PREVENTING INSTABILITY

PRACTICAL TELEVISION

AND TELEVISION TIMES

1/-

EDITOR F. J. CAMM

A NEWNES PUBLICATION

Vol. 4 No. 39

AUGUST, 1953

FEATURED IN THIS ISSUE

- Picture Tube Control
- Fault Symptoms
- The Tilted Wire Aerial
- The P.T. "Lynx" Receiver
- Conversion to Magnetic
- Sound Reception

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350-0-350 v 250 ma, 6.3 v 6 a, 4 v 8 a, 0-2-6 v 2 a, 4 v 3 a, for Electronic Engineering Televisor	67 6
425-0-425 v 200 ma, 6.3 v 4 a, C.T. 6.3 v 4 a, C.T., 5 v 3 a, suitable Argus Televisor, etc.	51 -
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6J6	9/6	12K7GT	10 6	EB91	8/9
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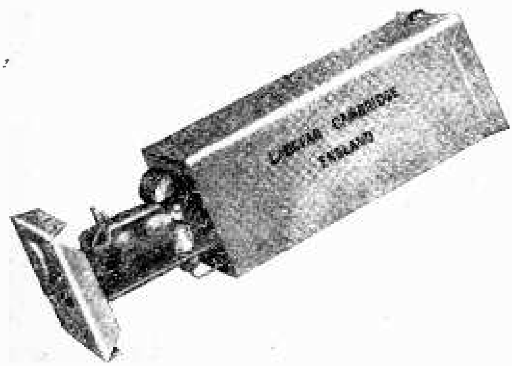

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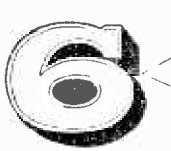

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PRACTICAL TELEVISION
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TELEVIEWS

The "Super-Visor"—Our Latest TV Receiver

SINCE the launching of this journal just over three years ago, we have sponsored the design of a number of highly successful TV receivers, most of them built in our own laboratories, but all of them carrying our guarantee of performance. The designs have been prompted by requests from readers for designs of a comparatively simple character which could be built and aligned by constructors not too well equipped with test apparatus.

The first was our P.T. receiver, using a 9in. tube and making use of 18 valves. The continued sales of our 3s. 6d. booklet and the blueprints for this receiver, coupled with the many hundreds of letters we have received from those who have built it, are tributes to the soundness and simplicity of its design.

But there were many who could not afford to build this receiver and who called for a design incorporating the VCR97 which can be obtained quite cheaply from those dealing in government surplus stocks. To comply with this demand we produced the free gift blueprint for the highly successful "Argus," thousands of which are in successful operation whilst hundreds more are in process of construction.

This was followed by the "Lynx," concluding details of which appear in this issue.

The earliest issues of this journal, of course, dealt with the "View Master," thousands of which, also, have been built. But there has been during the past three years a steady demand for a receiver incorporating the very latest circuitry and making use of the very latest tubes.

During the past six months we have experimented with a design incorporating the very latest features and it is with enthusiasm that this month we publish the introductory article dealing with our very latest design—the "Super-Visor."

This new design incorporates 20 valves, plus three metal rectifiers and employs the latest 16in. metal tube introduced by the English Electric Company. It incorporates automatic gain or picture control and fly-wheel sync. Notwithstanding this, the construction is as simple as it is possible to make it. For example, only one chassis is necessary to accommodate the power, audio and video circuits. It has been tested, not only in our own laboratories but also in the laboratories of independent television engineers under the supervision of the manufacturers of the tube, and we launch this latest design with every confidence that it will be built in its thousands. We have taken pains to see that the components incorporated comply with our specification and that they are in adequate supply. We have made arrangements with a leading cabinet maker to supply the cabinets so that constructors will experience no difficulty in obtaining the various parts. When completed, constructors will have a receiver as up-to-date and as efficient as any commercial receiver costing from £90 upwards.

Readers may build it with the assurance that it will give them entire satisfaction and that they will be speedily helped out of any difficulties they may encounter in alignment, through the services of our Free Advice Bureau. Those who prefer to work from full-size blueprints will be glad to know that these are in course of preparation. We shall, of course, give full wiring diagrams herein, but a full-size blueprint is valuable in saving marking out time.

We are assured by the manufacturers of the tube that adequate supplies are available.

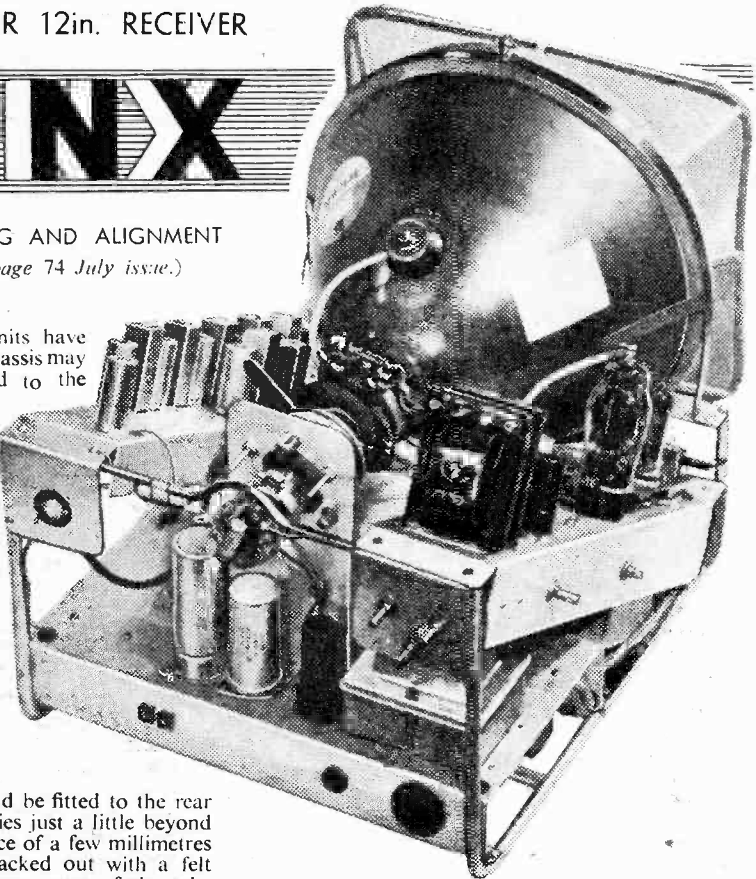
Sponsored or Commercial TV ?

THE White Paper on sponsored television is to be published in the autumn. In the recent debate in Parliament, however, five conditions under which commercial television might operate were laid down. From these it is clear that few licences will be granted, the stations will be of low power and limited range, a controlling body to advise the P.M.G. on commercial programmes, the owner of the station will be responsible for the broadcasts at the risk of losing his licence, and the hours of operation will be clearly defined.

It would seem, therefore, that it is commercial rather than sponsored programmes which are being permitted. The question of wavelengths has not yet been decided.—F. J. C.

OUR 12in. RECEIVER

The LYNX



GENERAL CHECKING AND ALIGNMENT

(*Continued from page 74 July issue.*)

Completing the Wiring

WHEN the individual units have been wired the power chassis may be permanently bolted to the framework, and the tube, complete with scanning coils, may be rigidly fitted to the rear bracket and the front clamping bands. The rear bracket hole should be lined with a large rubber grommet or a felt washer to provide a firm sliding grip on the tube, and the front clamps, when tightened about the mask as the various photographs depict, will be found to give the tube a firm support so that the main framework may be tilted to either side without movement of the bulb. The scanning coils should be mounted with the tag-board uppermost, and the focusing magnet should be fitted to the rear bracket so that its front edge lies just a little beyond the rear of the coils ; this space of a few millimetres or so may conveniently be packed out with a felt washer. The side cap anode connector of the tube should be arranged to be uppermost. The photographs show the assembly quite clearly.

The ion trap magnet (if the tube type calls for one) should be slid on to the neck with the arrow in line with the mark on the neck, and pointing towards the screen end ; the trap should be temporarily tightened just in advance of the tube base.

The tube base holder should now be fitted and the various leads from the brightness control, video output, etc., soldered to the appropriate pins. The following components are soldered on this base : C26, R26 and R28, with C27 taped to the cross rail just to the left.

Unused pin contacts are used as anchors where necessary ; it is important, however, to use only contacts on the holder corresponding to *missing* tube pins, as the base pins of some tubes, even if apparently unused, are internally connected to supports, etc. The pamphlet of the tube manufacturer should be consulted in this respect.

Resistances R59 and R60 are wired on the scanning coils themselves, across the appropriate tags.

Preliminary Assembly

In order that checking and alignment may be carried out easily, the two sloping side chassis (vision-sound strip and time-base units) should be connected to the power supplies, scan coils, etc., by long leads, the units themselves being free of the framework so that they may be upended for alignment. Earthing leads should not be forgotten. The rear control panel, carrying VR3, VR6 and VR7, should similarly be "free" on the end of longish connecting wires for the present.

Heater Voltages

When the wiring has been completed as detailed above and in the previous articles and double checked, the heater supply chain should be set to suit the mains supply voltage. The mains auto-transformer itself, of course, should be set to the correct tapping points, the 10-volt extension winding being employed for mains supplies of 210, 230 and 250 volts.

Remove the main rectifier valve V18, check the mains points for polarity, and arrange the plug from the receiver so that the neutral mains wire is joined to the chassis. The chassis must not be directly earthed, but may be so connected through C60 when finally in use. For alignment and checking, no earth point should be used. It is advisable, even necessary, to work on a dry wood floor, preferably carpeted, and wooden bench or table during these alignment proceedings, and there is then no possibility of shock.

The value of R69 and the additional Rx (if this latter is required) must be set so that the valve chain receives the correct voltage drop across it (147.4 volts theoretically), and the following table gives the nearest practical values and combinations of resistances for the various supplies. The final value is not critical, but if R69 is low a small additional resistance Rx may be inserted in the position shown in the underchassis view of the power unit last month. Wattage ratings are those of the nearest available values, and higher ratings may be used.

In place of fixed resistances, a 0.3 amp. sliding tapped type dropper may be used, which can be set precisely; these components are generally rather large, but they can be accommodated in the space provided.

Mains	R69	Wattage	Combinations
200	180Ω	20	2 of 350 paralleled
210	200Ω	20	
220	250Ω	25	
230	270Ω	25	2 of 470 paralleled
240	300Ω	30	
250	330Ω	35	2 of 680 paralleled

Note that the use of two paralleled 470Ω resistances for the common 230-volt supply allows for an additional value to be inserted at Rx of about 47Ω (2 watt). The resistances used in the original model were 30-watt Welwyn vitreous, two parallel 470Ω being used for 230-volt supplies as above.

With the value selected, switch on the set and check that the valve heaters glow and that the voltage on each valve is approximately correct. Allow at least two minutes for stability to be reached, having a suitable meter wired across V9 as check. All valves should drop 6.3 volts except V13 (30 volts), V14 (19 volts) and V17 (16.5 volts). The tube heater should, of course, be either 6.3 volts or 2 volts, depending on the manufacturer and the tapping from the mains transformer. A tolerance of ± 7 per cent. is permissible on the heater voltages; this is equivalent to a range of 6 volts to 6.6 volts on the 6.3-volt valves. Any abnormal voltage should be investigated, the valve is possibly at fault.

It should be noted that if no voltage is recorded on any valve, there is an open-circuit on the heater chain or one or more of the valves have broken heaters.

Never unplug a valve for continuity checking with the set switched on, or some of the others may be damaged. Note also that all heaters, with the exception of V9, are above chassis potential.

Checking with H.T. Applied

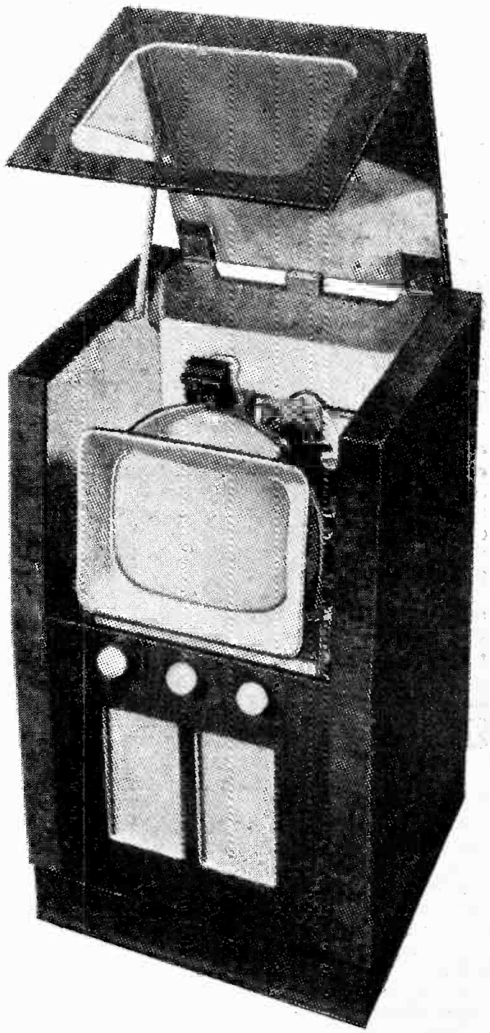
It is assumed that the above has been performed with the sloping side chassis standing free from the main framework, the connecting leads being left long to permit easy handling. The following checks may also be made with the units arranged in this way.

Plug in the rectifier V18, switch on, and allow two minutes to warm up. A voltmeter check should be made at the cathode of the rectifier (across C61), which should finally read about 300 volts, and a visible watch should be kept for a while to ensure that there is no sudden overheating or other sign of trouble. The brightness control should be set at minimum all the time during these checks.

Take voltage readings at the various H.T. rails; these should correspond roughly with those indicated in the theoretical diagram in part I of this series, and individual electrode voltages should correspond to those given in the table on page 102.

Now, with contrast reduced, turn up the brightness control very carefully. A raster of some sort should appear on the screen, and rough preliminary focusing can take place. Set the line hold until the pitch of the whistle is just at the limit of audibility, and set the frame hold to give a continuous pattern without appreciable flicker.

With brightness reduced to a point where the raster is barely visible, push the ion trap along the neck until the brightest raster results, keeping the arrow in line with the mark on the neck. When the correct point has been found, lock the trap in position. Mullard tubes are marked on the neck for this



The novel cabinet, obtainable from Messrs. Tallon, which enables the tube face and protecting glass to be kept clean.

adjustment, but some tubes of other make are not marked in any way, and the instructions of the individual manufacturers should then be followed.

Reduce brightness to minimum, and align the vision and sound receivers as follows.

Alignment

A signal generator is required for alignment, and a reasonable control of its output is necessary, although an actual figure of the output is not required unless a check is to be made against the sensitivity curves of Fig. 2 in part 1 of this series.

With the output audio-modulated, and with the volume control advanced, inject 9.5 Mc/s at the grid of V8 and tune L17 and L18 for maximum output from the speaker. An A.C. voltmeter (10 volts) may be used as an indication if necessary. Disconnect R7 from the H.T. rail (which puts the oscillator out of action), inject 9.5 Mc/s at the grid of V2 (mixer half), and peak L16 for maximum sound output. Recheck L17 and L18 and seal these latter cores.

Now wire a 0-1 mA meter in the earthy end of R22 as an output meter for vision, and with the signal generator set to 11.5 Mc/s inject a large signal to the grid of V5. Tune L12L13 for maximum output. Transfer the generator to the grid of V4, set it to 10.2 Mc/s and tune L10 (bottom core) for maximum output, reducing the generator output as necessary. Set the generator to 9.5 Mc/s and tune L11 (top) for minimum output. Set very carefully and seal. Transfer the generator to the grid of V3, and similarly tune L8 to 12.2 Mc/s for maximum, and then L9 to 9.5 Mc/s for minimum, output.

With the generator now connected to the grid of V2, tune L7 to 10.6 Mc/s, and recheck the setting of L16 at 9.5 Mc/s for minimum output.

Reconnect R7 to the H.T. rail, and with an input to the grid of V1 (advance contrast as necessary) of appropriate frequency (see part 3), tune C8 for *maximum sound output*. Then tune L3L4 to the frequency specified, and reset C8. An insulated trimming tool is *essential* when adjusting this condenser.

With the generator connected to the aerial input, adjust L2 appropriately.

Swing the generator through the range of the local transmitter, i.e., for London, 40 to about 46 Mc/s. There should be maximum output on sound at 41.5 Mc/s which should disappear abruptly as this frequency is passed, and a vision output should appear which should follow the curve of Fig. 2 (Part I) for overall response approximately, being substantially flat from 42.25 Mc/s to 44 Mc/s and falling to half at 45 Mc/s.

On an actual transmission, C8 will require readjusting, but this must be set for maximum sound signal, and is fairly critical.

When alignment is completed, bolt the vision chassis to the framework, but ensure that C8 is "tilted" so that it can still be adjusted from beneath.

NOTE.—The chassis of the signal generator must not be directly earthed, but should be connected to the set chassis.

Faults

The following gives a brief list of possible faults, but assumes that the valves and applied voltages are substantially correct.

No raster. Ion trap incorrectly set ; no E.H.T. ; brightness control faulty ; C28 shorting.

Sound on picture. C8 incorrectly set ; sound traps not properly aligned ; microphonic vision valve (only evident when sound output is large) ; overloading of the mixer (fit gain control in cathode of V1 if within 10 miles of transmitter).

Spots on picture. External interference ; slight corona trouble on E.H.T. strip ; noisy vision valve.

TEST VOLTAGES

Valves	Anode	Screen	Cathode
V1 to V5	220	220	1.5-2 (except V3)
V2(pin 6)	150	—	4 (pin 3)
*V7	210	230	2.5
V8	220	220	2
V9	50	—	—
V11	150	45	—
†V12	35	—	—
‡V13	—	200	6.0
V14	—	—	80-100 (across C50)
†V15	35	—	—
V16	265	—	4.0
V17	195	210	15

* No signal. † Synchronised to signal.
‡ No measure, high flyback voltage.

Raster cramped top or bottom. For cramped top, reduce R58 ; for cramped bottom, increase R58. C57 and C59 also have an effect.

Line scan non-linear on right. Increase C51 up to limit of 500 pf ; experiment with C43 and C44.

Poor frame hold. Check C53 ; this insulation must be very good.

New G.E.C. Barretter

THE new 305 barretter recently introduced by The General Electric Co., Ltd., is a hydrogen-filled current regulator. It has been designed primarily for the protection of series-connected television receiver heater circuits, using 0.3 amp valves.

The wide variation in mains voltage experienced under present-day conditions is a contributory cause of premature failure of valves or picture tubes due either to over- or under-running. There is no guarantee that the set-up of the mains tap on a receiver will correspond to the actual voltage at any time. Too high a setting of the tap when the mains voltage falls results in loss of focus and sometimes in the ultimate poisoning of the cathode and loss of emission ; too low a setting of the tap when the mains voltage is high may result in short life, particularly to the picture tube or the cathode emission.

The introduction of the G.E.C. 305 barretter into the heater chain ensures that the current is maintained within 5 per cent. of its nominal value of 0.3 amp for a voltage drop across the barretter of 40-90 volts. It obviates the necessity for a tapped series resistor for the heater chain, but the use of a limiting device (Thermistor) is usually still necessary to prevent excessive current surge when switching on from cold. The tapped resistor for the H.T. circuit will normally still be required.

The barretter has a pear-shaped glass bulb mounted on a standard Edison screw base. Its overall length is 95.5 mm. (max.) and its diameter 45 mm. (max.). Its maximum operating temperature is 350 deg. C.

PREVENTING INSTABILITY

METHODS OF PREVENTING UNWANTED FEEDBACK

By Gordon A. Symonds

PROBABLY one of the greatest obstacles to constructors is finding the cause of and curing instability in a newly built receiver. If tackled systematically, success can be achieved very quickly, but frayed tempers and finally abandonment are the result of a haphazard and unplanned search. The best method is, of course, prevention rather than trying to cure the instability after it has occurred. To do this one must design the receiver in such a way as to make it difficult for the trouble to start.

Most constructors favour the straight circuit, primarily because of its simplicity of alignment. In the author's opinion, however, this type of receiver must be very well designed if a completely stable result is to be obtained.

With those constructors living well within the service area of a TV transmitter the trouble in question may never arise, since only a moderate amount of amplification of the signal is needed, but those who have the misfortune to be at the fringe of the area, or beyond, as is the author's case, will doubtless encounter the trouble sooner or later.

Symptoms

Beginners to television receiver construction may not be aware of the symptoms of instability, so it is proposed to run over them briefly at this point.

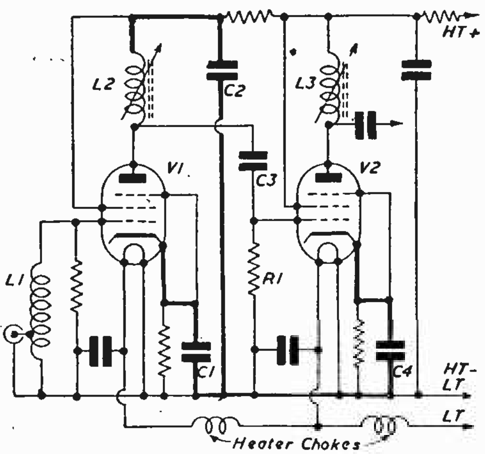


Fig. 1.—Section of circuit commonly used in amateur built receivers. Heavy lining indicates the earth return circuits of L2.

Firstly, it is caused by unwanted coupling, usually between the input and output circuits as these are the points of greatest difference in signal level ; or it may be because of bad layout, that only one or two stages are in a state of oscillation. A receiver for use on the fringe will have a gain of the order of 100,000 times ; it therefore only requires one 100,000th part of the detector output to find its way to the receiver input to sustain oscillation. The need for very thorough screening will thus be apparent.

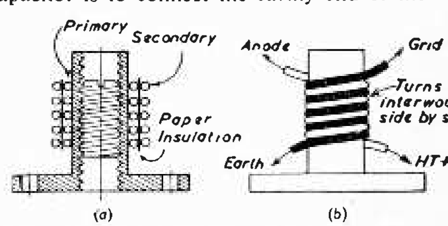
With the gain control at a low setting, and assuming there is nothing else wrong with the receiver, it will probably behave quite normally. As the gain is increased and the point of instability neared, the definition of the picture becomes impaired. A further increase in gain causes flaring of whites, making them extend well beyond their normal boundaries. There may even be a considerable increase in valve-noise, which will appear as large white blobs over the whole screen. Finally, a further increase in gain sets the receiver oscillating ; all signs of a picture disappear, leaving a very brilliant, defocused raster if the tube is directly connected to the video valve anode, or, if a capacitive coupling with D.C. restoration is employed, the tube face will be unilluminated.

Tuned-anode Coupling

A section of a circuit commonly used in amateur-built receivers is shown at Fig. 1. Tuned-anode coupling is employed, C3 conveying the signal to the grid of V2. R1, which completes the grid circuit of V2, also serves to damp L2 to give broad-band characteristics. For correct operation the H.T. end of L2 must be connected, as far as R.F. is concerned, to the cathodes of V1 and V2. This is done by C1, C2 and C4. L2 is, therefore, common to both the anode circuit of V1 and the grid circuit of V2. The R.F. return path, indicated by the heavy lining, is seen to be completed through the chassis, and since with this form of coupling all stages will use the chassis as part of the return circuit it can easily be the cause of unwanted coupling between the circuits.

Tinplate Chassis

It is common practice in amateur circles to use a tinplate chassis and to solder all connections to this. At first sight this may appear to be the best method of obtaining very short earthing leads, but it should be remembered that the R.F. currents, which are being bypassed, do not finish here. The object of the bypass capacitor is to connect the earthy end of the tuning



Figs. 2a and 2b.—Two methods of making 1 : 1 transformers.

inductors and the screening grids to the cathode of their respective valve. So that as far as R.F. is concerned they are at the same potential. This cannot be made a direct connection, as there usually exists between the coil and cathode, and certainly between the screen-grid and cathode, a D.C. voltage difference. The capacitor, however, provides the R.F. current with a low-impedance path and effectively connects these points together.

With the type of intervalve coupling used in Fig. 1 the number of R.F. stages in a straight televisor for use within the service area is usually four. Thus there are a great many chassis connections, with the result that R.F. currents are flowing in all directions at the same frequency and at various stages of amplification in the same conductor.

If instability is present in such a receiver, and it is not a very bad case, a cure can possibly be effected by cutting a narrow slot across the chassis between each stage. The object being to isolate to some extent the individual circuits and prevent R.F. currents from later stages influencing those where the signal is weaker. This is only possible, of course, where the earthing points are conveniently grouped around the valveholder.

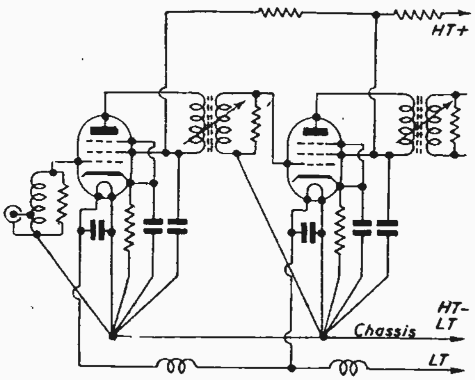


Fig. 3.—The use of double-wound coils and taking all chassis connections to one point for each stage eliminates chassis currents.

Single Point Connections

Taking all chassis connections to one point for each stage greatly assists in preventing instability, but there still remains the problem of C2, in Fig. 1, which is common to both stages but which cannot be earthed at both stages without incurring long leads. There is quite a simple method of overcoming this, and, incidentally, the author fails to understand why it is not used more in televisors sold in kit form and intended for home construction. The method is simply to make all tuning inductors in the form of 1 : 1 transformers.

If the coupling is made very tight they behave for all practical purposes in the same manner electrically as a single coil. Two methods of winding are available to the constructor and these are shown at Figs. 2a and 2b. In Fig. 2a the secondary is wound over the primary with one turn of waxed paper between the windings for insulation. In 2b the method is to put both windings on together so that the turns are completely interwound. If this type of coil is employed it is advisable to use wire with an insulation of enamel and single silk since the H.T. voltage exists between the two windings.

Owing to the fact that it is impossible to obtain 100 per cent. coupling a certain amount of band-pass effect is present. The coils resonate at the frequency to which they are tuned and to a much higher frequency depending on the actual degree of coupling. At this very high frequency, however, the input resistance of the valves will be so low that it is quite possible for the stage gain to be less than unity resulting in no amplification at these frequencies. The circuit thus behaves as it would with single wound inductors.

Two points to remember when changing to this type of coil are : 1, Each winding will require approximately 25 per cent. more turns than the single coil it replaces. 2, Adjacent ends must be connected as shown in Figs. 2a and 2b, arranging that the H.T.+ and earth connections are at one end of the winding and anode and grid at the other.

Fig. 3 shows a typical circuit in which these coils may be used. Here it will be seen that the grid coil and all the decoupling capacitors are taken to one point for each stage, thus making the R.F. circuits completely independent of the chassis. A convenient method of doing this is to place solder-tags under the

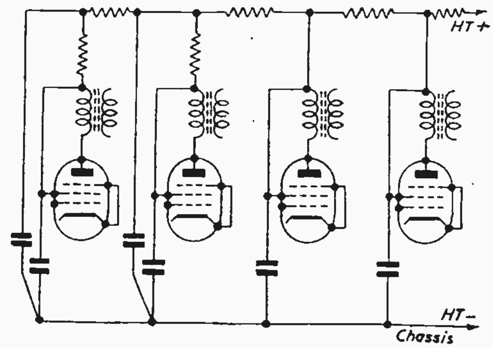


Fig. 4.—Skeleton circuit indicating the method of providing progressive H.T. decoupling.

valve-holder fixing nuts, and to run a tinned copper wire from one tag, passing to all valveholder tags that require earthing, and finally to the remaining solder-tag. All earthed connections for that stage are then made to the copper wire at the most convenient point. The H.T. and L.T. supplies must, of course, flow through the chassis, but if decoupling is adequate this should not give rise to any R.F. coupling.

Progressive decoupling of the H.T. supply is recommended for straight receivers (see circuit at Fig. 4) with double decoupling on the early stages. It is also advisable to connect a .001 μF capacitor across the heater pins at each valveholder and to supply the L.T. through heater chokes. These can be self-supporting coils made of 20 S.W.G. tinned copper wire insulated with P.V.C. sleeving. About 15 turns close wound to a diameter of approximately ½in. will suffice.

These precautions are not normally necessary in a superhet receiver owing to the much smaller degree of amplification at any one frequency. The heater chokes and capacitors can be dispensed with, and the anode decoupling arrangements simplified. One decoupling resistor and capacitor is usually sufficient for each stage, taken direct from the H.T. rail which can be run through all stages.

The usual form of chassis used by amateurs is one of channel section divided into compartments by fitting screens across the valveholders, the coils being mounted one in each compartment. While this amount of screening is usually sufficient for a superhet, a straight receiver requires considerably more, and it

(*Concluded on page* 136).

Conversion To Magnetic C.R.T.

DETAILS OF TWO EASILY BUILT UNITS BASED ON ELECTROSTATIC TIMEBASES

(*Continued from page 66, July issue.*)

IF E.H.T. is being produced and the C.R.T. heater is receiving correct voltage, then it is possible that the cathode of the tube is at too high a potential. Try dropping it down the H.T. potentiometer network by connecting VR4 between R12 and R13 instead of R11 and R12. In the limit it can be dropped down to earth potential, for test purposes.

Check that an H.T. voltage does not exist on the grid of the tube. (A small positive voltage will be felt here because of the action of the phase splitter valve.)

If E.H.T. is not being produced, then the Line circuit should be inspected and by means of a loudspeaker or phones the sawtooth oscillation should be traced from the sawtooth oscillator to the coils of the scanning assembly.

Important.—Do not try to connect phones or speaker across anode circuit of V1. Very high voltages are produced at this point and a nasty shock can be obtained.

Brilliance Control will not Black Out Raster

Switch off. Now check the grid circuit to ensure that it is connected to earth at some point. (It should be earthed via the cathode resistor of the phase splitter.) Check that H.T. positive is reaching the cathode.

If both these points are in order, try splitting R11 into two 27 KΩ 1 w resistors and insert the brilliance control between them. Now try again.

In the limit, insert the brilliance control between the H.T. rail and R11.

Line Only Received

This simply means that the frame circuit is not functioning and it can be checked in the manner suggested previously, with the aid of phones or loudspeaker.

Raster Much Too Large. No Focus

This is caused by too low an E.H.T. and the circuit should be checked. Increasing the applied H.T. to V1 will improve matters but care must be taken not to overrun this valve.

Raster Much Too Faint

See remarks under the paragraph above and under "Nothing seen on the screen." If you are using a second-hand tube beware! Some of them suffer from low emission.

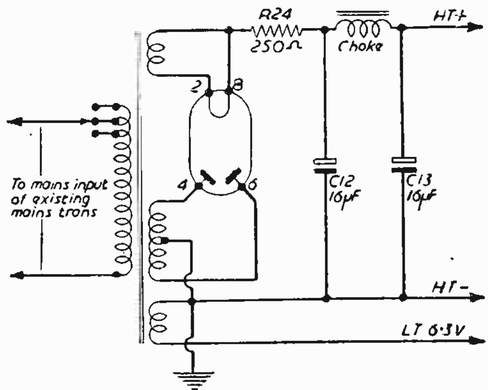


Fig. 16.—The power supply.

Raster Distorted on Left (Wavy Lines)

This is due to interaction between frame and line coils. Try increasing damping across frame coils.

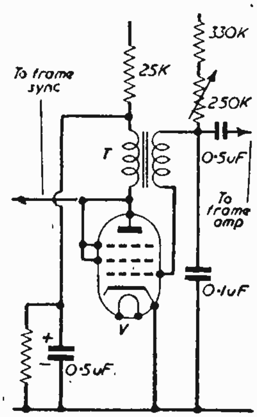
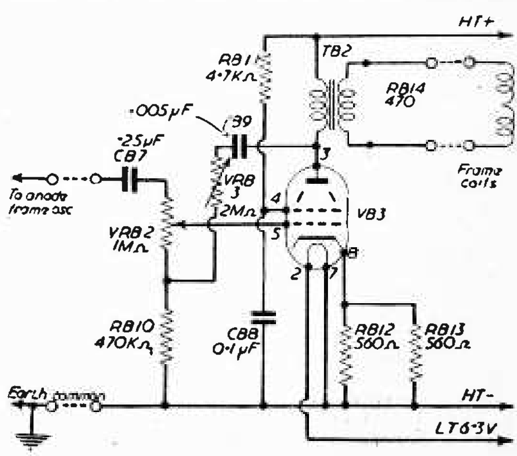


Fig. 17 (left).—The oscillator stage of Model "B".

Fig. 18 (right).—The frame output stage of the receiver.



Bright Line on Left of Raster

This is due to line non-linearity and can be corrected by operation of the line linearity control.

General Non-linearity of Frame and/or Line

It should be remembered that defects in the line or frame oscillator circuits which were not noticeable on the small VCR97 become rather magnified when using a larger tube. The coupling components in the line and frame amplifiers of the new unit have been carefully chosen to suit inputs from Miller timebases. If linearity is poor, attention should be directed to the oscillator circuits themselves.

Interlace is Poor

It is admitted that the Miller type of oscillator is inclined to fail in this respect though tolerable interlace can be obtained. To obtain 100 per cent. interlace is quite a costly business and many ingenious circuits have been devised.

For those who have serious trouble in this respect an alteration to the circuit can be made by scrapping the existing frame oscillator and using a blocking oscillator instead. A suitable circuit is given in Fig. 17.

Unit "B"

This unit has been designed on similar principles to the first unit, i.e., by using the existing sawtooth oscillators and constructing the unit as a self-contained line and frame amplifier.

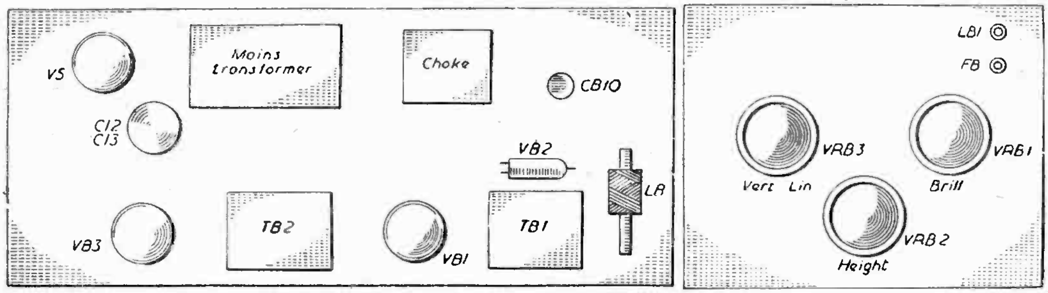


Fig. 20 (a) and (b).—Top view of chassis and panel of Model "B".

It was thought that some constructors would prefer to use standard methods of deriving E.H.T. through an overwound line transformer and this has required considerable alteration of the circuits.

A suitable set of scanning coils together with line transformer and frame output transformer have been used and they are standard parts, being quite easy to obtain.

The experimenter may depart from the specified design in so far as these components are concerned, provided the scan coils and their respective trans-

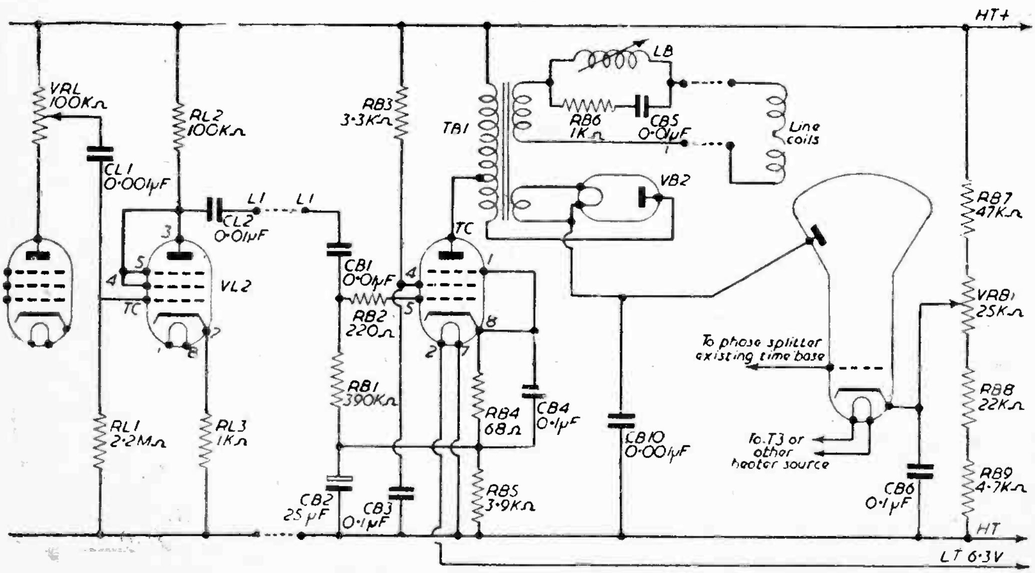


Fig. 19.—Line timebase amplifier, E.H.T. circuit and C.R.T. networks, using overwound line transformer.

formers are correctly matched. It is possible to reduce the overall cost by using ex-bankrupt stock.

Whatever components are used, the frame output transformer must be suitable for use with a valve of the 6V6 class and the line transformer suitable for use with a valve of the EL38 class.

The new frame circuit is given in Fig. 18. The basic principles are the same as those in the previous version though the component values have been altered. This is because of the use of the transformer output feeding low resistance frame coils and the input to the valve must be suitably shaped to provide a linear scan through the coils.

The line circuit is shown in Fig. 19. Again it is quite orthodox, though component values will be found a little different from those in the previous version. The phase reversal stage remains the same as before and is built in the existing timebase.

In this circuit E.H.T. is derived from the line flyback, but the transformer is overwound to provide a step-up in voltage, the resultant being rectified by the EY51 rectifier. The constructor may, if he wishes, use a metal rectifier for this position and the 36E.H.T.100 will be found to be a suitable type.

VRL will be found to function as a linearity control while width is controlled through the inductance LB. LB can be mounted on an easily made bracket on the main chassis.

The heater of the C.R.T. can be fed directly from the 6.3 v. common if it is rated for that figure, and if the tube is free from cathode-heater shorts. Otherwise a separate heater transformer must be used and this can be either one of those available commercially, or can be constructed on the lines of T3 in the previous version.

Coupling between existing timebase and the unit is made in the same manner as in the other unit by using coaxial cable and Pye plugs and sockets. Controls are mounted on the front panel, though once again the panel is not strictly necessary and they can be mounted directly on the chassis.

The chassis can be made of any suitable material which is to hand and a layout diagram is given in Fig. 20.

A wiring diagram is given in Fig. 21. The C.R.T. chassis wiring is the same as that in Fig. 14. A chassis for the C.R.T. should be constructed on exactly the same lines as for the previous unit.

Preliminary setting up and faulting are the same as for the previous unit.

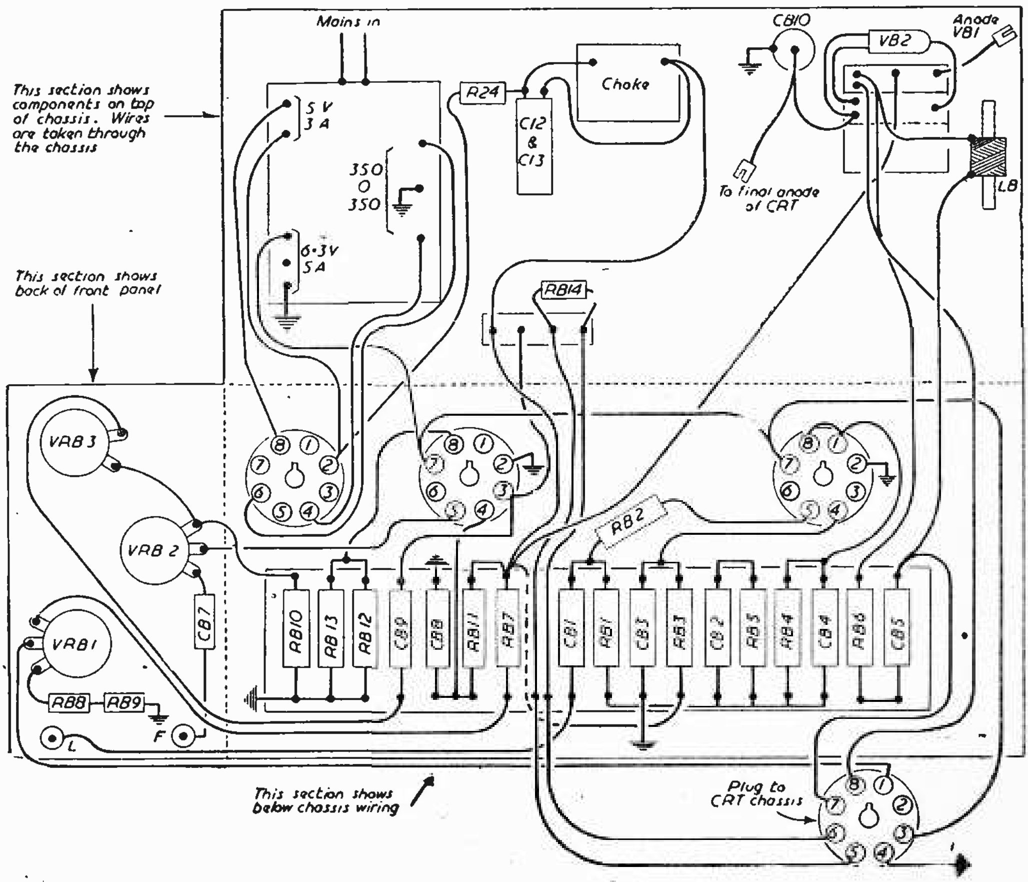


Fig. 21.—Wiring Diagram of "B" Unit.

Picture Tube Control

BRIGHTNESS CONTROLS AND MODULATION ARRANGEMENTS

By "Engineer"

THIS article is not intended to describe the actual function of a picture-tube as an entirety, for this has been adequately covered elsewhere (see "More About the Cathode-ray Tube," PRACTICAL TELEVISION, October, 1951). Neither shall we go very deeply into the mode of beam deflection, for, again, information in this respect can be found in a previous article in this publication (see "Scanning Amplifiers," PRACTICAL TELEVISION, May, 1952), but here we shall concentrate mainly on how the electron beam is modulated, and how the various tube controls make this a visible possibility. Our discussion will embrace suitable commercial circuits and their style of operation in this connection, together, of course, with faults that often develop and cause the constructor and experimenter much bewilderment.

Brightness Control

First of all then, it must be possible for us to obtain illumination on the tube face ; we know how this is achieved, and we also know that our timebase circuits are engaged in deflecting the scanning spot on the screen vertically and horizontally, thus firming our raster, upon which the image is created.

Now before we go any further let us get clear in our minds that a plain unmodulated raster should not be visible on the screen when the brightness control is correctly adjusted—we have, of course, seen an unmodulated raster, but only because we wanted to, and made it possible by advancing the brightness control beyond its correct setting. This does not mean, however, that we should turn the brightness control right down and hope for the best, for the black level limit of a picture is determined by this control ; therefore, its accurate positioning must first be achieved before a picture of correct contrast ratio will resolve.

We know that by advancing the brightness control we are simply reducing the negative potential on the grid electrode of the picture-tube relative to the cathode, and as with any radio valve this function allows the cathode-to-anode passage of more electrons and, on the picture-tube, more brilliance. Now, if we consider this in conjunction with the grid voltage/anode current characteristic of a picture tube, we shall begin to realise why it is so important to ensure that the brightness control is accurately adjusted in the first place. The curves of Fig. 1 depict such a function, and, also show the application of a video signal which makes the grid potential less negative, dependent on video signal amplitude, irrespective of whether the tube is cathode or grid modulated—we shall understand this better later. In the meantime, though, let us investigate the curves a little closer—in fact, let us concentrate our attention on the curve at (a). From this one we can see that the operating point on the grid volts line has been adjusted for beam current cut-off—representing black signal level. Thus, as the signal swings into the white region, the grid potential is made less negative, and the picture-tube screen is illuminated ; the actual brilliance being determined, of course, on the precise amount of white in the signal element. At the end of a line (or frame) scan a sync. pulse is also applied to the tube, but this carries the grid potential even more negative than what it is at normal black level, or, in other words, the picture signal goes blacker than black—into the sync. pulse region.

All is well—provided we are really operating on this point of the grid volts line. But how can we be absolutely certain that the brightness control is adjusted for this desired working condition ? Well, this is easy enough by first of all ascertaining that no modulation or signal of any sort is reaching the tube. The best way of ensuring this condition is by retarding the contrast control and removing the aerial lead from the receiver. Next, turn up the brightness control until an unmodulated raster is displayed on the screen ; and then gradually back off the brightness setting until the raster *only just* fades away—finally, make certain that the control has not been retarded beyond the optimum point.

We can see from this, of course, that the illumination of the room at the time of adjustment will determine the optimum setting, for it is obvious that the "blackest" black obtainable on a picture is dependent on the room illumination which is reflected from the picture-tube screen ; it follows, therefore, that true "blacks" can be obtained only in a completely dark room.

Certain manufacturers position the brightness control at the rear of their receivers in the form of a pre-set adjustment. This is really a good idea, and one which minimises the temptation of advancing the brightness setting should the picture signal fade

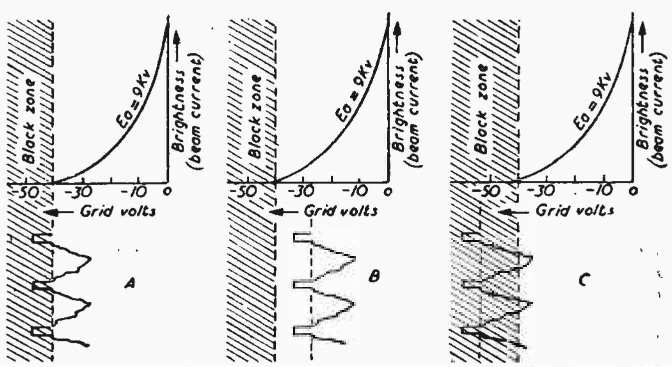


Fig. 1.—Diagrams showing the effect of picture contrast ratio for various brilliance settings. (a) Correct, (b) too much and (c) too little brightness.

—often this undesirable operation is practised ; but with the " contrast " in the form of a main control at the front of the receiver, a picture fade is rightly counteracted by an advancement of the contrast setting.

The curves at (b) and (c) indicate the effect of too much and too little picture brilliance respectively—(b) will result in a picture of diminutive contrast ratio. The real " blacks," for instance, will be manifested as a light grey, and since the screen illumination is not completely extinguished during the sync. pulse periods, flyback lines will be visible across a picture of apparent " flatness."

On the other hand, condition (c) will create a reverse effect—the light greys will be shown as black, and a picture will appear in heavy contrasted form, sometimes known as a " soot and whitewash " effect !

A similar set of conditions is bound to result should the contrast control be incorrectly adjusted. Nevertheless, once we have accurately adjusted the brightness control and reinserted the aerial connection, it is a simple matter to turn up the contrast control until a picture of correct contrast ratio is formed—this is perferably done by making full use of the tuning signal radiated before the commencement of a programme sequence.

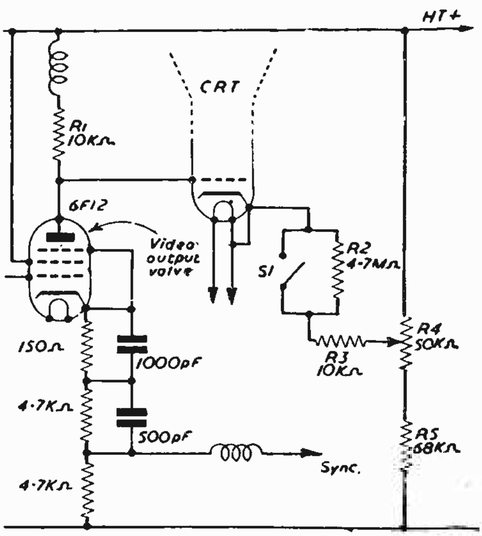


Fig. 2.—The picture-tube control circuit of an old-style Murphy receiver.

Picture-tube Bias

The question of tube bias often puzzles the beginner, particularly when one talks of negative grid bias, and yet the grid is found to be in direct contact with the H.T. rail ! Let us investigate a typical picture-tube circuit and discover the solution to this apparent paradox. The circuit at Fig. 2 depicts the brightness control and video output stage as used in one of the older style Murphy receivers—as we can see, grid modulation is adopted, and apart from certain refinements, the network is typical of many employing this mode of modulation.

Here we have the picture-tube grid electrode in direct contact with the anode of the video output valve, which will, in most cases, correspond to a potential in the region of 250 volts. Now the most important point to remember is that the potential at the grid of the picture-tube must be measured relative to the cathode—and not relative to the earth line which would, of course, give it a highly positive potential. The cathode potential can, therefore, be looked upon as a neutralising potential, sufficient—for correct operation (see Fig. 1a)—to make the grid 40 volts negative with respect to cathode. Knowing, therefore, that for zero video signal the anode of the video valve reads a steady 250 volts, we can clearly see that it is necessary to raise the cathode potential 40 volts above this figure for beam cut-off. The precise point is determined by the brightness control, which is arranged, by virtue of resistor values, to provide beam cut-off at its approximate midway setting.

Thus, once we have positioned this control for correct operation, the negative going video signal arriving at the grid of the video output valve will reduce the current through the load resistor (R1), and cause the anode potential to rise—or, in effect, apply a positive-going video signal to the grid of the picture-tube. This, of course, will reduce the negative grid cathode bias potential, and create a brightness on the picture-tube screen dependent on the magnitude of the video signal.

A special feature of the circuit in consideration is the 4.7 megohm resistor shunted by a switch in the cathode circuit of the picture-tube. This switch (S1) is ganged to the main on/off switch, so that when the receiver is switched off S1 opens and includes the high resistance in series with the cathode circuit, which acts as a very efficient beam-limiting device, and prevents the formation of the large blob of illumination on the tube screen, often typical of this type of receiver when switching off.

Cathode Modulation

The circuit shown in Fig. 3 is from the Ferguson Model 988T, and since the anode of the video output valve is directly connected to the cathode of the picture-tube the arrangement is sometimes called

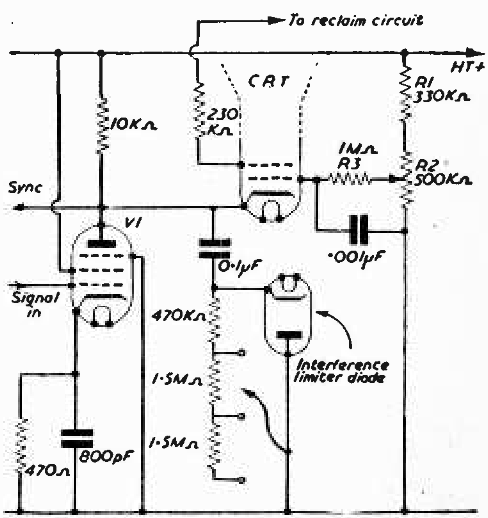


Fig. 3.—Picture-tube control circuit of the Ferguson Model 988T.

cathode modulation. Tube modulation, as we have already seen, infers a variation in beam current (or screen illumination at any instant depending on the character of the transmitted picture element); therefore, the only way this can be performed is by subjecting the grid to the varying video signal potentials. Nevertheless, by applying the signal direct to the cathode the same effect is created as we shall see.

Again, we must consider the picture-tube grid potential with respect to cathode, but in the case in question the cathode is held at a constant potential (provided no video signal is present) determined by the potential at the anode of V1. Therefore, to make the grid 40 volts negative with respect to this potential it must be taken to a point in the circuit 40 volts less positive than the cathode. This is easily provided by incorporating the brightness control circuit in connection with the grid and the H.T. positive line. Resistors R1, R2, and R3 perform this function and are so arranged in value that the midway setting on the brightness control R2 corresponds to beam cut-off.

Let us assume, then, that the tube is adjusted exactly for beam cut-off, and a *positive* going video signal is applied to the grid of V1, in which case the current through V1 increases depending on the magnitude of the signal, and the potential at the anode reduces in sympathy. In effect, then, we have the picture-tube cathode potential swinging to something less than 40 volts with respect to grid, or in other words, the control grid swings to something less than minus 40 volts with respect to cathode—it boils down to the same thing, anyway! We can see then that with cathode modulation we vary the grid potential in a roundabout sort of way—the effect is precisely the same whichever method we decide to adopt. Certain design advantages are gained by employing cathode modulation, and the picture-tube is exposed to less danger under certain fault conditions.

Fault Effects

Once the basic principles of any circuit are mastered it is a good idea to endeavour to visualise the effect which certain component faults may manifest on the picture-tube screen. In this respect let us first consider the circuit of Fig. 2. A total failure of the video output valve in this circuit will, of course, take the tube grid to the H.T. line potential, since no volts will be dropped across R1. The brightness control circuit will not be able to counteract this potential, even at its minimum setting, for then the picture-tube cathode will be at the same potential as the grid, and zero bias potential will exist between grid and cathode. At any other setting of the control, the control grid will go positive with respect to cathode. A highly dangerous set of conditions, so far as the picture-tube is concerned, will result, which will give rise to an intense glare on the screen that can be extinguished only by switching the receiver off.

The same symptoms would, of course, result should the valve cease to pass current for any other reason—an open circuit heater wiring, or cathode circuit, for instance.

A partial failure of the video output valve might take considerable time to diagnose, unless one is well versed with the accompanying symptoms. The usual effects are that the control of brightness is limited—screen illumination can be observed, even with a minimum setting of brightness and contrast controls—coupled with a poor, weak picture, often accompanied by an unstable picture lock.

Faults in the brightness control circuit itself are usually self evident, particularly if the brightness control goes open circuit at one point of the track. R5 going open circuit would, of course, have the effect of holding the tube cathode more positive than the grid irrespective of brightness control setting, with a consequent cutting-off of beam current. The same would apply should R3 fail. A point worthy of note, particularly with circuits embodying a beam-limiting device (S1, R2), is that if the switch which

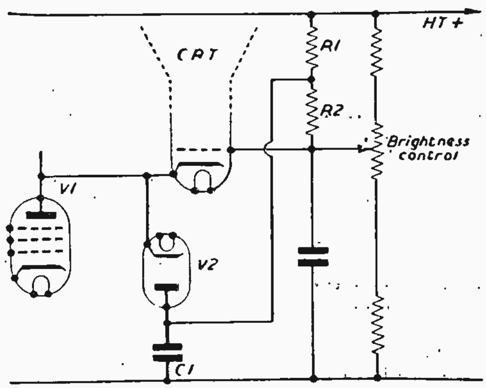


Fig. 4.—Illustrating the vision interference limiter circuit as used in certain G.E.C. receivers.

introduces the resistance does not close properly on switching on, a degree of hum with some loss of picture brightness will result due to the limiting of the beam current.

Referring now to Fig. 3, we can see that a failure of V1 in this circuit would produce a converse effect, for the grid would be less positive than the cathode under fault conditions, thereby giving rise to beam cut-off. Again, symptoms similar to the previous consideration would be evidenced due to faults in the brightness control network, as also by a change in the working conditions of the video output valve.

Picture-tube Faults

The commonest faults in this category are inter-electrode shorts, especially the heater-to-cathode short-circuit, which may, of course, produce varying symptoms depending on the picture-tube control arrangements. Although the leakage which may develop between electrodes is seldom measurable, a complete receiver breakdown may result, which might not at first be associated with the picture-tube. With a heater-to-cathode short the usual symptom is uncontrollable brilliance; this is easily realised if we consider the circuit of Fig. 3, bearing in mind that in this receiver the tube heater is at chassis potential. Thus, the cathode potential together with picture signal is short circuited, and the grid goes highly positive with respect to cathode—a dangerous situation indeed. A similar effect would occur on a grid modulated tube, but sometimes the picture modulation may be vaguely discernible beneath the flare of the screen.

These remarks, however, would not apply to the circuit of Fig. 2, for here the cathode of the tube is externally connected to one side of the heater.

(To be continued)

FAULT SYMPTOMS

THE CAUSES OF COMMON FAULTS, AND METHODS OF CORRECTION

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

AN understanding of the reason why a defect in a television receiver produces a certain characteristic symptom on the picture-tube screen or from the loudspeaker enables the service engineer or experimenter to locate the faulty section and responsible component in the minimum time. From such an aspect this article has been written, and in it we shall follow closely the reason why a failing or altered value component can upset the desired working conditions of a certain stage and thereby give rise to the various tell-tale symptoms which are often looked on by experimenters as uncanny occurrences well beyond their comprehension.

Various commercial receivers and the effects to be expected under typical fault conditions will also be considered. This style of presentation should assist the home-constructor who is desirous of servicing his own equipment and give him at least some idea as to the probable cause of the trouble.

Pulling on Whites

This fairly common effect is essentially the result of a poor high-frequency response from the circuits preceding the sync separator stage, and is particularly noticeable on test card " C " where it appears in the form of a series of " stepped " edges to the circle or any vertical section of the pattern. Observation will show that the white squares—which together with the alternate black squares form the border of the test card—coincide with the steps to the left-hand side of the circle or vertical pattern formation. This, of course, creates the illusion that the black sections of the border produce a displacement to the right-hand side of a vertical section of the test card, and in this way the impression of steps is formed.

When viewing a picture the symptom can be most disconcerting, for it gives the appearance of white portions of the picture moving sideways to the left, and when a scene changes or a subject movement occurs the magnitude of horizontal picture displacement, or picture tearing, also changes.

The reason for this effect can best be understood if we first examine the signal corresponding to one scanning line of a television image. This is shown in the diagram of Fig. 1, and from this we can see that the line starts always with a black (representing 30 per cent. modulation) lasting for 5 microseconds. Similarly, at the finish of the line the carrier again falls to the black level for half a microsecond. These black level intervals are sometimes termed the front and back " porches " to the sync pulses, and their purpose is to facilitate a change in carrier level from black to peak-white (or from peak-white to black) which might occur at the beginning or the end of a line-scan. It would, of course, be almost impossible to make the amplitude of the carrier rise instantly from zero level to 100 per cent., and no receiver could respond to such an instantaneous change in modulation level, anyway ; but if the preceding line does happen to finish at white, the half microsecond interval is sufficient to restore the signal to the black level before the sync pulse occurs.

Now, if the high-frequency response of the circuits in front of the sync separator is poor, the effect of the black level interval will be lost, and a degree of delay will occur before the signal returns to the black level. This will have a delaying effect on the sync pulse, so that the succeeding line will be displaced. We can clearly follow how this happens when it is realised that the sync pulse will cause the line generator to " fire " late, and the following line-scan will, therefore, start late. This effect is illustrated by the waveform at Fig. 2, and it will be appreciated, of course, that the delay cannot occur to the same extent if the sync pulse follows a black line, so that under these conditions no line displacement is evidenced.

A poor high-frequency response of the video channel proper could, of course, be the prompting factor of pulling on whites, but if this is so an examination of test card " C " will reveal that the receiver is failing to resolve the vertical gratings which correspond to the higher video frequencies. In this case, then, our aim must be to discover where in the video circuits we are losing the higher picture modulation frequencies. Usually—particularly in home-constructed receivers—the symptom is brought about by incorrect vision channel alignment, and is easily corrected by realigning the receiver to the specifications stipulated by the designer. It has been known for " pulling " to be due to two or, in some cases, to only one tuned circuit slightly out of adjustment. Therefore, before settling down to the task of completely realigning a receiver displaying the symptoms of pulling on whites, it may be advisable to adjust each tuned circuit associated with the vision section of the receiver in turn during the transmission of the test pattern, and noting which of the iron dust cores effects the pull, making certain, of course, to return

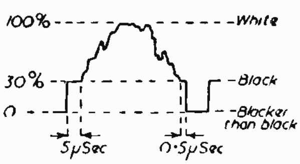


Fig. 1.—The signal corresponding to one scanning line of a television image.

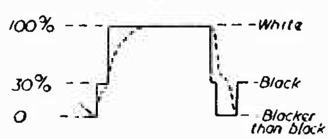


Fig. 2.—The solid line shows the video waveform corresponding to a white line, whilst the dotted curve depicts the effect of an inadequate H.F. response.

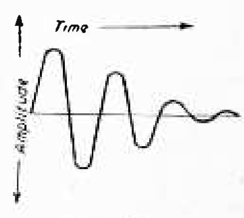


Fig. 3.—A, damped oscillation.

the cores to their original positions if no alleviation of the effect is observed.

Oscillator Drift

In superhet style receivers—and this applies equally to commercial models—a frequent cause of a falling high-frequency response can be traced to a drift in the frequency of the local oscillator. Certain receivers employ devices to combat oscillator frequency drift, which is invariably the result of temperature changes of critical elements of the oscillator circuit. Other receivers, particularly the older types, employ no such artifice, and it is often necessary to make slight adjustments to the oscillators of these receivers from time to time to maintain not only picture quality but also sound volume, and to minimise the effects of vision on sound, or sound on vision.

The R.F. or I.F. circuits also tend to drift for the same reason, but owing to the less critical nature of such circuits a slight drift in frequency is rarely noticed on the picture. Sound vibration from the loudspeaker, however, often tends to upset the alignment by loosening the iron-dust tuning slugs in the coil formers, and causing them to turn slightly so that over a period of time a marked deterioration in picture quality is observed, often coupled with the symptom of pulling on whites.

There is also the possibility for a damping resistor associated with one of the vision-tuned circuits to go open circuit, and even though this is not a very common occurrence it should not be overlooked, especially if the symptoms connected with a poor high-frequency response suddenly develop. On the other hand, the video output stage is more liable to develop a fault affecting the amplification of the higher video frequencies. In this respect the anode load resistor—which, in order to maintain a good high-frequency response, has to be of fairly low value (see "The Video Amplifier," PRACTICAL TELEVISION, March, 1952)—sometimes goes high in value, and in consequence produces a marked reduction in relative high-frequency output.

Certain circuits of this nature often embody a high-frequency compensating network in the form of an R.F. choke in series with the anode load resistor. Sometimes the choke develops short-circuited turns which reduce its effective inductance and modify the amplification of the higher video frequencies. Another method of correcting the high-frequency response of the video output stage is by the inclusion of a critical value capacitor across the cathode resistor. An un-bypassed resistor would, of course, introduce a degree of negative feed-back and therefore reduce the gain at all frequencies, but the presence of the capacitor modifies the effect so that more feed-back occurs at the lower than the higher frequencies, and thus the overall response of the stage is maintained to correspond to the desired working conditions. It follows, therefore, that an open circuit or a reduction in the value of the cathode decoupling capacitor will alter the desired effect and reduce the video output at the higher frequencies.

It may happen, however, that the effect of pulling on whites is not accompanied by a reduction in picture band-width, in which case the most likely cause is the presence of stray capacitance in the coupling between the video output stage and the input of the sync separator. Unless the relevant wiring has been severely disarranged, this effect rarely occurs on commercial equipment. If the receiver is home-constructed, however, conditions may be a little different, for the coupling components may be mounted so that they have a too high capacitance to chassis, in which case the remedy lies in circuit rearrangement. The use of metal-cased type capacitors should be avoided in this section owing to their excessive capacitance between circuit and case, or if they are used, care should be taken to ensure that they are not in direct contact with the chassis.

Astigmatism

This effect is usually prompted by a defective picture-tube and, owing to its less known cause, is one which often bewilders the experimenter. The symptom is displayed by the inability of the receiver to resolve clearly any vertical definition when adjusted for optimum focus in the horizontal plane. For instance, a receiver manifesting the effect of astigmatism will generally focus the horizontal scanning lines sharply, but at the same time the vertical picture definition will appear extremely poor. This can be better observed on test card "C," where the vertical bandwidth bars will clearly show the defect. A slight adjustment of the focus control from the optimum horizontal setting, however, will provide maximum vertical definition with a poor horizontal focus. With a receiver exhibiting such conditions it is, therefore, advantageous to compromise between the two focus control settings, and thus obtain a picture of moderate definition. Unfortunately, however, such a precise adjustment is rather difficult to achieve in practice, unless, of course, it is actually performed during the transmission of the test card.

The fault is due to an asymetrical scanning spot, which, instead of being truly circular, assumes an elliptical form. The axis of the ellipse, however, rotates with focus control adjustment, or focusing field; and maximum horizontal focus results when the major axis is in a horizontal plane. In this position, then, we can clearly visualise why a reduction in vertical resolution occurs, and why the converse follows when the major axis of the elliptical scanning spot manifests in a vertical plane.

The elliptical spot is generally due to a picture-tube defect, resulting from asymmetrical electrostatic fields within the tube and, apart from tube replacement, little can be done to remedy completely such a defect. A degree of alleviation is sometimes available, particularly if the effect is aggravated by the presence of any stray fields, by rotating the tube with respect to chassis to an optimum position.

Horizontal Scan Distortion

One of the most disconcerting distortions in this connection resolves on the left-hand side of the screen in the form of alternate dark and light vertical bars. Generally speaking, this effect is the result of damped oscillations which are prompted to become superimposed on the line sawtooth waveform during the flyback period. What actually happens is that the large voltage pulse—which is created during the line flyback—jolts the inductive and capacitive elements of the line output stage into oscillation. The line output transformer and scanning coils, together with their self and stray capacitances, form a tuned circuit which is resonant in the region of 30 to 50 kc/s. It follows, therefore, that during the flyback period the circuit is severely disturbed and tends to oscillate at its resonant frequency—much the same as a harp string which, if plucked, oscillates at the frequency to which it is tuned. In the case of the electrical equivalent, however, the flyback pulse can be taken to represent the "plucking" action. In both instances the effect is the same; we generate an unsustained (or damped) oscillation, meaning that its amplitude will diminish with time, as shown in Fig. 3.

The illustrations of Fig. 4 show at (A) the desired current waveform in the scanning coils, and at (B) how the waveform is modified by virtue of the damped oscillations. Since the oscillations are superimposed on the portion of waveform corresponding to the start of the scanning stroke, they tend to distort the left-hand side of the raster by alternately cramping

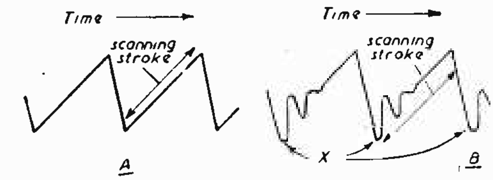


Fig. 4.—(A) The desired current waveform in the scanning coils, and (B) how the waveform is modified by virtue of the damped oscillation.

and expanding it due to variations in the horizontal velocity of the electron beam, and thus the alternate dark and light vertical bars are formed.

Sometimes this effect is referred to as "ringing" in the line output stage; "ringing" in this sense is an ambiguous term which has nothing to do with bells, but simply refers to the effect of damped oscillations.

In the early days of television receiver design a form of frequency selective damping was employed in the line output stage to reduce the effects of horizontal scan distortion. This style of damping consists of a series resistor-capacitor combination connected in shunt with the scanning coils; the resistor performs the function of a damping device and prevents the line output circuit from oscillating at its natural or resonant frequency—just the same as the application of a finger on an oscillating harp string would cause the oscillations to cease.

The capacitor is incorporated simply to make the damping frequency selective; or in other words, it offers a high impedance to the actual scanning frequency, and a low impedance to the flyback. This is necessary to prevent the scanning stroke from being undesirably attenuated by virtue of the resistive element. A circuit after this style is depicted by Fig. 5, and it is in fact the method adopted by Murphy in their V114 and V118 receivers. It will be seen that a variable and two fixed resistors are embodied in the design; the variable element allows a controllable degree of damping to be selected at will, and this control is often notated "line linearity," for it will, of course, affect the left-hand side of the raster by virtue of modifying the flyback time. The two fixed resistors act as padders for the control, evening out the adjustment of linearity and preventing the scanning circuit from being shunted only by the capacitor, when the variable element is at its minimum value.

We can now clearly see, then, that an alteration in value, or a complete failure of one or more of the components connected with the flyback damping network, may alter the form of the horizontal scan and severely distort the raster. Heavy damping such as occurs if the resistive portion of the network is too low in value—or if the capacitive section is too high—will compress the left-hand side of the raster, and in severe cases a fold-over will result. Conversely, insufficient damping—due to a damping component going high in value—will stretch the left-hand side of a picture relative to the remainder; and a complete open circuit of one of the components will result in the extreme condition leading to the effects of velocity modulation.

A large amount of energy is dissipated in the damping resistor during the line flyback; in fact, the energy necessary for the actual purpose of beam deflection is negligible compared with the wasted energy! This is a true indication, of course, that the line output stage operates under extremely inefficient conditions when this mode of damping is employed.

In more up-to-date designs, however, this section of the receiver uses a much more economical method of damping, so that the energy, which would normally be dissipated in the damping resistor in the form of heat, is used to contribute to a portion of the actual scanning stroke. Instead of a resistor this type of circuit involves the use of a high voltage low impedance diode connected across the line scanning coils. An arrangement after this style and used by the G.E.C. in their model BT2147 series receivers is depicted by Fig. 6 (A).

The operation of the circuit being that during the first half cycle of damped oscillation (sections of waveform denoted (X) Fig. 4 (B)), the damping diode is wrongly connected in direction to allow it to conduct, but on the next half cycle passes the oscillatory energy into the 25 μF. capacitor C1 which charges and holds the diode at cut-off during the subsequent scanning stroke. We can realize this function better by referring to Fig. 6 (B), where we can see that the normal flyback comprises the section of waveform (a) (b); section (b), (c), (d) is virtually the initial negative half cycle of damped oscillation resulting from the flyback. Thus, from point (c) to (d) a fairly linear current rise commences to flow in the line scanning coils—derived solely from the oscillatory energy—and the scanning spot starts its horizontal sweep across the picture-tube. At point (d) the line output valve commences to conduct due to the effect of the sawtooth waveform from the line generator, and the remainder of the scan—section (d) to (e)—is derived from the actual power generated in the line output stage.

Owing to the damping effect of the conducting diode, the initial half cycle of oscillatory energy only is allowed to enter the scanning coils, and a distortionless scanning stroke is obtained, a portion of which is contributed from the oscillatory energy as

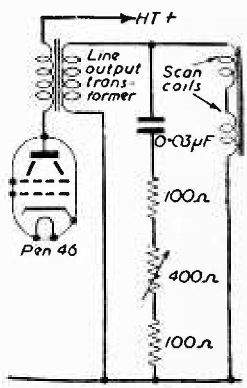


Fig. 5.—The flyback damping circuit as employed in the Murphy V114 and V118 receivers.

shown. It should be noted, however, that the amount of scanning current reclaimed from the oscillatory energy is dependent on the magnitude of damped oscillation. The employment of a special line output transformer—one providing a large degree of oscillatory energy (overshoot)—is essential to yield the full benefit from this type of circuit. Some constructors consider that it is only necessary to include a damping diode in place of the usual damping resistor to bring their receivers up-to-date. Unfortunately, this is not usually the case, for it is often necessary to replace not only the line output transformer, but also the scanning coils when it is desired to perform a modification of this kind.

Referring again to Fig. 6 (A), we can see that the steady voltage developed across C1 is effectively added in series with the H.T. line voltage before application to the anode of the line output valve. In this way the line output stage is made even more efficient in operation, and in certain cases the effective H.T. voltage can be raised as much as 25 per cent., but this again depends on the design of the output transformer and associated components.

Defects which give rise to a distorted scan in this type of circuit can usually be traced to a faulty charging capacitor (C1, Fig. 6) or a low emission reclaim diode. Although it does sometimes happen that, apart from a distorted scan, a reduction in picture width is also noticed when the essential reclaim components are responsible for the defect. An open circuit, or a "leaky" charging capacitor, should not be overlooked when investigating a receiver for this fault, and substituting the suspected components for some which are known to be efficient is the best way the experimenter can tackle a fault in this section—the secret being, of course, to *know* approximately where in the circuit the fault lies.

It often happens—and sometimes on new commercial receivers of certain types—that the effect of "ringing" is apparent even though the components, which could give rise to the effect, are known to be up to standard. When it has been established that the symptoms are definitely the result of line output stage "ringing" the responsible element may be excessive loss inductance in the line output transformer, for obviously any inductance (plus a little stray capacitance) in this section—whether loss inductance or otherwise—unless satisfactorily damped, will produce the same undesirable effect. Little can be done by the experimenter, however, to minimise inductive losses in the transformer, and it is very rarely the fault of the designer—for even designers have to operate to a price limit!

Home-constructors can ensure that loss inductance "rings" in their own receivers will be at a minimum provided the line output transformer employed is the one stipulated by the designer of the circuit. Excessive "ringing" will be observed, for instance, if it is endeavoured to obtain a wide angle scan from a standard transformer.

Any other inductive elements connected with the line output stage will tend to "ring" unless adequate damping facilities are provided. The picture width inductor (L1, Fig. 6), for instance, is a frequent offender in this respect, and is often shunted by a resistor-capacitor combination to provide not only damping, but also a fixed degree of horizontal linearity. It follows, therefore, that should a receiver suddenly display a bad horizontal form coupled with "ringing" to the left-hand side of the picture, the components C2, R1 (Fig. 6) should be suspected for an alteration in value or an open circuit.

It should be mentioned that, by the use of the auto transformer principle, modern line output transformers suffer less from the possibility of loss inductance "rings" than their older style counterparts, and for this reason such a mode of transformer design is being extensively incorporated in modern large-screen receivers.

Other Causes of Horizontal Scan Distortion

It sometimes happens that a certain amount of the energy liberated during the line flyback is radiated from the connecting leads associated with the line output amplifier, and finds its way back to the modulating electrode of the picture-tube. The resulting symptom is very similar to that of "ringing," but it is possible to determine the precise cause by temporarily decoupling the cathode and grid pins on the picture-tube to chassis, via a large value paper capacitor. Should the then unmodulated—but synchronised—raster be free of horizontal distortion the fault definitely arises from an unwanted coupling between the anode or grid—or both—picture-tube connecting leads and the line output stage. The remedy lies, of course, in re-routing the susceptible connecting leads clear of the line output amplifier and associated circuitry.

Another rather interesting symptom takes the form of an area of raster—about one-third at the left-hand side of the screen—being slightly brighter than the remainder, and sometimes the brighter section has the appearance of being affected by R.F. interference; for instance, faint pattern interference can be discerned floating across this section. It should be noted, however, that when such an effect is in evidence, no apparent vertical line appears to separate the two sections of raster as would be expected.

Receivers manifesting this symptom always feature a reclaim circuit, and the brighter section on the left-hand side of the screen.

(To be continued)

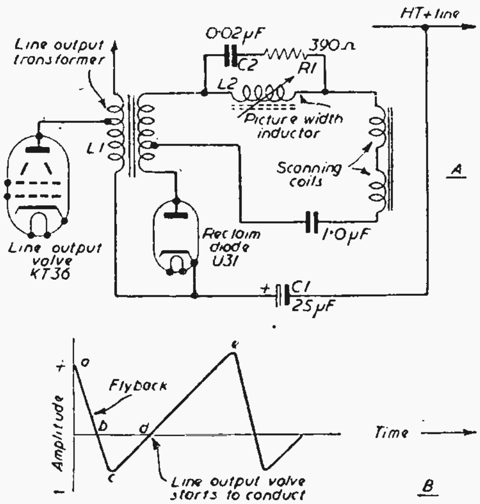


Fig. 6.—(A) Flyback damping and reclaim circuit as used in G.E.C. BT.2147 series receivers, and (B) curve which will be explained in the next article on this subject.

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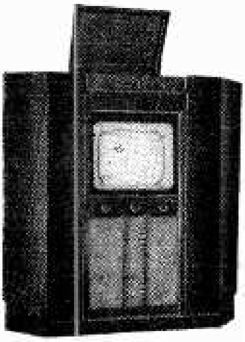

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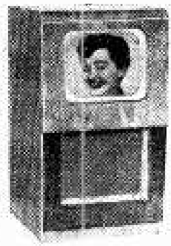

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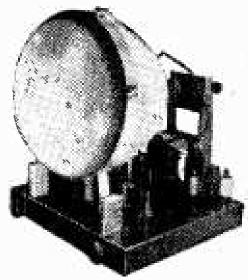

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SOUND RECEPTION

SOME HINTS ON A NEGLECTED SECTION OF THE MODERN TELEVISION RECEIVER

By W. J. Delaney (G2FMY)

IT would appear that many amateur constructors spend most of their energies in developing the vision side of their receivers allowing the sound side to more or less take care of itself. Whilst it is true that the eye is much more critical than the ear, and thus it is essential to get the best possible picture, it must also not be forgotten that the sound side of television offers considerable scope for experiment. It is already well known that, just as on the vision side, the frequency band which is used for sound is very much wider than that used on normal sound broadcasting. As a result it is possible to obtain very much better musical quality at television frequencies than on the medium wavebands. There is, however, a very important phsycological problem which enters into the design of the sound section of a television receiver. If one is using a 12in. tube, the images of the received performers are quite small, and it is therefore useless to try and develop an elaborate 15 watt amplifier to feed a properly-designed acoustic cabinet. First, the volume of sound will not match the size of the image and it would appear that few people can tolerate a four or five inch man singing at normal human volume; secondly, the acoustic cabinet will obviously have to be separated from the television screen container, and again the sound will be divorced from the image. For the combined sound and vision reception, it would appear that it is desirable to restrict the sound output to 3 watts or less, and that the speaker must be mounted as close as possible to the picture tube. At these low volumes high quality is not really possible, nor apparently is it desirable as it will not be in keeping with the size of the picture. Perhaps with projection devices where the picture is projected on to a screen about 4ft. by 3ft. some attempt may be made to use a greater output in a properly designed cabinet, but for the ordinary self-contained receiver the small output is most satisfactory.

Quality Aims

This does not, of course, mean that any type of single valve output stage will do. As the quality is available some attempt should be made to do justice to it, even with a single output stage and a small loudspeaker, and here the ordinary lines of good quality amplifier design should be followed. Most important, the interference limiter which is used on the sound side should be very carefully chosen, and if possible dispensed with entirely. In most cases some cutting of the top is bound to arise and unless one is on a main road or in some situation where interference is more or less continuous, a switch to cut out the limiter will serve to show on good musical items what difference is experienced, and it may then be thought desirable to tolerate the short periods of interference in the interests of better sound quality. Whilst a good audio pentode with negative feedback will be the choice of many, it is possible to use two good valves in a push-pull stage, and apply sufficient feedback to give maximum quality and minimum volume.

Frequency Restrictions

In many receivers the sound is tapped off from the vision circuit either from an R.F. stage or from a mixer, and as a result some restriction of the frequency band may be introduced by the tuning of the early stages in order to obtain the best possible picture. It should be considered, therefore, whether it is not desirable to remove these restrictions by using a separate sound receiver entirely, taking the aerial socket direct to the first tuning coil in the sound receiver through a 68-ohm half-watt resistance. This will isolate the receiver and both sound and vision circuits may then be tuned to obtain maximum performance without having to worry about mutual interference. Of course, to avoid sound on vision and vision on sound, the same care is needed in adjusting the tuning circuits, but often a good picture is only obtained at the expense of the sound reception in those receivers where common tuning circuits are employed.

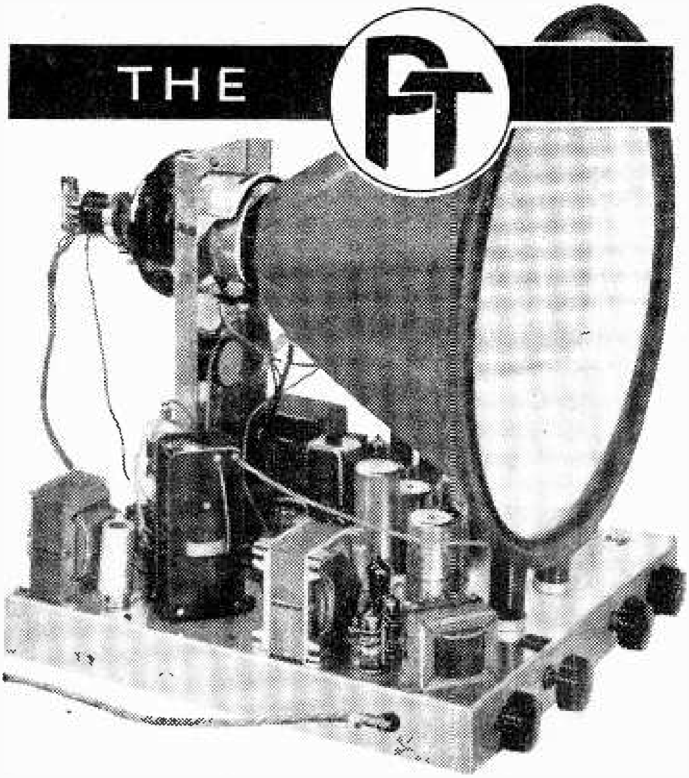
A plan adopted by many who are interested in good sound quality is to use a straight receiver for one circuit and a superhet for the other. Two superhets should not be used in view of the risk of interaction between either mixers of the I.F.'s. On the London frequencies it will generally be found preferable to use the straight circuit for vision and a superhet for sound.

Unfortunately there are too few good musical programmes on TV which justify the design of high-quality sound reproducers, but for those music lovers who do want the best from the odd occasions when they appear it may be considered desirable to ignore vision and concentrate on the music and in that case there is something to be said for a larger output, fed to say a properly-designed cabinet, and to use the vision only as an added item. It is hardly worth while building a vision receiver only to turn off the picture when a musical item is being received.

Projection Equipment

As already mentioned, where a large screen projection installation is in use there is quite a differerent method of attacking the problem. Here a greater output volume may be tolerated and as the cabinet will have to be placed near the screen (as distinct from the control panel, for instance) then a good acoustic cabinet may be used and is justified, together with an appropriate speaker. But again, 15 watts is hardly in keeping with even a full orchestra on such a screen, although an individual performer seen in close-up would probably justify maximum volume. It would be interesting to have readers' experiences of this side of television reception and of any special arrangements which have perhaps been made to cope with different situations—close-ups, long-shots, orchestral or band performances, solos, etc.

THE PT SUPER-VISOR



CIRCUIT DETAILS OF OUR NEW SUPERHET 20-VALVE BIG-SCREEN TELEVISION

SOME time ago we asked readers to let us know what features they would like incorporated in our home-constructor receivers, and a large number of very interesting suggestions were received. These were tabulated, and it appeared that apart from smaller individual features, which would have a limited general appeal, there were two main circuit details which were asked for by over 90 per cent of our readers. Setting out all the features it appeared that what might be termed a "de luxe" receiver would be popular, in spite of the cost and the large number of valves which would be needed. Again, we asked readers whether we should prepare a design which would ignore the cost of construction or whether we should try and keep down to a given figure, and eventually we were able to arrive at a standard which finds its practical application in the "Super-Visor," one view of which is seen on our cover this month and another in the heading above. A full circuit diagram is given on page 122 and the salient features are shown on the opposite page. It will be seen that there are 20 valves in the complete receiver, in addition to three metal rectifiers, and, of course, the tube. This is the English Electric metal T.401, a 16in. model which enables a picture nearly 14in. by 10½in. to be obtained, using a double-D mask.

Circuit Features

As the majority of readers prefer to know what function is performed by the various parts of a circuit, the following analysis of the circuit is given. V1 and V2 are standard R.F. amplifiers which give the receiver a wide range of reception and enable it to be used in remote fringe areas. As described later they may be used on any channel. Next comes the mixer which provides both the vision and the sound signals, the former being at 13.3 Mc/s and the latter at 9.8 Mc/s. On the vision side there are two I.F. stages.

On the sound side 1 I.F. stage follows the mixer, and this feeds a double-triode diode detector and first A.F., all the other stages so far described utilising a standard R.F. pentode. The tuning coils are all tuned by adjustable cores and in some cases by parallel capacitors, the cores, as will be seen from the details on the circuit diagram, being mixed iron and brass. It is, of course, very important to make certain that the correct cores are used in the required coils, as the frequencies are very different with the two-core materials.

On the vision side, after the last I.F. stage (V5) the signal is fed to a small metal rectifier and is then taken to the video stage through a peaking choke, two other chokes of this nature being included in the video stage to ensure that the frequency response is maintained right through the receiver. A very efficient A.F. pentode is used as video amplifier, this being the Osram N78, and it will be noted that quite a low value of anode load is employed (3.3k, obtained by using three standard 10k ½-watt resistors in parallel), but as will be mentioned later this load may have to be increased in certain fringe areas. As most readers will remember, the low anode load, whilst giving a very level frequency response, also provides only a low gain and this may be increased, with some loss of linearity in the response, by increasing the load.

Automatic Picture Control

Following the video stage is a double-diode which utilises one diode as a standard noise limiter and the other as a rectifier for providing a voltage for automatic picture control. A great deal of interest has been aroused in recent months by the publicity given to this type of circuit, and there is little doubt that, in fringe areas, where fading and interference are experienced, some arrangement for overcoming the resultant loss of detail and picture tearing or slipping is of great value. The weakness of details as a signal fades may be overcome by a similar arrangement to the automatic volume control used in sound receivers, although there are certain complications which prevent the identical arrangement being used in vision circuits, as explained in an article recently on this subject in these pages. However, it is of little use applying automatic gain control alone in a receiver as whilst it may do a lot to restore some of the loss and provide a worth-while picture, under bad conditions the weakening of the sync pulse resulting from the fade may result in the picture slipping or tearing and this is where the flywheel sync arrangement comes in. We therefore apply the rectified signal voltage back to the first vision I.F. stage, and from this point take the picture modulation to the grid of the picture tube. As a coupling condenser is interposed in the grid feed a D.C. restorer becomes necessary, and accordingly for the sync separator a double triode is employed, the first section acting as a grounded grid, cathode input limiter, which also acts as the D.C. restorer. The second half of the valve has outputs taken from both cathode and anode, thus providing both positive and negative sync pulses which are taken to the line and frame timebases.

Frame Timebase

The frame coils are fed from an amplifier of the same type as used in the video stage, and to ensure a high standard of linearity the bias resistor and feed resistor from the oscillator stage are of critical tolerance, and in addition a feed-back circuit is provided with a variable control so that precise adjustments may be made to take care of any variation in valves or components. The amplifier is driven by a double triode operating as a cathode-coupled multivibrator, and the sync pulses from V8 are fed to this stage through two further stages (a pentode and a double diode) which function as pulse shaper and clipper, thus making certain that a really reliable interlace is obtained.

Line Timebase

From V8 the pulses are fed to the line timebase through another double diode which is the comparator stage. This compares both phases of the incoming sync pulses to the output voltage of the line output transformer, and provides the appropriate correcting voltage to the oscillator to maintain synchronisation. The oscillator is on similar lines to that used in the frame timebase—a double diode operating as a multivibrator—and it will be noted that in the first anode circuit of this stage is a load tuned to the line frequency, this giving the flywheel action. The D.C. voltage provided by the comparator stage is applied across C78, a .1μF condenser joined between the first grid and the earth line. The line output valve is one of those designed specifically for this purpose and is actually a Brimar 6CD6G. The damper, a booster diode, a 6U4GT, suppresses the back E.M.F. and enables an output of about 350 volts to be obtained to augment the H.T. rail for the oscillator stages. In place of the usual line output transformer an auto-transformer is used, and this simplifies many of the problems connected with the design of the output stage, whilst permitting a receiver to be operated by low H.T. supplies. The E.H.T. rectifier is mounted directly on the auto-transformer, and is of the 6.3 volt heater type, providing in this particular circuit a voltage of between 14 and 15 kV for the anode.

SPECIFICATION

16in. Metal Tube and 20 valve circuit, plus 3 metal rectifiers Superhet receiver adjustable for any BBC channel.
Automatic Picture Control
Flywheel Sync Control
Electromagnetic Focusing
Vision and Sound Interference suppression
Multivibrator oscillators on both Timebases
Single chassis construction

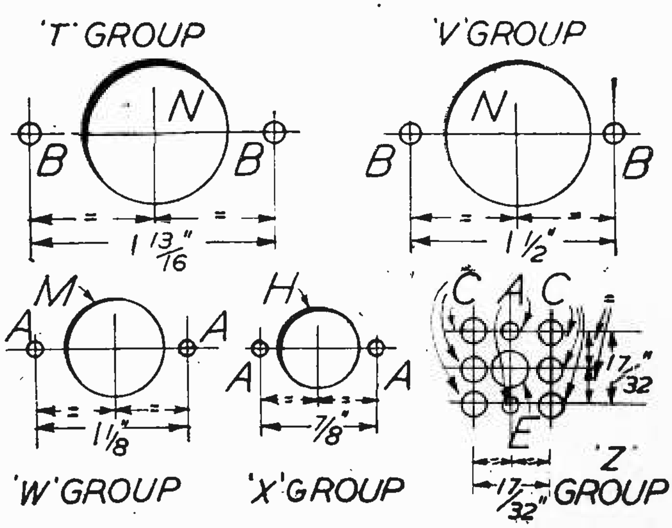


Fig. 3.—Drilling data for "Group" holes in Fig. 2 (p. 120)

Audio Output

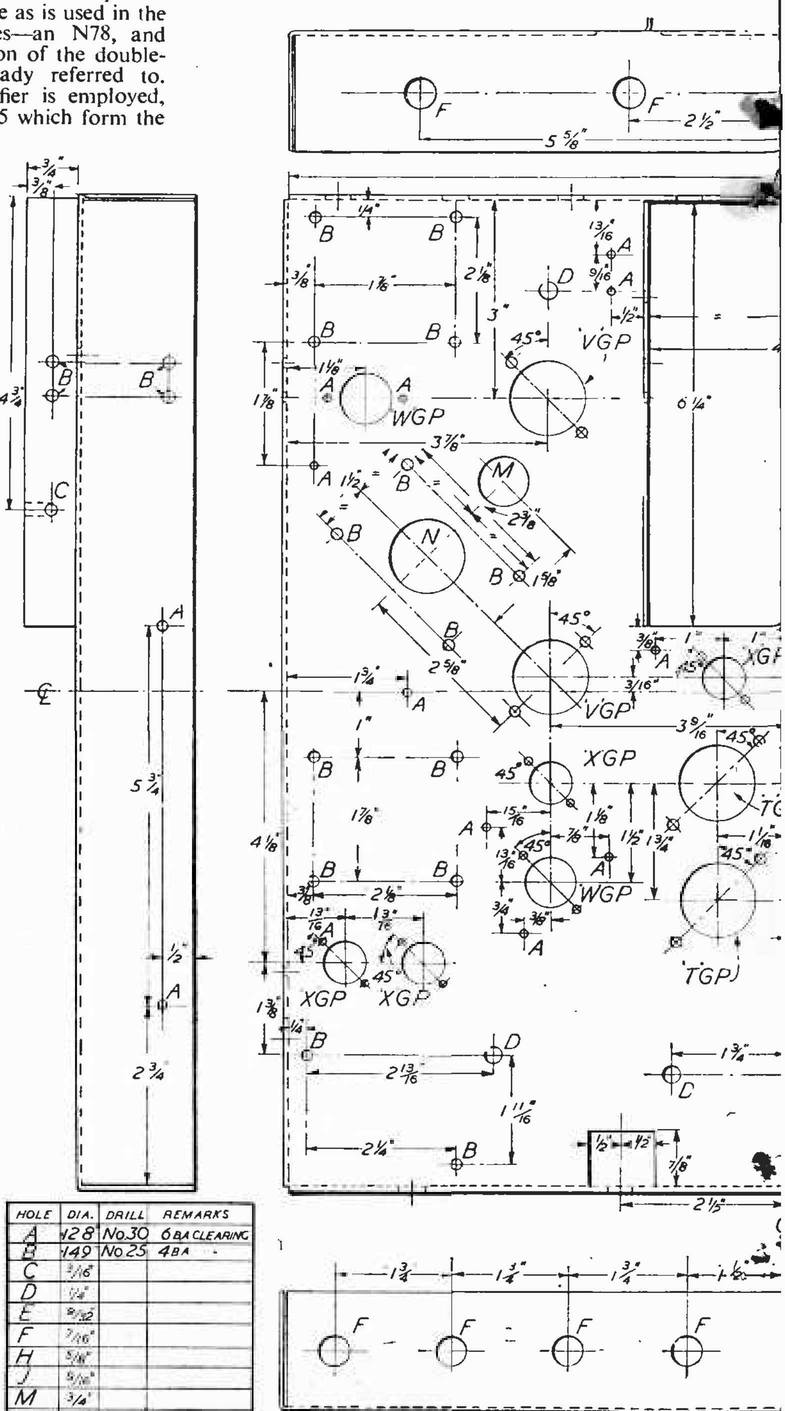
The output stage which feeds the loudspeaker for sound is a valve of the same type as is used in the video and frame amplifying stages—an N78, and this is driven from the triode section of the double-diode-triode first A.F. stage already referred to. For noise limitation a metal rectifier is employed, and in this connection C44 and C45 which form the essential parts of the noise filter may be adjusted in use according to the degree of interference which is experienced in any particular locality. A value of 220 pF is specified, but it is possible to increase these up to 1,000 pF in very severe cases of interference.

Mains Section

For the mains section an auto-transformer is again employed, and the tapped sections are brought out to a mains voltage selector panel so that with any mains supply from 200 to 240 volts a steady 240 volts may be obtained to feed the half-wave metal rectifier. Adequate smoothing is provided by a low-inductance choke and high capacity condensers, and additional smoothing is provided by a focusing network consisting of a focusing coil and associated controls. The usual arrangement of focusing with an electro-magnet is to shunt the magnet and thereby regulate the D.C. flowing through it, but this often introduces troubles by modifying the H.T. applied to other parts of the circuit. With the arrangement used in this receiver there is very little modification to the final output voltage and good control of focusing is provided. Although a 6.3 volt winding is provided on the mains auto-transformer to feed the tube as well as all the valves, if desired a separate isolating transformer, such as the Forrest, may be used to supply the tube alone.

Layout

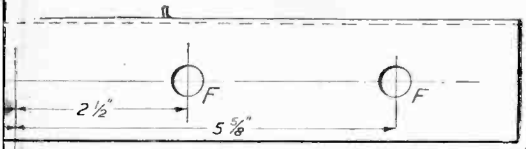
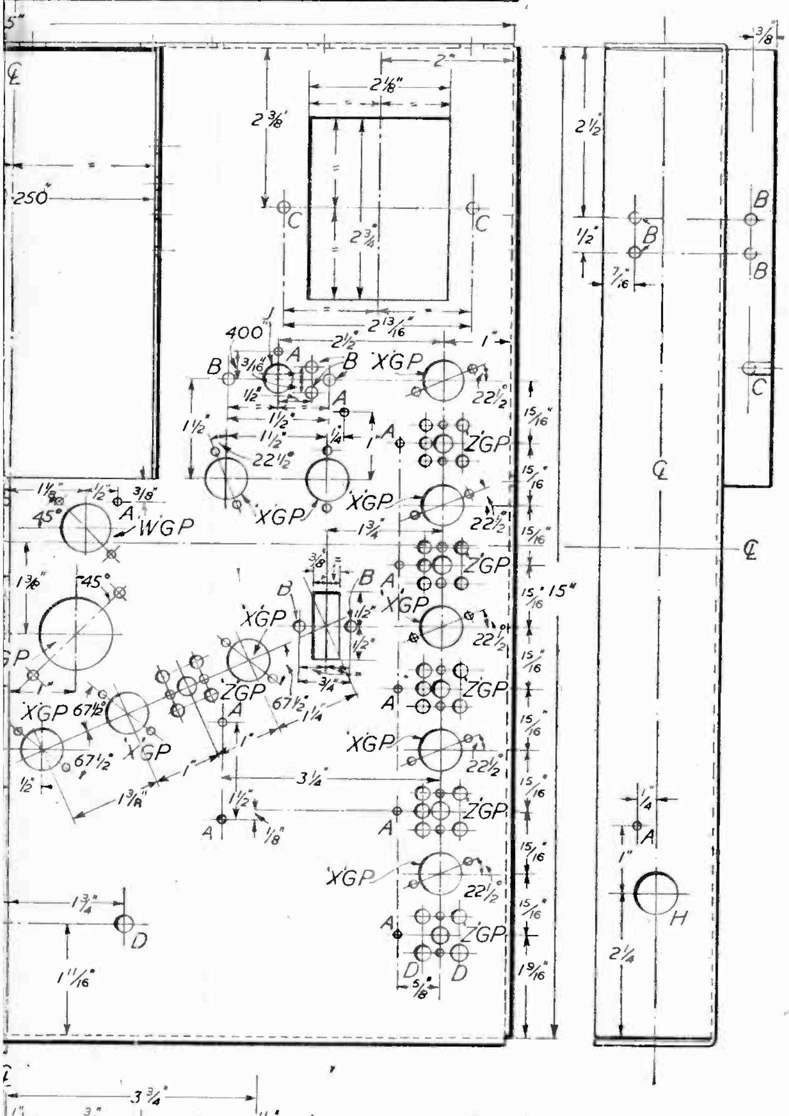
So much for the general features of the circuit. From the illustrations it will be seen that we have returned in this design to the single chassis arrangement which is preferred by the majority of constructors. The chassis measures 15in. square and is 1¾in. deep. A ready-drilled chassis may be obtained from Messrs. Denco, but for those who prefer to



HOLE	DIA.	DRILL	REMARKS
A	·128	No.30	6BA CLEARING
B	·149	No.25	4BA
C	3/16"		
D	1/4"		
E	9/32"		
F	7/16"		
H	5/8"		
J	9/16"		
M	3/4"		
N	1 1/8"		

make their own full details are given on this page. The diagram has naturally had to be reduced considerably to accommodate it in our page size and as a result it would appear a little cramped. To simplify drilling each set of holes has been given a letter or group number. Where there is a single letter the drilling size is indicated in the small panel at the bottom of the diagram. Where there is a letter followed by the letters "GP" (indicating Group and meaning that there are several holes of this particular dimension) the details are given on page 119 in Fig. 3. Again the actual drilling sizes are indicated by the single letter and are in the panel in Fig. 2. Note that there is a large cutaway portion at the rear centre of the chassis into which is mounted the rectifier and to the sides of which are bolted the vertical strip which carries the deflector and focusing coils.

The cutting of holes of large size in the chassis presents a number of difficulties unless one uses the special types of punch which have now become available to the constructor. Typical examples are the Q-Max and the Osmor. The former are available in various sizes to suit the valveholders (7-, 8-, 9-pin, etc.), whilst the Osmor is available in double-ended versions which carry an octal and a ⅝, etc. When using either of these punches it is easiest to grip the stationary portion in a vice, and therefore after the pilot hole has been drilled for the threaded portion, the smaller or inner portion should be placed on top of the chassis and thus the cutter operation is carried out from the underside. There are two advantages in this method of making the hole: firstly, the fixed portion of the punch is more easily held in the vice when cutting holes near the edges, as the sides of the chassis do not get in the way of the vice, and secondly, the edges of the hole are turned slightly downwards and a neater result is obtained. It will be noted that on the first edge a small portion has been cut away. This was to clear the focus control and the cut-out may be avoided by making the sides of the chassis slightly deeper. If there is any doubt in this connection the constructor should obtain all his variable controls before making the chassis.

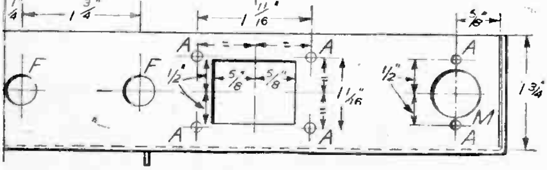
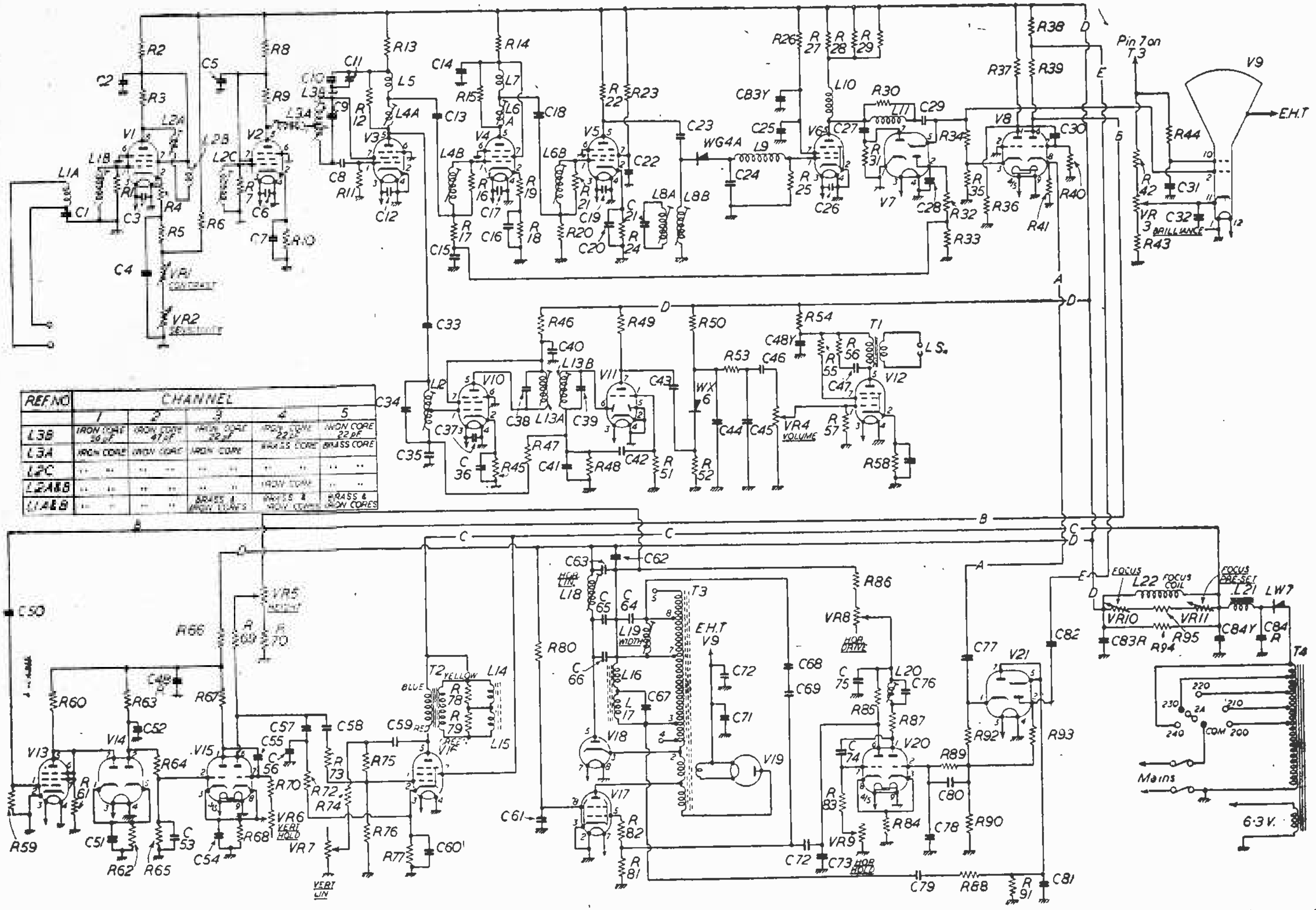


Fig. 2.—Main chassis cutting and drilling data. See also Fig. 3 on p. 119.

Other metal-work will be given next month.

(To be continued)



REF. NO.	CHANNEL				
	1	2	3	4	5
L3B	IRON CORE 36 pF	IRON CORE 47 pF	IRON CORE 22 pF	IRON CORE 22 pF	IRON CORE 22 pF
L3A	IRON CORE	IRON CORE	IRON CORE	BRASS CORE	BRASS CORE
L2C	" "	" "	" "	" "	" "
L2A & B	" "	" "	" "	IRON CORE	" "
L1A & B	" "	" "	BRASS & IRON CORES	BRASS & IRON CORES	BRASS & IRON CORES

Fig. 1.—Theoretical circuit of the "Super-Visor." One side of the speech coil of the L.S. should be joined to frame of L.S. C44 and C45 can be increased up to 1,000 pF in cases of very bad interference.

LIST OF COMPONENTS

CONDENSERS.—All 20% and 350 v. unless otherwise stated (T.C.C.).

C1—1,000 pF ceramic.
C2—ditto.
C3—ditto.
C4—10,000 pF ceramic.
C5—1,000 pF ceramic.
C6—ditto.
C7—10,000 pF ceramic.
C8—100 pF S.M.
C9—See table.
C10—.1 µF paper.
C11—1,000 pF ceramic.
C12—ditto.
C13—ditto.
C14—ditto.
C15—10,000 pF ceramic.
C16—ditto.
C17—1,000 pF ceramic.
C18—ditto.
C19—ditto.
C20—10,000 pF ceramic.
C21—in L8 coil can.
C22—1,000 pF ceramic.
C23—47 pF ceramic.
C24—10 pF S.M.
C25—1,000 pF ceramic.
C26—ditto.
C27—.05 paper.
C28—22 pF S.M.
C29—.1 µF paper.
C30—.01 µF 500 v. paper
C31—.1 µF paper 500 v.
C32—.1 µF paper.
C33—8.2 pF+5% S.M.
C34—47 pF±10% S.M.
C35—10,000 pF ceramic.
C36—ditto.
C37—1,000 pF ceramic.
C38—in L13 can.
C39—in L13 can.
C40—1,000 pF ceramic.
C41—47 pF ceramic.
C42—.01 µF 500 v. P.T.
C43—.05 µF
C44—220 pF ceramic or S.M.
C45—220 pF ceramic or S.M.
C46—.01 µF 500 v. P.T.
C47—.01 µF.
C48R-Y—32-32 350 v. electrolytic.
C49—50 µF 12 v. electrolytic.
C50—.1 µF.
C51—220 pF ceramic.
C52—470 pF S.M. or ceramic.
C53—.05 paper.
C54—.05 paper.
C55—.01 paper 500 v.
C56—.01 paper 500 v.
C57—.1 µF 750 v. paper.
C58—.5 500 v. paper.
C59—.1 500 v. paper.
C60—50 µF 12 v. electrolytic.
C61—.05 paper.
C62—.02 500 v. paper.
C63—.02 500 v. paper.
C64—3,000-4,000 pF S.M.
C65—.05 500 v. paper.
C66—.01 500 v. paper.
C67—in deflector coils.
C68—47 pF ceramic.
C69—ditto.
C70—.001 12.5 kV.
C71—.001 12.5 kV.
C72—.005 paper 500 v.
C73—680 pF S.M.
C74—390 pF S.M.
C75—.5 500 v. paper.
C76—.01 500 v. paper.
C77—.001 500 v. paper.
C78—.1 µF 500 v. paper.
C79—.02 500 v. paper.
C80—.01 500 v. PT.
C81—.02 500 v. PT
C82—.001 500 v. PT
C83R-Y—32-32 µF 350 v. electrolytic.
C84R-Y—60-100 µF 350 v. electrolytic.

RESISTORS.—Tolerances all 20% unless specified, all ¼ w. unless otherwise stated (Erie).

R1—4.7K Ω.
R2—4.7 K Ω (½ w.).
R3—5.1 K Ω.
R4—33 Ω.
R5—100 Ω.
R6—680 K Ω.
R7—10 K Ω.
R8—1K Ω.
R9—4.7 K Ω (½ w.).
R10—150 Ω.
R11—100 K Ω
R12—5.1 K Ω.
R13—4.7 K Ω. (½ w.).
R14—4.7 K Ω (½ w.).
R15—5.1 K Ω.
R16—10 K Ω.
R17—10 K Ω.
R18—100 Ω.
R19—33 Ω.
R20—10 K Ω.
R21—10 K Ω.
R22—6.8 K Ω (½ w.).
R23—22 K Ω.
R24—330 Ω.
R25—5.1 K Ω.
R26—22 K Ω.
R27—10 K Ω (½ w.).
R28—10 K Ω (½ w.).
R29—10 K Ω (½ w.).
R30—22 K Ω.
R31—4.7 M Ω.
R32—1 M Ω.
R33—4.7 M Ω.
R34—5.1 K Ω.
R35—220 K Ω.
R36—33 K Ω.
R37—10 K Ω.
R38—3.3 K Ω.
R39—22 K Ω.
R40—10 M Ω.
R41—3.3 K Ω.
R42—220 K Ω.
R43—33 K Ω.
R44—470 K Ω.
R45—150 Ω.
R46—1.5 K Ω +10%.
R47—470 K Ω.
R48—47 K Ω.
R49—220 K Ω.
R50—2.2 M Ω.
R51—10 M Ω.
R52—1 M Ω.
R53—33 K Ω.
R54—1.5 K Ω (1 w.).
R55—150 Ω.
R56—10 K Ω.
R57—470 K Ω.
R58—270 Ω.
R59—1 M Ω.
R60—100 K Ω.
R61—33 K Ω.
R62—220 K Ω.
R63—680 K Ω.
R64—150 K Ω.
R65—22 K Ω.
R66—4.7 K Ω (½ w.).
R67—47 K Ω.
R68—1.5 K Ω ±10%.
R69—470 K Ω.
R70—390 K Ω.
R71—47 K Ω.
R72—6.8 K Ω ±5%.
R73—220 K Ω.
R74—47 K Ω.
R75—3.3 M Ω.
R76—2.2 M Ω.
R77—220 Ω ±10%.
R78—, R79— On deflector coils.
R80—10 K Ω (2 w.).
R81—1 M Ω.
R82—47 Ω.
R83—100 K Ω.
R84—1.5 K Ω ±10%.
R85—220 K Ω.
R86—22 K Ω.
R87—10 K Ω.
R88—68 K Ω (2 w.).
R89—470 K Ω.
R90—4.7 M Ω.
R91—33 K Ω.
R92—100 K Ω.
R93—100 K Ω.
R94—1 K Ω (6 w.).
R95—500 Ω (4 w.).

VARIABLE RESISTORS :

VR1—Contrast 5 K Ω pot., wirewound (3 w.).
VR2—Sensitivity 25 K Ω pot., wirewound (3 w.).
VR3—Brilliance 100 K Ω (carbon).
VR4—Volume-control and D.P. switch ½ M Ω (carbon).
VR5—Height 2 M Ω carbon.
VR6—Vertical hold 200 K Ω.
VR7—Vertical linearity 100 K Ω.
VR8—Horizontal drive 100 K Ω.
VR9—Horizontal hold 100 K Ω.
VR10—Focus 500 Ω 4 w.
VR11—Focus preset 500 Ω 4 w.

COILS AND TRANSFORMERS :

L1AB—Aerial coil
L2ABC—1st R.F. transformer
L3AB—Oscillator mixer transformer
L4A & B—I.F. transformer
L5—I.F. coupling coil
L6AB—I.F. transformer as L4
L7—I.F. coupling coil as L5
L8AB—Diode feed coil and trap
L9—Corrector choke
L10—Corrector choke as L9
L11—Corrector choke as L9
L12—Sound trap
L13—Sound I.F. transformer
} Allen Components, Ltd.

L14—, L15—, L16—, L17— Deflector coils DC 300/C
L18—Linearity horizontal GL16
L19—Width GL18
L20—Flywheel adjustment as L19 GL18
L21—Smoothing choke SC312
L22—Focus coil FC302
} Components, Ltd.

T1—Speaker transformer, 7,000 Ω to 3 Ω.
T2—Vertical output transformer WA/FMA1 (Denco (Clacton).
T3—Horizontal output transformer WA/LOT1 (Denco (Clacton).
T4—Mains transformer AT310 (Allen Components, Ltd.).

VALVEHOLDERS :

Fourteen B7G McMurdo Type No. BM7/U.
One Can and spring Type No. 2/21.
Two Noval Type No. BM9/UD.
One Noval with can and spring, Type No. BM9/UB.
One Duodecal, Type No. BM12/U1.
Two Octal 1/0, Type No. B8U.
One aerial plug socket.
One Clix mains voltage adjustment with 2 amp. fuse 5-way, marked 200-209, etc., to 239-250.

(Continued on page 136)

The Capacity Loaded Tilted Wire

DETAILS OF A READER'S RESULTS WITH AN UNUSUAL TYPE OF AERIAL

By R. Pinkney

SOME months ago I tried out various types of television aerials and the results obtained were published in PRACTICAL TELEVISION. One of the aerials tried was the "Tilted Wire." At the time, though very directional, I found the signal strength from this type of aerial appreciably less than from an "X" or an "H."

I have always felt I had not done this aerial justice, so very recently I have carried out further comparisons between an "X" on a 30ft. high pole and a tilted wire stretching from a pole the same height.

The results convince me I had either a bad mismatch or a bad connection somewhere when I first tried the tilted wire, as this time the tilted wire had a gain of nearly 30 per cent. over the "X."

The capacity-loaded tilted wire is an E.M.I. product, and as they have facilities for making and testing aerials not available to me, I should expect still more gain from one of their factory-made aerials.

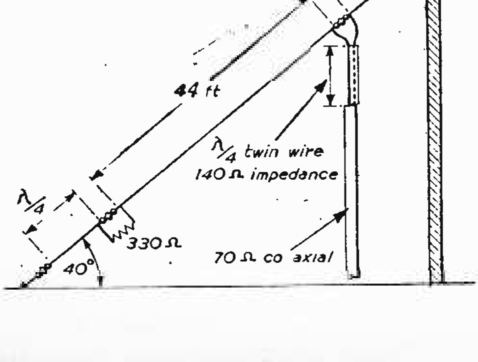
Construction

The construction of my tilted wire was as follows: I stretched two 44ft. lengths of 19 gauge D.C.C. copper wire between two insulators. As the wire itself would not stand much strain, also stretched tightly between the insulators was a length of thin line.

The wires were soldered together where they connected to the insulators. I then cut each alternate wire every quarter wave along the length of the aerial. The wires were twisted lightly together so that there were about three twists every quarter wave. The wires and line were then bound securely together. A quarter wavelength of stranded copper wire of the type used for ordinary broadcast aerials was joined to the outer end of the insulators at both ends of the aerial, with insulators on the ends of the quarter waves. A 330 ohm resistor was connected across the insulator at one end of the aerial between the quarter wave and the aerial. This must always be the end pointing towards the transmitter.

As the impedance of the aerial is between 250 and 300 ohms, the other end has to be matched to the feeder, which is normally 70 ohms. I tried various methods and the one I found most satisfactory was the simplest.

Measurements and details of Mr. Pinkney's tilted aerial.



Matching

I had a length of 80 ohm semi airspaced co-ax. cable; from this I cut two quarter wavelengths. One piece I stripped to the wire; from the other I removed the outer cover and the braiding: I then bound the bare wire along the length of this, giving me two parallel wires semi airspaced. The impedance worked out at about 140 ohms, which was what I wanted.

One end of this matching piece was then joined, one wire to the aerial, the other to the quarter wave. The other end was joined to the feeder, the centre wire of the feeder going to the wire connected to the aerial.

Length

The length of the aerial bears no relation to the wavelength, the longer the aerial the better. It can tilt either up or down in the direction of the transmitter, but it must as near as possible make an angle of 40 degrees with the base line, and it must be taut and not allowed to sag. The feeder must always be connected to the end farthest from the transmitter. Use line, not wire, for securing the aerial in position.

My aerial was made for London and I used 5ft. 6in. as a quarter wave. It is very directional; moving the aerial 20 degrees either side of the optimum reduced the signal to almost half.

Though I have never been in position to try it, I should think this type of aerial might be the answer in hilly country where ghosts are troublesome.

New Spencer-West Aerial

THE Spencer-West type AC/8 television aerial unit is a new departure in aerial design. The aerial and an amplifier unit are combined in a manner which it is claimed provides a very efficient and compact arrangement. The aerial element which is one quarter wavelength long, feeds directly into the first valve of the amplifier unit, thereby ensuring maximum transfer of the received signal. Six additional elements are horizontally disposed radially around the base of the aerial element, providing an elevated earth (counterpoise), which ensures efficient shielding of the aerial from ground level interference. One of these counterpoise elements is continued in a vertical direction and this vertical section serves as a reflector element. If interference conditions warrant it, more than one of the counterpoise elements may be similarly extended so that the aerial element is screened still further from the interference.

The aerial is primarily intended for "Fringe" and "Long-distance" reception, but it is also very suitable for service area reception in situations where the interference level is high. Fully descriptive and illustrated leaflets are available from Spencer-West, Quay Works, Great Yarmouth.

ALPHA RADIO SUPPLY CO.

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MAINS TRANSFORMERS
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MT2 as above, but with 350-0-350 H.T. winding ... ... **17/6 each**

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6.8 Pf., 5 Pf., 12 Pf., 50 Pf., 180 Pf., **5d.** each

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We have a quantity of condenser and resistor panels, removed from new ex-Government equipment. All contain a good selection of resistors and condensers. 6 types available, **1/3** ea., or 6 for **6/6**.

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6AK5	9/-	1A5GT	7/6	EL32	8/-
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RESISTORS ¼ and ½ watt.
We send whichever rating is available at this price :
3.3 kΩ, 1.5 kΩ, 68Ω, 2.2 meg.Ω, 100Ω, 12 meg., 330 Ω, 10 meg., 27 kΩ, 470 kΩ, 2.2 kΩ, 22 kΩ, 150 kΩ, 6.8 kΩ, 5.6 kΩ, 600 Ω, 39 kΩ, 120 kΩ, ½ meg. Ω, 10 kΩ, 330 kΩ, 15 kΩ, 220 kΩ, 33 kΩ, 5 meg.Ω, 1 kΩ, 51 kΩ, 30 kΩ, 1.8 meg.Ω, 33Ω, 20Ω, 1.8 kΩ, 15 meg.Ω, 270Ω, 220, kΩ, 350Ω, 40 kΩ, 47 kΩ, 60 kΩ, 100 kΩ, 18 kΩ, 270 kΩ, 68 kΩ, 680 kΩ, 25 kΩ, 23 kΩ, 5 kΩ, 150Ω, 250Ω, 200Ω, 22 kΩ, 50Ω, 4.7 kΩ, 680Ω, 56 kΩ, 56Ω, 470Ω, 4 kΩ, 47Ω, 50 kΩ, 150Ω. All **3d.** each.

RESISTORS 1 WATT
1.5 kΩ, 15 kΩ, 6 kΩ, 390 kΩ, 3.3 kΩ, 620 kΩ, 350 kΩ, 5.6 kΩ, 75Ω, 8.2 kΩ, 2.5 kΩ, 20Ω, 680Ω, 1 meg., 5 kΩ, 250Ω, 100Ω, 40 kΩ, 150Ω, 6.8 kΩ, 9 meg.Ω, 8 meg.Ω, 7 meg.Ω, 4.7 kΩ. All **6d.** each.

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Various colours : Red, Blue, White, Green, Yellow, etc. **5/6** per 100 yds.

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ALLADIN COIL FORMERS
¼in. and ⅜in., complete with iron dust cores. **9d.** each.

CONDENSERS
METAL-CASE TYPE ELECTROLYTICS
8 mfd., 450 v., **1/11** each ; 16 mfd., 450 v., **3/3** each ; 16 x 16 mfd., 450 v., **4/9** each ; 16 x 8 mfd., 450 v., **4/6** each ; 8 x 8 mfd., 450 v., **4/-** each ; 25 mfd., 25 v., **1/3** each ; 32 mfd., 350 v., **1/9** each ; 32 x 32 mfd., 350 v., 25 mfd., 25 v., **5/3** each.

TERMS : Cash with order or C.O.D. **MAIL ORDER ONLY.** Illustrated List available ; send 6d. stamp.
Postage, 9d. to 10/- ; 1/- to 20/- ; 1/6 to £2 ; 2/- to £5. Minimum C.O.D. and postage charge 2/3.

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The Finest Cored Solder in the World

No matter how good your constructor set, the finished job won't do you credit if the solder you use fights shy of those intricate joints. Set designers recommend Ersin Multicore because its accelerated fluxing reduces the surface tension of the molten solder so that it runs *right into the joint*. Ersin Multicore is the only solder containing 3 cores of extra - active, non - corrosive Ersin Flux. Correct proportions of solder to flux prevent oxidation, actually *clean* surface oxides and make 'dry' or H.R. joints impossible. Solder securely—with Multicore.

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SEE US AT THE **Radio Show** **STAND 111** FOOT OF MAIN STAIRCASE IN CENTRE HALL

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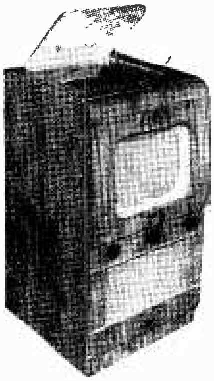
Armstrong

3 NEW TELEVISION RECEIVERS OF EXTREMELY ECONOMICAL PRICE



TELE-GRAM

A 14in. flat-faced rectangular Television receiver combined with the very latest three-speed record player, housed within a handsome veneered walnut cabinet 35in. high, 20in. wide, 20in. deep. 19 valves. Aluminised tube with tinted filter, pin point focusing coupled with full bandwidth and accurate interlacing ENSURES BRILLIANT DAYLIGHT VIEWING. 5 channels—selected instantaneously. 10in. loudspeaker for magnificent reproduction. A.C. mains 200/250 volts.

Price : **78 guineas** (inc. P.T.).

TV 5. 14in. CONSOLE

The 14in. Console model is exactly similar in all respects to the Tele-gram, with the exception of the record player, as described above.

Price : **69 guineas** (inc. P. Tax)

TV 5. 17in. CONSOLE

Similarly this 17in. model which gives a superb large picture has the same specification as the 14in. models.

Price : **79 guineas** (inc. P. Tax)

ARMSTRONG WIRELESS & TELEVISION CO. LTD.,
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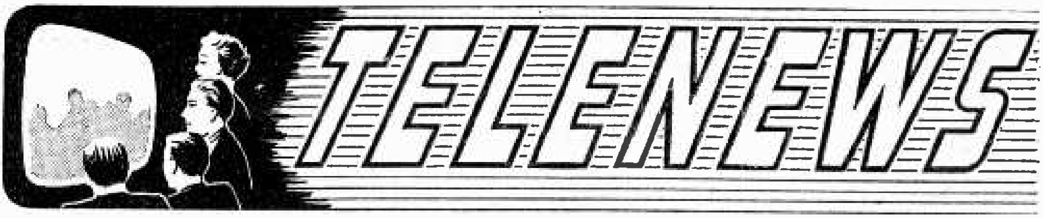


BBC Denies Report

A RUMOUR that BBC officials had been scouring the Norfolk and Suffolk area with a view to finding a possible site for a television transmitting station has been scotched.

In his denial, a spokesman of the BBC said, "This is not true. Provision was made in principle at the recent Stockholm Conference for a television transmitter to be erected in Norfolk, but our plans for the five medium-power stations, which are at present held up, do not make provision for such a transmitter. It is still the aim of the BBC to give television to the Norfolk area as soon as possible."

Television Licences

THE following statement shows the approximate number of television licences issued during the year, ended May, 1953. The grand total of sound and television licences was 12,945,828.

Region	Number
London Postal ...	751,452
Home Counties ...	262,336
Midland	489,325
North-Eastern ...	269,308
North-Western ...	301,306
South-Western ...	76,089
Wales and Border ...	88,550
Total England and Wales	2,238,366
Scotland	75,854
Northern Ireland ...	2,380
Grand Total	2,316,600

Trouble Afloat

BECAUSE people living on rivers in houseboats have complained about TV interference, motor-boat owners are being asked to suppress their engines.

Viewing in Mull

TELEVISION tests on the island of Mull produced excellent results that surprised even the experts as Mull is well outside the normal range of reception.

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

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

Receivers have now been delivered to the island and installed for the residents.

Abuse of Controls

RADIO dealers in the North complain that the majority of service calls received are not the result of a receiver fault but of unnecessary "knob twiddling" by inexperienced viewers.

Too many of them try to obtain a clearer picture by interfering with not only the brightness and contrast controls but the pre-set adjustments as well.

Coronation Naval Review

THE Coronation Review at Spithead on June 15th was more than the first naval review to be televised; it provided the first occasion that a live television broadcast for the BBC had ever been made from a British warship. As at the 1953 Oxford and Cambridge Boat Race, frequency-modulation V.H.F. radio transmitters and receivers were supplied by The General Electric Co., Ltd., for the television sound-link from ship to shore. But whereas at the Boat Race only one launch was involved with two transmitters on board (one spare for an emergency), the Review transmission was made from two ships. This demanded the use of four transmitters (including spare units), two in the communications room in H.M.S. *Eagle* and two in the communications room in H.M.S. *Reclaim* and four receivers on shore at Portsdown.

State Aid for Films

ACCORDING to a recent statement in the House of Lords, the Government is to extend the powers of the National Film Finance Corporation for three more years after March of next year.

This, said Lord Mancroft addressing the House, would enable the film industry to combat the impact of television on box-office takings.

Interference Research

BAD reception is the main bugbear of the average viewer, yet two dozen men near Bristol are deliberately doing their utmost to ruin television and sound radio programmes.

It is all for a good cause, however, for they are workers at the Post Office Radio Laboratory at Blackwell Hill. Their mission is to discover more about reception disturbances to enable appropriate steps to be taken towards their elimination. They have been able to measure the amount of interference caused by some electric gadgets relative to others; hair dryers, door bells, sewing machines and car ignition systems have all been thoroughly studied.

Another South Coast Station?

IT is expected that permission will soon be given for the BBC to commence construction of a new transmitter to serve the south coast.

Most probable site for the station is on the Isle of Wight, but it may have less power than previously planned.

Someone Who Should Know

A MIDDLESEX set owner tells of how he called in a service ngineer who in a short time had his receiver fault remedied and a perfect picture on the screen. A minute after the engineer had left, a " snowstorm " invaded the tube.

Who was the van owner who had no suppressor fitted? The TV service man.

Boom at Factory

EDISWAN'S valve factory at Sunderland has experienced a boom in supply demand lately.

The increase in demand for receivers has caused the hiring of a further 90 employees.

Three-dimensional Demonstration

A DEMONSTRATION was presented by the American Broadcasting Company in Hollywood recently of three-dimensional television.

The system employs a synchronised mirror which rotates 30 times a second in front of the camera to produce two images with a lateral displacement equivalent to a normal pair of human eyes. These appear on two separate tubes at the receiver and are projected on to a special screen which is viewed through polarised glasses.

Advertising Silencer

WE learn from the United States that a remote-control attachment for television receivers is on the market which enables viewers who do not wish to hear commercial talk to switch off the sound until the programme continues.

The control costs approximately one pound.

Hidden Theatre

TELEVISION producers, who were looking for extra studio space, searched down a back alley in Kansas, U.S.A., and found an old door marked "suitable for storage."

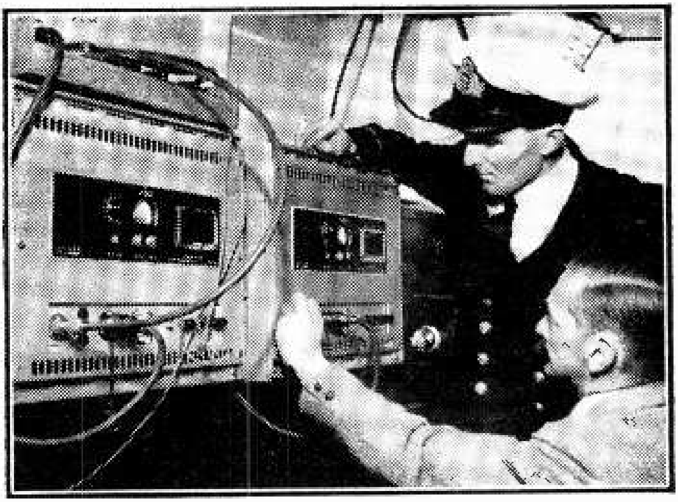
On opening it, they discovered a theatre auditorium, complete except for seats. No one even knew it had ever existed, nor could anyone say when it had been built. Fittings and other objects showed that it had been used long before the days of electricity.

Lens on Loan

MARCONI'S Wireless Telegraph Co., Ltd., have loaned the BBC a new lens of 80in. focal length for television cameras.

The lens has twice the magnifying power of the 40in. lens, three of which Marconi's lent the BBC last year. In testing, the lens picked up clearly lattice work on an aerial over three miles away.

A BBC official introduced the idea on his return to this country from America where he had seen a 60in. focal length lens in operation.



Two new G.E.C.' frequency modulation V.H.F. transmitters in the communications room of H.M.S. "Eagle." They were employed for the ship-to-shore sound transmission of the BBC television broadcast of the Coronation Naval Review.

Colour Information

RADIO manufacturers report that they cannot state a possible date of the introduction of colour TV until the BBC decides the system to be used.

A Radio Industry Council spokesman says " For reception of colour TV a new transmitter and a new receiver will be needed. But people using non-colour models will still be able to receive black-and-white pictures from the signals sent out by the new colour transmitter. Possibly some type of conversion will have to be made to old sets, but no one at present knows what adaptation will be necessary until a system is decided on."

M.P. Protests

ABOUT twenty thousand people gathered in the Welsh mining village of Ystradgynlais, Swansea Valley, to see and hear the proclamation of next year's Royal National Eisteddfod to be held there. Before the commencement of the ceremony, Mr. Watkins, Socialist M.P. for Brecon, protested against the BBC's declining to televise the proclamation.

He said the excuse did not hold water, that too many men would be needed to move the equipment used for the televising of the Spithead Naval Review. Racing had been relayed from Ascot and surely viewers would prefer to see children doing floral dances to fashions on parade at Ascot. He told the people that he was in complete agreement with the complaint lodged by the local authority.

Cup Final

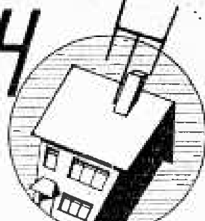
FOR the ultimate benefit of television sports fans, the opening day of the English Football League programme will clash with the last Test Match against Australia at the Oval.

Originally planned for Saturday, August 22nd, the soccer start has been brought forward to Wednesday, August 19th, so that matches fixed for May 1st of next year may be played off at the beginning of the season to leave the Cup Final the only match on May 1st.

Thus, provided that satisfactory terms are arranged, the Final will be televised and broadcast without affecting League gate receipts.

TELEVISION PICK-UPS AND REFLECTIONS

UNDERNEATH THE DIPOLE



By Iconos

CORONATION Day was television's greatest day, not only here, but in America, too. Now, the man-in-the-street regards TV with the respect it has long deserved. No longer can it be the butt of the comedians, the revue writers or the film producers; stories and jokes about TV's technical hitches and distorted faces are not funny any more—they have become corny and boring. TV has indeed arrived! What next?

MONKEY TRICKS

THE next step for TV in Britain will be the provision of alternative programmes, though not necessarily supplied by sponsored TV networks. Public attitude to sponsored television reacted sharply to the news that BBC Coronation films had been "debased" in America by the interpolation of advertising and in particular by the chimpanzee called "Fred Muggs," mascot of one of the sponsored programmes. This was unfortunate and exceptional. But opponents of sponsored TV in Britian capitalised on this lapse of good taste to press home further blood-curdling objections to sponsored television being introduced here. The effect of this campaign was revealed by one of the public opinion polls, which registered a higher percentage "against" than "for" sponsored TV. The fact is, that a very large proportion of the general public seem to be under the illusion that sponsored television will displace BBC television; they do not realise that the intention is to provide additional television services, which will be looked at by viewers only if the programmes are good enough. Fred Muggs certainly has damaged the case for sponsored television here, but the almost unscrupulous exaggeration and exploitation of a few unfortunate isolated incidents might yet recoil upon the TV monopolists. The BBC's own first reports upon the matter were almost studiously unfair. My own opinion is that a little competition would do the BBC a world of good. Besides, this vital instrument of sight and sound propaganda should not be under the influence of any of the BBC's long-haired boys from Bloomsbury, some of whom are known to have extremist political views, repugnant to both the main Parliamentary parties. Even in such a moderate form as in "India's Challenge," the documentary series, political instruction is unwelcome. This is the kind of item which will be a boon and a blessing to programme sponsors on a rival TV network. They will know that the maximum number of viewers will be available on just such occasions as when items of the "India's Challenge" type are on BBC TV. It drives home the axiom that the sponsors will scramble to arrange their programmes to synchronise with the least attractive of the BBC programmes. And the viewers will be content to change the tuning of their sets. Everybody will be happy—except the Bloomsbury boys! They are the Fred Muggs of British television, making monkeys out of us—the customers underneath the dipoles.

A TECHNICAL TRIUMPH

TECHNICALLY, the Coronation transmission was a triumph. Almost at the very commencement, we were treated to one of the finest ever "panning" close-ups of the Queen as her coach left the gates of the Palace. With a long-focus lens picking up every detail, the camera operator followed the moving vehicle with incredible precision for a long and exciting period. The use of the fine new zoom lenses was not overdone, but was extremely effective. The handling of sound and especially the dignified commentary upon the ceremony by Richard Dimbleby were memorable. The views in the Abbey and the fine microphone pick-ups could not have been bettered. The "editing" from shot to shot was handled in an inspired manner. What a long road has been travelled since those first flickerings of Baird's first low-definition mechanical television! The big screen TV by Cintel, Ltd., at several London cinemas was also absolutely first class, according to friends who took seats. In one place the procession could be seen somewhat uncomfortably in the rain from the balcony of the cinema, while the ceremony and other parts of the transmission could be viewed comfortably inside. The success and the importance of this big screen TV makes it imperative for transmission licences to be available to the film industry for its own relays of big national and sporting events.

COMPRESSION PICTURES

THE motion picture industry of America has been badly hit by television competition, but is regaining ground by exploitation of technical devices, both ancient and modern. One of the newest methods to present a picture in a manner which makes it look quite unlike TV, is the CinemaScope. This device is really a cylindrical lens attachment, fitted to the front of both camera and projection lenses. When photographing, a scene having proportion of 8 : 3 is compressed into the normal film frame proportion of 4 : 3. On projection, the picture is expanded back into its original 8 : 3 aspect ratio. The picture is reproduced on a huge panoramic screen. These lenses, the invention of a Frenchman, Prof. Chretien, are called Hypergonar objectives. There would be no need to use these devices for compressing horizontally a television camera pick-up. In this case, it would merely require the touch of a knob to introduce the correct degree of linear distortion. But I'm not so sure of what would happen when the pictures were unscrambled on a big screen TV projector with a Schmidt optical system. In any case, these big wide screens require an enormous amount of light. On the other hand, lateral compression of a scene on an electronic film camera could be correctly expanded to its original shape with a cinema projector fitted with an Hypergonar lens. Here is a development which, no doubt, Norman Collins' High Definition Films Company have already tackled.

MUSIC ON TV

MUSIC critics quite rightly assert that the best way of appreciating music is to listen with one's eyes shut. What is the point, they ask, of showing pictures of the conductor, the orchestra as a whole, or close-ups of individual instrumentalists. Nevertheless, the ordinary man-in-the-street does, in fact, like looking at the pictures of individual soloists, if not at bands in bulk. It all depends upon the handling of the various camera angles and precision of timing in cutting from shot to shot. Changes of angles should coincide with the ends of musical phrases, and, used with discretion, can assist the musical interpretation, or at least the musical phrases or punctuation. The close-ups of hands on keyboards have always fascinated me, and there is no doubt that the addition of the picture rivets the attention of the viewer upon the artiste. After all, these purist music critics should remember the small attention that music does, in fact, receive from the sound radio listener. As often as not, he will be playing cards, talking, or not paying any attention at all to the "background noise." Yet, put him in front of a television set and he will listen to the same music, watching the soloist with wrapt attention.

I admit that the features of some of the soloists and of the orchestral players are not always inspiring, to say the least. After all, they are not performers, in the music-hall sense. Still, it is possible to put on the screen pictorial backgrounds appropriate to the music, as an alternative to the faces of musicians. Pictorial counterpoint to music may not please music critics but, when expertly handled, has proved popular with viewers. Christian Simpson has often delighted with a combination of ballet, music and interpolated backgrounds and his technique is well worth studying.

G.P.O. Interference Analysis

A RESUME OF THE YEAR'S TROUBLES FROM THE TELEVISION VIEWER'S POINT OF VIEW

THE G.P.O. recently issued a detailed analysis of the radio and television complaints received and investigated in the 12 months ended January 16th, 1953. The following is the table which will most interest the readers of this magazine, as it deals only with interference with television reception. It will be noted that one item is "Unknown ; not observed by P.O. Staff." This refers to those complaints in which either the interference was so transitory that it had ceased before the P.O. engineer arrived to investigate, or it was so intermittent that it was not possible for a visit by the P.O. to coincide with the interference ; no useful steps could therefore be taken by the authorities. The G.P.O. point out, apart from the causes usually under the control of the listener, such as inefficient aerial and/or earth systems, faulty equipment and faulty electric wiring, the most prominent cause of complaint on the sound side was radiation from time-base circuits of television receivers of the flyback E.H.T. type—a matter which is receiving the attention of the radio industry. They also point out that for television reception, inefficient aerial-earth systems give rise to much less trouble to the P.O. owing to the fact that it is still common practice to use relatively efficient television aerials.

Another noteworthy point is that the complaints of ignition interference are on such a small scale. It is pointed out that this is not because the interference itself is on a small scale, but that it is usually of a transitory nature, and as a result cannot be attributed to specific vehicles against which the P.O. could take any action.

The most frequent causes of interference to reception of television broadcasting expressed numerically, and as a percentage of cases closed.

Unknown ; not observed by P.O. staff	13,972	26.5
Sewing machine motors ...	9,936	18.9
Faulty receivers	4.273	8.1
Hair-dryers	4,155	7.9
Inefficient aerial-earth systems	1,827	3.5
Motor-car ignition	1,778	3.4
Motors, miscellaneous... ...	1,647	3.1
Drills	1,521	2.9
Vacuum cleaners	1,452	2.7
Lamps (filament type)... ...	1.193	2.3
Fan motors	1,069	2.0
Overhead power lines ...	1,062	2.0
Refrigerators	937	1.8
Bed-warmers	766	1.5
Thermostats, miscellaneous ...	755	1.4
Radio transmitters	698	1.3
Radiation from superhet. local oscillator	650	1.2
Neon sign tubes	645	1.2
Medical apparatus (valve) ...	439	.8
Mis-operation of receivers ...	410	.8
Hair-clippers	361	.7
Faulty wiring of buildings ...	301	.6
Electric toys	281	.5
Dental motors	254	.5
Bells	241	.5
Fluorescent tubes	176	.3
Rotary convertors	163	.3

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).

SIGHT STRAIN

SIR,—It is too readily assumed that television viewing causes sight strain. This is simply not true. Viewing makes apparent what is already there ; accentuates symptoms, and causes "eye consciousness." Symptoms of any sort fulfill a useful purpose, they draw attention to a fault. The fault as we all know, is there already. The Editor of the "Optician," issue June 12th, states that there are twenty million people in this country needing eye care. Twenty million "ametropes." The word he uses in opposition to emmetropia. This is a gross understatement, for emmetropia means perfection as relating to the eye . . . which is a physiological impossibility. Even if emmetropia was established in any given eye, a burden could be lightened by a supplementary lens placed in front of the eye. The burden caused by television viewing is carried all the time the eye is accommodating for diverging rays. Theoretically all rays are diverging from any object situate within twenty feet. Accommodation is that state of the crystalline lens in action ; neutralising diverging rays to bring to a focus on the retina for sharp vision, which sharpness is always qualified by the clarity of the media and sensitivity of the various end organs of the retina. I hope that it can be seen from the above, and ignoring the millions of combinations of ametropia, much help can be given optically, for those many people who are now more conscious of the eye's effort to work on demand. —FRANCIS WORDEN (Chester).

[*We do not agree that twenty million people in this country need eye care, merely on the ipse dixit of the editor of the "Optician." No doubt it would be good for the opticians if it were so !*—EDITOR].

RECEPTION OF FOREIGN STATION

SIR,—Recently in our service area we were, as the BBC had warned us experiencing considerable interference from a foreign station. I went out to see one of our installations, the fault being sound on vision. The set I could do nothing with, due to the patterns and lines of this particular offender completely upsetting our normal reception. I came home for tea and put on my own 9in. superhet receiver and waited till the BBC closed down, then seeing that the intruder was still on, I decided to experiment a little. First I advanced the Contrast full, this completely overloaded my set so I turned it down a fraction and to my surprise the foreign announcer came through at about half volume—the vision was quiet prominent and the sync pulses being quite strong, I adjusted my line hold but could not synchronise at all, but then I tried the frame hold and it nearly locked. I dashed up to the loft and swung the aerial (H-type) and then came down again to see the result, it seemed a little weaker, but to my amazement I reached to turn up the sound more and the frame locked momentarily, I was now getting a black (monitor bar) up and down the screen identical to the bar between our frames. When I removed my hand the bar vanished—I tried several times and it locked and vanished alternately. It seemed to me that this hand capacity effect was doing the trick.

With my very limited knowledge of foreign language this station is without doubt North West German. I must say I've tried since, but the strength of the TV intruder seems to have waned. I hope this is of interest to readers.—E. W. PHILLIPSON (Goole, Yorks).

BOOSTER RECEPTION RESULTS

SIR,—The following information may be of interest to enthusiasts, particularly in the Portsmouth area, and in general areas within a radius of about 45 miles from the new booster station at Shoreham, on channel (3) 56.75 Mc/s.

After hearing mixed reports about the signal strength of channel (3), it was decided to make a direct comparison and settle the matter to at least our own satisfaction.

Two Phillips type 1437 U.F. receiver, (which can be easily modified for any channel by simply changing 3 plug in coils) were used, also for a further check a Vidor receiver, in everyday use for the London transmitter, channel (1) 45 Mc/s. was available. For the channel (3) aerial two types were tried, a cut down channel (1) Belling-Lee Junior, and a standard channel (3) J-beam, a Belling-Lee also being used for channel (1).

It was found that reception from Shoreham, though still far from perfect, was considerably better than the London signal, the most noticeable points being that the picture was black and white instead of grey and white, and that it did not fade. The great thing about Shoreham is that the picture is always of programme value, whereas the London signal in Portsmouth varies from minute to minute and day to day. Another advantage is that when the I.O.W. transmitter is in operation it will only be necessary to redirect the aerial. It was found that the addition of a pre-amp produced an even better picture.

To convert a channel (1) aerial to channel (3) the lengths of the elements *and spaces*, are simply scaled down inversely proportionally to the frequencies, i.e., multiply the dimensions of the channel (1) aerial by 0.795, this amounts to as much as 13.5in. off each side of the dipole element and reducing the spacing of the reflector by 12.75in. One should work to an accuracy of about 0.25in. in the measurements. It was found that the cut-down aerial tried in the above experiments gave slightly better results than the standard channel (3) J-beam.—M. R. HARKNETT (East Southsea).

WATERY PICTURE

SIR,—I think I can help Mr. Miller, Aylesbury, May, 1953, in his query. If he replaces the electrolytic condenser 20 on the Premier timebase this should clear his trouble of a dull watery picture. —H. G. SHAW (Romford).

OLD RECEIVER RESULTS

SIR,—The following may be of interest. I purchased a television and radio receiver (3 bands) in 1939. It was used for televising before the war, during the war was used for broadcast reception, it went through the "blitz" in South London it has been serviced only once, three or four small condensers replaced on sound only. Otherwise everything is as purchased, same 12in. tube and valves, there is a slight "ion burn" on tube, but the picture is still 100 per cent. at Croydon, using an inside aerial. I am not certain, but I think I paid £45 for the set in console cabinet, and it all looks as good as new today. I wonder if there are any more veterans giving such service?—ALFRED RYALL (Croydon).

AERIAL DESIGN

SIR,—Despite the kind invitation in a recent letter, I feel that it would be wise to keep out of the discussion on the relative merits of different aerial spacings, etc. Though I make no claim to be an angel, this is one place I fear to tread. There are too many variable factors concerned to make any definite ruling on the point possible, and I will only comment that the vast majority of those who are dogmatic about the exact effect of aerial dimensions on performance base their conclusions on insufficient data. The more data you have, the less you are inclined to be dogmatic.

A recipe for an interesting aerial known locally as the "Walter-Match," after its originator, may provide food for thought. Construct a four element array, using any convenient bits of angle-iron, conduit, rod, etc., leaving out the usual dipole insulators so that the whole thing is electrically bonded. Connect the outer of the co-ax to a point on the horizontal bar just behind the second element from the rear, which, as usual, forms the actual pick-up element. The inner cable, without the outer screen, is run up parallel to the upper half of the pick-up element and connected to the element at a point roughly one-third of the way up. This connection is best made by a clip so that it can be adjusted for good results.

Greeted with howls of derision on its first appearance, this aerial has since proved ideal for long range work, and was recently demonstrated indoors (ground-floor level) at a point where the average signal strength is certainly below 100 μV/m, and probably around the 50 μV/m mark. Think that one over!

To change to something rather different, Teleking users may be interested to hear that a G.E.C. preamplifier type BT166 is giving very good results in an area generally regarded as barely possible. Though the signal is boosted from flat greys to the possibility of overload the noise is generally invisible with full vision bandwidth. Power supplies come from the set, and the preamplifier (and the cost) are conveniently small.—D. W. THOMASSON (Exeter).

COMPONENTS FOR THE SUPER-VISOR

(*Continued from page* 123).

VALVES AND TUBE:
One T901 picture tube (English Electric). V9.
Seven Z77. V1, 2, 3, 4, 5, 10, 13. } (G.E.C.).
Three D77 V7, 14, 21. } (G.E.C.).
Three N78. V6, 12, 16. } (G.E.C.).
Three 12AU7 (Brimar). V8, 15, 20.
One DH77 (G.E.C.). V11.
One R12. V19. } (Brimar).
One 6U4GT. V18. } (Brimar).
One 6CD6G. V17. } (Brimar).
One WX6 } (Westinghouse).
One WG4A } (Westinghouse).
One LW7 } (Westinghouse).

SUNDRIES:
Chassis, Focus bracket, Mounting bracket, Tube fixing clips, Scan coil bracket } Denco (Clacton).
1-way tag panels, 2-way tag panels, 4-way tag panels } Bulgin.
P.M. loudspeaker 10in. (Whiteley Electric).
Four knobs marked.
Vol. on/off
Contrast, Brilliance, Focus } Bulgin.
Mask, 16in. double D; Filter Perspex to suit mask } (Lasky's Radio).
Tube, anti-corona ring; Tube sheath } (English Electric).
Ion trap, magnet type IT8 (Elac).
6BA bolts, cheese head ¼in. — **4BA bolts, cheese head.**
6BA nuts. — **4BA nuts.**
6BA Lockfast washers. — **4BA Lockfast washers.**
6BA solder tags. — **Wire.**
Systoflex. — **Multicore solder**
Calicult (Tallon).

PREVENTING INSTABILITY

(*Continued from page* 104)

is advisable to place the coils in screening cans mounted on the upper side of the chassis. Under-chassis screening is not then normally needed.

Checking for Feedback

It is not sufficient merely to obtain a degree of stability that does not allow actual oscillation to take place.

If an excessive amount of feedback is present the frequency response curve will not have the same shape at all settings of the contrast control. Indeed, this is a convenient method of determining whether or not feedback is actually occurring. A calibrated oscillator and an output meter are essential for this test. The output meter can be either a 0—1 mA. meter connected in series with the vision detector load resistor at the earthy end, or an A.C. voltmeter connected between the V.F. valve anode and earth. In the latter case an A.F. modulated signal will be required. A .1 μF blocking capacitor should be used to protect the meter from the direct current.

Set the contrast control at a low position and adjust the coils to obtain the required response shape. Increase the setting of the contrast control to maximum, reduce the oscillator to a suitable level and check the response curve again. If the shape is substantially the same as before, all is well, but if a peak has appeared, feedback is occurring at a frequency indicated by the peak. Steps must then be taken to prevent the feedback by giving attention to the possible causes outlined above.

By far the easiest method of obtaining stability is to build the receiver in the form of a superhet. The main difficulty with such a receiver is, of course, the need for a signal generator for alignment, but even if this can be overcome only by employing the services of the local TV engineer, the cost will be well repaid by the superior results obtained.

YOUR Problems SOLVED

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 95 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

"VIEW-MASTER" LINEARITY

I have built Viewmaster as double deck working on 210-volt mains and have a fairly decent picture, but have never been able to master correct proportion of test card as circle, or clock, which is egg shape, and there is black border on left-hand side of screen about ¾in. I have plenty of height, but have to reduce this to about ½in. from top to get something like the proper circle.—Percy Green (Darlaston).

The non-linearity which you mention is most probably due to the fact that your A.C. mains voltage is only 210 volts and, therefore, your H.T. supply is low. We suggest fitting an auto transformer so as to increase the H.T. to the specified value of 280 volts, then reduce R46 to 47 KΩ and connect a .1 MΩ variable resistor in series with it which must then be adjusted for best linearity.

LEAKAGE

I decided to build vision unit adding sound later, so I purchased 1355 unit, built a converter as described in PRACTICAL TELEVISION, March, 1951, for Birmingham, making the coils, L1 prim. 2 turns, sec. 6 turns ; L2 5½ turns ; L3 4½ turns ; L4 55 turns ; hoping this would tune to the Belfast frequency. I built Argus timebase, mains unit, C.R.T. and E.H.T. with some departures as follows : R70 and R71, 490 KΩ ; R67, 190 KΩ ; R57, 58, 59, 60, 2 MΩ ; left out R73 and C68 until I built sound section. Used VU120 for E.H.T. on 2-volt heater. Added contrast control (8,000Ω pot.), one end to 3 on W plug of 1355 unit, other end and slider to chassis. Switched on, turned up brilliance control, received raster lines on tube but flickering badly. (Line hold seems to coarsen lines.) Reduced brilliance and adjusted contrast, but screen remained blank. Adjusted cores and condenser with no result. I then connected 'phones to video valve anode and received stations jumbled together, on touching I.F. grids, so I think I.F. strip is working, but I notice 100 KΩ resistor connected to first I.F. valve is very hot. Now a new trouble has appeared. I had tube connected and brilliance turned up to give lines on screen when it started flashing off and on and I saw that V19 is emitting bright flashes so I have switched off and only hope for some good advice from your department.

What caused the flashes in V19 and would it damage tube or E.H.T. transformer ?

Is contrast control properly connected ? Which defective component would cause the 100 KΩ resistor to become so hot ?—R. J. Cairns (Carrickfergus).

If the 100 KΩ resistor associated with V1 gets warm then you have a leakage at some point which must be checked. Examine the 25μF condenser and the 0.005μF associated with this resistor.

You will not receive Belfast with coil details for Sutton Coldfield. You should try adding two turns to each coil.

Note that C43 in the timebase should be 0.005μF, and if trouble with foldover at the top is experienced then try 0.002μF for C44.

Flashing of V19 indicates a bad leakage in the E.H.T. network, probably C61 is faulty but this point of the circuit should be checked. The tube should be in order as the flashing takes place between anode and cathode of V19.

Your method of connecting the contrast control is correct.

FRAME FOLDOVER

Your advice on a small fault which has recently developed on my View-Master will be appreciated.

I built the set about five months ago and it is working quite well apart from the appearance of closely spaced white lines, apparently fly back, which begin to appear at the top of the picture approximately 20 minutes after switching on, and slowly increase in number until they reach about ten to twelve lines, where they remain steady.

The picture is normally quite steady and foldover is only experienced after a play, when the titles, etc., are moving upwards and pass through the lines.—J. Goldsmith (N.22).

The foldover which you mention is probably due to a component changing in value as it warms up, in particular we suggest checking R66, R60, R61, and V12 and probably the most convenient method of checking would be to connect a voltmeter across the cathode of V12 and note whether there is a change of voltage which coincides with the foldover.

ARGUS—NO SOUND OR VISION

I have just completed building the Argus Televisor for Wenvoe frequency, and I find that I have no sound or vision.

I have a Duplex X aerial at a good height.

I have H.T. reading on all valves, but am now wondering if my coil winding is at fault.

I have wound all coils except L10 and L11 clockwise, but 10 and 11 secondaries are anti-clockwise with the primaries wound over them in a clock-wise direction, as shown in issue, with 22 s.w.g. bore wire primaries. Although I have tried touching the grid pins with a wet finger or the blade of a screwdriver I find the clicks heard in the speaker get weaker as I bring in more stages and I can hear nothing on the aerial input at all.

The Televisor has been built from a kit of parts which I presume are all new components.

When I measure the H.T. on all valves supplying sound I get loud clicks in the speaker, although response from the grids get weaker.—K. V. Fry (Barnstaple).

You should get a good strong click from the aerial socket and no click indicates a fault between here and the loudspeaker.

It is better to try for the visional signal first in the manner suggested in the data, as it is much stronger. You will require a pre-amp—possibly one of two valves.

If difficulty is experienced you may find it beneficial to loosen the coupling between vision and sound stages by taking the coaxial from the tap on L9 and winding on to L9 a coil similar to L2a. Earth the bottom end of the new coil and take the top end to the coaxial.

Note that L7 is very critical and for Wenvoe you may find it beneficial to reduce L3 by one turn.

NO TIMEBASE H.T.

I have completed building the "Argus" Televisor, and am writing to know if you could help me to get it to function.

On switching on for the first time, a spot appeared on screen, and then faded out.

I switched off and thought the H.T., or the filament of the timebase, was at fault.

I went through the circuit of timebase, and found it O.K.

I switched on again, and I heard what sounded like a spark gap in the region of the C.R.T. network and the power pack.

Both mains and E.H.T. transformers seem to be O.K.

When I switch on now, one of the fuses (1 amp.) is blown immediately.

I am at a loss to account for the trouble, and must mention that I have no technical knowledge, so would be very grateful if you could give me some help in this matter.—F. Phillips (Brighton).

The appearance of a spot only on the tube face indicates that no H.T. was reaching the timebase; this, coupled with the fact that the fuse has blown, indicates that you have a short circuit on the H.T. line at some point.

Check that C65 is in order and if it has broken down, try inserting a Brimistor CZ3 in series with the lead to C65 before switching on again.

If you have no test instruments you may be able to localise the H.T. short circuit by using a bulb in series with a battery and connecting it between H.T. plus and the chassis.

PICTURE KINKS

I have a fault on my ex-Government set using VCR 97 and TRF with EF50's. I feel you may be able to tell me what the trouble is, because it is very elusive. I am sure that the trouble is either in the frame T.B. itself or the sync separator, but the point is I get good synchronisation lock on both line and frame which rather rules out the sync. Here is a description of the fault; for a whole programme I get a perfect picture, but then, usually coinciding with a change of programme, I get—a kink. Now the important thing which I think rules out faulty condensers, etc., is that when the *next* programme comes on, the picture is *again perfect* and so that of course makes me suspect the sync circuit.—N. Blackwood (Liverpool).

It is not quite clear from your remarks whether the picture invariably "kinks" at the bottom or whether it is inclined to kink at other points as well. In the general case there are two possible explanations: A sideways kink indicates line timebase trouble. It can be due to "pulling on whites," which means that when there is a bright white part of the picture that section tends to move to the right.

The effect is that of a "kink" which will shift when the picture content changes such as when changing from one scene to another.

The second possible cause is of the line timebase slipping periodically, due to either a weak sync pulse or picture content getting through into the sync circuits.

The first trouble can be cured by re-alignment and the second by increasing the line sync pulse or by adjustment of the sync separator.

We cannot enter into particular details not knowing the circuit you are using.

TWISTED VERTICALS

I ask you once again for your assistance regarding a fault in my "View-Master," which is built of entirely new specified components. I am deriving my E.H.T. from a Nera R.F. E.H.T. unit, this being the only deviation from specification.

The fault takes the form of twisted verticals and slight non-linearity in the frame scan. Suspecting the H.T. supply I replaced MR4, C53, C54 and C55. I also increased C53 and C54 to 200 μF each and put two additional 5 henry chokes in series with WB104. This effected a very slight improvement, but not much. It of course reduced the H.T. rail voltage. I then disconnected the power pack and fed the receiver from a separate power pack, including 2.6 v. negative to V4. This power pack had full-wave rectification and bags of smoothing. It made no difference.

I then suspected the scanning components so I replaced frame transformer, scanning coils, V11 and V12. To ensure that I had no faulty connections I stripped and rebuilt the whole timebase chassis, re-routing all wires carrying A.C. to prevent any coupling. I have also tried removing MR5 and C52. As I am using a tetrode C.R.T. (MW 31-16) I tried supplying anode 1 from the H.T. rail in case there was any hum from the line transformer on this anode.

I then ran the set under no-signal conditions, with the whole line timebase inoperative. This showed that the frame trace on the C.R.T. was not straight, the line wriggling on the screen like a snake. The frame hold control will stop this wriggling, the resultant bulge being approximately the same as that shown on a picture or a blank raster edge. I would add that the faint return or flyback trace which can also be seen, is perfectly straight.

If I connect an AVO40 in series with the frame coils the wriggle on the trace coincides with, and is shown on the meter as, a variation of current in the coils. Earphones connected to output of the choke also indicate a very slight hum which has the same periodicity as the wriggle on the frame trace and the variation of current in the coils.

I would also add that the line trace is not altogether straight, it being slightly bowed. This, however, can be almost entirely eradicated by tilting the ion-trap magnet on the tube neck and I just add this information in case it may be of use. I have tried re-tuning the vision receiver, but this, in common with all my other efforts, has proved of no avail.—George A. Gascoigne (Gillingham).

You appear to have carried out very complete tests to determine that the vertical distortion is not due to ripple in the D.C. supply and therefore it is just possible that either the distortion is due to a stray magnetic field or to a 50 cycle voltage appearing in the anode of V10. This last fault may be due to a faulty valve, such as a leakage between heater and cathode and this should be checked, whilst if the fault is due to a magnetic field it may be checked by moving the tube, with scanning components, 15in. to 18in. away from the receiver.

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5,000 METERS from **7/-** upwards; 10,000 surplus Valves from **2/6;** Baseboard Mtg. Valveholders, octal, **3/-** doz.; IFTs 10/13mcs canned, new, **1/6;** 7mcs (R1355 diode type), **1/6;** 7mcs IF Trap Coil, **9d.;** RF24 Coils, bak., **6d.;** Ceramic, **9d.;** RF Units, type 24 **18/-,** 25 **25/-,** 27 **40/-;** R1082 bat. Rxs, 6 valves, less coils, **25/-** (carr. 3/6); Collaro AC37 'Gram Motors, ⅜in. dia. spindle, **30/-.** Terms: Cash with order; immediate delivery. S.A.E. for list or enquiries. W. A. BENSON, 308, Rathbone Rd., Liverpool, 13. Closed July 26 Aug. 3 inc.

NEW BOXED VALVES. — "Viewmaster" Kit, 12 valves as specified **£6/2/6;** EF91 **8/-,** EB91 **6/6,** SP61 **4/6,** 807 **7/6,** EBC33 **8/-,** 6SN7 **9/6,** EF36 **6/-,** EF39 **7/6,** 1T4, 1S5, 1R5, 3S4, 6AT6, EL32, 6F6, 6V6, 6X5, 7S7, 7B7, 5Z4, 5U4, U14, all at **8/6** each; EF50 **7/6;** Co-ax Cable ¼in., 80 ohms, **8/6** doz. yds.; EHT Trans., 2.5 kV, **39/6,** 5 kV, **62/6;** "Viewmaster" Coils, set of 13 and choke, **17/6;** Electrolytics, BR, 500vw, Card/tub, 8 mfd **2/6,** 16 mfd **3/6,** 8 x 8 **3/9,** 8 x 16 **4/3,** 32 mfd **4/3,** 32 x 32 **4/9;** 0.1-500v Moldseal, **10/-** doz.; Non-mag. Speakers, 6in. **13/6,** 10in. **21/-.** New list available. RADIO UNLIMITED, Elm Rd., London, E.17. (KEY. 4813.)

"DO IT YOURSELF the Derwent Way," 44-page illustrated Booklet for Handymen. Read about Formica; Tileboard; making T.V. Cabinets and Tables; making Seagrass Stools; French Polishing, and where to buy materials. From your newsagent, price 6d., or 8d. by postal order from the publishers: DERWENT CRAFTS, Bridgegate, Derby.

BOOKLETS: "How to use ex-Gov. Lenses and Prisms," Nos. 1 and 2, price **2/6.** Ex-Gov. Optical lists free for s.a.e. H. ENGLISH, Rayleigh Rd., Hutton, Brentwood, Essex.

ARGUS KIT with tube and chassis; offers? Box No. 154, c/o PRACTICAL TELEVISION.

ALUMINIUM can electrolytics T.C.C., 60/350v, **5/-;** 150/350v, **8/6;** B.E.C., 32/32/350v, plus 25/25v, **4/6;** Polystyrene Coil Formers, with slugs, **9½d.;** Perspex dark screen 12in. tube, **7/6;** Metal-cased Tubulars, 1mf, 250v, **9d.;** .1/600v, **1/-;** .1/500v, **10d.;** .1/350v, **7d.;** .05/500v, **9d.;** .02/750v, **9d.;** .01/1000v, **10d.;** .001/1000v, **8d.;** Sylvania EF50 Valves, **7/6.** All goods new and guaranteed; add postage under £1. REBUS ELECTRIC, LTD., Gladstone Place, Newton Abbot, Devon.

500 NEW BOXED Receivers, type 1124, complete, 6 valves, 25/- ea. AMATEURS PARADISE, 155, Humberstone Rd., Leicester.

WANTED

NEW VALVES WANTED, small or large quantities, 3Q4, 6V6, 5Z4, ECL80, EF80, KT66, KT61, 6L6N, VR150/30, 5R4, 80, etc., etc. Prompt cash. WM. CARVIS, 103, North Street, Leeds, 7.

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FREE! Brochure giving details of Home Study Training in Radio, Television, and all branches of Electronics. Courses for the Hobby enthusiast or for those aiming at the A.M.Brit.I.R.E., City and Guilds Telecommunications, R.T.E.B., and other Professional examinations. Train with the College operated by Britain's largest Electronic organisation. Moderate fees. Write to E.M.I. INSTITUTES, Postal Division, Dept. PT28, 43, Grove Park Rd., London, W.4. (Associated with H.M.V.)

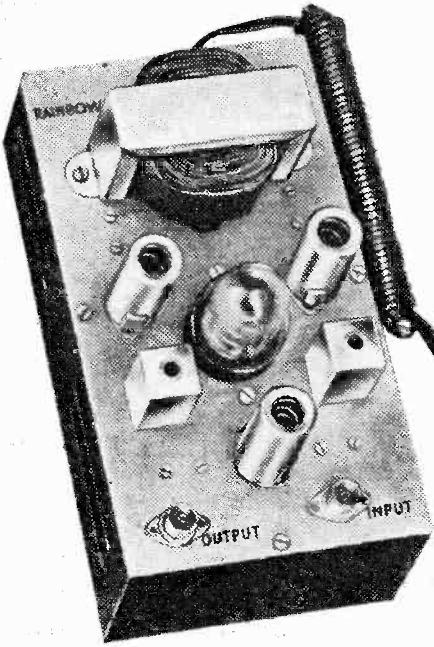
I.P.R.E. Data for constructing TV Aerial-strength Meter, **7/6;** 5,500 Alignment Peaks for superhets, **5/9;** sample copy "Practical Radio Engineer," **2/-.** Membership-examination particulars, **1/-.** Syllabus of seven postal courses free and post free. SECRETARY, I.P.R.E., 20, Fairfield Rd., London, N.8.

News from the Trade

TV Converter

IN this improved converter by the Rainbow Mfg. Co., two EF91 valves are used as frequency changers, one for the sound and the other for the vision channel, and these are preceded by a single stage wide-band pre-amplifier employing another EF91 valve. A receiver, designed for one station may, with this converter, be tuned to any other BBC TV transmitter.

The frequency changers are of a very stable and reliable type, and the oscillator coils are readily accessible for minor initial adjustments. Other tuning coils are placed below deck.



The new Rainbow Converter for any of the 5 BBC channels.

The H.T. supply is of special interest, two metal rectifiers being used, and the output is stabilized by a VR150 voltage regulator.

Coaxial input and output sockets are provided and clearly indicated. The converter is contained in a black crackle finish steel case, measuring 8¾in. x 4¾in. x 4¼in. high. The price is £10 10s., complete with coaxial plugs and it is for use on A.C. mains (200/250 v. 50 c/p) only.—Rainbow Radio Mfg. Co., Ltd., Mincing Lane, Blackburn, Lancs.

New Mazda Tube

THE Edison Swan Electric Co., Ltd., are now producing a cathode-ray tube with a 14in. round bulb. Designated type CRM.141, this tube is fitted with an ion trap tetrode gun assembly and has an aluminised screen. The face plate is of clear glass and the tube has a B12A duodecal base. List price of this tube is £14 15s. (plus £5 15s. 1d. purchase tax).

A further addition to the Ediswan/Mazda range is the 20P4, a new line timebase output tetrode. This valve has a re-designed screen (G2) the dissipation of which has been greatly reduced, thereby enabling the valve to handle considerably higher current pulses on the active portion of the operating cycle. Owing to the improved mutual conductance figure the power sensitivity of the valve has also been increased. List price of the 20P4 is 17s. 6d. plus 5s. 9d. purchase tax.—Edison Swan Electric Co., Ltd., 155, Charing Cross Road, W.C.2.

Forrest Transformers

PICTURE tubes which have heater/cathode leaks and are normally unsuitable for use in standard receivers may, in most cases, be satisfactorily operated if a special transformer is used to run the heater. For this purpose a specially designed transformer should be used, as described in some recent issues, and a very good example which we have tested in this connection is that supplied by Forrest, of Shirley, Birmingham. The principal requirement of these transformers is that they should have a low capacity and a restricted field so that they may be placed in an existing receiver without any deleterious effects. On a sample which we tested the capacity was less than 30 pF, and a tube which had been discarded as of no further use in normal receivers was run with complete satisfaction. The price is 15s. 4d. (plus 1s. for postage and packing). This firm also manufacture a special Booster transformer which may be used to over-run a heater in a tube in which the emission has run low, and again a further useful span of life may be given to an expensive tube.—H. W. Forrest, Shirley, Birmingham.

Ekcovision Model TC206

E. K. COLE, LTD., announce the introduction of model TC206, a new Ekcovision receiver in a contemporary style console cabinet.

This model incorporates many outstanding features, including full automatic control of picture and sound to counter aircraft "flutter" and signal fading. The 14in. cathode-ray tube is the latest type aluminised tetrode with ion trap, providing an extra large picture of 108 sq. in. (12in. x 9in.).

The chassis is based on the "triple-link" design of proved efficiency and reliability.

The receiver is for operation on A.C. mains and is suitable for any of the five BBC television channels. Price 74 gns. (tax paid).—E. K. Cole, Ltd., Southend-on-sea, Essex.

QUERIES COUPON

This Coupon is available until August 21st, 1953, and must accompany all Queries.

PRACTICAL TELEVISION, August, 1953.

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