms can safely be used here. There is no need to worry about any other values for this component.

The potentials applied to this stage must assist in obtaining the desired small grid base, and some designers use a very low H.T. voltage whilst others use a very low screen-grid voltage. An aid to satisfactory working is to use a large electrolytic condenser for by-passing the S.G. and 8 or 16 μF may be used in this position with advantage. Resistors R3 and R4 must be chosen according to the valve in use and, in general, should be such as to keep the voltage on the screen very low. Again, to assist in finding a suitable working point a potentiometer may be used as shown in Fig. 2. To avoid the high cost of a wire-wound control of high value a normal control may be used with fixed resistors on either side, and these may be changed in the experimental stages to find the most suitable point for the valve in use.

The working point of the valve will also depend upon the particular grid leak and condenser values and these may be found very critical. The "invisible" component mentioned also comes in at this point and it is the self-capacity which exists between the grid condenser and the chassis, and also probably between chassis and

Fig. 2.—Variable grid leaks and screen potentiometer, as shown here, assist in obtaining maximum performance from the arrangement shown in Fig. 1.



resistor R1. For this reason both of these components should be so placed in the wiring that they are well clear of the chassis, and heavy gauge wire should be used to connect them together so that they may be held firmly "in the air." For the same reason R1 should be as small as possible ($\frac{1}{4}$ watt is satisfactory here) and the condenser should be as small as possible. Values from .02 to .1 μF may be used, and to assist in adjusting to the correct working point it is recommended that the grid leak (R2) be in the form of a potentiometer (Fig. 2). The effect of the adjustment of this on the interlace is very instructive, and it is easy to see the effect when it is adjusted whilst a picture is being received. Values for R2 range from 390 kΩ up to 4.7 MΩ, so it will be seen that there is a wide range from which to choose.

Time Base Pulses

It will be found that in most cases a potentiometer of 2 MΩ will enable a suitable working point to be obtained with a .05 μF condenser, but in some circuits it may be found that as this control is adjusted it will at the same time be found necessary also to adjust the frame frequency control to obtain a steady interlace. So far all that has been done has been to separate the combined pulses from the picture pulses and it is now necessary to separate the two sets of time bases from each other. It is necessary to prevent the pulses from one section from influencing those of the other section and it is here that most of the elaboration takes place. In most cases it is only necessary to include a low value of resistor (R5) in the anode circuit of the separator and to take off the line and frame pulses from each end as indicated, the separator load resistor being R6.

In areas of strong signal and little interference a simple R.C. network may be arranged to feed each of the time bases, but where the signal is very weak or interference is very bad more elaborate arrangements have to be introduced. The simple R.C. networks used in a Ferguson receiver are shown in Fig. 3, line pulses being fed through C1 and frame through R1, R2, C2, C3. It will be found that this arrangement works very well indeed even with a fairly low signal and the arrangement is inexpensive.

(To be continued)

The Telecinema

THE Telecinema at the South Bank Exhibition has been planned to demonstrate to the public the most up-to-date techniques in the motion picture and television fields and the equipment installed there may be regarded as representing some of the most advanced equipment available anywhere in the world to-day. From all contemporary British cinema projection equipment, standard S/U/P/A projectors were chosen for the Telecinema to demonstrate to the world the latest ideas on the projection of stereoscopic pictures and stereophonic sound. Another feature of the Telecinema equipment is a projected illuminated surround whereby the picture on the screen is surrounded not by the usual black frame but by a lighter border, which changes in intensity and colour according to the relative intensity and colour of the picture being projected.

Stereoscopic Films

Present techniques have not yet reached the stage where it is possible to present a stereoscopic picture to a large audience without making some compromise between the ideal and what is possible ; this compromise involves the wearing of some form of spectacles by the audience. Two methods of stereoscopic viewing are possible by means of spectacles, the first using two-colour spectacles and the second perpendicularly polarised spectacles. As two-colour spectacles preclude the use of colour films, the polarised-light system has been adopted for the Telecinema.

Two images maintained in horizontal and vertical register are projected on to the screen by running two separate film projectors in synchronism with one another, the light beam from each being polarised in a suitable manner by filters carried on the projectors. The resulting images on the screen, when viewed through polarising spectacles, give a remarkably effective three dimensional picture. Accurate synchronisation of the two projectors running side-by-side is accomplished by the use of Selsyn motors.

As far as the stereophonic sound reproduction is concerned, this differs from conventional practice in that no sound is recorded on the films running through the picture projectors, but is, instead, recorded on a film coated with magnetic material for running through a separate sound reproducer head. A requirement of stereophonic sound is that there should be two or more completely separate sound channels and in this equipment three-channel stereophonic magnetic recording is employed. A fourth sound channel is employed solely for sound-effects reproduced from speakers mounted in the main and balcony ceilings and at the back of the auditorium. The sound from the three stereophonic tracks is reproduced from behind the screen, where three speaker systems for this reproduction each consist of a standard S/U/P/A combination of twin-unit low-frequency horns and twin-unit high-frequency horns, with a changeover frequency of 500 cycles. Each of the three stereophonic sound channels feeds one speaker combination and the sound from the screen accompanies its apparent source on the screen. The screen speakers are used not only for the reproduction of stereophonic sound, but also for monaural sound in conjunction with normal films, television sound and interval music.

Picture Surround

Another feature of the presentation of all the films at the Telecinema is a projected picture surround—a development for which BTH is solely responsible. It is a result of pre-war investigations by the company into the possibility of providing an alternative to the black border around the picture which, it is felt, detracts from the appearance of the picture. For optimum presentation of picture detail and colour, the picture should be presented against a neutral background such that the highlights on the screen are always brighter than the surroundings, and the dark portions of the picture always darker than the surroundings. These conditions are achieved in the Telecinema fairly simply by making use of the light normally wasted during the pull-down period when the shutter is closed. A standard shutter, having a reflecting rear surface is employed to reflect the normally-wasted light on to a mirror and then through a special optical system on to the screen. This optical system contains masks to shape the light beam so that it only illuminates the surround.

Field Television Equipment

Some Interesting Details of Portable Outside Broadcast Equipment

By F. B. HICKMAN

ONE of the most popular types of B.B.C. television programme is the outside broadcast. Many of the memorable broadcasts of recent years have been of this kind, and the B.B.C. is devoting considerable attention and study to perfecting the technique and also the equipment needed for such outside pick-ups.

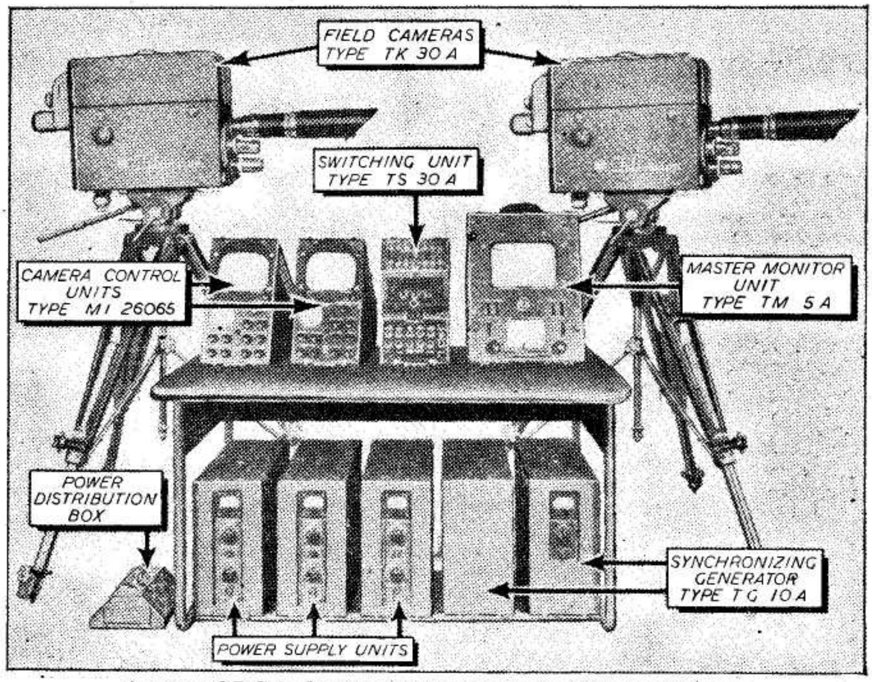
Figures published by one of the major American television networks show that 40 per cent. of its programme hours are devoted to outside broadcasts and other programmes not originating in the studio. Such events as boxing promotions, football and baseball matches have always been considered to hold an important place in a well-balanced programme service.

As will be realised, the successful transmission of outside television broadcasts calls for specialised equipment often differing very considerably in mechanical detail from the equivalent apparatus as used in the studio. A special line of field equipment has been developed in the U.S.A., and similar equipment is now being used in this country, which is assembled in small self-contained units each approximately of suitcase size, and special mobile studio and transmitting units are regularly used to carry all the requisite units to the remote sites. In a typical outside broadcast, equipment such as that described below, with up to four field cameras, may be used as much as 15 miles or more from the base station. Land lines may be used to link the remote point with the studio, but often it is cheaper and considerably more convenient to use a micro-wave relay link to carry the video signal, whilst the audio sign only is carried by land line. The only limitation then to the distance of the remote pick-up is that there should be a line-of-sight path from the relay transmitter to the receiving aerial of the base station.

Limitations of Early Field Equipment

Field television equipment, which in the early days suffered from serious limitations, has been continuously developed, until in 1946 Image Orthicon tubes became available in quantity production for field cameras. The Image Orthicon has a photo-cathode area approximately one-quarter that of its immediate predecessor, the Orthicon, and a light sensitivity from 10 to 30 times greater than that of the Orthicon. The small size of the mosaic area permits the use of optical systems equivalent to those used on standard 35 mm. motion picture cameras and makes practicable the use of a lens turret. A typical Image Orthicon camera uses four lenses, any one of which may quickly be brought into place by turning a handle at the rear of the camera. Changing from one lens to another and refocusing requires only one-and-a-half seconds. The main focusing control on the camera moves the camera tube bodily towards or away from the optical system. The lenses may also be prefocused in the usual manner. This provision of a lens turret greatly increases the latitude of operation of the camera unit.

The signal-to-noise ratio of the Image Orthicon under conditions of strong illumination is not quite so good as that of earlier camera tubes, although at low



A group of R.C.A. Outside Broadcast Units, identified for reference.

illumination levels it shows considerable advantage. Early Image Orthicons possessed high infra-red sensitivity necessitating the use of optical filters for televising most outdoor scenes, but later developments have a response corresponding very nearly to that of the human eye. A most important advantage of the tube is its ability to handle a very wide range of light values. With a correct setting of the various electrode potentials, a change in light intensities in an outdoor pick-up from deep shade to brilliant sunlight will not produce a serious degradation in the transmitted picture, even without any adjustment of the camera controls.

Electronic Viewfinder

The TK30A camera uses an electronic viewfinder which forms a completely detachable unit. At low light levels an optical viewfinder would not be satisfactory. The finder employs a 5in. C.R. tube with voltages adjusted to give a satisfactory picture under normal outdoor light conditions. The camera operator sees on the face of this tube the picture being transmitted to camera control and is thus able to focus his camera directly, and at the same time monitor the quality of the picture. Interchangeable viewing hoods are provided for the viewfinder. All the necessary controls for making adjustment of centering, linearity, gain, picture height and width on both camera tube and viewfinder are grouped at the rear of the camera. These controls are used only for initial set-up of the camera and during operation are protected by hinged covers. All the controls which require adjustment during operation are remotely located at the camera control unit. The camera operator has, therefore, only to keep his camera focused on the scene of action. He is kept in touch with the camera control unit by an intercommunications system and indeed in special cases the viewfinder may be dispensed with altogether, the necessary focusing instructions being passed from the camera control unit to the camera operator.

General Arrangement

The normal arrangements of units in a field television set-up are as shown on page 11. The camera control units, one of which is used for each camera in the chain, are normally grouped at some convenient point along with the switching system, the synchronising generator and the master monitor unit. The production director sitting at this control point can watch on the camera control units the scenes being picked up by the various cameras and can switch whichever scene he chooses on to the line to the transmitter.

Camera Control Unit

Each camera control unit provides a means for observing and controlling the quality of the picture signal generated by the camera. A 7in. tube is used as a picture monitor, while a 3in. tube acts as a waveform monitor. The unit includes a picture signal amplifier driven from the pre-amplifier in the camera. This amplifier also mixes the picture blanking signal with the signal from the camera and establishes black level at the beginning of each scanning line by means of a " clamp " circuit. The composite picture and sync signal is delivered to a 75 ohm coaxial transmission line. High-level driver stages are included for driving the two monitoring tubes. Pulse line amplifiers feed driving signals over coaxial conductors to the camera deflection and blanking circuits. These amplifiers enable one synchronising generator to feed several cameras which may be operated at distances up to 1,000ft. away from the control unit. Vertical and horizontal scanning circuits are provided for the picture monitor tube. The horizontal sweep signal for the wave-form monitor is generated in a conventional thyratron circuit. Two sweep frequency ranges, each allowing for viewing two or three blanking pulses, are provided for the vertical and horizontal frequencies respectively. The high-voltage supply is derived from the usual half-wave rectifier circuit.

Power Supply Unit

The power supply delivers approximately 1 amp. at a stabilized voltage adjustable between 270 and 285 volts. The power transformer is of very small physical size for its rating and uses glass and silicone insulating materials. To ensure as low an operating temperature as possible, the transformer is enclosed in a housing through which air is drawn by a fan. The airstream is also used to provide cooling for the whole unit.

Switching Unit

The next link in the chain is the switching equipment which serves as the nerve centre of the system. It provides all the necessary input and output switching together with means of adding synchronising pulses to the camera output circuits. The switching system comprises the video and the inter-communication units.

The video system includes a switching panel, video amplifiers and synchronising circuits. Six inputs are provided for, of which normally four are connected to Image Orthicon cameras. The other two may be connected to a studio line, film camera or other input. Six push buttons each with its own pilot light allow instantaneous selection of any of the input circuits. Only one circuit, however, can be used at a time. The selection is done at the direction of the programme director, who makes his choice by watching the individual camera control units. When a button is pressed the pilot light above the button lights up and at the same time corresponding lights go up on the camera control unit and camera proper, as an indication of which position is " on the air." The video signal is amplified and mixed with a synchronising signal from a field synchronising generator to give a composite signal which is further amplified and fed via a 75-ohm coaxial line to the studio or to a relay transmitter. An additional stage of amplification feeds the master monitor unit. This monitor can be switched to the picture output, to the output of the relay transmitter or to either of the auxiliary input circuits. The switching system is therefore extremely flexible and allows the operator to monitor the picture at any desired point.

The inter-communication system provides speech circuits between camera-men, camera control operators, technical director, programme director, etc., in addition to a circuit for distributing the programme sound to all operators. Each operator wears a double earphone and a microphone. One earphone reproduces the programme sound, while the other carries the operating instructions. Jacks are provided on all cameras and camera control units. A switch panel provides a wide variety of cross connections covering every possible operating set-up and also allows for emergency operation. The switching system operates from a power supply identical with that used for the camera control unit.

Synchronising Unit

To provide the timing signals for driving the scanning generators in the cameras, the picture tubes in the camera control units and the mixer amplifier circuits in the switching system, a field synchronising generator is used.

The generator consists of two suitcase units, a pulse-former and a pulse-shaper.

The pulse-former generates three fundamental timing frequencies, viz. field, line and twice-line frequency. These frequencies are controlled either by locking in with the power line frequency or by a built-in crystal oscillator. For convenience in checking the various oscillator circuits a 2in. cathode-ray oscilloscope is built into the unit.

The pulse-shaper unit includes the complex circuits which are necessary to form the pulses generated by the pulse-former into the required waveshape and to combine them as required to obtain the complicated pattern of the synchronising voltage.

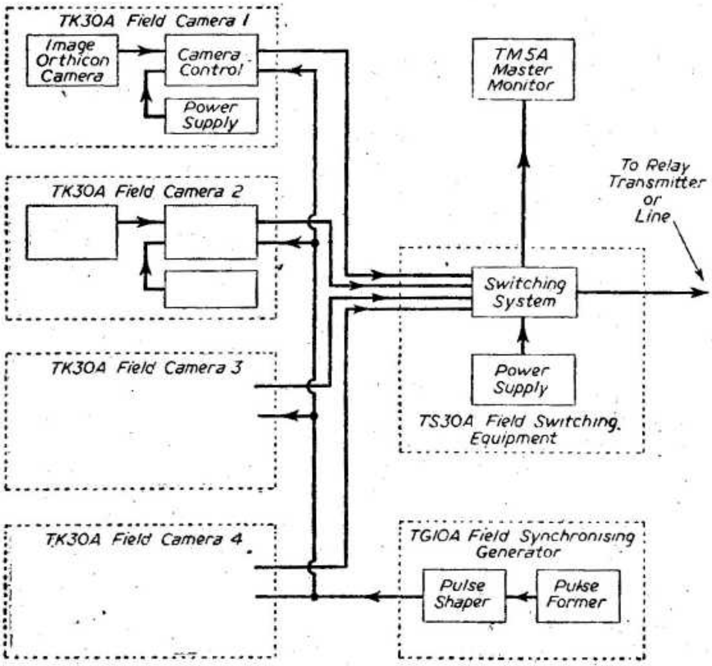
The signals provided by the generator are the horizontal driving signals, the vertical driving signal, the synchronising signal and the blanking signal. The horizontal driving signal consists of short duration square-wave pulses which trigger the camera saw-toothwave generator supplying the horizontal scanning voltage for the pick-up tube. The vertical driving signal consists of rather longer square-wave pulses which trigger the saw-tooth generator in the camera supplying vertical scanning voltage. The synchronising signal is a composite signal consisting of horizontal synchronising pulses, vertical synchronising pulses, and equalising pulses. The blanking signal consists of square-wave pulses at horizontal and vertical scanning frequencies which are added to the transmitted video signal to blank out the return trace in the receiver picture tube.

Tube voltages for the operation of both units are obtained from a regulated power supply unit built into the pulse-former unit.

Master Monitor Unit

As mentioned previously, a master monitor unit may be employed as a supervisory unit providing a large-sized reproduction of the transmitted picture and a convenient means of measuring signal levels, and monitoring waveform. The picture appears on a 10in. picture tube at the top of the unit, while a 5in. oscilloscope mounted just below reproduces the waveform. Two low-capacity video input circuits are provided, one of which goes to the picture amplifier and the other to the waveform amplifier. These two circuits are normally common, but may be used independently. The picture input amplifier is a three-stage amplifier with a response characteristic substantially flat up to 6 Mc/s, the final stage being a cathode follower stage feeding the picture tube grid. A D.C. restorer stage maintains the picture black level constant. The output of the video stage also feeds a " clipper " stage which isolates the synchronising component from the picture signals. The synchronising pulses are then separated into vertical and horizontal components, which in turn are fed to the scanning generators. The pulses are also used to generate the scanning frequency pulses and to supply deflection for the picture tube in the unit.

The input to the oscilloscope circuits is passed through a three-stage amplifier to the vertical deflecting plates of the 5in. oscilloscope. This amplifier also includes a D.C. restorer stage and a calibrating stage which enables a check to be made of the value of the peak-to-peak video signal. A switch on the front panel of the monitor unit allows either horizontal or vertical waveforms to be viewed on the oscilloscope. The unit contains its own valve filament supply. Amplifier valve voltages are supplied from the switching system power supply. Anode voltages for the picture tube and oscilloscope are derived from the picture tube horizontal scanning voltage.



Block Diagram of the Field Television Equipment.

Robot Answers Back

A LOT is heard about robots lately. The Foire de Paris, the annual Paris international trade fair, was not without one, and it certainly startled visitors. If you make any slighting remark within its hearing, it will answer back, and if you ask it a question, it will reply. To this it adds motion, walking along the front of the stand and pointing out the article you ought to buy.

The robot is worked by distant control. It is by means of a finely constructed microphone within it that whatever is said within 6ft. is heard by the distant hidden operator and it is he who shoots back the replies, which issue from a loud-speaker hidden in the robot's head.

The new robot was seen in the Packing and Shop Equipment section, one of the most important among the 100 sections of the 125-acre fair.

Variable E.H.T. Generator

A Useful Experimental Unit for the Workshop or Laboratory

By T. M. RODWELL

THIS article describes an E.H.T. generator whose output is variable from 2kV to 8kV. It is non-lethal.

The author has found many uses for this generator in experimental television work, and there are numerous uses to which it can be put. The testing of a television set whose existing E.H.T. supply has broken down; the break-down testing of a condenser, or to do the work that requires a high-voltage supply with extremely little current, are a few of these.

On studying the circuit diagram the reader will see that the generator works on the pulse principal.

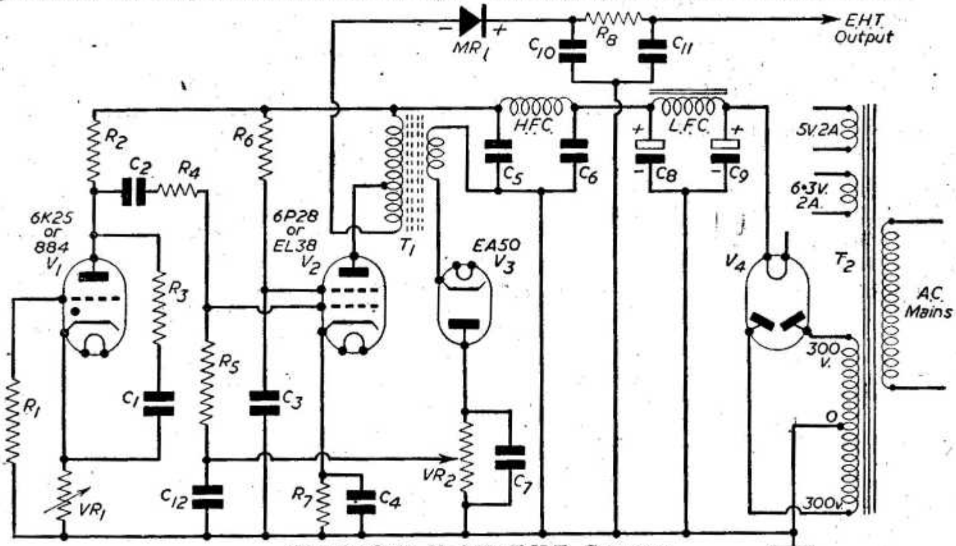
V1 is a thyraton sawtooth generator, R2 and C1 forming the discharge circuit. VR1 controls the frequency of the sawtooth and also the output of the generator. The sawtooth output is fed to the amplifying valve V2 via C2 and R4. In the anode of the output valve is an ordinary overwound line output transformer, and the pulses are here rectified by a Westinghouse metal-rectifier E.H.T.36-100, and filtering is carried out by C10, R8 and C11. The winding on the transformer normally used to feed the line-scanning coils is used to develop a negative bias, one end of the winding being earthed and the other end of the winding being taken to the cathode of an EA50 diode. In the anode circuit of this diode is connected the load, VR2, C7 being the reservoir condenser. The centre arm of the potentiometer is connected to the grid of the output valve via the grid resistor R5, C12 providing further smoothing to the negative bias. The action of this bias is to tend to give a small amount of regulation over small fluctuations in H.T. voltage, but its main purpose is to enable the user to set the range over which he wishes the generator to work.

Adjustment

The setting up of the generator is extremely simple, and the reader would be well advised to borrow a voltmeter capable of reading up to 10kV if he wishes to calibrate the output voltage, but if all that he wants is a source of H.T., he may dispense with this operation.

Connect the voltmeter across the E.H.T. output terminal and chassis, set VR1 to minimum resistance and VR2 to about the midway position, and switch on the power supplies to the generator, and after a short interval a high-pitched note may be heard and, at the same time, a reading should be noticed upon the voltmeter. Adjust VR2 until the generator is developing the lowest voltage that is likely to be required—about 2kV. The output of the generator may be now controlled by varying the frequency of the sawtooth oscillator by means of VR1, and if this control has a calibrated dial, the output voltage which may be expected may be plotted by observing the dial reading for a given voltage as indicated on the voltmeter.

Although the unit may be built to the reader's own design, it must be remembered that the unit must be screened top, bottom and sides, in order to prevent radiation, and also in the interests of safety.



Circuit of the Variable E.H.T. Generator.

LIST OF COMPONENTS

R1 : 25,000 Ω.
R2 : 150,000 Ω.
R4 : 50 Ω.
R5 : 500,000 Ω.
R6 : 2,000 Ω.
R7 : 120 Ω.
R8 : 100,000 Ω.

C1 : .01 μF.
C2, C3, C5, C6 : .1 μF.
C4, C7 : .02 μF.
C8, C9 : 16 μF. 500 V. wkg.
C10, C11 : .001 μF., 10 kV. wkg.

MR1 : Westinghouse 36 EHT100.
V1 : 884 (American) 6K25 Mazda.
V2 : EL38 Mullard, 6P28 Mazda.
V3 : EA50 (Mullard).

HFC : 2.5 mH.
LFC : 12 H. 50 mA.
T1 : Line output transformer (Plessey).
T2 : Mains Transformer, 300-0 300v.—60 mA., 6.3 V. 2 A. ; 5 V. 2 A.

Automatic Gain Control

A Reader's Suggestion for Overcoming Fading Effects in Long-range Reception

I WAS interested by Mr. Barnard's article, "On the Fringe," in a current edition. I would like to point out though that A.G.C. circuits have been devised for use with television receivers. To the best of my knowledge these have not been used with commercial receivers, probably because the three or four extra valves required together with the added complications would push the price of the receiver up by more than the average buyer would be prepared to pay. Even in the U.S. where the negative modulation system makes the use of these circuits easier they have not proved such a remarkable success.

On the other hand they should provide a useful field of experiment for the home constructor.

Basically the D.C. component of the demodulated "video" carrier is not proportional to the strength of the signal alone as it is with an "audio" carrier, but varies also as the mean illumination of the picture varies, being larger with a white picture than with a black; therefore, any attempt to apply A.G.C. by using the D.C. component for A.G.C. bias to the R.F. and I.F. stages will result in all pictures taking on the same mean level. What has to be done is to "sample" some portion of the video carrier which is unchanged by picture composition and develop a bias controlled by this portion alone.

Two possibilities exist. One is the frame sync pulses corresponding to 30 per cent. mod. or black and the other is the "back porch," of the line sync pulse. I favour the use of the latter, as having a higher recurrence rate it should be possible to use shorter time constants and thus be able to follow the rapid fading caused by aircraft.

Suggested Circuit

I have not yet been able to try out any circuits but feel that the arrangement below may be useful as a basis for those who would like to try these circuits.

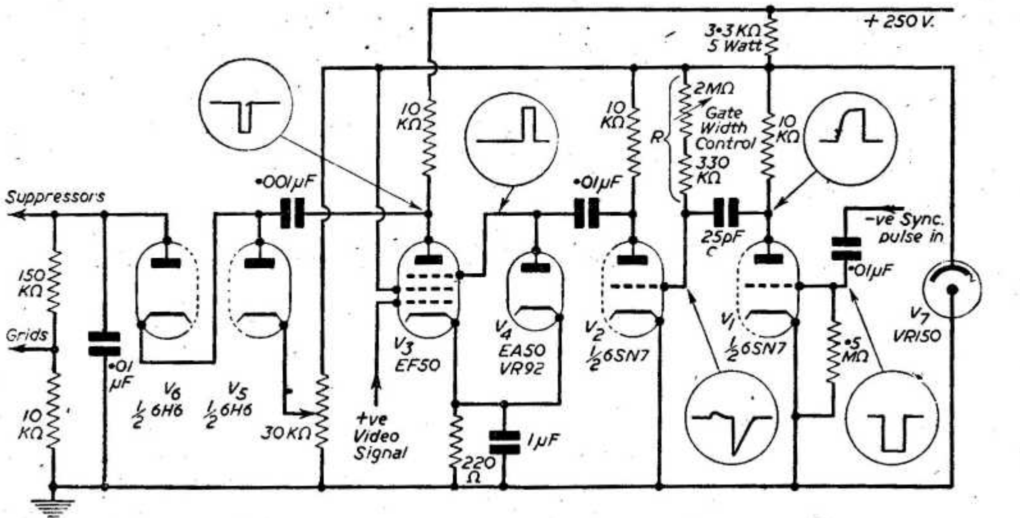
V1 is an inverter. The negative-going sync pulse from the sync separator is fed to its grid being D.C. restored by the grid and cathode behaving as a diode.

The positive-going sync pulse appearing at the anode is differentiated by C and R. The positive pip corresponding to the leading edge will be washed out by grid current in V2, but the negative-going back edge will cut off V2 for a time depending on C and R, and the voltage R is returned to, in this case, 150 v.

Thus a positive pulse appears at V2 anode at a time corresponding to the line sync pulse back porch. This is applied to the suppressor of V3 so that it conducts to its anode during this time. V4 being used to D.C. restore the waveform to ensure that V3 is cut off on its suppressor for the rest of the time.

V3 anode falls during this "gate" pulse by an amount depending on the control grid potential, this grid having the complete positive-going video waveform from the demodulator (which would best be independent from the signal diode) or from a tapping on the cathode follower load resistor using direct coupling, or a D.C. restorer if capacitive coupling is used. V5 and V6 form a rectifying circuit for the negative-going pulses

(*Concluded on page* 23).



Circuit of the arrangement described above.

"T.B." Attacks TV!

Another Attack on Television Exposed

By THE EDITOR

A FEW months ago I took Monica Dickens to task because of an ill-informed article attacking television which appeared in "Woman's Own." A writer in that famous family weekly, "Tit-Bits," which makes a speciality of guiding public opinion against possible dangers, and which, in its sixty years of public service, has ably fulfilled that duty, in a recent issue delivered a further oblique attack on TV which is quite unjustified, unreasonable and unreasoning.

It would seem that the writer, as with so many other critics, first erects his Aunt Sally and then proceeds to snipe at it from all quarters.

Practically every scientific development which has benefited mankind has been attacked by laymen. The bicycle, the internal-combustion engine, the gramophone, the aeroplane, radio, the cinema, all have attracted the attention of waspish critics. Television has been no exception. Quite recently the opticians, through one of their official bodies, endeavoured to encourage the sale of spectacles by issuing a pamphlet innocuously telling the public how to look in, and ingenuously ending their advice with the suggestion that it *may* be that television is harmful to the sight and that special spectacles are necessary! (See leading article in this month's issue.)

Schoolmasters imply that scholars neglect their homework and arrive at school in the morning tired because they have stayed up late watching television programmes. Naturally, the theatres and the cinemas do not like television, and there will continue to be further sniping from those quarters.

It seemed, therefore, that the possibility of further criticism had been exhausted until "Tit-Bits," in a front-page article with banner headlines, published a criticism entitled "TV, Grave New Danger," with a sub-title "Unrealised Power for Harm." The writer, who subscribes himself T. A. L., says that startling reaction to the TV thriller "Dinner at Eight" had caused anxiety in the Advisory Councils of the B.B.C. Within a few days of its production, he says, two tragedies occurred which *may* have been caused by the play. Notice the use of the subjunctive in the initial structure of his metaphorical Aunt Sally. In one case a man and in another a woman were found dead in gas-filled rooms. Each had committed suicide in the manner revealed in the play. "The technique was the same in every detail."

The writer therefore thinks that the problem confronting B.B.C. Governors is: Should scenes of this nature be banned? We can answer that question with an unequivocal no!

It is not so many years ago that Professor Joad, in a Brains Trust broadcast, justified the action of *felo de se*. Whatever is broadcast could have the same arguments held against it. The films show on their screens far more gruesome plays than "Dinner at Eight," and the Dick Barton programmes could be criticised on the argument that they teach crime.

There is no evidence, however, that the two people concerned committed suicide *because* of the play. They may have made up their mind to commit suicide anyhow, and obviously must have done.

No one is going to watch a murder on the stage and go home and commit a murder or any other of the incidents which occur in the action of a play. The writer thinks that TV is different from the stage and the film because it is so much more intimate and that it is this difference which matters, because people with nervous disorders, possibly too unwell to go out for their entertainment, can watch it in the home.

"It is possible for an individual so afflicted to watch a play alone, without that contact with other humans which should bring comfort." Surely people with incipient suicidal tendencies who are ill would not be left alone, and we refuse to believe that they would be affected by a play in any case.

As well to suggest that children should not be taught Shakespeare because of the murder of King Duncan of Scotland, or because Shylock planned by legal means to have a pound of flesh from the breast of Bassanio.

According to his argument, invalids should not read thrillers. We should prohibit the sales of textbooks dealing with poisons and medical books dealing with the intricacies of the interior! Should we prohibit the sale of books on firearms because such weapons are used occasionally for self-destruction? Should the sale of razors be abolished because people cut their throats with them? A chemist's shop is packed with instruments of self-destruction which can be purchased by anyone of any age. Shall we close the chemists' shops? Shall we prohibit the sales of children's chemistry outfits? One merely has to ponder on these things to realise the absurdities of the arguments of T. A. L.

Plays such as "Rope," Ibsen's "Ghosts," and many others have been successfully broadcast without untoward effect.

In order to bolster up his argument, T. A. L. draws attention to Lord Horder's warning which resulted in the withdrawal of the pamphlets which were to be issued telling people how to reduce excessive avoirdupois. This is a totally different matter, because in this instance the programmes *set out to tell people how to slim*, whereas murder plays do not set out to tell people to commit murders or suggest methods of committing suicide. His argument is quite specious. In fact, there is nothing in the article which supports its title.

When the writer goes on to say that it seems as if the B.B.C. have not yet comprehended the enormous power of the new medium which they control I can only suggest that he has not studied the Beveridge Report, which rather suggests that they have taken it too seriously.

No one would object, of course, if some of our politicians had looked in to "Dinner at Eight" and adopted the methods used in the play as an alternative to the more painful methods suggested to t em by many of their critics!—F. J. C.

Merits of 625 Lines

Why the Australian Authorities Chose This Standard

By R. B. MAIR, Technical Director, Australian Broadcasting Control Board

As most readers know, the clarity of a television picture depends to a large extent on the number of lines. In the following article, which first appeared in the Australian journal "Teleview", an explanation is given of the technical background to the Broadcasting Board's recommendation for the Australian standard.

They have adopted a 625-line picture, a degree of picture resolution greater than that adopted over here (405 lines) and America (525 lines), and less than in France (819 lines).

The Board believes that a 625-line system will give a more satisfactory resolution than the British or American systems, for only a small increase in cost.

The general concensus of opinion among most engineers is that up to about 600 lines the definition improves rapidly with an increase in the number of lines, but thereafter the improvement is less noticeable.

Overseas Investigations

To adopt a nation-wide standard, you don't just think of a number and weave other technical factors around it.

The 625-line standard was only adopted after a careful analysis of all relevant factors, together with an exhaustive investigation overseas on existing systems and likely developments.

I spent a great deal of time discussing picture definition with leading authorities in America, Britain and Holland.

I saw laboratory demonstrations of television pictures having line structures ranging from 400 upwards, including a 1,000-line picture in the research laboratories of a British firm.

The demonstration also included the effect of varying band-widths and sequential scanning as against the more generally adopted interlace method.

The sequential scan is capable of giving a very high picture quality but has the disadvantage of requiring double the band-width.

On my return to Australia, research on certain aspects of the system was carried out, using P.M.G. laboratory facilities, before standards were proposed.

The 625-line standard was proposed to two successive Governments, and accepted by both.

It is worthy of note that, as far as is known, Australia was the first country in the world to announce publicly her acceptance of the 625-line standard.

This standard now appears to be coming into general favour, and it is gratifying to see that a recent meeting of a sub-committee of the International Radio Consultative Committee of the International Telecommunications Union, in an attempt to agree on a world standard, adopted 625 lines.

It is reasonable to assume that a definition of 625 lines will be the standard in most future systems.

If Britain and America could start all over again, it is doubtful whether they would adopt their present definitions.

Viewer's Angle

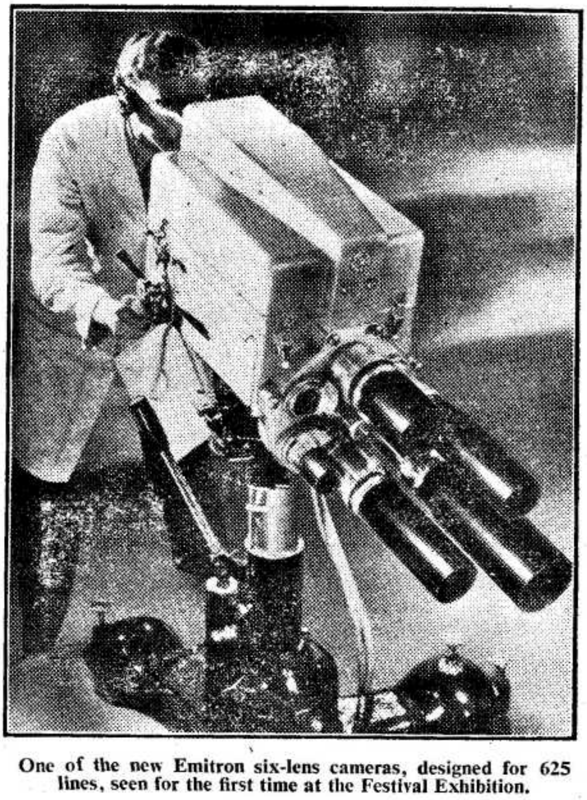
Looking at the problem of definition from a viewer's angle, we find that he is likely to be sitting about three or four feet from the screen. He will have found by experience that this is the best distance to avoid eye strain.

It has been demonstrated that the most satisfactory viewing distance is four times the height of the picture. An average screen would be 8in. or 10in. high.

From this distance, the normal eye can detect the line structure when a definition below 600 lines is used.

The line structure and noise fluctuations are readily discernible in a 405-line picture. They tend to disappear rapidly as the number of lines is increased to 500, and more slowly thereafter.

For a lesser viewing distance of about three times the picture height, as is often used, this improvement continues up to about 600 lines.



One of the new Emitron six-lens cameras, designed for 625 lines, seen for the first time at the Festival Exhibition.

Why Not 1,000 ?

It is generally admitted that the higher the definition the better the picture, so long as other technical features are altered in proportion.

Various claims to the contrary have been made, but usually by organisations which would have had something to gain from acceptance of a lower standard.

In Britain, for example, in one widely published instance, a 405-line and 625-line signal were passed through a circuit which simulated the effect of broadcasting the signal. The result was serious distortion of the 625-line picture.

In this case, however, the 625-line signal was "squeezed" into a narrow simulated bandwidth. Where sufficient bandwidth can be allotted, it remains true that a higher definition will give a better picture in the home, provided the receivers are designed for the wider bandwidth.

This being so, and remembering that our primary aim is to get the best possible image, it may be asked why we did not adopt 800- or 1,000-line definition.

The main factors were :

Extent of gain.
Bandwidth required.
Increased cost.

Less Improvement

From the demonstrations I saw overseas, it was quite evident that 600 lines was better than 400, and 1,000 better than 600.

However, the difference between 600 and 1,000 lines was not nearly so marked as that between 400 and 600.

My immediate impression was that a definition of round about 600 lines would be ideal. The curve of picture quality against number of lines apparently begins to flatten out at this definition.

This first impression was borne out later when detailed investigations and experiments were carried out.

Bandwidth Needed

Adequate bandwidth is needed to do justice to a high-definition system.

The bandwidth required increases as each of the following factors increases :

Horizontal resolution.
Vertical resolution.
Number of pictures per second.

The number of pictures per second is fairly standard, at about the 25 used in the Australian system, or the 30 in the American system.

Horizontal and vertical resolution are more important determining factors.

A properly engineered television system should be designed to resolve an approximately equal number of dots in a horizontal and vertical direction.

So if we increase the vertical resolution we must also increase the horizontal resolution, which means a great increase in the number of picture elements that have to be transmitted, with consequent increase in bandwidth required.

(This increase is not as great as may be feared at first sight. Due to the characteristics of the eye, reduced resolution in the horizontal direction is to a considerable extent compensated for by increased resolution in the vertical direction, and vice versa.)

As a result of these factors, Britain, with her 405 lines, can get along on 3 Mc/s bandwidth ; America, using 525 lines, needs 4.5 Mc/s ; and Australia, with 625 lines, will use 6 Mc/s.

Had we chosen a definition of the order of 1,000 lines, and given it adequate bandwidth, there would have been room for fewer channels in the portion of the spectrum at present available for television in Australia.

With our present standards, it has been found practicable to reserve initially three channels of the necessary bandwidth and provision has been made to allow for development for many years to come.

Increase in Cost

There has been some difference of opinion among manufacturers as to the effect of increased definition on the price of transmitters and receiving sets.

Increased definition means increased bandwidth and therefore must increase the cost of both transmitting and receiving equipment.

While an increase in the cost of the transmitter is relatively unimportant, the cost of receivers is important to the public.

It is believed, however, that with the bandwidth necessary to take advantage of the vertical resolution of 625 lines, the increase in receiver cost will not be very great.

The cost would probably rise rather steeply with the greater bandwidth necessary for higher resolutions of 800 to 1,000 lines.

Beyond a figure of the order of 600 lines it is doubtful whether the additional gain in picture quality would be worth the extra cost the public would have to pay for receivers.

The cost of coaxial cable or radio links to relay signals between cities also rises greatly as bandwidth is increased.

Economic reasons such as these were all-important in the final decision.

625 for Sync.

After considering all these factors, we arrive at a working figure of approximately 600 lines as a compromise.

The question remains why exactly 625 lines, and not 567, 605, or some other figure near the 600 mark, should be chosen.

For technical reasons associated with the synchronising of lines and pictures it is desirable to employ a total number of lines that is an odd number which is the product of an odd whole number of as low a value as possible raised to a certain power.

For example : $5^4 = 5 \times 5 \times 5 \times 5 = 625$.

No other number in the vicinity of 600 is as satisfactory in this respect.

The fact that some manufacturers have experimental 625-line systems in operation shows nothing more than that they have been working on the same basic principles as motivated the Board in its decision in favour of 625 lines.

Not Entirely Satisfactory

We believe the 625-line system is good, but we do not pretend it is the final answer.

The resolution of even a 625-line picture is still much inferior to that of standard 35 mm. motion pictures.

This would become an important factor, for example, in the event of standard television pictures being projected in theatres, where viewing distances of less than three times the picture height are used.

For general public service, however, the Board believes that 625 lines is the best compromise.

"Viewmaster" – Latest Developments

Details of Some Improvements and Modifications for Higher E.H.T. Supplies

By W. I. FLACK

SO as to keep the "Viewmaster" completely up to date, development work has been carried out in operating the receiver with the latest cathode-ray tubes requiring higher E.H.T. voltages.

By suitable modification it has been found possible to operate a 12in. aluminised tube at 9kV or a 15in. aluminised tube at 11kV. At the same time, it has been necessary to increase the line and frame-scanning amplitude as well as taking care of the line linearity.

A special heater transformer has also been developed, the primary winding of which may now be used as an auto-transformer, thus enabling the H.T. supply in the receiver to be maintained at the highest value over the range of input voltages between 190 to 245 volts.

Obtaining a Higher E.H.T. Voltage

To obtain the maximum brightness and contrast when using an aluminised tube it is necessary to increase the E.H.T. voltage up to 9kV or 11kV D.C., dependent on the particular tube. Only by so doing can full advantage be obtained from the aluminised tube, the picture brightness and contrast being improved appreciably, whilst the definition is enhanced due to the smaller spot size.

An increase in E.H.T. volts of up to 9kV may readily be obtained by making use of the high-peak voltage appearing at the anode of the line amplifier V10. The voltage at this point has a peak value of about 3kV, and after rectification is connected in series with the normal E.H.T. supply obtained by the over-winding on the line transformer.

The circuit of this arrangement is given in Fig. 1, from which it will be seen that the only additional components required are two Westinghouse metal rectifiers and two T.C.C. high-voltage condensers.

The regulation of the E.H.T. supply is the same as for the normal half-wave rectifier system, but in practice results are considerably better, due to the small current taken by the cathode-ray tube, thus giving the effect of improved regulation.

Referring to the circuit diagram Fig. 1, MR3a and C45b are the rectifier and smoothing condenser respectively for obtaining the additional E.H.T. supply from the anode of V10. C45a is an isolating condenser and permits the E.H.T. voltage, derived from the auto-winding and rectified by MR3 and C45, to be connected to the negative side of MR3a, thereby connecting the two supplies in series and so obtaining an output of around 9kV.

MR3b connects the two H.T. supplies in series. A resistor of around 2MΩ could actually be used in place of MR3b, but the regulation of the supply would not be as good, due to the higher series impedance. The advantage of using a rectifier is that in the forward direction it has a relatively low resistance, whilst in the reverse direction its resistance is very high and therefore the loading on V10 is reduced.

Little work is entailed in fitting these additional components, though care must be taken with all soldered joints, making certain that they are finished off smoothly and that there are no bare wires, wire ends or sharp points at the soldered connection which could cause brushing.

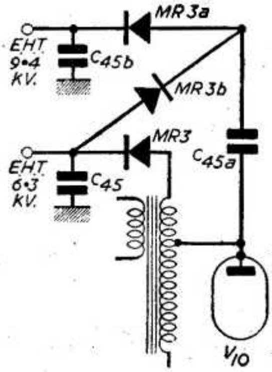
To Increase Line and Frame Amplitude

With an increase in the E.H.T. supply it will almost certainly be necessary to increase the scanning amplitude of both the line and frame time bases. The following changes are recommended for increasing line amplitude and maintaining good linearity:

Connect a 0.33MΩ resistor in parallel with R48.
Connect a 0.5μF condenser in parallel with C41.
Connect a 1,000Ω resistor in parallel with R51.
Connect a 1MΩ resistor in parallel with R46.

Note.—If, when these changes have been made, it is found that there is a bright vertical line a few inches from the left side of the screen it will be necessary to remove the additional 1MΩ resistor connected in parallel with R46.

It must also be emphasised that for good linearity it is essential that the impedance of L14 must be at least equal to 50 per cent. of its maximum value, thus the iron-dust core must be well inside L14; only under these conditions will R52 operate correctly and the left side of the picture will be in correct proportion to the right side.



LIST OF COMPONENTS

C45a: 0.001μF T.C.C. type CP55QO.
C45b: 0.001μF T.C.C. type CP56VO.
MR3a: 36 E.H.T.50 Westinghouse.
MR3b: 36 E.H.T.45 Westinghouse.

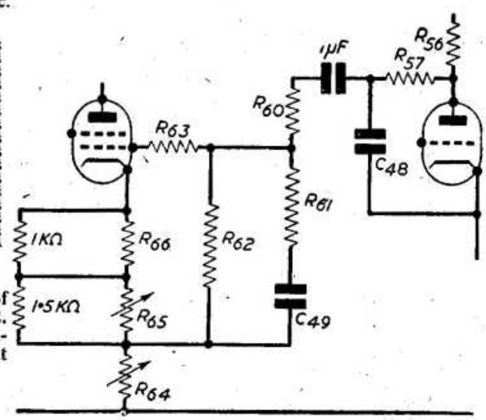


Fig. 1. (left) Circuit diagram of the E.H.T. booster and Fig. 2. (right) Frame circuit modifications for improved linearity at maximum amplitude.

To increase frame amplitude it is only necessary to reduce the value of R56 slightly, the easiest way being to connect a 2.2MΩ resistor in parallel with it.

Some increase in amplitude may also be obtained by increasing the value of R67, and it might also be possible to eliminate it entirely.

Under certain conditions it is occasionally found that there is some non-linearity of the frame apparent as a cramping at the bottom of the scan, and this frequently occurs when a large amplitude is required.

To overcome this it may be necessary to modify the coupling between V11 and V12 so as to obtain an extra 25 volts for the anode of V12. This change is carried out in the following manner:

Break connection of R60 and the junction of R75 and C48, and connect a 1 μF condenser across these two points.

Connect a 1KΩ resistor in parallel with R66.

Connect a 1.5kΩ resistor in parallel with R65.

The operation of the circuit is in no way changed, R65 still controlling the linearity at the top of the scan and R64 the amplitude. There should, however, be a marked improvement in linearity. (See also Fig. 2.)

Components

All resistors used for making the above changes both in the line and frame time bases are Morgan type "T," whilst the .5μF condenser is a T.C.C. Metalpack type CP47N and the 1 μF condenser is a T.C.C. type 62.

Use of the Special Auto-transformer

The best operating conditions for the "Viewmaster" are obtained with a mains input voltage of 240 to 245 volts. Only under these conditions is the E.H.T. voltage at a maximum, with ample scanning amplitude.

In those areas where the mains voltage is very much lower than this, picture quality suffers, due to the lower E.H.T. supply. It is, however, possible to obtain optimum operating conditions with a low mains voltage if a suitable auto-transformer is used.

A transformer combining the functions of the normal heater supply transformer and an auto-transformer has been developed and will readily replace the heater transformer previously specified. The connections to the two heater windings are in no way changed, whilst the only change on the primary winding is to connect the negative side of rectifier MR4 directly to the 245 volts tapping, and the mains input lead to the appropriate primary tapping, dependent on the input voltage.

The following input voltages are allowed for on the transformer primary, 190 volts, 210 volts, 230 volts, 245 volts, the tapping nearest to that of the mains supply voltage being used. A circuit diagram showing the use of this transformer is given in Fig. 3.

This transformer, designated type WB/103A, is of necessity slightly larger than that originally specified; it will be necessary, therefore, when fitting the auto-transformer to drill four additional fixing holes as close to the original fixing holes as possible to allow for the different fixing centres.

Transformer WB/103A is supplied by Whiteley Electrical Radio, Ltd.

From an examination of the queries received by post, very few are of a serious nature, the majority being due to incorrect wiring, with occasional failures in components. One query, however, has arisen on various occasions in which the fault is due to neither components nor to incorrect wiring; this is the complaint that interference suppression on sound has not been entirely effective and has caused considerable annoyance, particularly in the fringe areas where the signal-to-noise ratio is low.

Poor interference suppression is usually due to a narrow bandwidth in the sound receiver, causing a poor frequency response, thereby increasing the width of the interference pulses.

To overcome this defect it is necessary in the first place to ensure that there is no instability whatsoever in the sound receiver, as this will have the effect of reducing the bandwidth. At the same time, the wiring of the sound receiver, particularly around V7, should be examined carefully to ensure that there are no unwanted couplings.

If, after examination, these points are satisfactory, the following slight modifications may be carried out so as to improve the frequency response even further.

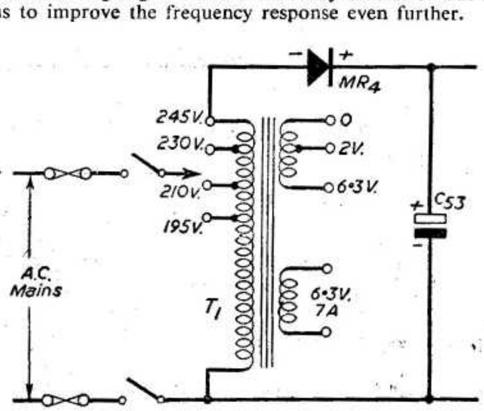


Fig. 3.—Circuit of combined heater and auto-transformer type WB/103A.

C25 should be reduced in value to 47pF (where the receiver is exceptionally stable it may be found possible to remove this condenser entirely).

Reduce the value of R32 to 47KΩ, and use only low-capacity screened wire for the volume control leads.

These changes will have the effect of improving the audio response, and if interference should still be excessive then the fault must lie in the R.F. portion of the receiver, which will probably be found to be slightly unstable.

Finally, it will be of interest to know that development work on the "Viewmaster" is being carried out with a view to making it suitable for operating the very largest tubes made, in particular the "English Electric" 16in. metal tube. This tube has a 38mm. neck and is not usable without different scanning coils and focus ring.

When all necessary work has been carried out and details are available, design information will be published.

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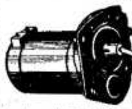

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HOW IT WORKS

The Differentiator and Integrator

An Explanation of Time-base Circuits

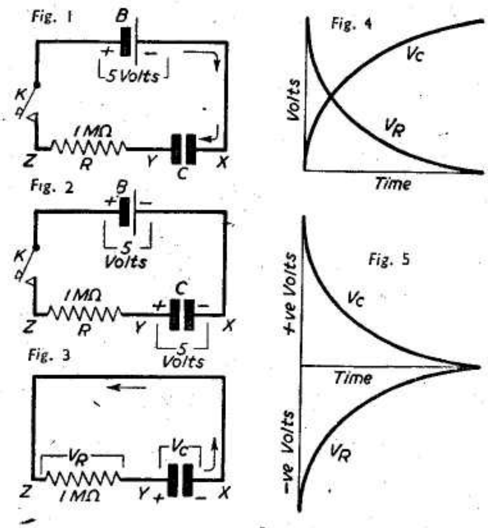
By A. DUNN

IN the modern television receiver some form of amplitude filter or limiter is employed to separate the sync. pulses from the picture signal. Whatever type of sync. separator is used its output contains both the line and frame pulses, and it is normal practice, in order to separate these, to feed them to the time-bases through frequency discriminatory circuits. Since these are merely resistance-capacitance networks a study of this type of circuit under varying conditions is indicated.

Fig. 1 shows a capacitor C connected in series with a 1 megohm resistor R to a battery B supplying an E.M.F. of 5 volts. When the key K is closed electron movement will take place in a clockwise direction towards plate X of the capacitor (which will become negative) and away from plate Y (making it positive) through R to B. C will develop a potential equal and in opposition to B (Fig. 2). If the battery is now removed and the points X and Z are connected C will discharge causing an electron flow in an anticlockwise direction through R (Fig. 3). The capacitor behaves exactly as a generator with an initial E.M.F. of 5 volts which gradually drops to zero.

At the instant when key K is closed the capacitor offers no effective opposition and the full E.M.F. of the battery will be dropped across R (ignoring the internal resistance of B). In consequence the current will equal 5 microamps (5 volts/1 megohm). From this moment the conditions in the circuit will alter as C gradually charges. Let the various voltages and currents be tabulated as shown below.

the curves in Fig. 4 which illustrates the decrease in the P.D. across R (VR) as the capacitor E.M.F. (Vc) rises.



Figs. 1 to 5.—Charging and discharging of a condenser.

Table 1. Capacitor Charging.

Battery E.M.F.	5	←	5	←	5	←	5	←	5	←	5
Capacitor E.M.F.	0	→	1	→	2	→	3	→	4	→	5
P.D. across R	5	→	4	→	3	→	2	→	1	→	0
Current in microamps.	5	←	4	←	3	←	2	←	1	←	0

Table 2. Capacitor Discharging.

Capacitor E.M.F.	5	→	4	→	3	→	2	→	1	→	0
P.D. across R	5	←	4	←	3	←	2	←	1	←	0
Current in microamps.	5	→	4	→	3	→	2	→	1	→	0

Observe in Table 1 that the current value at any instant is determined by the difference between two opposing forces—the E.M.F. of the battery and that of the capacitor—and that it is proportional to, and in phase with, this resultant voltage.

Progressing from column 1 to column 6 the current, and therefore the rate of charge, is falling. The increment in capacitor E.M.F., however, as between one column and the next is the same—1 volt. It follows that the time interval for the increase from 1 to 2 volts (charging current 4 to 3 microamps) must be greater than that required for the change from 0 to 1 volt (charging current 5 to 4 microamps). In a like manner a potential rise from 2 to 3 volts is a longer process than the 1 volt addition from 1 to 2 volts and so on. This is actually shown in the table by increasing the lengths of the arrows between the columns. It explains the shape of the curves in Fig. 4 which illustrates the decrease in the P.D. across R (VR) as the capacitor E.M.F. (Vc) rises.

The collapse of Vc during discharge is shown in Fig. 5. The reversal of polarity across R is indicated by drawing the accompanying VR curve in a negative direction.

Speed of Charge

The E.M.F. across the terminals of a capacitor is directly proportional to the charge and inversely proportional to the capacitance; i.e. $V_c = Q/C$ (V in volts, Q the charge in coulombs and C in farads). It can then be accepted that the speed with which the capacitor E.M.F. rises can be increased either by decreasing the capacitance or increasing the current (1 ampere = 1 coulomb per second). A larger capacitor or a slowing up of the rate of charge would mean a more sluggish rise in Vc. Now the current is inversely proportional to R so the charging time is entirely dependent on the values of C and R. The product of these two in farads and ohms, or more conveniently in microfarads and megohms, is referred to as the time constant of the circuit. The capacitor will reach full charge (actually 99 per cent.) in a period equal to 4CR seconds.

It is now proposed to observe the effect of applying to the circuit of Fig. 6 a 5-volt pulse of the form shown in Fig. 7. It is assumed that the source P is of negligible impedance.

The pulse commences by going instantaneously from zero to 5 volts and the position presented is similar to that of column 1 in Table 1. Subsequent developments depend on the period of the pulse and each variation will be dealt with separately.

Condition 1. *Pulse duration equals* 4*CR*.

If the duration of the pulse from A to D (Fig. 7) is equal to the time taken for C to charge, then Tables 1 and 2 present an exact picture of the series of events from the start of the pulse until C has discharged. In consequence the capacitor and resistor voltage curves of Figs. 4 and 5 can be put together to give the composite pictures of Figs. 8 and 9.

Condition 2. *Duration of pulse greater than* 4*CR*.

This time, Tables 1 and 2 offer the head and tail of the picture. In Fig. 10 the pulse occupies a time interval equal to AD. The shorter interval AY, however, completes the charging process (Table 1, cols. 1 to 6).

Fig. 6

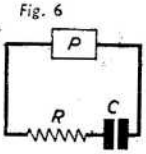
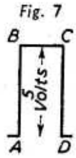
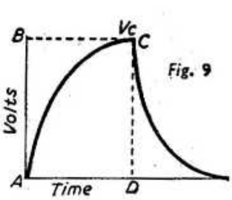


Fig. 7





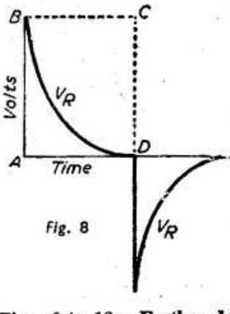


Fig. 8

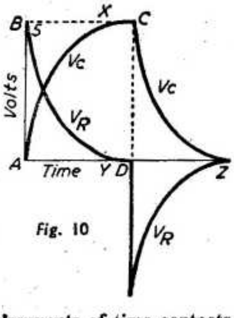


Fig. 10

Figs. 6 to 10.—Further developments of time contacts.

Vc has risen to the value of the pulse and Vr has dropped to zero—and there they remain until the pulse ends. Both curves, therefore, show a straight portion XC and YD. At the conclusion of the pulse the current through the circuit reverses, Vr goes 5 volts negative and drops to zero in step with Vc.

Condition 3. *Duration of pulse less than* 4*CR*.

In this case the action is interrupted before the charge is complete. Assume that column 4 in Table 1 has been reached when the pulse ceases. At this moment Vc and Vr have reached the values of 3 volts and 2 volts and these positions are indicated on their respective curves in Fig. 11 by X and O. For the discharge of C attention is now switched to Table 2. In column 3 it is seen that Vr becomes equal to Vc and has changed its sign. Columns 3 to 6 explain the converging of the two curves on the zero line to meet at Z.

Suppose that the circuit is subjected to a series of pulses the interval between which is comparatively short. The second pulse may occur when Vc has descended to P in Fig. 12 (Fig. 11 reproduced but Vr omitted). As a result the curve would commence to rise again for a period equal to that of the pulse—say to Q. The cycle of events would be repeated for each pulse, Vc taking a gradually rising path with serrations, as shown at O, Q and S, corresponding to the intervals between the pulses.

Sync. Pulses

It is now opportune to discover the effect of applying the sync. signals to the differentiating and integrating circuits which feed the line and frame time-bases. The waveform in the output of the amplitude filter is similar to that of Fig. 13 (i). Should this appear unfamiliar remember that it is now inverted and the pulses are positive-going.

The line period from A to C is 100 microsecs. of which 10 microsecs. are occupied by the line pulse AB. A point worthy of note is that prior to, and immediately after the pulse, the modulation remains at black level for .5 and 5 microsecs., respectively. The first interval to avoid a time delay in the start of the pulse and the second to give time for the flyback. However, that is by the way, and need not be considered at the moment.

The differentiator circuit of Fig. 14 has as typical values C = 50 picofarads and R = 50,000 ohms. The time constant of the circuit is 2.5 microsecs. and 4CR thus equals the duration of the pulse—10 microsecs. This is covered by condition one above and since the output is

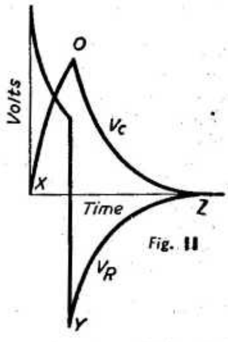


Fig. 11

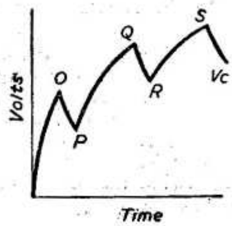


Fig. 12

Figs. 11 and 12.—Pulses produce these effects.

across the resistor R it is to be expected that it will be similar to the curve of Fig. 8.

The two frame pulses DE and FG (Fig. 13(i)) which occur during a line period each last for 40 microsecs. with two intervals of 10 microsecs. This is repeated until the series is complete.

The values for an integrator are given in Fig. 15 as C = .001 microfarads and R = 20,000 ohms, a time constant of 20 microsecs. So 4CR = 80 microsecs. which is twice the length of the pulse duration. It is clear that reference should be made to condition three above, and in view of the repetition of the pulse Fig. 12 illustrates the expected effect.

Direct comparison can now be made between the input waveform and the output from the two separator circuits.

In the case of the differentiator the response will take the form shown at (j). Fig. 13. O, P, X and Y are the now familiar result of the two line pulses immediately above. It may be as well to emphasise that it is the leading edge of the pulse which actually fires the time-base. As it is essential that the line time-base shall maintain synchronism during the period when the frame sync is in operation the frame pulses are broken

Fig. 13

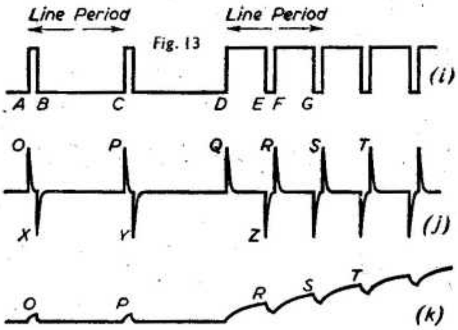


Fig. 14

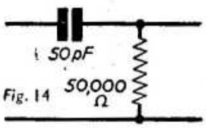
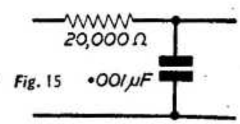


Fig. 15



Figs. 13. 14 and 15.—Further explanatory circuits.

up so that a positive-going leading edge occurs at the end of each line. The result is noted at Q and S. The duration of the frame pulse is, of course, greater than the 4CR of this circuit, and condition two and Fig. 10 explain the gap between Q and Z. Pulses R, T, X, Y and Z will have no effect on the time-base. The first two because conditions will not be ripe for triggering and the latter three because they are negative-going.

Now for the output from the integrator as seen at (k), Fig. 13. The short line pulses appear greatly reduced in amplitude, as shown at O and P, and exist as serrations R, S and T in the rising curve produced by the frame pulses. It is necessary to ensure that the frame time-base trips at a higher voltage level than the peak output of the line pulse. In this there is no difficulty in view of the gradually rising voltage available across the output.

The input waveform shown is that which exists during even frames—that is the frames traced out by lines bearing even numbers. While the waveform for odd frames differs slightly from that given above this does not affect the general explanation.

Combined Circuit

A combined circuit of differentiator and integrator is shown in Fig. 16. C3 and R3 are to filter out the steady voltage from the amplitude filter and have values in the region of .1 microfarad and 100,000 ohms.

Figure 17 illustrates how the two circuits can be isolated and fed from a double diode sync. separator. The positive-going frame pulses across R1 are applied to the integrating circuit R2 and C1. The line pulses are developed across R3 and differentiated by C2 and R4.

Fig. 16

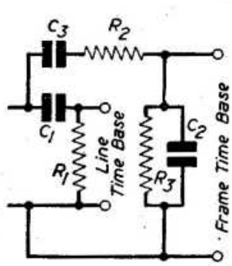
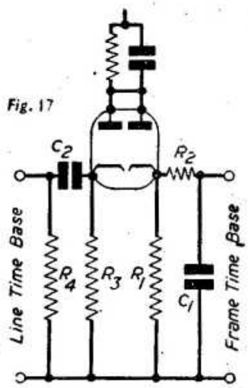


Fig. 17



Figs. 16 and 17.—Line and frame separating circuits.

PHYSICAL SOCIETY AWARDS FOR 1951

SEVEN Marconi's Wireless Telegraph Company Limited apprentices have gained awards in the 1951 Physical Society Craftsmanship and Draughtsmanship Competition for Apprentices and Learners. This important competition always attracts many entrants, and this year the Marconi apprentices won their awards against the stern competition of a large number of entries.

Details of the Marconi apprentices' successes are:

D. J. Cork, Class VI (Senior)—First Prize.

R. C. Pallemaerts, Class II (Senior)—Second Prize.

P. S. Champ, Class VI (Senior)—Third Prize.

G. C. Barnes, Class VI (Senior)—Certificate of Honourable Mention.

G. Evans, Class VI (Senior)—Certificate of Honourable Mention.

J. M. Brewer, Class I (Junior)—Certificate of Honourable Mention.

J. D. Worsdale, Class VI (Senior)—Certificate of Honourable Mention.

Out of six entries in the Draughtsmanship Class these apprentices gained five successes, and two successes out of four in the Instrument Making Class.

AUTOMATIC GAIN CONTROL

(*Continued from page* 13)

at V3 anode. The .001 μF capacitor being charged via V5 between pulses and discharged during pulses via V6 in the .01 μF capacitor. The network composed of 150 kΩ and 10 kΩ is used so that bias voltages in the right proportion are applied to the suppressor and control grids of I.F. and R.F. amplifiers of the EF50 and SP61 type. The 30 kΩ potentiometer provides a "delay" voltage to the cathode of V5, thus limiting the charge on the .001 μF to a value determined by its setting, and thus is an effective means of setting the operating level of the A.G.C. bias and consequently the contrast.

Waveforms at various parts of the circuit are shown in circles. The gate width control should be set to give a width of half that of the sync. pulse.

V7 could be replaced by alternative dropping arrangements, but as shown it does help to reduce the effects of H.T. variations on the circuit.

V3 screen should not be taken to a higher potential than 150 volts, as during the greater part of the time it is receiving the full space current in the valve. The same applies to V1 and V2 as these are both normally fully conducting.—By D. W. M'Que

Using the 19

A Vision Superhet Built fro

By B. L.

THIS inexpensive strip can be conveniently converted to a powerful, self-contained superhet vision receiver, requiring only an external power supply. A simple preamplifier forming an integral part of the unit makes it eminently suitable for long-distance reception and the whole unit is extremely compact.

In its unmodified form it consists of a six-stage I.F. unit using VR65s with a VR92 diode detector and a VR53 output valve. Very few extra components are needed to make the conversion. The overall measurements are about 16in. by 4in. by 3in.

Fig. 1 gives a side view of the receiver. The first step is to remove the VR53 valve marked V9; it is replaced with a VR65 which forms the video output valve. The modifications required here after changing the valve-holder are to remove the 0.1 μF condenser and the two resistors in the grid circuit of the original VR53; the grid of the VR65 is then connected directly to L14 located at the front left of the V8 compartment.

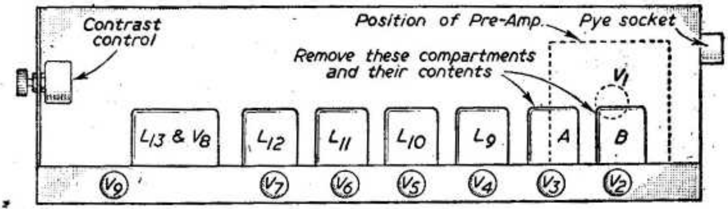


Fig. 1.—Chassis layout and details of modification.

The Circuit

The I.F. stages and video circuit are shown in Fig. 2. Most of the components are already in the unit.

Having fitted the valve base of V9 it is wired up as shown in Fig. 2. A 23KΩ resistor originally connected between the screening grid and earth should be removed, also the small inductance originally connected in the anode circuit. The inductance L15 is constructed by winding 40 turns of 34 S.W.G. enamelled S.C.C. wire on a ¼in. diameter mandrel and mounted on the tag strip.

R38 and 39 are existing in the strip but R40 and 42 must be added.

C55 and 57 and 41 are existing but C59 (electrolytic 250 volts working) and C56 must be added.

This work completes the video section.

The gain control can now be fitted and a hole must be drilled for this on the front panel. If required, the control can be mounted remote from the strip by using a length of coaxial cable between it and the strip, earthing the outer conductor of the cable to tag 3. This is a very useful feature for fringe area reception where fading occurs as the control can be extended by coaxial cable so that it can be operated some feet from the receiver.

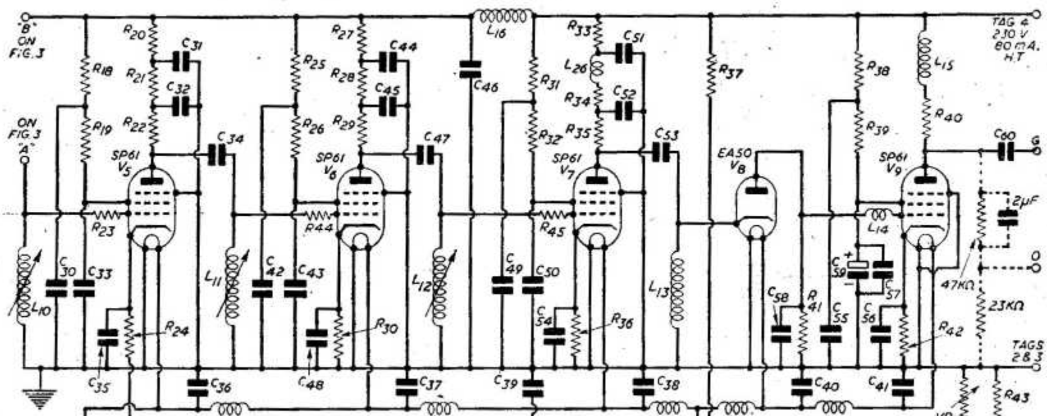


Fig. 2.—Circuit of the I.F. and video stages.

LIST OF COMPONENTS

R18, 20, 21, 25, 27, 28, 31, 33, 34, 39 : 1 KΩ.
R19, 26, 32 : 15 KΩ.
R22, 29, 35 : 5.6 KΩ.
R23, 44, 45 : 10 Ω.
R24, 30, 36 : 180 Ω.
R37 : 75 KΩ.

R38 : 36 KΩ.
R40 : 3.5 KΩ.
R41 : 6.2 KΩ.
R42 : 47 Ω.
R43 : 22 KΩ.
C34, 47, 53 : 100 pF.

C55 : 0.1 μF.
C56 : 0.01 μF.
C58 : 50 pF.
C59 : 8 μF.
All condensers not mentioned above : 230 pF.

94 I.F. Strip

m a Surplus Radar Unit

ORLEY

Connection to the time base is made from "G." If cathode modulation of the C.R. tube is used, the part shown in the dotted lines should be added, R40 being changed to 5KΩ and C60 omitted. Connection to the tube circuit should then be made from point "D." Also in this case the anode and cathode of the diode V8 should be reversed.

Coil Modification

The I.F. circuits should now be modified. Firstly, the coils are withdrawn, stripped of their existing windings and rewound. In the prototype the I.F. chosen was 11 M/cs and to provide adequate bandwidth the coils were wound as follows: L10 and 13, 34 turns: L11 and 12, 44 turns 34 S.W.G. enamelled S.C.C. wire. If it is desired to use another I.F. the coils and oscillator coil will have a different number of turns: A 13 M/cs I.F. for example will require approximately 28 and 38 turns respectively for the I.F. stages.

Having removed the first two cans and their contents the can containing L10 is tackled. The modifications here are very simple—remove everything the can contains except the 10-ohm resistor which becomes R23. The rewound L10 coil is then fitted and connected up.

L11 can requires a little different treatment. This can contains a decoupling condenser (C32) and four resistors. The 10-ohm grid resistor is retained (R44) and the decoupling resistor 1kΩ (R21). The remaining two resistors are removed. The anode load resistor R22 is now added and the coupling condenser C34; finally the coil is put back and connected up. This completes the modifications.

L12 can is dealt with in an identical manner.

L13 can contains the V8 diode and is divided into two sections separated by a metal screen. In the section containing the valve will be found two 27 KΩ resistors and an 0.0023 μF condenser which must be removed.

In the other section will be found a 2KΩ and a 6.2KΩ resistor which must both be removed. The V7 anode load resistor R35 can now be inserted between the junction of R34 (1kΩ) and C52 (which are in the can) and the lead leaving the can for the anode of V7. C53 can then be inserted from the anode side of R35 to the top of the coil L13, which should now be put in. The top of L13 is then connected to the cathode of the diode valve.

The I.F. portion is now completed, the remainder of the components being already wired in.

The Converter

The superhet converter portion can now be dealt with. The circuit is shown in Fig. 3 and it really comprises two parts, a pre-amp. (V1 circuit) and the converter proper. For areas of average signal strength the pre-amp. is not necessary, so it will be dealt with separately.

V4 is already in the unit (it is the third valve from the Pye socket end), but will have to be completely rewired as shown in the circuit diagram. All existing components are removed from the can and are replaced by C22, 23, 25 and 26, and R15 and 17. The coil is stripped and is rewound with three turns of 22 S.W.G. wire and becomes L9. The rest of the components of

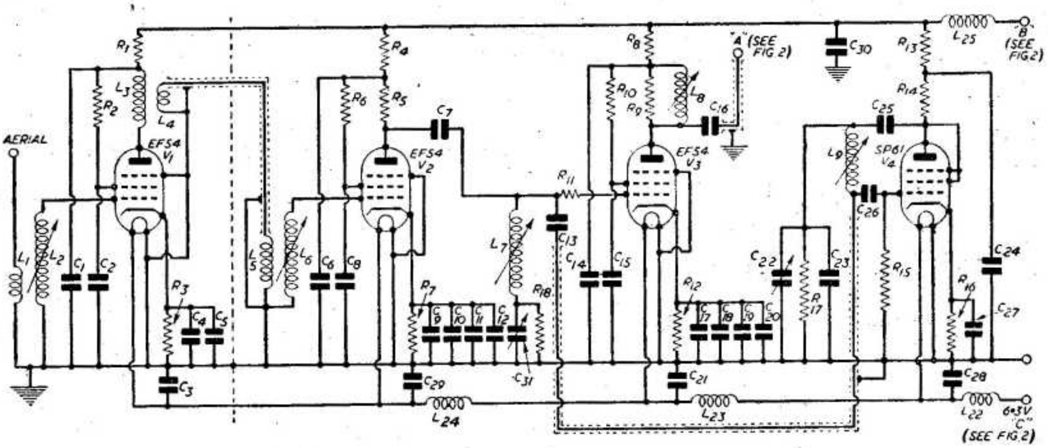


Fig. 3.—Circuit of the superhet converter section.

LIST OF COMPONENTS

R1, 4, 8 : 2.2 KΩ.	**R13 : 470 Ω.**	**C22, 31 : 0-21 pF.**
R2, 6, 9, 15 : 10 KΩ.	**R16 : 180 Ω.**	**C23 : 50 pF.**
R3, 7, 12 : 1 KΩ.	**R18, 47 KΩ.**	**C21, 24, 27, 28, 29, 30 : 230 pF.**
R5, 14 : 5.6 KΩ.	**C7, 25 : 100 pF.**	**All condensers not mentioned above : 500 pF.**
R10, 17 : 100 KΩ.	**C13 : 5 pF.**	
R11 : 10 Ω	**C16, 26 : 10 pF.**	

this valve are mounted underneath the chassis, a simple screen being erected between them and the rest of the unit.

This completes the oscillator circuit.

The first two valves and their associated components are removed and replaced by B9G valveholders. There is plenty of room for the rest of the components round the valveholders, including the coils. A suggested layout for this part of the circuit was given in the March issue of PRACTICAL TELEVISION (A Simple Superhet Converter).

The oscillator coil details have been given for the Birmingham frequency. For the Alexandra Palace transmitter the oscillator coil should have four complete turns, while the Holme Moss station will require three and a half turns.

Coil Data

The following list contains the turns required for London, Birmingham and Holme Moss tuning coils. There may be slight variations due to local wiring capacitances but the turns given should cover the range required. (The prototype is working on the Birmingham transmitter.) All turns are 22 S.W.G. wire.

Coil	*London*	*Birmingham*	*Holme Moss*
L7	5½	4	5
L6	6	4½	5
L5	2	1½	2
L4	3½	2½	3
L3	14	11	13
L2	14	11	13
L1	3½	2½	3

L5 and 6 are wound on the same former, which is a standard Aladdin type, as is also L7. L3 and 4 are wound on the same ¼in. diameter former, and L2 and 1 are dealt with similarly. L8 has 44 turns of 34 S.W.G. enamelled S.C.C. wire on an Aladdin former.

Where extra amplification is required the pre-amplifier comprising the V1 circuit can be used.

This portion is built on a small chassis measuring 2½in. by 2in. by 1in. deep. The coil details have been given above. All components are mounted underneath the chassis, a screen being erected across the valveholder to separate the two halves. This unit can be mounted in the position formerly occupied by the cans A and B, and connection is made from L4 to L5 by means of coaxial cable.

The power supply should be 230 volts at 60 mA and the L.T. 6.3 volts 5-6 Amps.

When completed the unit can be aligned.

Screw the cores of L10, 11, 12 and 13 until they are level with the tops of the formers: insert a pair of earphones in the anode circuit of V9. C22 is now adjusted until the signal is heard. L7, 3, 6, 2 and 8 are then adjusted for maximum volume in that order. L9 acts as a vernier control to C22.

The tube and time base can now be connected and L10, 11, 12 and 13 adjusted for maximum quality. The latter operation is best done when test card "C" is being radiated.

If a signal generator is available the I.F.s are adjusted as follows: L10=10.75 Mc/s, L11=7.75 Mc/s, L12 =8.25 Mc/s, L13=10.25 Mc/s.

If desired a companion sound unit can be constructed as described in the April issue of PRACTICAL TELEVISION (A Sound Unit for the R1355).. The I.F. coils in the sound unit will then cover the 7.0 Mc/s band and will require approximately 28 turns of 34 S.W.G. wire. The unit must be carefully screened.

Stereoscopic Vision?

A Reader Makes a Suggestion for Producing "Live" Pictures

PERHAPS very few inventors in the field of stereoscopic television have succeeded in devising systems working on the principle of "alternate presentation." This is a difficult engineering feat, owing to the fact that twice the normal frame frequency is required, and, of course, the successful working of such a system depends on perfectly synchronised shutters. A further difficulty seems to be of a purely optical nature, and that is finding a suitable method of superimposing images of the scene from both viewpoints on the photo-cathode of the same camera-tube, and this has usually been done by a rather cumbersome arrangement of four mirrors or right-angle prisms.

This problem could probably be solved by employing the fact that different parts of a large convex lens regard a scene from different viewpoints—a fact which is recognised by every photographer who "stops down" to a small aperture to secure a sharp picture of both foreground and background. For the purpose of stereoscopic television, however, the centre viewpoint of a convex lens would not be used, only two side viewpoints from places on the lens about 3in. apart.

The Principle

A 6in. diameter double-convex lens is placed at a distance equal to its focal length from the photo-cathode of a camera tube. A mask completely covers the lens, but light is allowed to pass through the lens in two places by means of two apertures about 1¼in. diameter with their centres nearly 3in. apart. With the two apertures in the mask arranged side by side, the 6in. convex lens is now effectively converted into two lenses of a stereoscopic television camera, and since both lenses have a common principal focus which is that of the 6in. convex lens, images of the scene from both viewpoints are perfectly superimposed on the photo-cathode of the camera-tube.

A rotating shutter adjacent to the mask allows light to pass through each aperture alternately in the period required for each frame transmission, thus the two viewpoints are transmitted in alternation.

A similar arrangement of lens and shutter at the receiver allows the picture to be projected on to a translucent screen, in such a way that the light forming one picture for the left eye of the observer is polarised in a plane different from that forming the picture for the right eye, whilst the observer views the screen through the appropriate pair of polarising spectacles.

With the convex lens of the camera at a distance equal to its focal length from the photo-cathode of the camera tube, one image only of the background would be formed, but nearer subjects would form two images on the receiving screen. This would mean that any subject approaching the camera would appear to approach the observer from the receiving screen.—G. LAND.

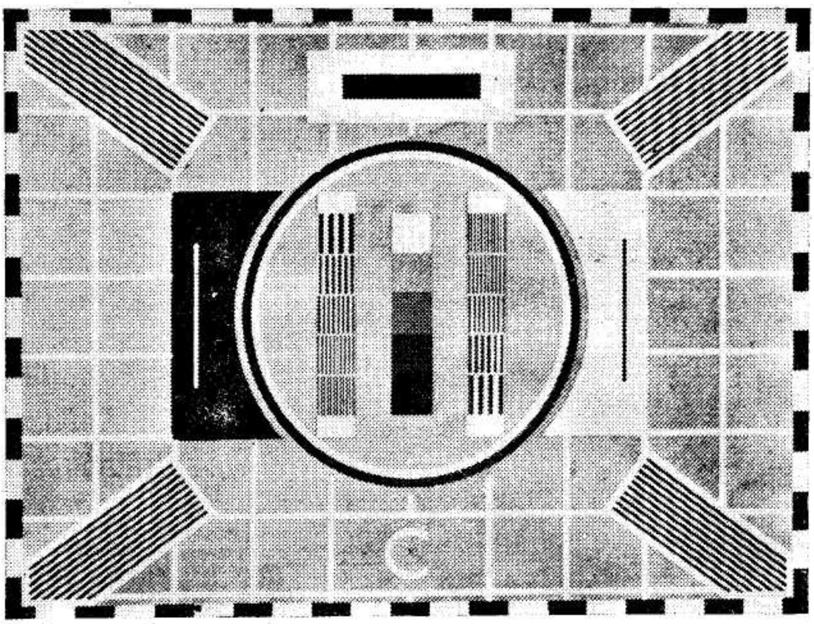
Test Card C

Full Details of the Various Features Which are Covered in the B.B.C. Test Transmission

SINCE we last published a reproduction of Test Card "C", a large number of inquiries have been received concerning the actual details of the transmission which are covered in this special picture. To assist those who are making up receivers and wish to make full use of the card the following official information is given concerning the picture. It should be pointed out that this gives an immediate indication of the performance of the complete transmission chain from the camera to the reproducing picture tube. As the performance of the transmitting equipment is maintained in accordance with an agreed standard during normal periods of radiation of still images for test purposes, the test card is really the only satisfactory way of checking adjustments and the performance of a receiver.

Each of the particular sections of the card is designed to assess one particular characteristic of the system as follows:

1. *Aspect Ratio.* Concentric black and white circles surrounding the five-frequency gratings will appear truly circular when the width and height of the picture are adjusted to the standard aspect ratio of 4 : 3.
2. *Resolution and Bandwidth.* Within the circles there are two groups of frequency gratings, each consisting of five gratings, having black and white stripes corresponding to fundamental frequencies of 1.0, 1.5, 2.0, 2.5 and 3.0 Mc/s. In the left-hand group the 1.0 Mc/s grating is at the top, the frequency increasing towards the bottom, and in the right-hand group the order is reversed. The response of the whose system is required to be uniform to 2.7 Mc/s, so that the 2.5 Mc/s gratings should be clearly reproduced, but the 3.0 Mc/s gratings may be blurred. The picture must just fill the viewing aperture during the test, with the black and white border visible.
3. *Contrast.* A five-step contrast wedge appears in the centre of the test card. The top square is white, corresponding to 100 per cent. modulation, and the lowest square is black, corresponding to 30 per cent. modulation. The three intermediate squares should be reproduced as pale, middle and dark grey.
4. *Scanning Linearity.* The background of the test card is a middle grey, bearing a graticule of white lines. The areas enclosed between the lines should be reproduced in all parts of the picture as equal squares.
5. *Synchronisation Separation.* The border consists of alternate black and white rectangles, which facilitate recognising interference between the picture signals and the synchronisation.
6. *Low-frequency Response.* A black rectangle within a white rectangle is provided and in a perfect system it would be reproduced as a rectangle of uniform blackness on a clean white background. At present imperfections in the transmitting system result in a slight streaking at the right-hand side of the black area, even with a perfect receiver, but by experience it is possible to judge whether the reproduction is abnormal.
7. *Reflections.* Reflections, which may occur in propagation or in the receiving installation, are indicated by two single vertical bars, which should be reproduced without positive or negative images at their right-hand sides. The width of these bars represents a pulse of 0.25 μs.
8. *Uniformity of Focus.* There are four diagonally-disposed areas of black and white stripes corresponding to a fundamental frequency of about 1.0 Mc/s, and all four should be resolved uniformly throughout.



Compare this reproduction with your received picture.

Television Goes Underground

Some Interesting Facts Concerning the Television Cables

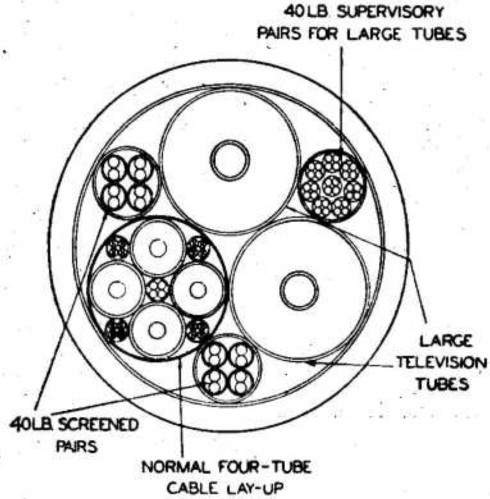
WHEN delegates to the recent C.C.I.F. (Internationa Consultative Committee on Telecommunications) conference in London visited Sutton Coldfield at the invitation of the B.B.C., they saw the world's largest television transmitting station being fed by programme signals sent from London over the most modern coaxial cable. Later, at Telephone House, Birmingham, the delegates saw a special demonstration showing the quality of television signals transmitted over coaxial cables, the route followed being from London, through Birmingham to Stoke, and back to Birmingham, a total distance of over 200 miles.

Consisting of three parts—the main cable and a short tail cable at each end—the latest London-Birmingham coaxial cable follows the route of the old Roman road via Watford, Aylesbury, Daventry, Coventry and Birmingham. The main cable, forming part of the post office trunk telephone network, covers a distance of just over 121 miles, with 43 repeater stations *en route*, of which 11 are required for present-day programmes. The cable terminates at Museum Exchange, London, and Telephone House, Birmingham, and the end connections to the transmitters are provided by tail cables between Museum Exchange and Alexandra Palace and between Telephone House and Sutton Coldfield.

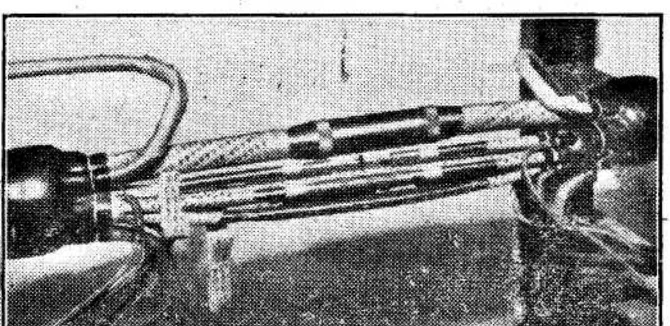
Coaxial Tubes

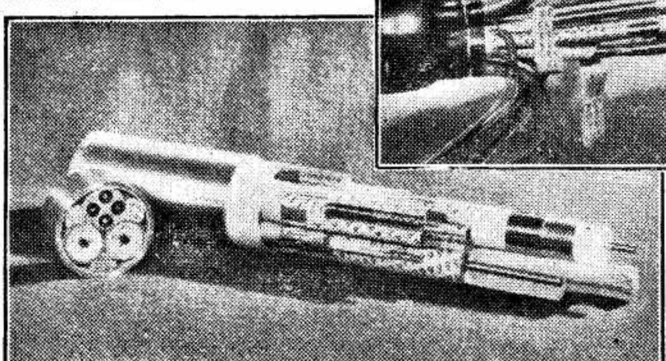
The London-Birmingham cable incorporates two 0.975in. and four 0.375in. coaxial tubes. The larger tubes are used, with repeaters at 12-mile spacing, for two-way transmission of 405-line television signals requiring a video bandwidth of approximately 3 Mc/s. Ultimately these tubes may be required for very-high-definition or colour television and frequencies up to 26 Mc/s. may be involved with repeaters at three-mile spacing. The 0.375in. tubes are used for broadband telephony purposes, each pair being capable of carrying 600 speech circuits. On the Birmingham-Stoke cable, 0.375in. tubes are used for the 405-line television transmissions, the repeater stations being at six-mile spacing. The whole system has been planned to meet the recommendations of the 1943 Television Committee.

The coaxial cable used for the television link, provided and operated by the G.P.O., was developed, manufactured, and laid by Standard Telephones and Cables Limited.



The "lay-up" of the television cable.



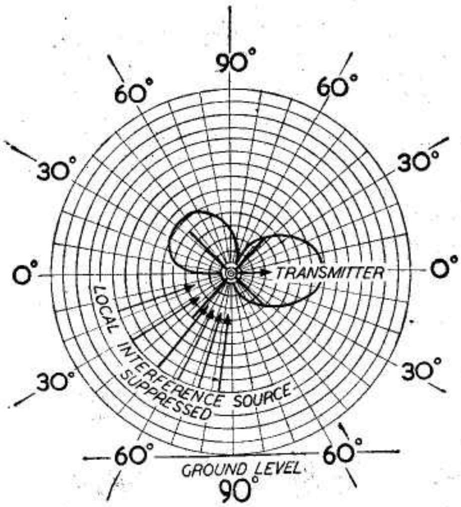


Two views of the cable. On the left the various sections shown separate, together with a cross-section of the cable, and above, jointing points.

The "Antex" Aerial

Performance Data of the Unusual "X" Type of Aerial

MANY queries have been raised concerning the design and function of the now popular "X" type aerial, and a number of conflicting reports have been received concerning its make-up. Some time ago we published details of this aerial and at the time it was purely experimental and no detailed information could be given. We have now received the undermentioned details from the manufacturers and we hope this will clear up many of the misconceptions which appear to have arisen.



Polar diagram showing elimination of signal pick-up from the back of the "Antex" aerial at an angle below the horizontal.

Construction

The "Antex" aerial is a fundamentally new design, having considerable advantages as compared with the normal "H" array in respect of both mechanical design and electrical performance.

Constructionally, the main advantage is that only one junction unit is required from which the aerial rods radiate in the form of an "X." This single junction unit replaces the cross arm having a junction at each end as required by the "H" aerials, with consequent reduction of weight and wind resistance. Furthermore, owing to the aerial rods being in a diagonal plane, the perpendicular length between the junction rods and the end of the lower aerial rods is reduced, thus enabling a shorter mast to be used with adequate roof clearance.

The junction unit is of moulded bakelite construction and has adequate leakage paths and is provided with metal clamps for attachment to a suitable mast. The total weight of the insulator complete with four aerial rods is approximately 1½lbs.

Results

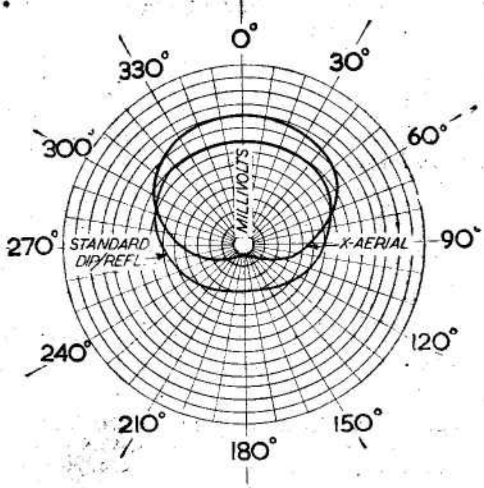
Electrically, the aerial has a much improved performance over the normal "H" array. The polar diagram at 45 Mc/s shows that the "Antex" has a forward gain approximately 2 db greater than that of the "H" array, whilst the front to back ratio has the extremely high value of 22 db. This high forward gain results in the "Antex" aerial having a slightly narrower bandwidth, the response being approximately 1 db less than that of the standard dipole and reflector at 41.5 and 48 Mc/s.

As the "Antex" aerial functions as a complete unit, it cannot strictly speaking be divided into dipole and parasitic elements. Some understanding of its performance can, however, be obtained by considering it to act as a modified dipole and director array The feeder cable is connected to one pair of aerial rods constituting a "V" dipole the apex of which is at the junction unit. The bisector of the angle of the "V" lies in a horizontal plane. The remaining pair of rods similarly form a "V" with the bisector of the angle also in a horizontal plane and again having the apex at the junction unit and form a modified director.

The aerial rods joined to the feeder cable are somewhat longer than those used in a normal dipole and the director rods are somewhat shorter. The maximum signal pick-up occurs when the shorter pair of rods, i.e., the director elements, are pointed towards the transmitter. The forward gain and high front to back ratio are due to the relative phasing of the director and dipole elements. In the forward direction the signals re-radiated from the director element arrive at the aerial element in phase with the normally received signal, thus providing a gain. In the reverse direction, the signals re-radiated from the director element arrive at the aerial element out of phase with the normal signal, and the two signals thus tend to cancel out.

Car Interference

The polar diagram of the "Antex" aerial in the plane of the four rod elements shows a large front lobe, and two small rear lobes at an angle of approximately 45 deg.



Polar diagram showing the comparative performances of the "Antex" and standard "H" aerials.

on either side of the axis of the aerial. When the aerial is used for receiving vertically polarised signals with the rods in a vertical plane, one of these small lobes points upwards and the other downwards. On examination of the " Antex " junction unit it will be seen that there is a connection between the director rods and the lower of the aerial elements. The effect of this connection is to suppress the lower rear lobe and results in almost complete elimination of pick-up at the " back " of the aerial from signals arriving from below a horizontal line drawn through its centre. This is a most useful property in suppressing car interference. If the aerial is mounted at normal height, the interference signals from a nearby vehicle must travel upwards at a steep angle in order to reach it. In other words they arrive at the aerial from well below the horizontal and under this condition very little of the interference can be picked up by the aerial. When the vehicle is comparatively close to the aerial and, therefore, the interference is at its strongest, the aerial itself is in its most insensitive condition and gives a very high degree of suppression.

The linking of the lower dipole rod with the reflector rods unfortunately also results in a slight decrease of forward gain. Generally speaking, however, the improvement in interference suppression more than counterbalances this slight loss, and the aerials are normally despatched with the link in position. Where there is little or no interference present, or where the field strength is extremely low, the additional gain obtainable by removing this link may be of value.

It Went Up in Smoke

EVERYTHING was ready.

All the wiring had been checked, the H.T. and E.H.T. were tested to ensure that no contacts existed between them or the L.T. line.

The valves were placed in position—all 24 of them.

So I crossed my fingers, and switched on.

A deep hum came from the power pack. The valves lighted up, and within a matter of seconds smoke poured from the interior of the time base !

I switched off.

Everything was tested but no fault could be found. Ah well, there was only one thing to do—switch on again and trace the smoke to its source.

This was done, and was considerably helped by a spitting noise as though something was arcing over. It proved to be a smoothing resistor in the E.H.T. feed. Tests were made to discover the cause of the breakdown and eventually I found it. A piece of flex used in the E.H.T. circuit had one stray strand only ¼in. away from a screening can and was arcing over.

Lesson 1. Keep E.H.T. wiring, where bared, at least ½in. from earthed items.

Voltage Rating

I switched on again. A raster began to appear, but a nasty smell, accompanied by a noise like frying chips, revealed the cardboard-type electrolytic condenser in the H.T. smoothing circuit was breaking down. A voltmeter check showed an H.T. of just over 500 volts, while the condenser was rated at 450 volts.

Lesson 2. Make sure that the working voltage of condensers is equal to the applied voltage in the circuit.

Unwanted Contact

Replacing the condenser with a higher-rated one I again switched on.

Hooray ! the raster appeared and I enjoyed myself focusing it and fiddling with the scanning coils. This was Television !

A nasty smell of blistering paint interrupted my game. Smoke poured out of the vent of a can containing one of the tuned circuits like the smoke from a factory chimney.

A check revealed that an anode load resistor was fouling the side of the can. This had not shown itself in my preliminary tests as I took no account of resistance values.

Lesson 3. When checking H.T. circuits take into account the values of resistance in the circuits to ensure that none of them are framing.

Odd Wires

Once again I switched on. The raster seemed to do all it was supposed to do and was fairly centralised on the screen, so I connected up the aerial and began to search for signals. Once again a nasty burning smell interrupted the proceedings.

This time I did not switch off but looked for the resistor which was causing the trouble. It was in the time base and was earthing to the chassis by means of a small piece of wire cut off and lying on the chassis.

Lesson 4. If you drop a piece of wire or solder into the works fish it out immediately. You may be sorry if you don't.

Faulty Surplus

When I switched on again the raster went for a joy-ride. It looked as though it wanted badly to lie down. This was a much longer job but was eventually traced to a leaky condenser in the time base circuit. It was of correct rating but was ex-Government surplus.

Lesson 5. Check very carefully the condensers obtained from surplus equipment.

After this things began to run more smoothly, and beyond finding the picture upside down (frame coils reversed) and inside out (line coils reversed), and the frame not holding (incorrect values of resistors), and the line slipping (too small a sync pulse), everything went fine.

Now all I have written above is completely true, and if you don't believe me you can ask my wife—she was there when I was tearing my hair out !

Was I unlucky, or just plain careless—I wonder !

—ERG.

"DENCO" ALIGNMENT OSCILLATOR D.A.O.I. This unit provides a modulated signal for the alignment of I.F. amplifiers and associated circuits. The two standard frequencies of 465 kc/s and 1,600 kc/s are selected at the turn of a switch. All supplies are derived from one U.10 cell and one 1289 battery inside the unit. Consumption of 50 m/a, single valve type DL92 is used. Dimensions of case: Width 3¼in., depth 2¾in., height 4¼in. Price, post free, only **47/6**.

FREQUENCY CONTROL CRYSTALS By American G.E. Co. Octal base fixing. Following frequencies only: 2,500 kc/s. 3,500 kc/s, 4,600 kc/s, 6,200 kc/s, 8,000 kc/s, **7/6** each. Also FT243 ½in. pin spacing, 5765KC/7975, **10/-** each. 8000/8425KC, **12/6**. New and unused.

R.3515 I.F. STRIP. A complete I.F. Unit comprising 6 SP61 I.F. Stages, tuned to 13.5 Mc/s, 1 EA50 diode detector and 1 EF36 or EF39 output or video stage. A few modifications only are required to adapt this unit, which will give pictures of extremely good quality. Price, complete with valves and foolproof modification instructions, is **45/-**, plus 5/- carriage and packing. Limited quantity only.

5CP1 C.R. TUBES. Brand New and Boxed. **25/-** carriage paid.

3547 RECEIVERS. Absolutely brand new, in sealed manufacturers' packing cases. Incorporating 15 valves type EF50, 2 of SP61, EF36, EBC33, 3 of EB34. Complete 45 Mc/s I.F. Strip, motor dial and drive, pots, etc., etc. **£6** only, plus 10/- packing and carriage. Whilst they last!

EX-R.A.F. INDICATOR UNIT TYPE 62. Containing VCR 97 CRT with mu-metal screen: Crystal Unit and valves 16/VR65 (SP61), 2/VR54 (EB34), 2/VR92 (EA50), etc., etc., two deck chassis in metal case, 18 x 18½ x 11½in. New condition, **67/6** each, plus 7/6 packing and carriage.

5M/A METER RECT., 5/-. W.6 and WX6, **1/6**.

Henry's

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No. 38 "WALKIE TALKIE" TRANS-RECEIVERS. Complete with Throat Mike, 'Phones, Aerial Rods and Junc. Box. Freq. Range: 7.4 to 9 mc/s. Brand new and guaranteed, **£4 19/6**. Carr. 2/6.

RECEIVER R.1355 as specified for "inexpensive Television." Complete with 8 valves VR65, and 1 ea. 5U4G, VU120, VR92, and a copy of "Inexpensive TV." ONLY **55/-** (carriage, etc., 7/6).

RECEIVER TYPE 21. The receiver portion of the W/S 21 operating from 4.2-7.5 Mc/s. Double superhet from 18-30 Mc/s. Incorporating B.F.O. and crash limiter. Valve line-up 7-ARP12 (VP23) and 2-AR8 (HL23DD). Absolutely brand new, complete with circuit. Only **45/-** complete. Vibrator power unit for above, brand new, **17/6** only.

Send stamp for current Component List. Probably the most comprehensive in the trade.

EF50 (VR91) BRAND NEW RED SYLVANIAN. **10/-** original boxes. British Types boxed **7/6**. Unboxed British Types, **5/-**.

I.F. TRANSFORMERS. Manufacturers' surplus. Iron-cored. 465 kc/s. Size 4in. x 1½in. x 1½in. Per pair, **8/6**, whilst they last.

INDICATOR TYPE 6. These units are brand new, in excellent condition and are all fitted with a VCR97 CRT, the tube which many constructors have put to T.V. use. Valves include 4/VR9 (EF50), 3/VR54 (EB34), plus a host of potentiometers and H.V. condensers, etc. The complete unit is enclosed in a metal box 18 x 8½ x 7½in. Price only **£3 19/6**, post paid.

VIBRATOR POWER UNITS, 2 volt. As for Canadian 58 set. Completely smoothed, output 1.5v. L.T. and 90v. and 180v. H.T. at 35 m/a. Complete in grey metal box. Size 8 x 3½ x 4½. **50/-** only.

R.3084 RECEIVER. Incorporating 7 EF50, 2 EF54, 1 EC52, 1 VU39A, 1 HVR, 21 EA50, plus 30 mc/s. I.F. strip. Guaranteed absolutely brand new in maker's original packing case. **75/-** (Plus 10/- carriage and packing.) This receiver is ideal for conversion to vision receiver.

METAL RECTIFIERS. **S.T.C., 300** volts 75 m.a., **5/-**; S.T.C., 24 volts 2½ amps., **17/6**. G.E.C., 6 volts 1 amp., **4/-**. Westinghouse, 12 volts 2 amp., **12/6**. Pencil Type E.H.T., 600v. 1 m.a., **4/7**; 1,000v. 1 m.a., **6/-**. 2,400v. 3 m.a., **15/-**; J50, 500v. 2 m.a., **7/6**.

FILAMENT TRANSFORMERS. All Inputs 200/50 A.C. 6.3v. 1.5 amp., **7/6**; Igranic 6.3v. 2½ amp., **10/-**; 6v. or 12v. 3 amp., **15/-**; 6.3v. 12 amp., **37/6**.

MAINS TRANS. (PARMEKO), 250-0-250, 90 m.a. 6.3v. 3 amp., 5v. 2 amp. Input, 110/250, **20/-**. Min. Mains Trans. 3½ high by 3 by 2½, fully shrouded 250-0-250, 60 m.a., 6.3v. 3 amp., 5v. 2 amp., **21/-**.

PREMIER RADIO CO.

MORRIS & CO. RADIO LTD.

WELL MADE WALNUT FINISH PEDESTAL CABINETS

are available from stock

For 6in. Tube, £5.10.0

For 9in. Tube, £6.15.0

For 12in. Tube, £9.9.0

Carriage and packing, 7/6

Due to the large number of orders in hand, coupled with supply difficulties, we are reluctantly compelled to temporarily close our **Postal Service.** *No Post orders can be accepted after June 14th until further notice. Our Technical advice and Service departments remain in operation. Resumption of Postal Service will be announced in these columns.*

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AERIAL EQUIPMENT.—Belling Lee L802/4/C Television Aerial, dipole with reflector and mast cap to fit own 2½in. mast. For Sutton Coldfield **£2 15s.**; L336 80 ohm twin feeder cable suitable for above **7½d.** per yard; L607PG 2-pin plug for twin feeder **2/10**; L607/S1 socket for L607PG plug **8d.**; L303/S wall mounting socket for twin feeder **3/6**; L303P plug for L303/S **1/10½**; L642P co-axial plug for ¼in. co-ax. **1/3**; L604S co-axial socket for L642P **1/3**; L616 co-ax. line coupler for extending co-ax. by means for two L642P plugs **1/3**. Insulated stranded copper aerial wire: 25ft. **2/3**, 50ft. **4/-**, 75ft. **6/-**, 100ft. **7/6**. Aerial Insulators: Egg **4d.**, Pyrex glass 3in. long **1/6**. Eddystone 946 Low Loss Aerial lead-in **3/3**. Ceramic "T" insulator for short-wave dipoles **1/6**. L391 Gutter insulator, enables television lead-ins to clear gutter, **2/3**.

TELEVISION PRE-AMPLIFIER.—New Ex-Govt. for London transmission. Complete with EF54 valve. Requires 6.3v. L.T. and 200/275v. H.T., which can be taken from televisor. **15/-** plus **1/-** postage.

VIEWMASTER COMPONENTS.—Westinghouse Metal Rectifiers: 14A86 **19/4**, 14D36 **11/-**, 36/EHT/100 **28/-**, WX3 and WX6 **3/7** each. Please note that Morganite Resistors are now: Type T ¼ watt, 20% **6d.**, 10% **9d.**, 5% **1/-**; Type R, 1 watt 20% **8d.**, 10% **1/-**, 5% **1/4**. Other Viewmaster components at prices as listed in our April advert.

ELECTRONIC ENGINEERING COMPONENTS.—See April advert.

PYROBIT SOLDERING IRON.—Miniature "pencil-bit" electric soldering iron (230 volts). Can be held in hand like pencil. Weight only 7 ozs. **22/6**.

CHOKES.—R.F. Type: Labgear RFC3 5-200 metres, D.C. current 60 ma., **2/6**; Eddystone 1066 All Wave **3/4**; Midget Medium and Long Wave **2/-**. L.F. Chokes: 40H 20 ma. **6/-**, 10H 40 ma. **6/-**, 20 H 70 ma. **13/6**, 10H 90 ma. **12/6**, 10H 150 ma. **15/-**.

TELEVISION LIST.—Send 2½d. now for our "Television List." All orders are dealt with day received.

Please include postage on orders under £2.

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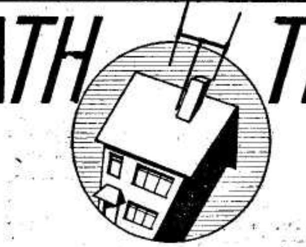
TELEVISION PICK-UPS AND REFLECTIONS

UNDERNEATH THE DIPOLE



By Iconos

FOCUS on newsreels! It seems years since we saw the first amateurish newsreel efforts of the B.B.C. At the time I wrote uncomplimentary things about it in this column, complaining about the unsteady camera work, the untidy editing and the poor recording. As the weeks rolled by, these faults were gradually corrected until the B.B.C. newsreel began to acquire the polish of a professional piece of film journalism. Progress was made with telefilm recording and new equipment was installed at Alexandra Palace for scanning cine films, giving much improved television transmission of all types of film. The rapidly increasing popularity of their newsreel with the TV public persuaded the B.B.C. to invest in an extensive range of cine camera and sound film recording equipment, until they possessed a collection of specialised news camera equipment second to none in the world. The result has paid handsomely and it can now be confidently claimed that the B.B.C.'s newsreel service is not only ahead of any newsreel in the world, TV or otherwise, but that it has a style, form and policy which has set the pace for the others. Apart from its technical craftsmanship, the B.B.C. television editorial staff have shown initiative and enterprise quite unusual in a monopolistic organisation—though, perhaps, it is spurred on by the frantic efforts of the cinema newsreels to stay the course.

COMPETITION

MEANWHILE, the cinema newsreels have taken up the challenge and, despite many surprising difficulties, are making headway again. The G.B., Universal and Pathé newsreels of the Grand National were brilliantly edited and commentated, with fine photographic quality, and the dramatic story of what must have been the most astonishing steeplechase ever run was put over with telling precision. A later edition recapitulated events of the race, with trick slow-motion and stop-motion photography to emphasize and analyse various contributory factors which led to so many horses falling. These fine newsreels were a concerted and yet competitive effort by members of the Cinema Newsreel Association to breathe a little more life into a phase of film making which was threatened by the "fireside" TV newsreel of the B.B.C. Unhappily, the freedom—nay, the very existence—of all newsreels in Britain has been threatened by another entirely new influence. Newsreels have been in existence for over forty years, and the Grand National, the Boat Race and the Derby have always been the highlights of the newsreel year. In the very early days, veteran producer Will Barker used to run on foot around the course just before the race, looking through each of the twenty-four cameras which were operated by his men, checking the focus and lens aperture. Most of the men were mere "handle turners" of the hold-fashioned wooden box cine cameras, and the film was developed in an improvised dark-room in a special van attached to a train from Liverpool to London. In this way, a few prints were ready for showing in the West End of London on the evening of Grand National day.

THE THREAT

I HAVE in front of me an astonishing memorandum circulated to certain employees at film processing laboratories on 21st March. It reads: "*Television Newsreel—Boat Race.*"

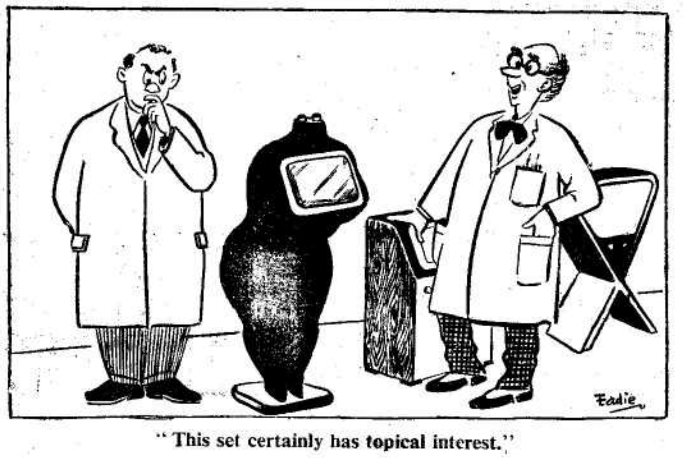
"There is a strong possibility that the B.B.C. will make another attempt to have their boat race material processed this week-end. If it is sent to your laboratory on no account should it be handled.

"Yours sincerely,

Organiser."

This was a directive sent by the union which organises the laboratory technicians, and which, for some reason or other, doesn't seem to like the newsreels. The result was that the important Saturday newsreel story of the University Boat Race did not reach the first-run cinemas until the following Thursday. The B.B.C. outwitted the ban by having their own newsreel material flown to the Continent for developing and printing, and a few hours later copies were back in London and were televised. The Boat Race itself had no "political" significance, of course, but this extraordinary union has been conducting a campaign against week-end work. And since about 50 per cent. of all newsreel "stories" occur at week-ends, an overtime ban capable of being imposed at any time could effectively gag any special story which the Moguls of this organisation did not approve. They seek to limit the number of week-ends to be worked to a fixed number per year, each to be selected well

PROFESSOR BOFFIN



"This set certainly has topical interest."

in advance. Such conditions threaten the very existence of cinema or TV newsreels, and constitute a situation which should not be tolerated, whatever the Beveridge Committee recommends. The television newsreel boys are to be congratulated on beating the ban.

"NEO-ART"

THE post-impressionist school of artists have never created much impression on the British public. Fortunately, they are in a position to ignore such pretentious nonsense by staying away from the art galleries or ridiculing posters which show arty-crafty impressionistic tendencies. They remain unmoved as they contemplate the notorious "Autumn" landscape, recently purchased by the British Council for the Festival of Britain. The fact that the picture is actually a remarkably good representation of the crumpled remains of a kipper, and is thereby (perhaps?) symbolic of the sad end of that fish, leaves them quite unenthusiastic.

But TV viewers can't get away from such precious stuff other than by switching their sets off. It seemed a pity that the good players who took part in the hotch-potch called "Passing Show" should be hampered by the extraordinary "photo-montage" treatment the producer gave it. For half an hour viewers watched this show with uncomprehending gaze, distracted by the disconnected assembly of a series of dull episodes and dance routines. Relief came at last when a technical hitch held up the proceedings, and an "Interlude" card came on the screen, accompanied by pleasant music. The idea of "Passing Show" was to present a cavalcade of events, extracts from shows and music-hall entertaiment over the first half of the century, which has been done so successfully in radio scrap-books and in the annual TV review of the year's events. The robust humour of the music-hall is good television material when presented in a straightforward manner. It certainly won't survive arty-crafty production methods.

PAINTED MATTE SETS

ECONOMY in the construction of settings is of vital importance for TV. At Alexandra Palace, great ingenuity was used in securing effects with small sections of sets in combination with painted backcloths. This method was not always convincing because it had to be used in instances where the flatness of the backing gave the game away. The B.B.C. engineers and the TV Art Department have been conscious of this limitation for a long time and have been experimenting with back projection by films and slides, with the "travelling matt" process (previously described in this column) and various other devices.

A method which is sometimes very effective is known as the "painted matte" system. The TV or film camera is set up in front of a small set, e.g., the barrier of a railway station. In between the set and the camera is erected a large sheet of glass upon which is painted the roof and other non-moving sections of the scene. The set, which is built on the floor, is seen through the centre of the glass where the paint is scraped away to reveal it to the camera. The painting technique has to be of a very special style, photographed in character, and the final marrying up of the glass foreground and the stage setting gives a result which could only be obtained at great expense and with considerable occupation of studio floor space. In ways such as this, the breadth of settings on TV will be enlarged and any sense of "phoneyness" will be considerably reduced, if not eliminated.

Reports from the Clubs

BRITISH TELEVISION VIEWERS' SOCIETY

Hon. Sec.: Leslie G. Pace, 140, Fairlands Avenue, Thornton Heath, Surrey.

THE monthly meeting of the British Television Viewers 'Society, held at Kennard's Restaurant Croydon on Monday April 2nd was undoubtedly an evening for viewers of all ages when the principal guest speaker was Miss Jill Allgood, the editor of television's "Telescope." She described the building-up of this popular children's programme, and spoke of the fine work done behind the scenes by B.B.C. engineers and technicians.

The late Mr. Harry Hemsley, the famous child impersonator, whose children are heard so frequently on radio and in "Telescope," was also present and entertained the audience with one of his clever and amusing domestic discussions with Johnnie, Winnie and Horace.

The third guest was Mr. H. G. Bigg, of the Studio Marionette Theatre, Chiswick, who demonstrated, much to the delight of the children (and adults) present, the glove and string puppets which he operates so skilfully in "Telescope."

Examples of children's ingenuity were on show after the meeting. These included maps, dolls' clothes and coloured designs of all kinds which had been entered in Children's Hour competitions.

The meeting closed with the answering by the three guests of several questions put to them by the chairman Mr. G. H. Warren and various members in the audience.

MUSIC on television was the keynote of the talk given by Mr. Eric Robinson, the well-known and popular television conductor, to members at another meeting.

The speaker mentioned first his early days as an orchestral player and the events leading ultimately to his present position as conductor on television.

He explained the difficulty of obtaining correct tonal balance on television as compared with radio and spoke of the hazards encountered when directing the musical accompaniments to television opera and similar big productions. The "remote control" method adopted by Mr. Robinson when conducting at Alexandra Palace and Lime Grove was fully described to members, and the speaker illustrated his talk by means of gramophone recordings.

A vote of thanks was proposed to Mr. Robinson by Coun. Stuart Edwards, a vice-president of the Society.

NORTHAMPTON AREA TELEVIEWERS' SOCIETY

Hon. Sec.: G. T. Wilson, 95, Ennerdale Road, Spinney Hill, Northampton.

THE above Society met the Letchworth Society at the Embankment Hotel on April 5th, at a dinner where all aspects of television were discussed.

At the annual meeting on April 19th, 1951, it was decided that an interference detector should be constructed in order to co-operate with the G.P.O. in Northampton and district.

Members were very interested re the article and reply to the ghost images ("Problems Solved") in the May publication, to a Northampton reader.

CHESTERFIELD MODEL ENGINEERING AND RADIO SOCIETY

Hon. Sec.: K. Robinson (G3BH9), 51, Hill Top Road, Old Whittington, Chesterfield, Derbyshire.

THE Society now meets at Bradbury Hall in the Hartington Room. Recent talks have been on the radio control of models and television.

Morse classes are being arranged, and these will be given in the Society's workshop.

The Society hopes to arrange a visit to a B.B.C. transmitter in the near future.

If any readers require further information on the club's activities it may be obtained on application to the Secretary.

FESTIVAL EXHIBITION

WITH reference to the note in last month's issue, I would like to point out that it is being held as part of the City of Birmingham Education Department's Evening Institute (Harborne and Quinton Section) Festival of Britain Week celebrations, and not as part of the West Bromwich celebrations. This error has, no doubt, occurred due to the fact that the area head of the evening institute has his office at his private house, which is given at the top of the official letterheads, at the neighbouring borough of West Bromwich, which is approximately five miles distant from Quinton.—J. S. K. (Instructor in Radio and Television at Four Dwellings School).

OUR FIRST BIRTHDAY

We wish to express our thanks to the many readers who wrote to congratulate us on attaining our first birthday.

An announcement regarding Indexes and Binding Cases will be made shortly.

Radio Show, 1951

MR. IAN JEFFCOTT, L.R.I.B.A., has been appointed by the Radio Industry Council as consulting architect for the radio show to be held at Earls Court from August 29th to September 8th, 1951. Exhibitors are free as before to have stands to their own designs, but Mr. Jeffcott will advise the organisers on special features, signposting and compliance with official regulations, and will supervise constructional contracts.

Broadcast Receiving Licences

STATEMENT showing the approximate numbers issued during the year ended March 31st, 1951.

Region	*Number*
London Postal	2,364,000
Home Counties	1,650,000
Midland	1,754,000
North Eastern	1,906,000
North Western	1,609,000
South Western	1,065,000
Welsh & Border Counties	729,000
Total England & Wales ..	11,077,000
Scotland	1,120,000
Northern Ireland ..	207,000
Grand Total	12,404,000

The above total includes 763,767 television licences.

Philips and the Festival

A WELL-APPOINTED club for the entertainment of business executives and buyers from home and overseas visiting the Festival of Britain is to be opened on an island site at the junction of Westminster Bridge Road and Lambeth Palace Road, and will conform with the general design of the Festival itself.

As the Festival is not regarded officially as a trade fair, provision of buyers' rooms was not visualised by the planners; but, with the full co-operation of the Festival authorities, a number of private firms are combining to provide, within 200 yards of the Exhibition, an International Trade Club, where home and overseas business men can be entertained in the atmosphere of a first-class club.

Philips projection television receivers will be installed in all the club rooms for the entertainment of visitors.

American Extensions

AT Easter the Federal Communications Commission of America opened up the ultra-high-frequency bands for broadcasting. It is claimed that this will enable some 70 new television channels to come into operation in addition to the 12 already being used in the V.H.F. range. It is stated that altogether there will eventually be space for about 2,000 television stations in over 1,200 communities, as compared with the present 107 in operation in 65 cities.

Tube Rejuvenation

A NEW device has been produced in the U.S.A. known as a tube reactivator. Electronic in its working, it is merely plugged into the mains and the tube removed from its cabinet. The process takes approximately 30 minutes, and the unit is extremely compact in form.

Holme Moss Transmissions

IT has been stated that signals have been picked up in the north from the new Holme Moss transmitter. Writing in a local paper, however, a well-known local amateur transmitter points out that the signals which have been heard are actually sub-harmonics from an aircraft beacon in the area. It has been officially stated that test transmissions will not commence earlier than July.

Television in Industry

RECORDS kept by the Glyn, Mills Bank of London in their Osterley branch may be perused direct from Whitehall, 14 miles away, by means of a banking television service recently introduced, the first of its kind.

The service, which is the result of four years of experiment, enables documents to be transmitted on to a private screen in the manager's office. The utmost secrecy is guaranteed, as no outsider can tap the high-frequency micro-waves employed.

Shopping by Television

JORDAN MARSH CO., of Boston, one of the largest department stores in America, are having colour television installed in their fashion departments and display windows as a means of advertising their latest stocks in clothes for men, women and children. The "Vericolor" system of closed-circuit colour television, manufactured by Remington Rand, Inc., will be used.

Newsreel Battle

THE week-end broadcasting of news items, such as the Boat Race, etc., have resulted in friction between the newsreel companies and the B.B.C. The Association of Cinema Technicians are taking up the matter, and it is claimed that due to the B.B.C. newsreels the public no longer regard the cinema newsreels as anything but a magazine—the topicality having been lost due to the delay in production.

Television for Scotland

AN official of the B.B.C. states that Scotland's high-powered transmitter at Kirk O'Shotts may be opened at the end of this year, or at latest by the beginning of 1952.

The Yankee Way

THE Senate Crime Committee in America was witnessed in session by more than 30,000,000 viewers. During the session some of the best known criminals of the underworld gave evidence. This has given rise to the criticism that it is encouraging crime, and disseminating criminal knowledge. Several American Schools gave the scholars holidays so that they could view the criminals and hear them explain their methods.

Price Reductions in U.S.A.

WHILST the television industry in Great Britain suffers from the incubus of a double purchase tax (66⅔ per cent.), in America television receivers have been reduced by £20 or more. The American television industry is turning out about 650,000 receivers a month, in spite of rearmament demand.

West Wales Off the Map

WHEN the B.B.C. announced its intention to erect a television station at Wenvoe, near Cardiff, it stated that the western fringes of Wales, particularly the counties of Cardigan and Pembroke, would not be able to receive the transmissions because of the mountainous nature of the country. The county councils of the districts affected have appointed a deputation to visit Mr. Ness Edwards, Postmaster-General, to press for television and better listening in the counties left in the wilderness.

TV Relay System

COMBINED radio and television receivers will be available to Yorkshiremen at a rental of about 11s. 6d. a week when the Holme Moss station opens. The receiver has four channels devoted to radio—Home, Light, Third and one selected foreign programme. The fifth channel is for television.

M.P.'s Witness Sponsored TV

THE first official demonstration of sponsored television was given in the House of Commons on April 24th. The Parliamentary and Scientific Committee, an unofficial group in the House of Commons, invited members of all parties to witness the demonstration.

A battery-operated portable television transmitter—recently demonstrated by R.C.A. in New York. Weighing only 53 lbs., the set has a range of about one mile and the camera is fitted with an electronic view finder.

12in. Tube to be Standard

IT is stated that efforts are being made to standardise the 12in. tube for television. Efforts are being made towards this end and it is said that the 9in. tube will be obsolescent by the time the National Radio Exhibition opens at Earls Court in August.

Opposition from R.E.P.

THE Renters, Exhibitors and Producers' Committee recently met to discuss the recommendations in the various reports to the effect that the industry should be allowed its own television wavelength, provided any material it transmits is made available to the B.B.C. on terms approved by the Postmaster-General. There is opposition to this, the counter-proposal being that the industry should have its own transmitter without having to obtain the approval of the P.M.G.

Low Power for Holme Moss

THE B.B.C. announces that when Holme Moss station opens it would operate on low power and that it would be some time before high power would be used. Holme Moss is designed to accommodate the most powerful television transmitter in the world and a 12 kilowatt sound transmitter.

TV Rules for Tenants

RULES for council house tenants in the North Riding who want to erect television aerials are to be drawn up by a body of surveyors of the various rural councils. There is to be a standardised aerial.

Old Tax for Pre-Budget Orders

WE understand that those who ordered television and radio receivers before the Budget will pay the old rate of tax—33⅓ per cent., even though they did not pay a deposit.

Portable Receiver and Transmitter

R.C.A. Laboratories, Princeton, N.J., recently demonstrated a new portable television camera and transmitter at the annual meeting of the Institute of Radio Engineers. It weighs only 53 lb. and has a range of one mile. It is battery operated.

Racecourses Ban TV

MOST racecourses are to ban the televising of races during the flat season, and recommendations to this effect have been sent to all courses by the Racecourse Association.

TELEVISION AERIAL DIPOLE and REFLECTOR MOULDINGS TYPE MKII

(1) Watertight assembly.
(2) Long leakage path.
(3) Element rods reinforced by the inserted metal tubes, at a point where fracture is liable to occur.
(4) Mycalex has high surface resistivity to moisture under damp conditions.
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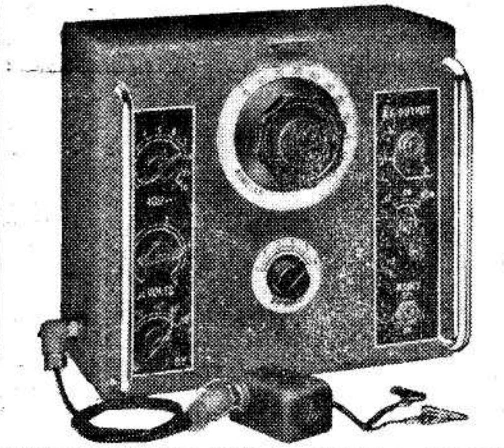

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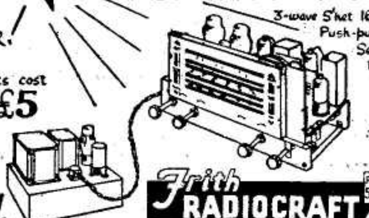

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Correspondence

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

BLACK SCREEN AND LINE STRUCTURE ELIMINATION

SIR,—It has come to my notice in my search for a cheap black screen for daylight viewing, that a moderately coarse-grained, dot half-tone screen not only is suitable, but effectively eliminates the linear appearance. The screen should be placed a small proportion of the viewing distance in front of the tube face, and rotated slightly for null of "moirée" effect. This is under control as the picture lines remain in the same direction.

Most printing firms will be pleased to supply this at a reasonable cost in sheet film, which can be secured at the edges by coloured cellulose tapes.

This is not a solution for lack of general picture resolution or reasonable contrast, but will hardly affect definition in itself.—G. CRAMP, M.I.B.P. (Kenton).

USING THE VCR97

SIR,—*Re* the letter concerning a VCR97, the fault may of course be in the tube itself.

I have purchased six of these at different times and only *one* is entirely free from faults!

Two of them suffer from internal short circuits, which became apparent after warming up. I can only describe the manufacture of these as rank bad workmanship. One wonders, in fact, whether they were subject to any inspection at all during assembly, the short is so obvious.

As a matter of interest I give below the serial numbers of these tubes and their faults:

No. 33015.—Grid connection touches one of the deflector anode connections.

No. 79416.—Only really good one.

No. 105594.—Two horizontal lines burnt across the screen, obviously from its wartime service in the "62" indicator set.

No. 85685.—No trace of fluorescence although filament is intact. This is very puzzling as the tube appears to be perfect and I took it out of a new sealed 6A indicator.

No. 116625.—Brilliance very poor indeed.

No. 116918.—One of the filament supports touches the edge of the grid "cup."

Either I have been very unlucky or else the VCR97 is a menace to the unwary!

It would be interesting to have other readers' experiences.—J. L. FARRANT (Brundall).

[*In view of various complaints which we have received concerning "surplus" equipment, it seems probable that amongst the various items may be some which were, in fact, rejects, or stock from "returned-faulty" stores.*—Ed.]

SET DATA

SIR,—In reply to Mr. Miller's query I would suggest that the receiver in question is one that was marketed just before the war by Baird Television, a company that has, to the best of my knowledge, no connection with the present company of the same name, and which is now defunct.

The units were made for them by a leading radio manufacturer.

The TSE4 valves in their copper compartments belong to the vision receiver, which comprises R.F. amplifier detector and combined vision amplifier and sync. output. Unless, however, an input of very high order is available the vision receiver is not very satisfactory, the available bandwidth being less than 2.5 Mc/s. However, with the replacing of the vision unit by a modified Pye strip this receiver can compare most favourably with the present-day commercial receiver, in fact, better than many.

The 12MW2 tube is cathode-modulated and fed with approximately 3.5 kV. on its anode. The time base, although very simple and economical, is efficient and very linear.

I have had considerable experience on these receivers and if Mr. Miller would care to contact me I would be happy to help him further.—C. G. KITTEL (Ruislip).

[*We thank all those readers who so kindly supplied the information required by Mr. Miller.*—Ed.]

BLACK SPOTTER

SIR,—I am in the unfortunate position of living in a hollow with a main road running just above my roof level and in line with my house and the television transmitter. As a result, car interference is at a maximum, and in spite of all my efforts I have not yet found a satisfactory suppressor which will not seriously mar the picture. I believe there is a circuit known as a "black spotter" in which the polarity of the interference is reversed, and I wonder if any reader has experimented in this direction, or perhaps one of your expert readers, like Mr. West or Mr. Barnard, could suggest a circuit which does this and at the same time focuses them to pin points as I am sure they would not then be so troublesome. Incidentally, I notice that no American television circuits are fitted with suppressors. Is this because negative modulation prevents the trouble, or because all their cars are suppressed?—K. JOBBLING (Sutton).

THE CASCODE (And Other Matters!)

SIR,—I note with regret that Mr. West finds me "not very receptive," and would be glad to "put me right" if he had the space and felt that I would take note of his words of wisdom. Of course I would. Long experience of both radio and television has taught me to be prepared at all times to be convinced that my existing ideas are in error. All that is needed is a good sound argument and I am converted,

In this instance I am not, for I have not been convinced. There, for better or for ill, I lay down the discussion. Let my terminological inexactitudes stand. Since all grounded-grid stages have a finite grid-lead impedance at television frequencies, I will not be led into concocting a new name for the circuit which puts that impedance to practical use.

I cannot even claim that my calculations were "verified with subsequent experiments," since I made no calculations. The analysis indicated that a certain condition should be obtainable, so I tried to obtain it. Calculation was pointless, since no known technique would have been able to measure the precise values. Nevertheless, using the analysis as a signpost in a process of trial and error, I did obtain the condition I expected, and made the circuit work. That, after all, was the object I had in view.

There I would end, had not Mr. West raised a fresh hare, and in two places, at that. Both in his reply to my letter and in a letter on the previous page he refers to generators for alignment purposes without mentioning the very important matter of frequency accuracy. Let me hasten to warn the unwary of the trap he has inadvertently set.

Consider the use of two generators beating together for response checking. Both, presumably, may be of the normal type having a stated accuracy of $\pm$ 1 per cent. in respect of frequency. At 50 Mc/s, in the heart of the television band, this allows a deviation of 500 kc/s in either direction. We set for a frequency difference—according to the calibrations—of 3 Mc/s, and we may get anything between 2 and 4 Mc/s. This is scarcely accurate enough for response curve checking. The average experimenter might put up with an error of 300 kc/s either way, but that would require the use of much more accurate—and expensive—generators.

It has been found possible to use two generators in a different way, however, one being used to modulate the other. This will give signals from about 100 kc/s upwards with a fairly good generator, but the response tends to fall off at the upper frequencies. Another difficulty is that the generator supplying the carrier signal must be set very accurately, and the best method of doing this is to "back-tune" to the B.B.C. signal; i.e., set the generator for zero beat with the B.B.C. signal during a transmission. Then lock the tuning and you have as good an accuracy as you will obtain without special gear.

This, incidentally, is the only practical way of calibrating a home-made generator for television alignment work. Use a separate generator for the sound and lock both tuning adjustments.

On reading other letters I see that G3GEO quietly rejects the cascode, stating that the first valve serves no useful purpose. His reasoning is not exact—he ignores the change in input impedance involved—but that is not important, since his results are definite. Mr. West and I fiddle with the technical aspects while G3GEO burns the whole idea. Perhaps G3GEO can convince us we are both wrong, though I rather doubt it !—D. W. THOMASSON (Exeter).

VIDEO STAGES

SIR,—With reference to R. Young's letter I feel I must point out to him that one cannot say that the EF55 is inherently better than the 6AG7, since the frequency response of a video stage is a function of many external factors such as anode load, input impedance of following stage, grid input network, etc. It is, incidentally, easier to obtain 6AG7's cheaply on the surplus market than the EF55, and both, in well-designed video stages, will give a flat response from 0-3 megacycles. —W. LAMBERT (G3GEO) (Leeds).

LOW-NOISE PREAMP.

SIR,—It is with a sense of disappointment that I read Mr. Lambert's letter concerning the "Low Noise" pre-amplifier design due to your contributor Mr. Rodwell. After Mr. Thomasson and I have debated this circuit at some length during the past few months, it makes of us very foolish people to learn that we have been using one too many valves all the time. For those of your readers who may be lead astray, and for that matter Mr. Lambert himself, it should be pointed out that the first valve of a cathode circuit is not to provide gain but to secure correct operating conditions for the second valve and for overall performance as a "low-noise" circuit arrangement. It also permits a higher gain to be secured from this second valve than would ordinarily be possible.

The superiority in performance of a "cascode" circuit is readily demonstrable and is measurable, assuming that it is correctly adjusted. I am inclined to think, from these findings of Mr. Lambert, there is some confirmation of my contention that the circuit is not easily "set up." Mr. Lambert at this stage will be wise to blame himself and not the circuit.

In passing I would also mention that a grounded grid amplifier at television frequencies and bandwidths is inferior to a straightforward pentode R.F. stage both so far as "noise" and gain is concerned so that Mr. Lambert is employing and recommending an arrangement which will provide inferior results.—S. WEST (Gt. Yarmouth).

ARE WE WATCHING ANOTHER WORLD ?

SIR,—I have been interested in this correspondence, and although the writer exaggerates to emphasise his points, his contentions in the main are reasonable.

Regarding larger screens—of course we want them: they will come eventually, so why not now?

It is no satisfaction to the present generation to know that all these improvements will be here when we are in our "boxes."

Mr. Penrose's letter is the type of reply that is always given when change or progress are suggested.

Jet aeroplanes, radar, etc., would never have been invented if all thought in this way.

What would he say about home movies if the screen used was no larger than the average television screen? A screen 4ft. by 3ft is quite normal in this instance, so why should anyone be laughed at for expecting the same for television?

It is no use bombarding us with science to keep us quiet; if the C.R. tube has reached its limit of usefulness, it is time to look round for some better system.

The real trouble is complacency. One has only to watch a television programme to realise this.

Take the question of picture brilliance. The B.B.C. kindly put on a chart to enable one to adjust their set to the correct contrast or brilliance, but how long does it keep up to that standard? Before long it is as though the scenes are being taken in a badly-lit coal cellar.

And the boat race; although they had ample time in which to prepare, the result was a "wash-out": they were even unable to swing the lenses into position without making a hash-up.

It would appear that we, the television viewers, have to bow to the opinions of the "great ones" and not question their superior wisdom. "For lost are they that do resist," etc.—E. F. WORKER (Sutton).

TELEVISION DANGERS

SIR,—Recently in the Press there was reported a case of a man who was electrocuted whilst making adjustments to a television aerial. Stories, too, have been heard of builders refusing to erect aerials on the grounds that television aerials are dangerous to handle.

Whilst it is appreciated that the earthed chassis of a television set can be thousands of volts positive in respect to the CRT cathode, how can this negative E.H.T. be applied to the aerial, which is to all practical purposes earthed?—T. J. MULLIGAN (Kendal).

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TRADE NOTES

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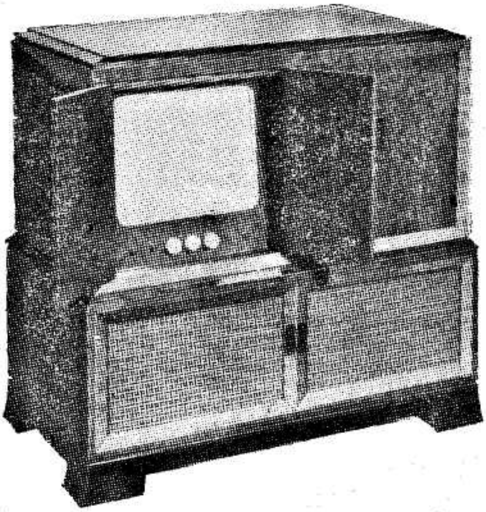
DETAILS are now available of the new 17in. rectangular glass-type picture tube produced by the R.C.A. Laboratories. Known as the 17BP4-A, this is a short, directly viewed rectangular picture tube having a picture area 14⅜in. by 10$\frac{1}{16}$in. Its design incorporates a high-efficiency, white fluorescent screen on a face made of Filterglass to provide increased picture contrast; employs magnetic focus and magnetic deflection; has an in-built capacitor formed by the internal and external conductive coatings to serve as a supplementary filter capacitor for the high-voltage supply; and utilises an ion-trap gun requiring only a single-field, external magnet. The 17BP4-A has a diagonal deflection angle of 70 deg. and a horizontal deflection angle of 65 deg.

Stella Radio Appointment

MR. ERIC W. BRADES has been appointed a director and sales manager of the Stella Radio and Television Co., Ltd., Oxford House, 9-15, Oxford Street, London, W.1. Mr. Brades has had 21 years' service with Philips Electrical Ltd., during which time he has been continuously engaged on radio industry activity.

H.M.V. Model 1902

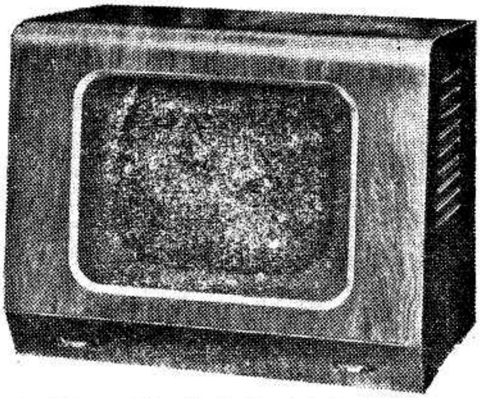
THE illustration below shows the general appearance of the new H.M.V. console receiver Model 1902. This is a combined television and radio receiver designed for high-quality results. The picture size is 12½in. by 10in. and the vision and sound circuits are of the T.R.F. type. In addition to normal picture and sound interference circuits provision is also made for attenuating the signal to prevent overloading in areas of high signal strength. Control and brightness controls are electrically interlocked to eliminate the need for readjustment of the brightness when the contrast control is varied over the normal operating amounts. The focus device consists of a combination of permanent and electro magnets,



H.M.V. Model 1902

and this provides finer adjustment. The radio unit is a 5-valve three-waveband circuit with push-button selection of three pre-tuned medium-wave stations. The A.F. and output stages are common to both radio and television sound, and separate bass and treble tone controls are fitted. In conjunction with a 13½in. elliptical speaker this provides very high quality sound reproduction.

The controls are standard, but there are in all eight push-buttons, giving waveband selection, gramophone, etc. An interesting feature is the provision on the front of the cabinet immediately below the screen of the height, width, horizontal and vertical hold controls, in addition to the main brightness, focus and contrast controls. All these are in line and fully accessible, the



The new Pye Black Screen table model.

mains controls only carrying large control knobs. The mains loading on television is 200 watts and the sound output 5 watts. Weighing approximately 295 lb., this receiver costs £230 19s. 2d. plus tax.

Price Increases

AS a result of the Budget increases in purchase tax most manufacturers have announced increases in price. At the same time Ultra announce that their V.71 series has been superseded by the V.72 series and a daylight viewing filter is now fitted.

Pye Black Screen Receivers

TWO new models are announced by Pye, one a console and one a table model illustrated above. These models have been designed so that they may be operated in any of the five areas without modification inside the receiver. At the back five rows of sockets are provided and the aerial lead is merely transferred to the appropriate socket whilst three screws are inserted at the same time in the appropriate row. The tube which is fitted is a 12in. model and designed for use with an ion trap. An adjustable noise limiter is fitted for vision so that it may be adjusted for maximum suppression with maintenance of picture quality. Mains consumption is approximately 125 watts and the price £71 for the table model and £85 for the console—including tax.

YOUR Problems SOLVED

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

SCREENING

"I have often read that where interaction takes place between mains transformer and chokes, C.R. tube or other components, the transformers and/or choke should be moved. As this often entails much work and sometimes complete re-design, is it not possible to use screening instead? If so, what material should be used? I cannot recall having seen screening mentioned in such circumstances."—E. E. Preston (S.E.12).

As you have no doubt seen, most ex-Government tube units are provided with a screen entirely surrounding the tube. The material used is mumetal (obtainable from the Telegraph Construction & Maintenance Co.), but it would be difficult to screen a modern picture tube with its scanning-coil assembly, focus unit, etc. Screening of the individual transformer or choke might be tried, but the metal is expensive and it is obviously much cheaper and simpler merely to orientate the separate components for minimum interference.

DEFINITION LIMITS

"My set is a 'manufacturer's surplus.' Could you please tell me how to get more definition of people's features on my set, which seem indistinct except on very close camera shots? Does the trouble lie in the scanning system? If so, what is the remedy?"—L. Brown (Burton-on-Trent).

On distant shots the feature details will be very small, and it would therefore appear that your receiver has insufficient bandwidth, due most likely to the tuning. If you refer to the reproduction of Test Card C on page 27 you will see that there is a set of very fine lines at the top of the right-hand column and at the bottom of the left-hand column. If you can tune in this card on your receiver during the morning transmission, you will undoubtedly find that this square is merely a dark patch and the individual lines will not be discernible. The tuning circuits must, therefore, be trimmed to improve the bandwidth and, if possible, to receive these lines, or at the least those of the next square, which correspond to a bandwidth of 2.5 Mc/s.

HUM

"On my home-made receiver there are two wide, dark shadows which appear on the plain raster—that is, before the clock comes on in the evening. When the picture comes up I cannot notice them, but I wonder if it indicates some fault which is actually spoiling picture quality. Can you suggest any cause and cure?"—G. Hardcastle (W.12).

The trouble is almost certainly hum due to inadequate mains smoothing. Whether it appears only in the time-base circuits or on any other part of the receiver will depend upon the general design, but it should certainly be eradicated in the interests of good picture quality. The cure may merely be additional smoothing capacity, or the fault may be due to interaction between A.C.-carrying leads or components.

BRUSHING

"I have had my receiver (P.T.) in use for about 12 months now, but am beginning to experience trouble which I am afraid is going to be serious. Some evenings after the set has been on there appears on the screen a very wide band of very fine dots, accompanied in the speaker by a sort of very high-pitched frying noise. The dots are similar to those caused by a passing car, but in a very much denser area and over a wider band. It does not always appear, but I should like to be reassured or otherwise concerning its cause."—G. Maunde (Notting Hill).

An electrolytic condenser developing a leakage can sometimes give this kind of trouble, but it usually continues once it has started and eventually leads to a breakdown in the condenser. In view of the rather erratic nature of your trouble, and the fact that spots are usually only due to arcing of some kind, we think you will find that brushing is taking place in your E.H.T. unit. This is a form of discharge from one lead to another, most likely from one of the leads from a fixed condenser in the unit. Normally, such leads and contact points are protected against this trouble by being coated with wax, and your unit may have been overheated at some time and some of the wax may have run off. In view of the intermittent nature of the trouble it may not be necessary to have the unit overhauled, but if you can we suggest you remove the screening cover and look at the unit whilst it is working. A fine stream of blue sparks will be seen at the point where the brushing takes place.

TRACING LOCAL INTERFERENCE

"Can you please give me a circuit for a small set similar to the one used by the G.P.O. for finding local interference. I am sure such a set would be of value, as so often when the G.P.O. man arrives the trouble is not on."—W. C. C. Barnes (Hull).

Nothing elaborate should really be needed, and you would probably find that a one-valve circuit (battery-operated and tuned to the television frequency) will meet your requirements. A small frame aerial should be used, and with 'phones on and a weak signal rotation of the frame aerial will give some indication of the direction of the interference. By taking the receiver round your garden or up and down the street you should be able to obtain two or three readings, and the point of intersection of these will be the source of the interference. We do not think an elaborate frame with search coil, etc., would be justified for your purpose.

GHOST IMAGE

"The picture on my set is completely spoiled by a ghost or double image caused by a high-power pylon about 50 yards away from the house. I have an indoor aerial in the loft, but no amount of adjustment of set or aerial makes any difference. Could you suggest a remedy?"—L. C. Fell (Birmingham).

This may be one of those cases where unorthodox steps have to be taken to cure the trouble. Much depends upon the direction of the transmitter from your house. A directional aerial array should be employed and this should be turned about and may have to be turned at an angle to the transmitter direction to give a satisfactory picture. The echo will be removed, but the weaker signal may have to be built up by means of a pre-amplifier, and if the aerial array is sufficiently directional and " off centre," so far as the pylon is concerned, you will get a clear picture. If, however, the station direction is in line with the pylon, then we do not think there is much which can be done.

CAR INTERFERENCE

" I should be glad if you could assist me with a problem concerning my —— receiver. We are situated rather close to a main road and get quite a bit of interference from car ignition. My neighbour next door picks up the same interference on his —— table model, but whereas on our set the interference on the sound is so great it is impossible to hear the programmes at times, our neighbour's is negligible. We have an ' H ' type aerial and my neighbour a cross type. Do you think our aerial could be at fault ? " —L. H. Evans (Northampton).

Both the receivers mentioned are fitted with interference suppressing circuits, and unless the particular circuit in your receiver is not functioning properly (due to the breakdown of a component), the only cause of the difference must be the aerial system. As you will see from the article on page 31, one of the claims for the " X " aerial is its rejection of car interference occurring below the aerial, and when it is possible to compare two identical performances next door in this manner you can judge more accurately the performance features. Probably your best plan is to ask your neighbour to let you connect your receiver to his aerial and see if it then functions as his does, or alternatively let him bring his into your house. If your set is still troublesome, then an overhaul of the interference suppressor circuit components is indicated.

LAYOUT PROBLEM

" I am building my own receiver but am in some doubt regarding the layout to adopt. Is it necessary to have everything on one chassis, or would it not be better to build each separate part of the receiver on its own chassis and to assemble these together in some way to make a compact design ? Any assistance you can give me would be appreciated in this problem."—K. Bonnor (W.11).

It is by no means essential to build everything on one chassis, and, in fact, separate units give much greater scope for experimenting and changes of circuit as desired. The main difficulty, however, in using separate units is in combining them into a compact unit without interaction between them. Probably one of the easiest schemes is to mount the tube on one chassis carrying the power pack and perhaps the time bases, and then to support the vision and sound units on a gantry or similar supports above the tube end. When mounting chassis in such a position that the valves are not standing upright, however, care must be taken to follow the makers' recommendations concerning the position of the heater or filament.

TUBE FAULT ?

" I have built three sponsored designs and they have all had the same defect—a dragging down or up of one or more corners of the picture or raster, according to which way round I connect the scanning coils. This effect is not caused by the scanning coils or the focus coil, or magnet or tube, as these have all been substituted and tried in other sets and found O.K. It is not due to external effects, as various positions have been tried. One set of scanning coils which gave a very distorted raster in one set gave a perfect raster when built into a ' home made design.' The distortion remains the same, even if the scanning coils are rotated on the neck of the tube. It has been suggested that the trouble could be in the time-bases, but I would like your opinion and, if possible, where to look for the trouble."—A. M. Cook (Twickenham).

If you built all receivers *complete*, we presume that the only component common to all of them, in view of the expense, would be the tube. Therefore, this is the most likely cause of the trouble. On the other hand, when you say you have built three designs, you may mean that you retained a power-pack and the time bases, for instance, and merely built the vision and sound sections. In this case, of course, the time bases or sync separator stage(s) may be faulty. The most satisfactory way of finding the fault is to endeavour to find some circuit or component which is common to all three designs and this should locate the trouble, but as already mentioned, it would appear to be the tube in this particular case.

A.C.-D.C. COUPLING

" I append a circuit of my home-designed and home-built receiver (*not reproduced*), and would be grateful if you could assist me in overcoming a picture defect. I gather from reading a recent article that some degree of faulty D.C. restoration is taking place, but at the same time there is a harshness (I can only describe it thus) in the picture contrasts. This cannot be removed by any adjustment of the contrast or brilliancy controls, and I have tried various modifications of bias resistor and compensating chokes, etc., without avail."—H. Gough (Welwyn).

An examination of your circuit indicates that you have used a modified form of A.C.-D.C. coupling to the tube. This arrangement, which is fairly common to-day, is primarily aimed at reducing the cathode-heater potential, and although the coupling condenser is shunted by a resistor the final result is not exactly D.C. coupling, and if the condenser is too small you will get poor or faulty D.C. restoration. We suggest that the condenser be increased to at least $2\mu F$, but if you can find a separate heater supply for the tube we recommend that the tube be direct-coupled to the video anode, merely connecting a .1 $M\Omega$ resistor between cathode and one side of the heater to tie them to the same potential.

POOR FRAME HOLD

" My commercial receiver has been in action for over two years now with every satisfaction. Lately, however, I find that from time to time the frame fails to lock properly and the picture runs, but comes to rest after a short time. This is increasing in its duration every night now, and I have tried all sorts of things to remedy it. Would you be good enough to suggest the most likely cause of the trouble." —G. Read (Cambridge).

We note that the deterioration has been gradual and, therefore, this points to a failing valve emission or a change in some component which can be affected either by heat or excessive current. Assuming that you have covered the usual tests such as substitution of valves, etc., we suggest that you look to the bias by-pass condenser in the video stage. If this condenser has become leaky it will result in a degree of negative feed-back occurring which might be fairly large at low frequencies.

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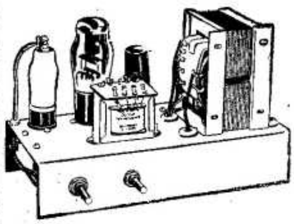

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