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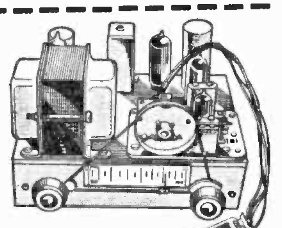

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Practical Television

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Contents

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 the 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, London, W.C.2.

Owing to the rapid progress in the design of radio and television 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.

"Convertible" Receivers

BEFORE the Radio Show, advance information was received from various manufacturers of their new season's models. Amongst this information, we repeatedly found references to receivers which were said to be "convertible". Up to the time of going to press, however, no actual details as to what is meant by the term "convertible" had been received. The inference was that the receivers concerned could be adjusted to receive any transmissions which might be made using new standards decided upon either by the Pilkington Committee or by the authorities. It is, however, very necessary that full details of any conversion facilities be made public, as there are so many possible differences which may be introduced by a change of standards. If a change were made to a completely different system, the video detector polarity might have to be reversed (a simple matter in many instances), AGC modifications might be necessary and the sound receiver might have to receive F.M. signals or intercarrier sound. As it is not yet decided which system will be used in the future, and experiments and tests are still being carried out, we do not see how any manufacturer can have produced a receiver which may be "converted" when any changes are made in the standards of transmission; certainly "conversion" will not be made possible solely by altering the frequency of the line timebase.

ANOTHER FREE BLUEPRINT

NEXT month we shall be giving away with each issue another large blueprint (size 22in. x 16in.), but unlike previous blueprints in this magazine, it will not consist of a design for a television receiver. In the past we have published details of several complete television receivers but, unfortunately, in nearly every case, the suppliers of essential components have been unable, after a short period of time, to continue the supply. There are, however, a number of pieces of apparatus (apart from receivers) which are of great value to the television enthusiast and it is felt that by issuing a blueprint for a comprehensive multimeter of high sensitivity, we shall be filling a long-felt want in the ranks of the home-constructor whose main hobby is television. The serviceman also, if he is enthusiastic about his trade and likes to make his own equipment, may find that home-built apparatus possesses advantages over the commercial article and will prefer to make such items for himself.

The design is such that much internal wiring is eliminated by the use of a printed circuit. Two rotary switches are connected directly to this circuit board to give about double the number of ranges usually found on a home-constructed meter. The movement used is robust and extremely sensitive—the basic f.s.d. is $50\mu A$. The scale employed is well spaced, clear, and, to facilitate accurate readings, extends over an effective length of 4½in.

All readers will find this precision instrument of value and the keen experimenter and constructor especially will be able to build this comprehensive multimeter at a considerable saving.

Our next issue, dated October, 1961, will be published on September 22nd.

Variable Voltage Stabilised Power Supply

By R. Brown

MAKING A SIMPLE UNIT FOR WORKSHOP EXPERIMENTAL PURPOSES

HIGH tension and filament supplies are two of the basic requirements for any experimenter or serviceman, yet the provision of these supplies is often given scant attention when setting up a laboratory or workshop, and for ever after, one is forced to delve into the spares box for the odd mains transformer, chokes and capacitors when these supplies are required. Inevitably the output of such a temporary arrangement turns out to be other than the one required. The H.T. voltage has to be obtained with dropping resistors, to bring it to the correct value for the circuit being tried out. The regulation of such a supply, even without the dropping resistors, is very poor, so that quite frequently one can change a component in the circuit, with the object of improving its performance, only to find that the change has, as a side effect, altered the H.T. current and this in turn has caused the H.T. voltage to change: an effect which frequently masks the desired result or gives a completely erroneous impression of the results of the component change.

It was after a series of such time-wasting, and incorrect interpretation of results, and one final fiasco when a whole series of laboriously plotted results had to be thrown away, that the author decided that something had to be done.

What is required is an H.T. supply which can be varied over a certain range and set to give an accurately known voltage. Once set the voltage must remain constant, irrespective of mains variation, and, perhaps most important of all, it must remain constant when the load current is varied. In other words, what is required, is a supply which can be set once, and then forgotten.

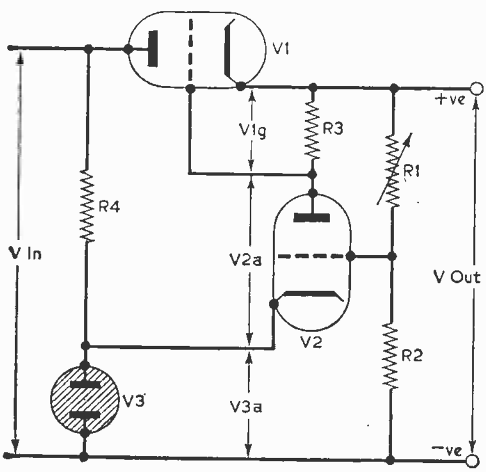


Fig. 1.—The basic circuit of a variable voltage stabilised power supply.

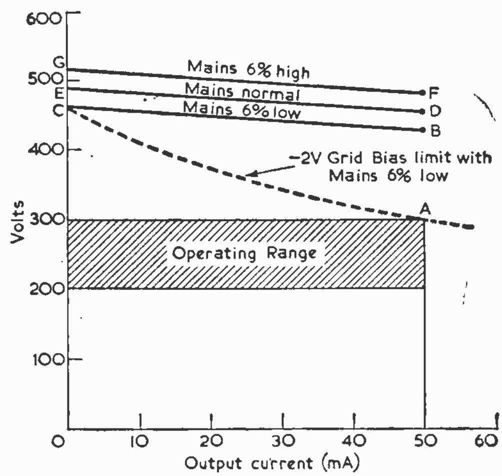


Fig. 2.—The operating range of the valve stabilised power supply.

Choice of Circuit and Performance

Voltage stabiliser circuits seem to have been analysed in great detail and a very great many different circuits have been produced. This causes considerable difficulty to anyone looking for a circuit to use—a difficulty which was further increased in this case, for the unit had to be a general-purpose one, and there was no fixed specification to work to. It was decided that the unit should be relatively cheap to make; should meet the needs of most experiments; should use components which are either in a spares box or are easily obtainable on the surplus market, and it should be possible to increase the output at some later date should this be found desirable.

The Series Valve Stabiliser

The useful range of output voltage and current was felt to be, 200V—300V, 5mA—50mA. A circuit suitable for stabilising and setting the voltage of such an output is the series valve stabiliser. This is shown in Fig. 1 in basic form. Two valves are used, one connected in series with the H.T.+ line, and one connected across the H.T. line. A neon stabiliser, V3, is also included. The action of this circuit can perhaps be best understood by seeing first of all how it maintains a constant output voltage when the input voltage is varied. Suppose, for instance, the input voltage Vin increases. This will initially cause the voltage Vout to increase; the voltage drop across R2 will also increase, so that the grid voltage of V2 moves in a positive direction. The cathode of V2 is, however, connected to the anode of the neon stabiliser and this will tend to keep the cathode voltage of V2 constant whatever the variation in Vin. The result of the increase of Vin will, therefore, be to cause the grid voltage of V2 to go positive. This will cause the anode current of V2 to increase, and the voltage drop across the anode load resistor R3 will increase; the voltage across R3 provides the grid bias for V1, and the V1 grid will thus go negative. This increased negative voltage, on the grid of V1, will cause the voltage drop across V1 (anode to cathode) to increase, and this will reduce the value of Vout. Thus the initial increase in Vin has resulted in a larger voltage drop across V1 which will almost completely cancel it out, leaving Vout almost the same as before.

A similar state of affairs occurs when Vin falls. This time the bias on V2 goes negative, decreasing its anode current, and reducing the bias on V1. This will cause the voltage drop across V1 to decrease and the value of Vout will remain constant.

When the load current taken from the unit varies, it will also cause Vin to vary, and these variations will be compensated for as described, and Vout will remain constant.

Pre-setting the Output Voltage

When it is desired to vary the value of the output voltage, and set it to a desired level, the potentiometer R1 is used.

If it is desired to reduce the output voltage, the value of R1 is decreased. This will cause the grid of V2 to go positive, increasing the anode current and, therefore, increasing the negative bias on V1. Thus the voltage drop across V1 will increase, and the output voltage will be reduced to the required value. In this way the output voltage can be varied over quite wide limits.

V1 Operating Range

The action of the stabiliser can be examined in greater detail with the aid of the load diagram (Fig. 2).

This is drawn in the following manner: the maximum-current/maximum-voltage point (A; 50mA/300V) is first plotted. At this point the current through V1 is a maximum and the voltage drop across it must be a minimum. This means that the grid bias on V1 must have its minimum value. The actual value of this minimum grid bias must be such as to ensure that under no circumstances does grid current flow. A value of -2V gives a wide safety margin and this value was chosen.

The next step is to look at the Ia/Va characteristics of the valve chosen for the V1 position. This

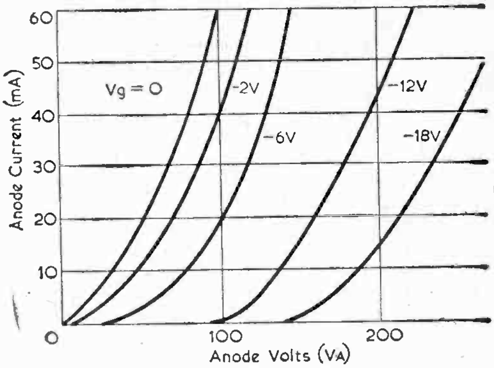
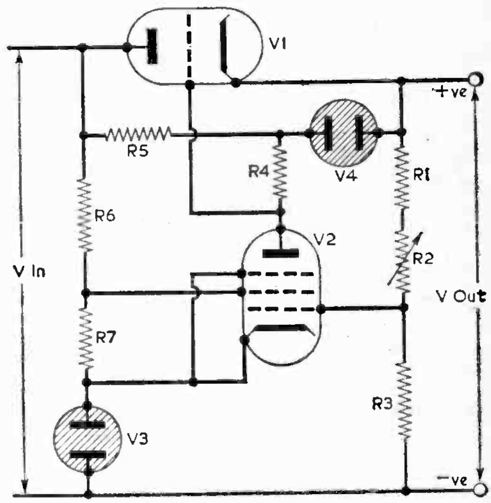


Fig. 3 (above).—The Ia/Va characteristics of the EL37 triode-connected.

Fig. 4 (below).—This circuit gives a higher and more uniform gain from V2.



is an EL37 tetrode with its anode and screen connected together as a triode. Fig. 3 shows the characteristics of this valve, and from these characteristics it can be seen that with the grid voltage at -2V and the anode current at 50mA, the anode voltage is about 115V. The transformer/rectifier unit must therefore provide a voltage equal to the voltage drop across V1 of 115V, plus the output voltage of 300V, when 50mA is being delivered to the load, and when the mains voltage it as its minimum. This fixes point (B) at 415V (Fig. 2).

The line BC can now be drawn and this shows the output voltage from the transformer/rectifier unit at different load currents. This is for the condition where the mains are 6per cent low, and the line DE can now be drawn in the position corresponding to the normal mains voltage. A further line parallel to this and 6per cent higher can now be drawn to show the conditions when the mains are 6per cent high.

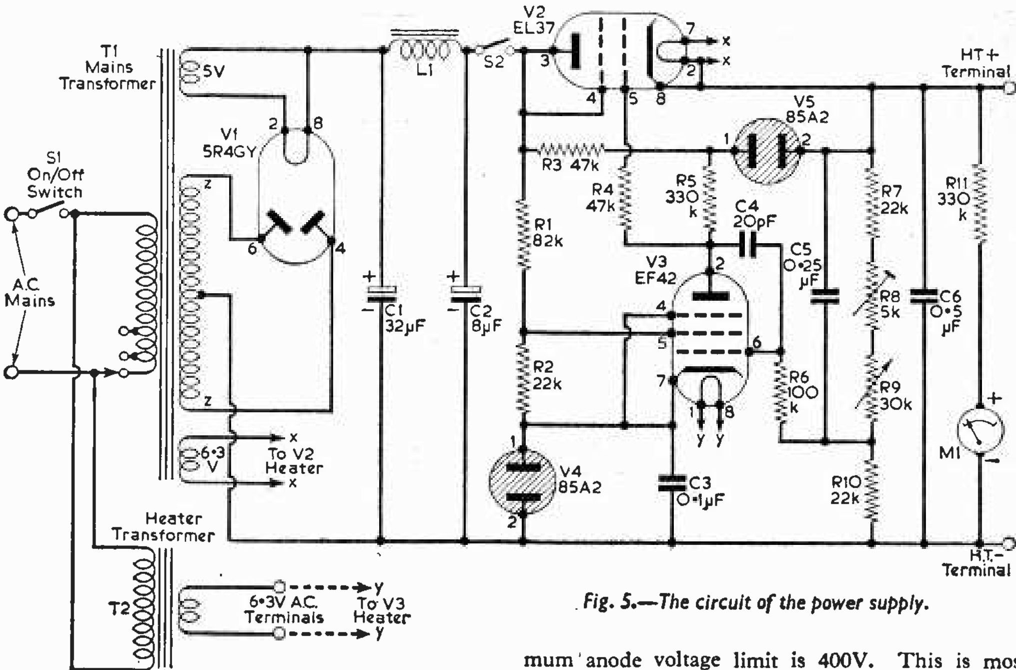


Fig. 5.—The circuit of the power supply.

Two other points are important as far as V1 is concerned. One is that the maximum anode voltage of V1 should not be exceeded, and the other is that the maximum anode plus screen dissipation of V1 should not be exceeded. For the EL37 the maximum anode voltage limit is 400V. This is most nearly reached when the load current is zero and the mains are 6per cent high, and it is in fact 400V below the line FG. The anode plus screen dissipation is 28W for the EL37, and in this unit is well below the working range. The anode voltage limit means that it is impossible to design the unit to give voltages of less than about 120V; but another factor creeps in here which limits the minimum output voltage for the unit to 200V, so that both these limitations can be ignored in this unit.

COMPONENTS LIST FOR FIG. 5

Resistors

R1	*82k 1·5W*	*R7*	*22k ½W*
R2	*22k ½W*	*R8*	*5k ¼W potentiometer*
R3	*47k 1W*	*R9*	*30k ½W potentiometer*
R4	*47k ¼W*	*R10*	*22k ½W*
R5	*330k ¼W*	*R11*	*330k ½W*
R6	*100k ½W*		
C1	*32μF 550VW electrolytic*	*C4*	*20pF 200VW*
C2	*8μF 550VW electrolytic*	*C5*	*0·25μF 300VW*
C3	*0·1μF 100VW*	*C6*	*0·5μF 400VW*
V1	*5R4GY*	*V4*	*85A2*
V2	*EL37*	*V5*	*85A2*
V3	*EF42*		

Mains Transformer

T1 350-0-350V, 60mA
6·3V, 1·5A
5V, 2A

Heater Transformer

T2 6·3V, 1·5A
S1, 2 Mains S.P.S.T. on/off switch
L1 5H 60mA smoothing choke
M1 1mA meter
Valveholders two B8A
two B7G
one international octal
5-way tagboard
Chassis 12in. x 10in. x 2½in.
Front panel 12in. x 8in.

We must now look at the design of the amplifier V2. Its cathode will be at a potential fixed by the neon stabiliser V3, and in this unit this is 85V. High gain is necessary so a pentode is used, actually an EF42. Almost immediately there is a difficulty in the basic circuit, and this is that the output voltage range is −2V to about −67V, the bias required for V1. A large load resistance is used, and the valve is operating under very low current conditions. Under these conditions the gain is very low with the output voltage at 2V, rising sharply as the output voltage increases. With the basic circuit the low gain will mean poor stabilisation. This can be overcome by the circuit shown in Fig. 4.

Here an extra neon stabiliser (V4) is connected in the grid/cathode path of V1. This will have a constant voltage across it of about 85V, and this voltage is such as to make the grid of V1 positive with respect to its cathode. V2 must now, therefore, provide a voltage equal to the bias required for V1 plus the voltage developed across V4. This for a bias of −2V on V1 the output voltage of V2 must be −2V + 85V, which is equal to 83V. The effect of this is to move the operating range of V2 up into a region where the gain is high and reasonably constant.

(To be continued)

USING A SIGNAL GENERATOR

By F. Burton

INJECTING SIGNALS INTO TV RECEIVERS

THE work of servicing and adjusting television receivers can be considerably simplified if an accurately controlled signal is available—a signal which can be set to the required frequency and its strength adjusted to a convenient level. For simple work, such as correcting straightforward faults or for roughly aligning I.F. strips, the transmitted television or sound carrier can be used. The limitations imposed by such a signal are, however, very great. A much more versatile test signal is really necessary. Such a signal can be produced with a signal generator. These instruments do, however, come in all shapes and sizes and before venturing to build or to purchase a signal generator, it is best to have a very clear idea of just what the requirements are.

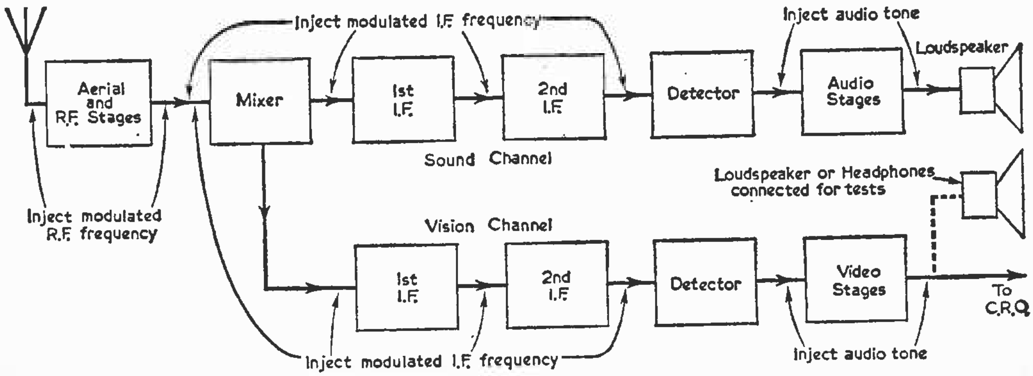


Fig. 1.—Using a signal generator to test for breaks in the sound and vision channels.

Basic Requirements

As a fault finding instrument, the signal generator can be used to find the position of a break in the signal path. To do this some form of output monitoring is connected to the output of the receiver and the signal generator is set to give a suitable signal which can be injected into the receiver, at different points back towards the aerial. The position of the break is found between the point at which the signal last gets through and the first point at which it fails to get through.

Obviously the signal generator should be capable of producing any signal necessary for fault finding. The block diagram of a television receiver (Fig. 1) begins with the sound channel. Testing this can be done with the loudspeaker as the monitor. The loudspeaker and the audio stages require an audio frequency signal, say 1000c/s tone, for testing purposes and so here is the first requirement—an audio frequency output. The actual output voltage will depend upon the test point and an output of only a few millivolts will probably be all that is necessary at the input of the first audio amplifier, but anything up to 20V may be necessary when testing the loudspeaker transformer.

I.F. Amplifier

The next stage in the receiver is the intermediate frequency amplifier. Here a radio frequency signal at the I.F. is required. An output voltage from the signal generator varying from say $50\mu V$ to 10mV will probably be sufficient. As we are using a loudspeaker to show the presence of a signal, the signal generator output must be modulated at an audio frequency. The 1000c/s tone, already mentioned, is usually used for this purpose. To check for a break between the aerial and the first I.F. stage a radio frequency signal, at the frequency of the sound carrier must be used. This should have a level of around $10\mu V$ to 10mV.

Video Stages

When investigating the vision section of a receiver a video frequency signal is required to test continuity in the video stages. A 1000c/s tone is good enough

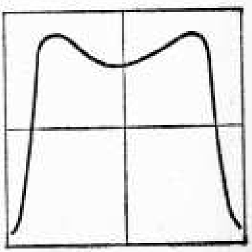


Fig. 2 (right).—A typical response curve of the sound I.F. stages.

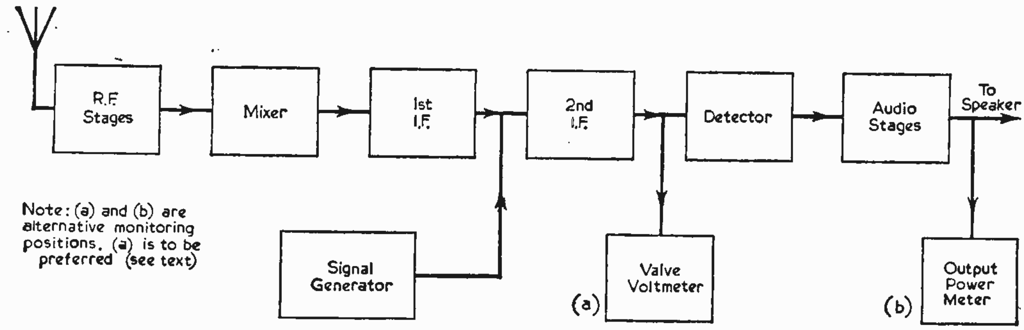


Fig. 3.—How the signal generator is used to align the I.F. amplifier.

for checking for actual breaks. A modulated radio frequency signal at the intermediate frequency is needed for testing the I.F. stages and the detector, and a radio frequency signal at the vision carrier frequency for testing the stages between the aerial and the first I.F. stage.

So for fault finding, a fairly simple instrument giving a radio signal covering the intermediate frequency and Band I and Band III television frequencies, which can be modulated with an audio frequency tone; the output of which can be varied (very roughly) in steps from approximately 10μV to 10mV, and which can give an audio frequency output of from a few millivolts to several volts, preferably as much as 20V, is required.

Bandwidth Measurements

The next most important application of the signal generator is the alignment of the intermediate frequency sound and vision strips. These strips must be adjusted to have a response curve which will pass signals at the required frequency at the minimum of distortion, while preventing the passage of unwanted signals. The typical response curve of the sound channel is shown in Fig. 2.

One way of adjusting this, is to connect an output meter across the loudspeaker and connect the signal generator to the grid of the last I.F. valve. The trimmers in the I.F. can, in the anode circuit of this valve, are then adjusted to their middle position. The signal generator is modulated and the output voltage is recorded with its frequency first set to the middle of the pass band, and then at various frequencies above and below the middle of the pass band. Results are then plotted and if the curve which results differs from the desired one, the I.F. can trimmers must be adjusted and the readings repeated until a correct response curve is obtained. The signal generator output is then transferred to the next but last valve in the I.F. strip and the whole process repeated, and so on until all the I.F. cans are correctly adjusted.

There is one disadvantage with this arrangement, and is one which is frequently overlooked. This arises from the fact that it is impossible to produce amplitude modulation without also producing a certain amount of frequency modulation. This causes trouble when the signal generator frequency is on or near the skirts of the response curve. Because of this frequency modulation, the signal generator frequency will vary throughout the audio frequency modulating cycle and for part of the time will be way down on the skirt, or possibly right outside the response of the amplifier. The result is that the output meter will indicate a lower level than the true one and the response will appear to have fallen off much quicker than it actually has.

Signal generators can be designed so that this effect is negligible, but it is a very expensive process and an instrument on the market which has been designed in this way costs over £300! The way to avoid this disadvantage is to use a technique which does not require the signal generator to be modulated. One method is to connect a valve voltmeter across the input to the detector where it will indicate the level of the unmodulated carrier (Fig. 3).

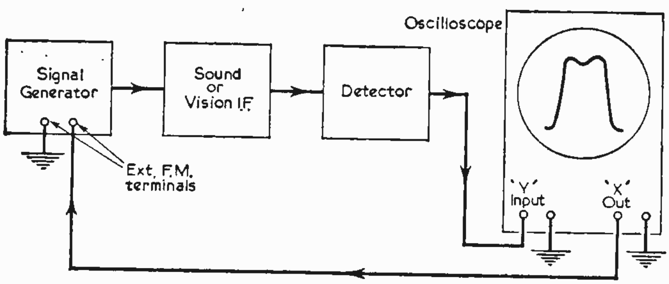


Fig. 4.—Using an oscilloscope with a signal generator to display the I.F. response curve.

The second disadvantage, which is never overlooked, is the great amount of time required to complete an operation. If the signal generator is provided with an external frequency modulation facility, a sweep technique can be used. The response curve can then be displayed on an oscilloscope and the whole process is completed very quickly. A suitable arrangement is shown in Fig. 4. The timebase of the oscilloscope is used to sweep the frequency of the signal generator across the pass band of the I.F. strip and the output from the detector is connected to the " Y " plates of the oscilloscope.

For bandwidth measurements then, the signal generator should, in addition to the facilities already mentioned, have facilities for external frequency modulation and if possible, although this may be expensive, produce negligible frequency modulation when amplitude modulated.

Sensitivity Measurements

The sensitivity of the whole receiver or of individual parts of it, such as the video amplifier, I.F. amplifier or radio frequency stages, are usually quoted in terms of the minimum signal generator output, modulated 30per cent, required to produce an audio frequency output of 50mW. An audio frequency power meter is required for this test and it should be connected in place of the loudspeaker. The signal generator is then connected to the aerial socket of the receiver, the amplitude modulation switched on and the modulation depth, if this is variable, set to 30per cent. The attenuator of the signal generator should then be used to reduce the level of the generator ouput until the power output meter reads 50mW (some manufacturers quote different figures than this, but the basic method of measurement is the same).

To carry out measurements on the sensitivity of the other stages, the signal generator output should be injected into the input of the stage and its frequency set to the appropriate value. These results are then compared with the manufacturers' figures.

Many of these figures are not given by the manufacturers, but it is worth while making a note of the figures for a good receiver so that when one is in doubt as to whether another receiver is really performing well or not, some definite yardstick to judge its performance is available. It would certainly help to save those arguments on whether or not a receiver or a stage in the receiver is functioning correctly.

Connecting the Signal Generator

When making fault finding checks and when aligning the I.F. strip, it is not usually important how the signal generator is connected; only ensure that there is sufficient signal reaching the point

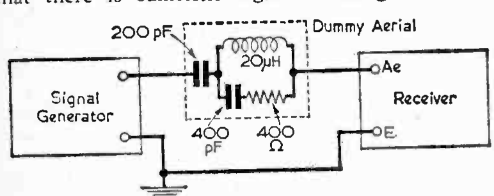


Fig. 5.—Connecting the signal generator to a broadcast band receiver via a dummy aerial.

where it is needed. Screened leads should always be used, however, so that the signal is not picked up by later stages in the receiver, where it might well give false results.

When making sensitivity measurements however, the signal generator should appear to the receiver as if it were the same as the normal aerial. For television receivers, of course, the aerial looks like a 80Ω impedance and most signal generators designed for these frequencies have output impedances of this value. All that is necessary when setting up the signal generator is that it is connected via a length of 80Ω coaxial cable. This does not, however, apply to short waves and broadcast band receivers and some form of dummy aerial may be necessary between the signal generator and the receiver. Generally speaking one should, with a signal generator having a source impedance of around 70Ω, connect it directly to a receiver designed to operate above about 30Mc/s and via a 300Ω series resistance to receivers designed to work between 2Mc/s and 30Mc/s. In the medium and long wave broadcast bands, a dummy aerial consisting of resistances, capacitors and inductors should be constructed. This should have an impedance roughly equal to the impedance of a typical aerial used at these frequencies. A suitable dummy aerial is shown in Fig. 5.

The Complete Signal Generator

Having decided what can be done with a signal generator, the specification of the instrument may be examined a little more closely. Fig. 6 shows a block diagram of a typical instrument. First there is the oscillator. This must be a variable frequency type and must cover all the radio frequencies to be used. Although its tuning dial will be calibrated in frequency, it is quite impossible accurately to calibrate a wide range variable frequency oscillator, but the frequency accuracy, which may be anything between 1 and 5per cent should be more than sufficient for servicing television receivers.

The H.T. supplies to the oscillator should be regulated, otherwise it will have a small amount of amplitude and frequency modulation which will result in noise and possibly false measurements.

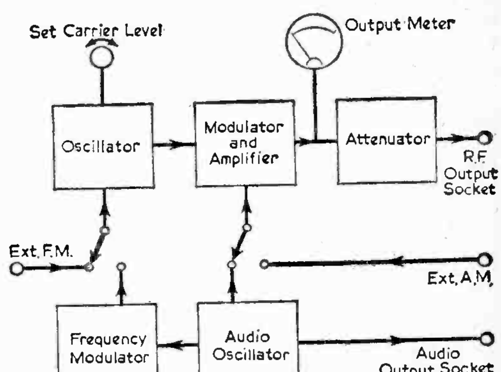


Fig. 6.—The main sections of a complete signal generator.

A.F. Generator

The audio frequency generator can be of many forms. The simplest is a single frequency, say 1,000c/s, oscillator with a fixed output. This is useful but a variable frequency output can be used to check the audio frequency response of video and audio stages. and a variable output is almost essential, for without it severe overloading may occur when checking the first audio stages.

(Continued on page 618)

Telenews

Television Receiving Licences

THE following statement shows the approximate number of Television Receiving Licences in force at the end of June, 1961, in respect of television receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland.

Region	*Total*
London Postal	1,940,774
Home Counties	1,587,466
Midland	1,716,331
North Eastern	1,840,171
North Western	1,494,850
South Western	971,965
Wales and Border Counties	690.158
Total England and Wales	10.241.715
Scotland	1,031,534
Northern Ireland	167,635
Grand Total	11.440,884

British TV Equipment for Brazil

RADIO GAUCHA of Brazil have recently concluded a contract with Pye T.V.T. Ltd. for the supply of the equipment of a complete television station. The completion of the station is planned for the beginning of next year at Porto Alegre.

The station is to include the necessary equipment for a three-studio television centre, with cameras. mixing systems and all ancillary apparatus. A 5kW Band III transmitter will also be supplied and additional equipment has been purchased to fit out an outside broadcast unit.

Underwater TV Inspection in the Suez Canal

THE canal dredgers which operate in the Suez Canal and in the entrances to Port Said and Suez Harbours suffer much damage to their cutting teeth, by submerged debris, which causes time-wasting and costly delays while they are being repaired. The canal authority therefore are to use a Marconi-Siebe, Gorman underwater TV camera to examine the condition of the canal beneath the water, in an attempt to eliminate much of the damage and to provide more accurate control of the dredging operation.

When any submerged parts of a vessel need to be inspected, the underwater TV equipment can be used to examine the damaged area and an engineer viewing on a monitor screen can supervise the repair work.

Television for Lighthouse Keepers

TRINITY HOUSE has decided to equip isolated lighthouses and lightships with Ekcovision television receivers. In the past a number of Trinity House establishments have been provided with television — principally through the efforts of local charitable organisations.

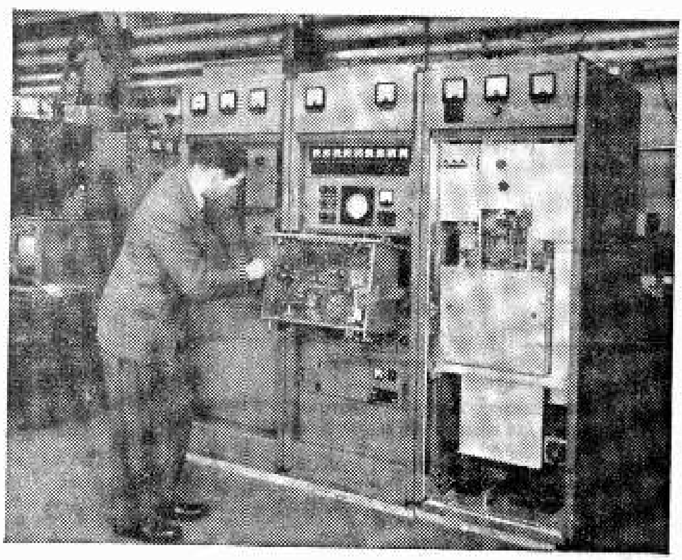
Now, however. all crews within range of a transmitter will, eventually, be able to watch television programmes.

Trade Tests in the Border Area

TRADE test transmissions from the Independent Television Authority's Caldbeck station, near Carlisle, began on Monday, 3rd July. The transmissions are broadcast from 10 a.m. to 5.30 p.m. daily except on Sundays. (See page 623.)

New TV Stations for Morecambe Bay

A NEW television station is to be built at Stewnor Park, six miles to the north of Barrow, to provide the Morecambe Bay area with BBC television programmes.



This is one of the vision transmitters which will be supplied by Marconi Wireless Telegraph Co. Ltd., to the Compagnie de Television du Liban et du Proche-Orient, a Lebanese commercial television organisation.

This will give improved reception of the BBC over the whole of the area, which includes Barrow-in-Furness, Lancaster, Morecambe, Carnforth, Grange. Dalton-in-Furness and Ulverston.

The Morecambe Bay Station will transmit programmes received by radio link from a receiving station which will be built at Walthwaite, about one mile to the South-East, where the programmes will be picked up from the BBC's television station at Holme Moss.

It is expected that the new station will be ready for service during the summer of next year. The transmissions will be on Channel 3 (vision 56·75Mc/s, sound 53·25Mc/s) with horizontal polarisation, which means that receiving aerials will need to be mounted horizontally.

Australian harbour officials and shipping representatives recently saw a demonstration of Marconi-Siebe, Gorman underwater TV equipment. The authorities think the cameras might be used for the Australian cray-fishing industry.

TV at Southend Airport

IN order to survey a busy intersection at Southend Airport which is not visible from the control tower, the airport authorities have installed a Marconi closed circuit television camera channel.

Mounted on a hangar gantry, the camera overlooks a main aircraft holding area and an important road and runway intersection.

Vehicles using the road between a nearby industrial site and the airport. as well as airport vehicles and aircraft taxying on the runway, can now be supervised from the control tower, where a 14in. monitor has been installed.

Closed-Circuit TV at "Northern Star" Launching

ON June 27th, at a Newcastle-on-Tyne shipyard, H.M. Queen Elizabeth the Queen Mother launched the new liner, "Northern Star."

At the subsequent lunch, the Queen Mother and other speakers were seen by overflow audiences, in adjoining rooms, over an EMI closed-circuit television system which televised the speeches.

New Design of TV Station

A COMPLETE television broadcasting system of an entirely new design was demonstrated recently by Pye T.V.T. Ltd. With studio, control room, telecine, transmitters, mast, aerial and all other equipment, the new system costs only £17,000.

The "Cambridge Station," as it is called. is a simple, economic TV station which, although low in price, has all the technical facilities necessary.

The studio contains two cameras, four microphones and lighting system. In the control room is a console with all monitoring and mixing facilities, two 16mm telecine units with slide projectors, two transcription/gramophone units, a monitor loudspeaker, two equipment cubicles and the vision and sound transmitters. An appropriate aerial system is mounted on a 100ft high mast erected immediately beside, or on top of, the station building.

TV Camera for Italy

THIRTEEN complete television camera channels have been ordered from EMI Electronics Ltd., by Radiotelevisione Italiana for use in their studios in Milan and Turin.

This order is for complete $4\frac{1}{2}$in. Image Orthicon camera channels type 203 and follows the earlier sale to the Radiotelevisione Italiana of four similar channels which were used in the coverage of the Rome Olympic Games last year.

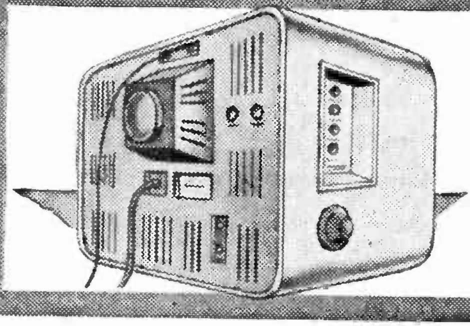
Television Station on Norwegian Island

THE Norwegian Telegraph Administration is building a television station on the island of Bokn in Stavanger Fiord and is to operate it by remote control from the mainland by means of a VHF radio link.

The transmitters selected for this purpose—two 4kW vision and two 1kW sound—are of Marconi manufacture and are suitable for unattended operation. In addition to the transmitters, Marconi's are to supply and install programme input and ancillary equipment.

The equipment will operate in Band III to 625 line CCIR standards. The two vision transmitters are to be connected for parallel working, as will the F.M. television sound equipments. Remote control facilities over the VHF link will include the independent on/off switching of all four transmitters; the control of blanking level, and the control of video and audio gain. An indication of power output at normal, high and low levels will also be provided over the link. It is intended that adjustments to the controls will be made in conjunction with a waveform display derived from a high-grade receiver and oscilloscope sited at the remote control position on the mainland.

Servicing Television Receivers



No. 71—THE INVICTA 338

By L. Lawry-Johns

THIS is a 17in. table model with a 110° tube and a single printed circuit panel. It is identical to a little known Pye model called the CIOV and has circuit features in common with several Pye and Pam models.

The cabinet and chassis layout has much to commend it since all but three of the valves are immediately accessible with no difficulty once the rear cover is removed. The three exceptions are the tuner unit valves, PCC84 and PCF80, and the EHT rectifier EY86. The tuner unit does present a little difficulty since the valves are sunk down and only the tops of them protrude. Loops of tape may be found however which, passing under each valve, render removal easier. Since the chassis is secured in the generous cabinet by four easily removed screws, dismantling may be carried out in a matter of moments. The front knobs require their centre grub screws slackened (volume and channel selector), the brilliance and fine tuner knobs pull

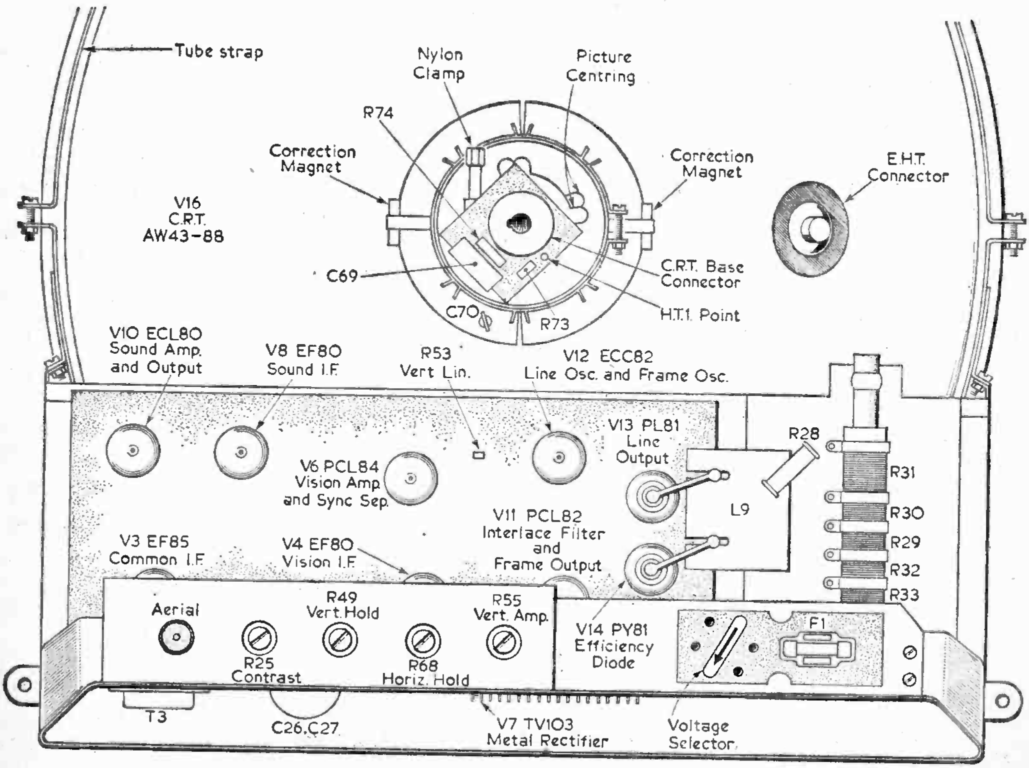


Fig. 1.—A rear view of the receiver showing the positions of some of the larger components.

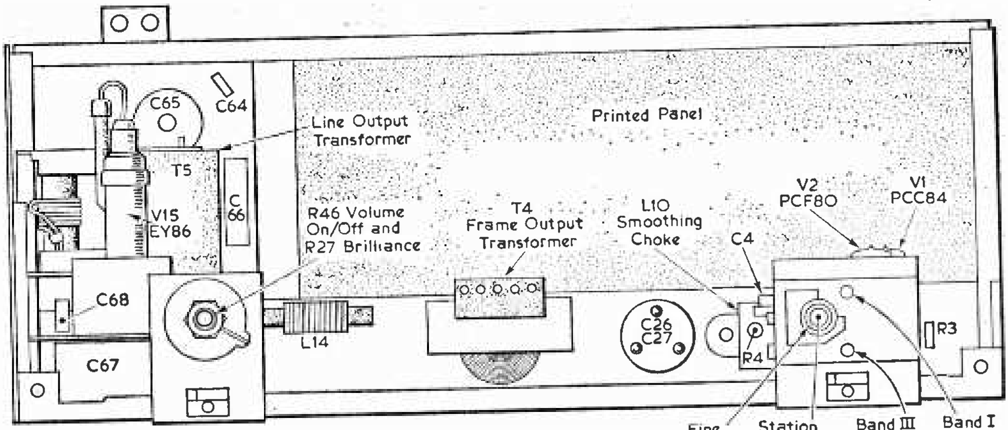
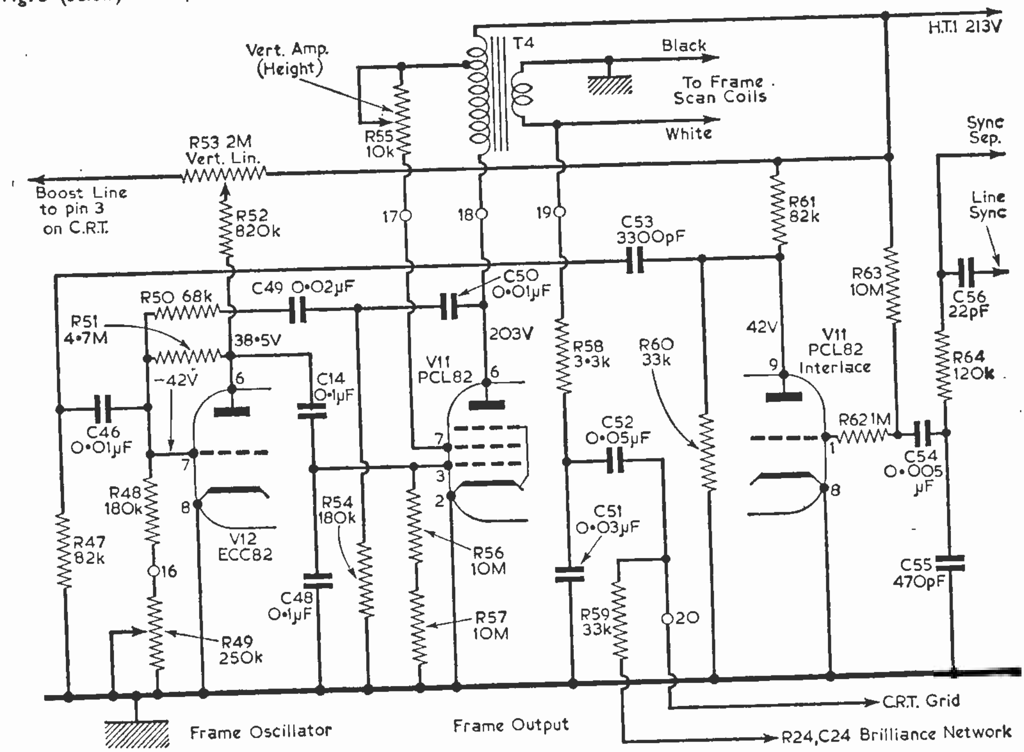


Fig. 2 (above).—The front of the chassis.

Fig. 3 (below).—The frame timebase circuit—note the bias arrangements for the pentode section of V11; R56 and R57.



off in the usual way. The loudspeaker leads clip on to the rear left side output transformer (T3).

A Tuner Fault

With the chassis removed, the tuner is more easily handled and although it may appear compact and intricate it may be stripped and reassembled in a very short time. This is rarely necessary, but the writer had occasion to remove the rotor for examination in connection with a rather interesting fault which at first sight appeared a trifle puzzling. The owner of the set complained that although BBC remained constant and good on channel 1, the ITV reception on channel 9 would fail after about ten minutes or so. This in itself is not so unusual but he also reported that at all times he could still receive channel 9 on the channel 10 position with the fine tuner hard over and with poor sound as is usual with continuously tuned units, the point being that this reception did not vary at all, although the reception on switch position 9 failed completely. This information, which was confirmed by trial, indicated that the valves must be in order and the tuning could not be drifting. It meant that there was apparently a poor contact between the coil studs and the contact springs in the channel 9 position only. Examination with the cover removed proved the contacts to be faultless. Until one is familiar with the type of tuner and realises that there is only a small loop of thick wire making the difference between channels 8 and 10 it cannot be appreciated just how awkward the symptoms were. However the rotor assembly was removed and upon very close examination, traces of white powder were observed in the soldered connection of the channel 9 stud. It was a matter of moments to clean and re-solder the connection, reassemble the tuner and have the set working on test to prove that channel 9 stayed put for longer than the specified ten minutes. A simple fault, only a "dry joint", but instructive all the same.

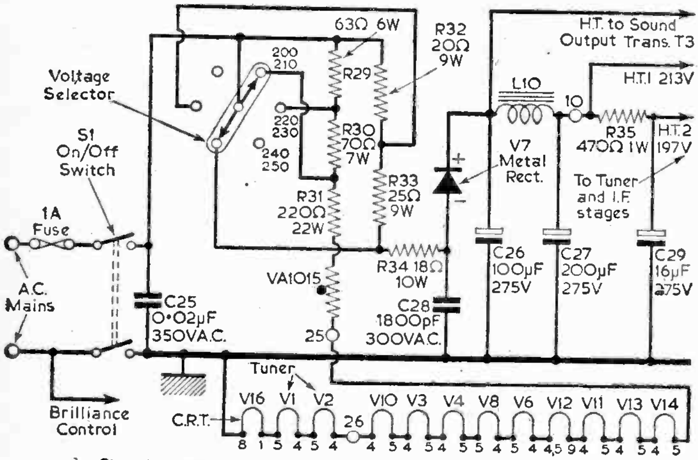


Fig. 4 (above).—The mains supply and H.T. circuit.

Unusual Features

The circuit of the main deck is fairly conventional but the method of biasing the frame output valve V11A should be noted. There are no cathode components and the control grid is biased by the high value of R56 and R57 (total 20M). The mean bias is about (−11·5)V.

(To be continued)

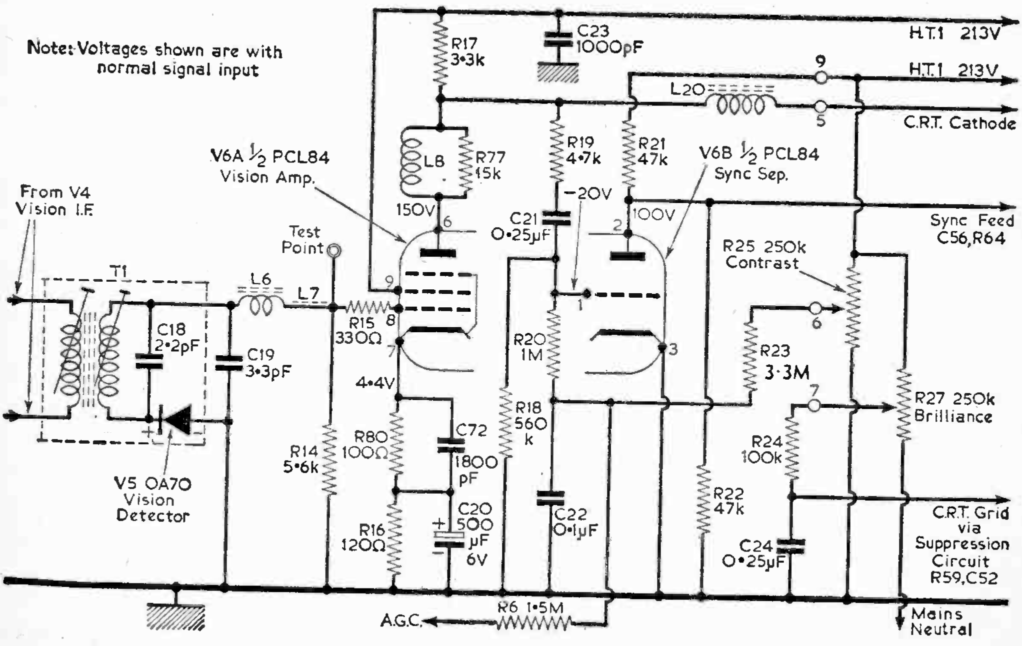
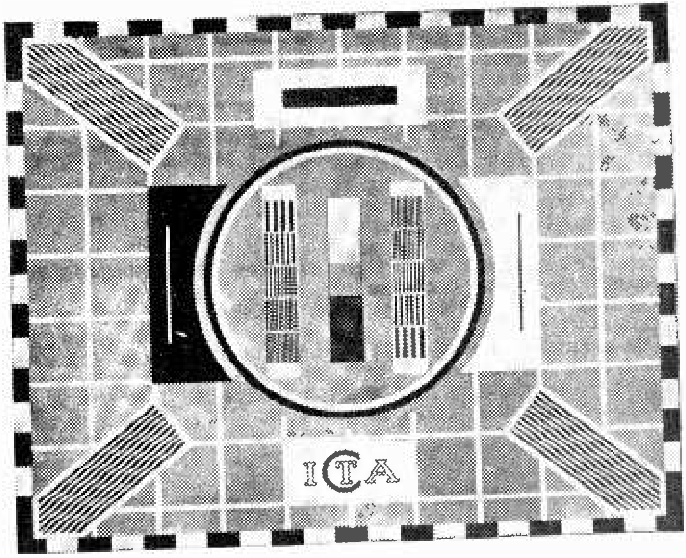


Fig. 5.—The video strip.

SOME APPARENT FAULTS ORIGINATE OUTSIDE THE RECEIVER

By L. E. Higgs



Recognising Transmitter Defects

AFTER spending a whole evening trying to clear a mysterious flickering picture on my television receiver similar to that produced by intermittent valve base contacts, I was dumbfounded by an apology by the announcer for the interference which was due to damage to the transmitter aerial by gale force winds. It was then that the importance of recognising defects originating from the transmitter, was finally brought home to me. Because most transmitter troubles can simulate receiver defects, and because of the high standard of reliability of our TV transmitters, it is easy to jump to the conclusion that the fault must be in the receiver, and a lot of mis-adjustment can take place before the truth emerges.

The first and easiest test, where transmission is suspect, is to switch over to another channel and see if the trouble exists there also. If reception is normal then the transmitter may be broadcasting the faulty condition or it may be caused by interference pick-up on that particular frequency. Even after this check it is always best to sit back and wait for a possible announcement rather than disturb a receiver that may be functioning perfectly. Even a simple action such as centring the picture on the Test Card could well be left until it is certain that the picture is not constantly off-set (as it is not unknown for the test cards on each channel to each be displaced with respect to each other).

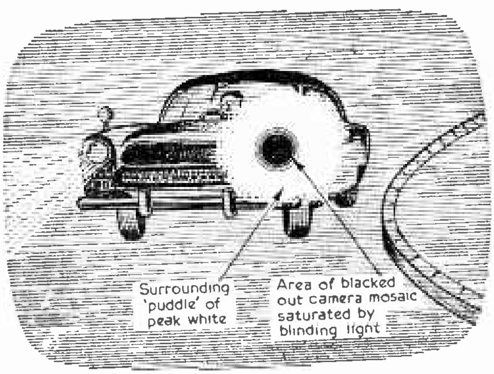


Fig. 1.—The effect of bright, direct light on the TV camera.

Studio Defects

These may be conveniently described as effects originating at the camera, possibly due to errors in handling or to adverse conditions—the transmitter being in normal working order.

Studio plays often display a picture with a flare of white at the bottom of the raster. This can be seen to come and go as the cameras are changed or as they shift about the studio. A badly placed studio light is often the culprit.

Out of focus subjects are quite frequently seen but the viewer must not expect to see all of the scene—near, centre, and distant in focus at the same time, as some customers complaints have suggested they should.

The aspect ratio of TV is 4:3 and cinemascope and other widescreen film types have the wrong shape to fit this mask. Consequently the broadcasters are compelled to reduce the transmitted height to accommodate all the film frame. The black gaps that result at top and bottom of the raster still cause concern, and service calls are frequent from persons unaware that it is intentional.

Microphone shadows on a singer's face can be puzzling, as can the occasional light which shines directly into the camera (Fig. 1). This saturates the sensitive mosaic retina in the camera, up to and past peak white, leaving a charged-up black blot on the raster surrounded by a "pool" of peak white. This saturated area takes a second or two to discharge if the control room staff do not switch in the next camera quickly.

Low contrast and wandering black level from one camera only, can be compared with the results from another and the changing grey background tolerated, leaving the brilliance control strictly alone.

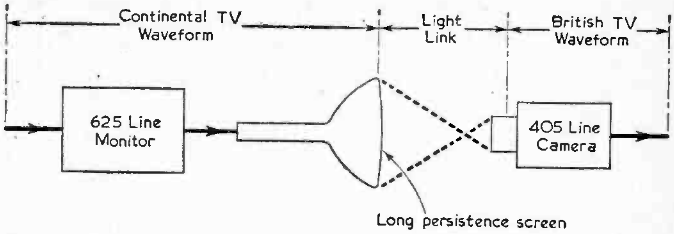


Fig. 2.— The basic method of translating Continental TV to British standards.

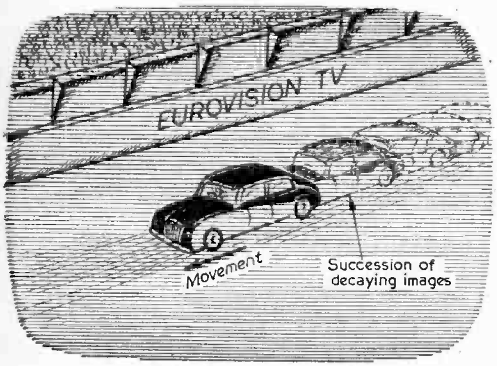
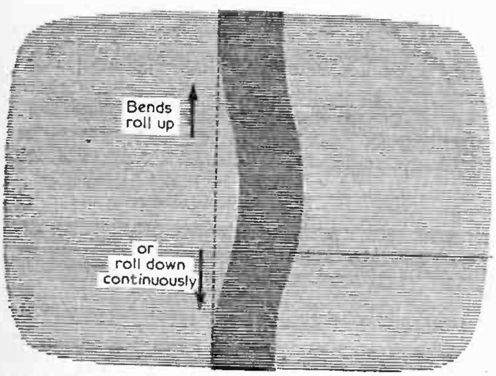


Fig. 3.—The effect of long-persistence phosphors in the standards translation.

Fig. 4.—When the vertical (frame) sync is not locked to the local mains, hum in the timebases of the receiver causes curves in vertical lines.



Outside Broadcasts

Horse racing and outside broadcasts in bad weather transmit some pictures of indifferent quality. Every bit of gain is used to obtain maximum sensitivity for those long-distance telephoto shots through the rain, and the white noise of electron movement and thermal agitation shows on the screen as a background of crawling drizzle. When the camera is changed the picture background usually clears. Unfortunately this "grain" looks exactly the same as that produced by frequency changer noise in the front end of the receiving TV—the effect of fringe reception on a TV with automatic gain control working on a poor aerial. To avoid jumping to conclusions wait until the announcer appears in the studio for the advertisements and use them for comparison.

Transmission Faults

Through a desire to maintain service as continuously as possible, it sometimes happens that a channel is compelled to radiate at reduced power. Local viewers notice no difference in such a case, intermediate distance viewers notice an increase in grain or decrease in contrast; but the fringe viewer loses sync with a rolling maze of lines.

The importance of taking note of breakdowns and transmission defects by persons who are called on to service TV is obvious here to save wasted time and money.

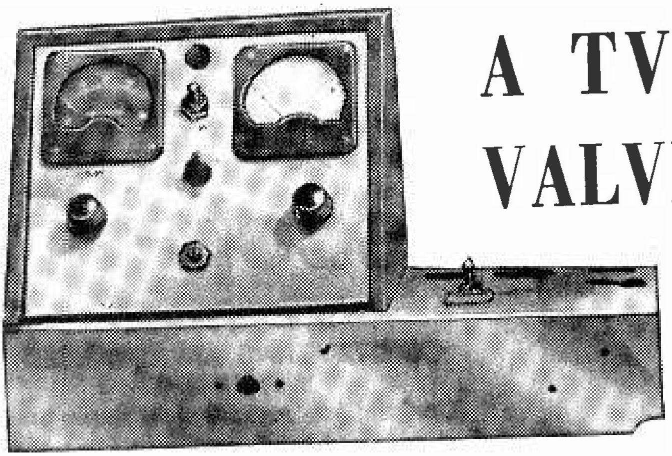
Trans-Atlantic Telerecordings

Probably the worst set of images which appear on television from time to time, are trans-Atlantic telerecordings. Smudgy, low definition pictures, sometimes accompanied by flickering ribbons of horizontal light from variations in tape speed across the head, are frequent. Far from doubting the efficiency of the receiver, most people start rubbing their eyes, but it is to be hoped that these transmissions will improve with time.

Standards Translation

Eurovision reception is remarkably good considering, not only the distance but the standards translation link from 625 to 405 lines (Fig. 2). This requires a display of the picture on a cathode ray screen with a long-persistence phosphor, from which it is re-televised on another standard.

The long persistence of screen light decay also fails to reproduce quick changes of movement of subjects being televised. Thus a man quickly raising his arm for a brief moment appears to have a successsion of jerky arm movements; or a car travelling is followed by a series of fading smudges due to the slow die-away of light (Fig. 3). These pictures can be identified as "translated" from this effect.



A TV VALVE TESTER

A USEFUL CIRCUIT WITHOUT COMPLICATED SWITCHING

By D. V. Curtis

THIS TV valve tester was built up mainly of surplus components and enables a large range of common valves to be tested for mutual conductance and behaviour under various working conditions. Nothing new is claimed for the circuit, indeed it is extremely simple (Fig. 1) with no multiplicity of switching, but almost any normal voltage or bias can be fed to the valve and voltage and anode current readings observed simultaneously.

Voltage Supplies

The H.T. is supplied from a 350-0-350V transformer connected to a full-wave rectifier with conventional smoothing. The screen grid supply is taken via a 50k wire-wound potentiometer. The anode supply is taken from a 20k wire-wound variable resistance and the variable bias resistance is 500Ω; also wire-wound.

These voltages are connected via a 2-pole 3-way switch to the 0-400, 0-40 voltmeter. The second half of this switch is used to switch in the necessary series resistor to cover the two ranges.

The two meters are both of the small ex-government type, the best of these two was utilised as the voltmeter, and this one had a sensitivity of 500Ω/V; not ideal for the purpose, but sensitive enough to give satisfactory results. The anode supply is metered by a milliammeter with a switch giving either 0-80mA or 0-20mA. The anode, screen and

(Continued on page 631)

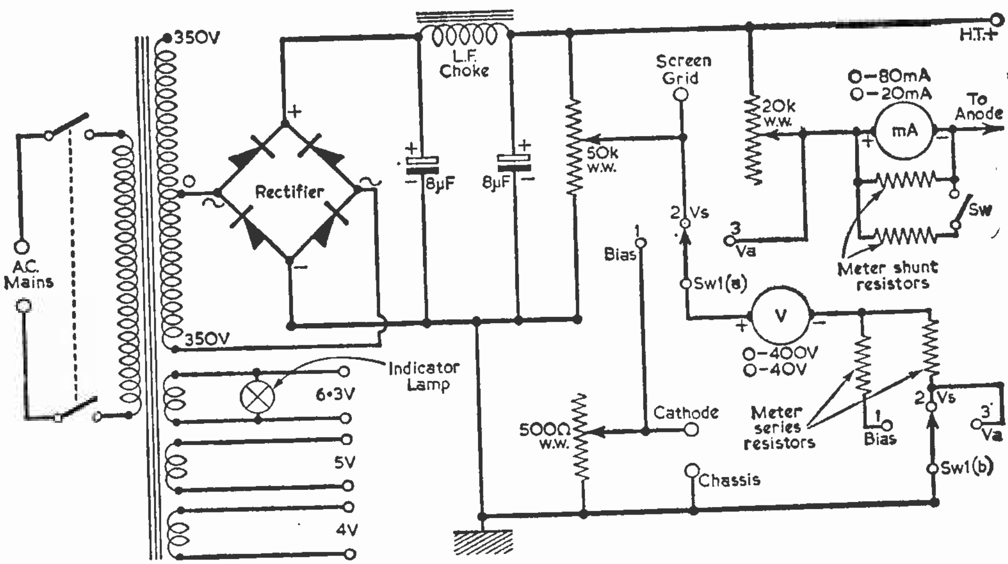
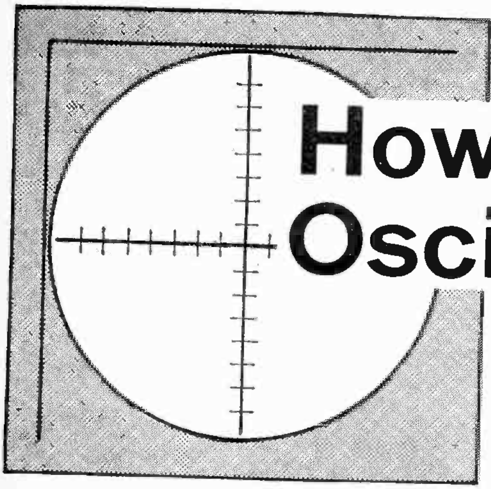


Fig. 1.—The basic circuit of the tester.



How to use Oscilloscopes

By D. R. Bowman

CONSTRUCTING AN ADVANCED INSTRUMENT

(Continued from page 552 of the August issue)

THE construction of two Y-amplifiers is described in this article; the circuit of the first was given in Fig. 13 on page 552 last month. The gain is very great and the bandwidth reasonable, and these combined with sufficient voltage output to give full deflection in the Y-direction may make it attractive for some purposes. Note that C14/R35 (3·3k) forms a corrective network which enables square waves to be amplified with negligible 'sag' down of frequencies of less than 10c/s.

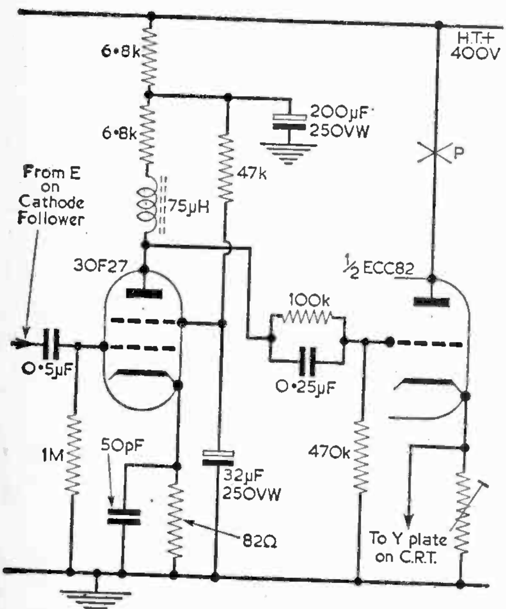
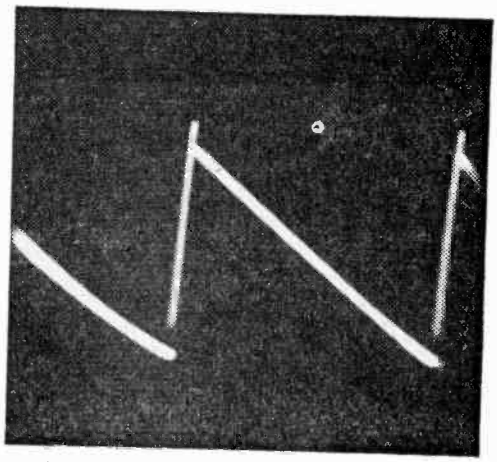


Fig. 14.—The circuit of a Y-amplifier using a frame-grid tetrode and cathode follower. The gain is at least 80 and the output voltage is over 80 with a bandwidth of 6Mc/s.

The circuit of a Y-amplifier which may be preferable to Fig. 13 last month is given in Fig. 14. The correcting choke consists of 85 turns of 36s.w.g. enamelled copper wire on 0.3in. diameter former, with a dust core. The method of adjustment of the core is as follows.

Apply a signal at 1·1Mc/s at the grid of the 30F27. Temporarily short-circuit the 6.8k resistor in the anode circuit, and place a capacitor of 200pF across the choke. Then adjust the core for resonance as shown by an indicator attached to the output from the cathode-follower. Remove the capacitor from across the choke, and remove the short across the anode resistor.



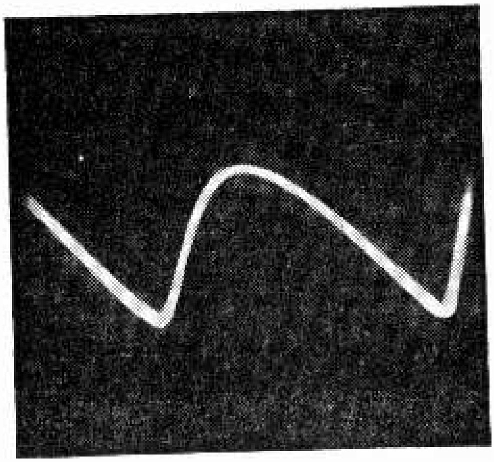
A sweep and flyback wave-form: f=100kc/s

The adjustment of the cathode follower resistor, which is a pre-set component, is carried out by breaking the anode lead at point P (see Fig. 14) and inserting a milliammeter (on its 0-20mA range). Adjust until the reading is 10mA. Re-connect the anode circuit.

This amplifier is quite suitable for most purposes, and has a good bandwidth. The video signal of a TV receiver, picked up at the detector, gives a trace about ½in. in height, which is often enough. There may be a little 'overshoot' on fast pulses, and, if this is more than about 2 per cent, the inductance of the correcting choke can be reduced a little by slightly withdrawing the core. A small grid-stopper of 50 to 100Ω may be needed to avoid parasitic oscillations. It should be noted that the heater voltage of 30F27 valve is only 3.7V, so that a 9Ω resistor must be placed in series with the 6.3V supply. This may be fashioned from a few inches of resistance-wire, or a 1W 10Ω carbon resistor may be used.

Y-shift

The other Y-plate is connected to a potentiometer slider across the H.T. supply. Fig. 15 gives suggested values of components. With this arrangement of Y-shift and Y-amplifier, the extremes of the trace in the Y direction will be not as well focused as the middle part of the trace. This effect is only serious with traces of large



With f=420kc/s, there is still a linear part to the sweep stroke.

amplitude, and the arrangement shown proves satisfactory in practice. If required, a balanced amplifier (push-pull) can incorporate Y-shift; the circuit would be similar to that of the X-amplifier, but using pentodes instead of triodes.

Power Supplies

The power supplies described in the article by H. Peters on the simple oscilloscope (June issue) will be found satisfactory if the H.T. is capable of delivering about 70mA. However, it may be found desirable to use two old 350V mains transformers instead of one; then the main H.T. supply can be of full-wave rectification, and the use of a

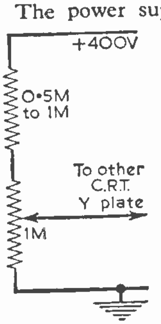


Fig. 15 (left).—The Y-shift control circuit.

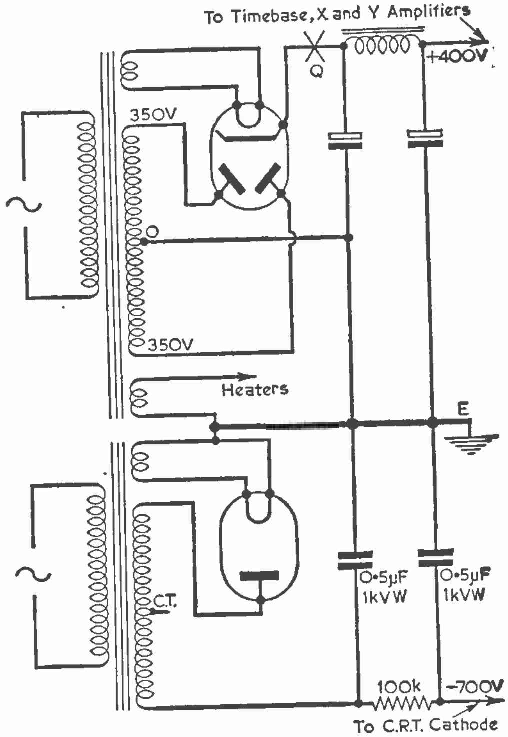


Fig. 16.—The circuit of the power supplies for the oscilloscope.

valve rectifier such as the EY51 can be an advantage. The second mains transformer will have a spare L.T. winding which can be used as in Fig. 16.

Separate H.T. and L.T. switches should be provided, which can conveniently be a Yaxley wafer. The first contact is 'off', the second switches on the mains; but the H.T. supply is broken at the point Q (Fig. 16) until the third contact is made. This arrangement allows the valves to warm up before H.T. is supplied, and this then gives a negligible 'surge' and the smoothing and decoupling capacitors are protected. This is necessary because, for economy, 250VW capacitors are specified in general as being much cheaper than 500VW components.

If care is taken in layout, the stray magnetic fields of two mains transformers can be made partially to cancel each other out. However, in the writer's instrument, these transformers are housed in a separate box, and connections are made by a cable form to the oscilloscope. In this way no difficulty exists with stray fields. ■

A Precision Wobbulator

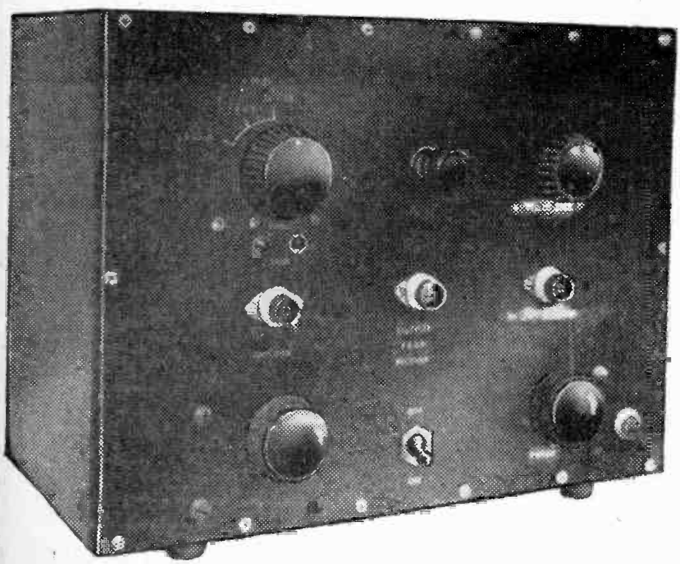
By N. Mears

THIS VERSATILE WIDE-RANGE INSTRUMENT WAS DEVELOPED AROUND A MODERN SEMICONDUCTOR JUNCTION DIODE

THE comparatively recent introduction of semi-conductor diodes which vary considerably in capacitance with applied voltage enables some interesting and useful circuitry to be developed. Applications such as remote tuning by D.C. control, automatic frequency control and parametric amplification at VHF are practicable. The writer recently acquired such a diode, and used it to develop a wide-range wobbulator for use with television receivers. The device proved so simple to use that it was thought worthwhile to extend the range of the wobbulator to cover F.M. response curves, and it also proved possible to add the usual broadcast I.F. range of 465kc/s. Thus, a general purpose instrument was designed, and is described here.

Capacitance Law

A preliminary investigation of the properties of the diode showed that if a linear relationship between oscilloscope trace and displayed frequency was to be achieved, the oscilloscope timebase generator could not be used to provide the voltage sweep needed, especially with TV and broadcast band ranges. It was therefore necessary to provide a separate source of variable voltage, with the correct waveform. This necessitated a waveform generator with special characteristics; and, as some complication was going to be incurred in any case, it was decided to make no effort to simplify the instrument, but to develop it into a more useful device by the provision of markers, sync output to lock the oscilloscope firmly, variable R.F. output, and a pre-amplifier and waveform mixer combined. It now became possible to arrange a logical layout of leads to and from oscilloscope and receiver—in fact, the wobbulator is also used as a distribution centre. This obviates the tangle of leads so frequently found when wobbulators are in use.



Sections

The instrument thus consists of the following elements—waveform generator, marker generator, R.F. oscillator, with variable reactance circuit, and waveform mixer. Outputs are provided at low impedance by using cathode followers. Fig. 1 shows in a block diagram how these various units are combined into one instrument.

R.F. Oscillator

It will be convenient first to describe the R.F. oscillator and its associated variable reactance circuit—which includes the variable capacitance diode type SVC1—since the requirements of this stage determine the design of the rest of the apparatus to a large extent. The variable capacitance diode is a semiconductor device in which, when biased in the reverse or non-conducting direction, the capacitance of the "deflection layer", at the interface of p-type and n-type materials, varies with the applied bias voltage. If this diode is made part of the tuned circuit of an R.F. oscillator, the frequency of oscillation will vary if the applied bias potential across the diode is made to vary. It might be thought at first sight that if part of the X-deflecting voltage of an oscilloscope were applied across the diode a suitable frequency sweep would result. Roughly this is true, but if no precautions are taken certain undesirable features appear. These are enumerated below.

(a) The frequency sweep is non-linear, being cramped at one end and extended at the other. Thus the oscilloscope trace is misleading, although, if corrections are applied. it can be useful. This effect will be discussed shortly.

(b) Sufficient sweep may not be obtained to cover the required range.

(c) The shape of the response curve may be affected by the speed of sweep, especially where selective circuits occur in the receiver under experiment.

The effect first mentioned above depends on the fact that in an LC tuned circuit, frequency of oscillation depends on the square root of the capacitance, the other parameters being constant.

$$f=\frac{1}{2\pi\sqrt{(LC)}} \text{ or } f=\frac{k}{NC}$$

The linearity or otherwise of the relationship between applied voltage and oscillator frequency depends on the relationship between applied voltage V and diode capacitance C. If C were inversely proportional to V^2 the above equation could be rewritten

$$f=\frac{k}{VC}=\frac{k^1}{\sqrt{(1/V^2)}}=k^1V$$

and linearity of frequency sweep would be obtained by applying a linear sawtooth voltage across the diode. The relationship $C \propto 1/V^2$ is approximately true for point-contact diodes, but is not precise enough for junction diodes. Fig. 2(a) shows the variation of capacitance of the writer's specimen of the SVC1, and it will be seen that there is a major departure from the law $f=kV$ when, as in Fig. 2(b), frequency is plotted against diode voltage.

Consideration of Fig. 2(b) shows that as the diode voltage drops from a certain value, the frequency drops more rapidly than it should. This effect could be reduced by adding capacitance to the circuit and so swamping the irregularity, but this would minimise the sweep available, by reducing the percentage capacitance change.

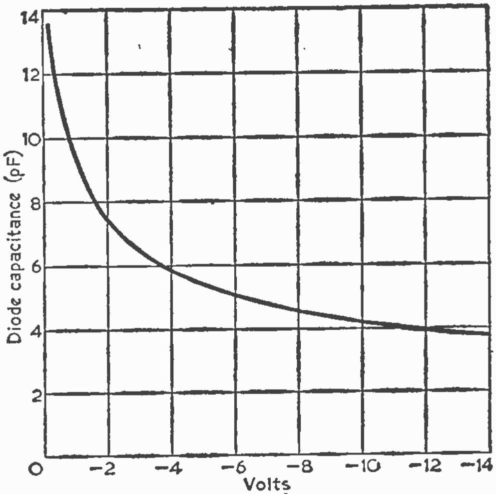
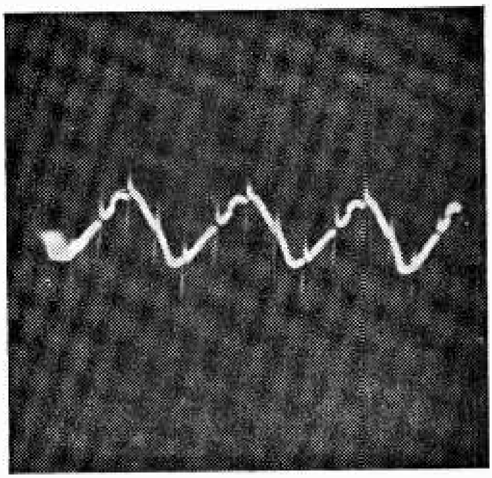


Fig. 2a (above).—The variation of capacitance with applied voltage of the SVC1.

Below: Alignment of wave-form generators.



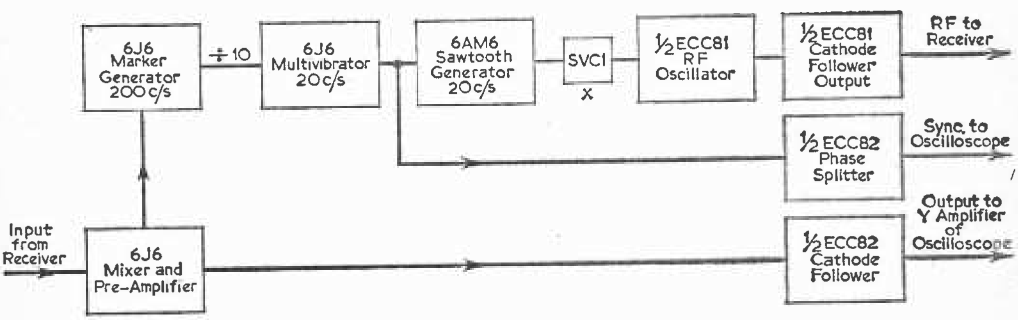


Fig. 1.—The block diagram of the wobbulator.

Exponential Sweep

It will be seen also that if it could be arranged for the voltage to drop less rapidly as it approaches zero, a much more linear frequency sweep could be obtained. A little calculation shows that an exponential drop in voltage gives a great improvement, and the resulting sweep—shown in Fig. 3 by plotting frequency against voltage on logarithmic graph-paper—is practically good enough. A little extra capacitance in the circuit can be afforded, since the sweep is ample, and occurs in any case

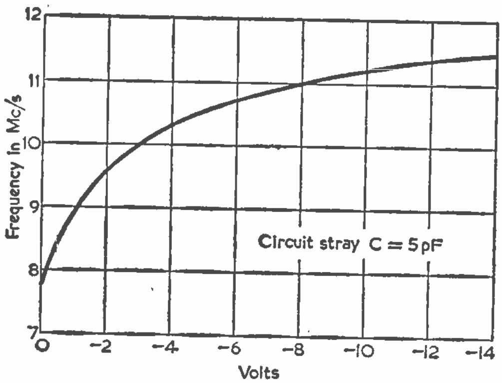
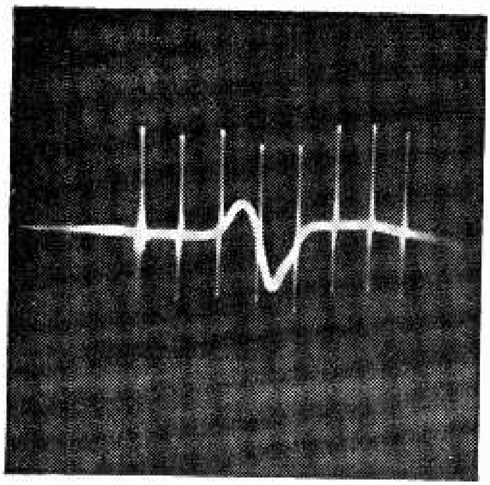


Fig. 2b (above).—Variation of the frequency with applied voltage of the SVC1.

Below: Curve from a VHF transistor portable.



because of "strays". This also improves results, and by the correct choice of voltage waveform an essentially linear sweep is achieved. However, only one or two pF can be allowed, and thus the aim must be to cut circuit strays to the minimum.

The choice of sweep generator is thus limited to one having ready exponential waveform output. In addition it should be negative-going; in this way, by combining it with a D.C. potential across the diode, the best sweep of frequency can be obtained. The choice is thus for a screen-coupled phantastron, whose source is a low D.C. potential. The usual Miller run-down is very linear when the H.T. line, the source of voltage, is at a fairly high potential. At low potentials, however, the run-down is "slightly" exponential in form, and by adjusting the charging potential to the correct value an excellent correcting waveform can be obtained.

Stray Capacitance

Obtaining sufficient sweep is essentially a problem reducing to that of minimising circuit capacitances. If this is carried out, very little voltage sweep is needed. With the SVC1 the maximum voltage is (−20)V, which allows for a maximum D.C. potential of (−10)V with a peak-to-peak sweep of 20V. It proves sufficient in this design to use a D.C. potential of (−8)V; a sweep of 16V to cover the required wavebands. It is probable, however, that in the 34-38Mc/s band, the usual I.F. for television receivers, the sound channel cannot be covered at the same time as the whole of the vision band. This is normally quite unimportant.

Sweep Speed

Highly selective circuits cannot deal with fast sweeps, and if the effort is made to use fast sweeps, it is found that the shape of the response curve varies with sweep speed. Ideally, something under 10c/s is preferable, especially where steep-skirted response curves are involved. This however requires A.F. couplings, in the various amplifiers, having time-constants of the order of seconds if distortion is to be avoided. In this design a sweep

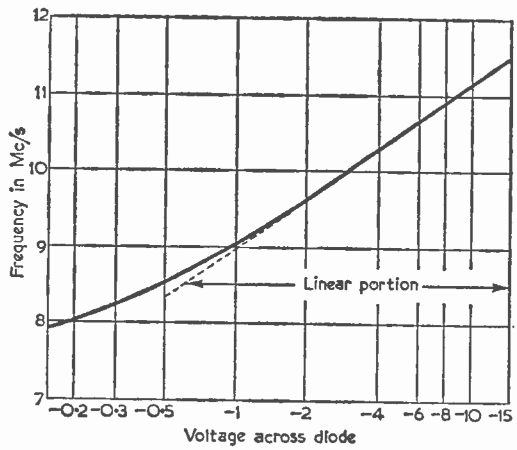


Fig. 3.—The SVC1 in variable circuit—strays = 5pF.

of about 20c/s is arranged; this is a compromise, certainly, but on the whole not a bad one.

Circuit capacitances are normally reduced to the minimum by using as the R.F. oscillator, a Colpitts circuit. The Colpitts circuit is inconvenient however when combined with the reactance diode, and an alternative circuit, the "Cathode Hartley" is here employed. By tapping the cathode into the tuned circuit as near "earth" as possible, the heater-cathode capacitance is reduced in effect. In addition, a relatively small coupling capacitor, connecting the tuned circuit to the valve grid, helps

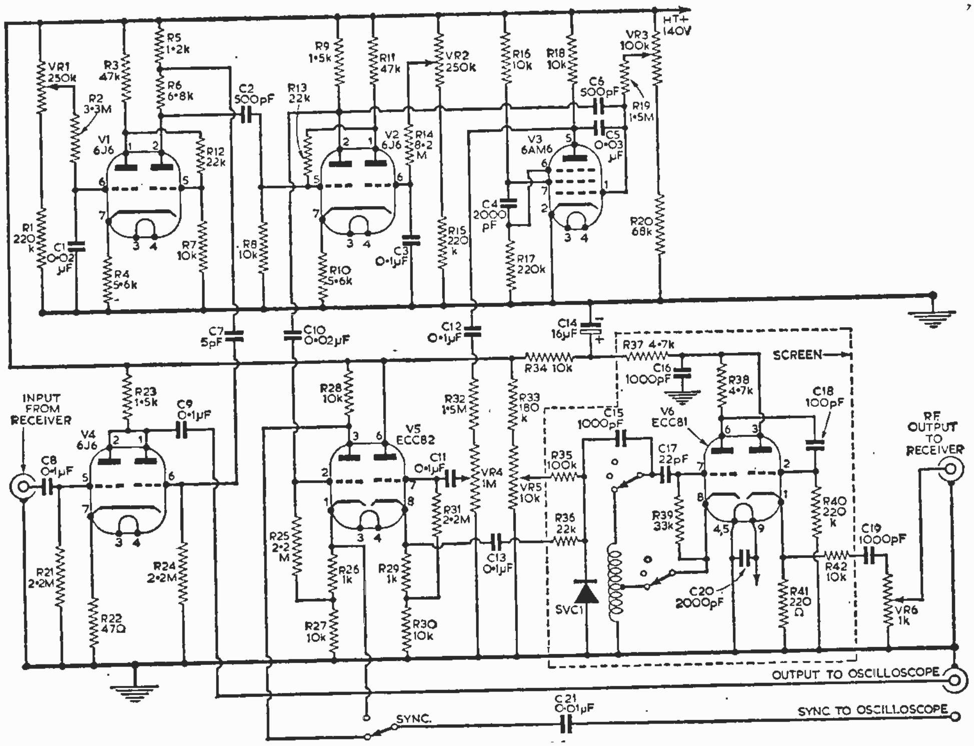


Fig. 4.—The circuit of the wobbulator.

to "stand-off" the tuned circuit from Cag and Cgk.

Marker Circuit

Markers for the oscilloscope trace are generated by a Schmitt trigger circuit—arranged to be free-running. With this circuit, sharp and narrow pulses are obtained which, on differentiation, afford positive and negative-going spikes of negligible width. This multivibrator runs at 200c/s, and is used to count-down to another similar multivibrator running at 20c/s. The output from the latter triggers a screen-coupled phantastron which also runs at 20c/s and provides the sweep voltage across the reactance diode. The 20c/s Schmitt valve also provides a sync pulse, brought out to a terminal on the instrument, to enable the oscilloscope to be locked to the same frequency. By interposing a cathode follower in this lead, the effect of external connections is reduced to negligible proportions, and by providing the cathode follower with an anode load resistor, a choice of either positive or negative sync pulses—to suit the oscilloscope—is available by way of a single-pole, two-way switch.

Mixers

The waveform from the receiver being tested is mixed with the marker pulses by using two valves (each half of a 6J6) with a common anode load resistor. A small amount of pre-amplification is provided by this stage, as this has been found to be convenient when a wide-band Y-amplifier is used in the oscilloscope. The displayed trace is thus divided by ten marker pulses, and it must be stressed that these are *equally spaced irrespective of the linearity of frequency sweep.* In use, the space between the markers is calibrated by using an external signal generator. The method will be described later.

The D.C. voltage across the reactance diode is applied by means of a potentiometer across the H.T. supply—an external control is provided. This is not used to set a critical control point—this is unnecessary since the trace is substantially linear with regard to frequency. It is used in practice to shift the trace to the desired point relative to the markers, which are fixed in position. Thus, accurate alignment with a desired marker can be carried out, and this is convenient where actual measurements are to be taken. Neither is the D.C. control used to tune the oscillator; it could be, but it is best to do any trimming on the actual oscillator coils themselves, leaving the D.C. control in a central position.

The extent of sweep is controlled by varying the amplitude of the sawtooth voltage across the SVC1 diode. For checking work only, any convenient sawtooth voltage can be used, but for measurement the maximum setting should always be used.

Fig. 4 shows the complete circuit diagram. This is by no means as complicated as it may seem, and the layout is far from critical. Some explanation of the practical arrangements used will be given next month.

(To be continued)

TRACING TV FAULTS

By G. J. King

TELEVISION servicing comprises two essential operations: finding out where the trouble lies; and repairing the fault. It is quite a simple matter to replace the faulty part once it has been found, but the biggest problem is in finding out exactly where it is located in the jumble of wires, components and valves making up a television chassis. The wrong thing to do is to remove the back cover and base and start making half-hearted tests on valves, components and circuits before giving considerable thought to the fault symptom and becoming acquainted with the general make-up of the circuit and the location of the key components.

Logical Procedure

Trouble tracing is really an exercise in logic, but before a logical sequence of testing can be carried out several factors have to be known. One of these factors is a full appraisal of the fault symptom. Even before the back cover is removed, the experimenter or service technician can often obtain a profile of a defect that will pinpoint the trouble to a particular stage and sometimes even to a particular component. This is possible by carefully observing the sound and picture (if present) while the various main and pre-set controls are adjusted.

Some knob twisting, coupled with clear thinking, will invariably provide a clue as to the approximate whereabouts of the trouble—but if what is wrong is not indicated, there should at least be some indication as to what is *not* wrong, and such information can be extremely useful at this stage of the exercise, bearing in mind that fault diagnosis sometimes develops into a process of elimination.

Let us take a typical case. Suppose that the picture is all right on all receivable channels, but there is no sound. The symptom has obviously told us that the vision stages are in order, including the timebase, the EHT section and the H.T. section. We know immediately, then, that the sound trouble is not in the H.T. rectifier, nor the tuner, nor the aerial system or diplexer, nor in the common I.F. amplifier stage (if fitted).

A.F. Stage

By turning up the volume control and listening closely near to the speaker we should hear residual mains hum. If we do, then the speaker is working and H.T. voltage is present on the output valve. When the volume control is turned we may hear a slight crackle from the speaker, indicating that the A.F. amplifier as well as the output valve is working. By that simple process and *without removing the back cover*, we have narrowed the trouble down to two stages. This is not bad, bearing in mind that there are twenty or so stages in a set.

Given in Fig. 1 is a block diagram of the sound, vision and sync stages of a typical receiver. By

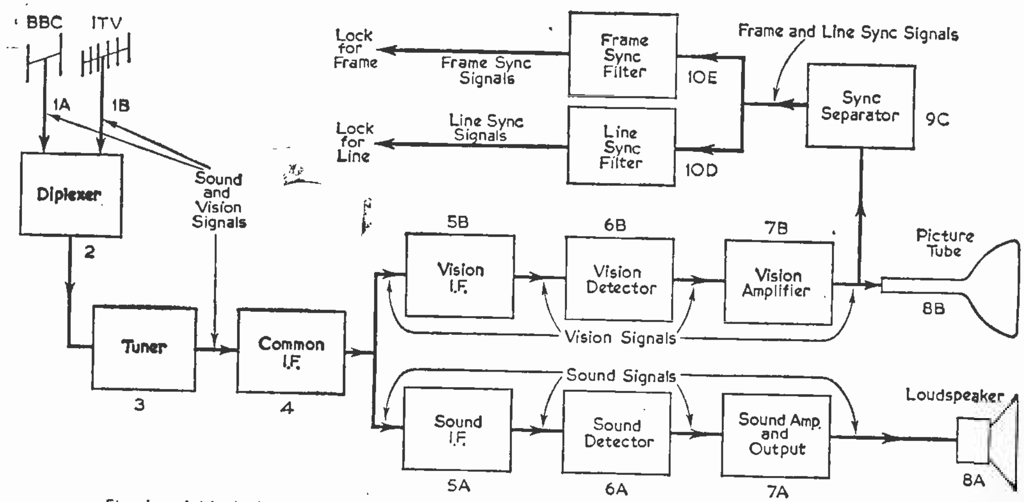


Fig. 1.—A block diagram of the signal stages of a television receiver showing the signal paths.

the process given above we know that sections all but stages 5A and 6A are working.

Had there been no residual hum from the speaker, then we could have been pretty well certain that the trouble would have been either in the speaker itself or in the output stage. The speaker leads could have become disconnected, which sometimes happens with plug and socket arrangements, the H.T. feed to the sound channel could have failed, or, most likely, the primary of the speaker output transformer could have gone open-circuit.

Stage Identification

The next move, then, would be to remove the back cover, but, before doing anything more, the primary stages of the receiver in terms of valves and major components should be identified. This is a simple matter if the service manual or service sheet for the particular receiver is available.

Most often, however, a service sheet is not available, and other methods for identifying the components have to be adopted. Our Query Service is always prepared to undertake this, for the experimenter, provided that a rough sketch of the chassis, showing the positions of the valves and major components requiring identification is included with the query together with a stamped addressed envelope and the current Query Coupon.

The general layout of most receivers follows a fairly consistent pattern and, with some straight thinking, quite a lot can be learned from observation alone. Again, the process is one of elimination; for example, one can quickly identify the H.T. rectifier, whether it be of the valve or metal type. This is invariably mounted near the power input end of the chassis, close to the mains transformer or mains dropper (the fairly large resistor carrying taps and which becomes hot). Moreover, the type number of the valve usually indicates conclusively that it is a power rectifier, and its

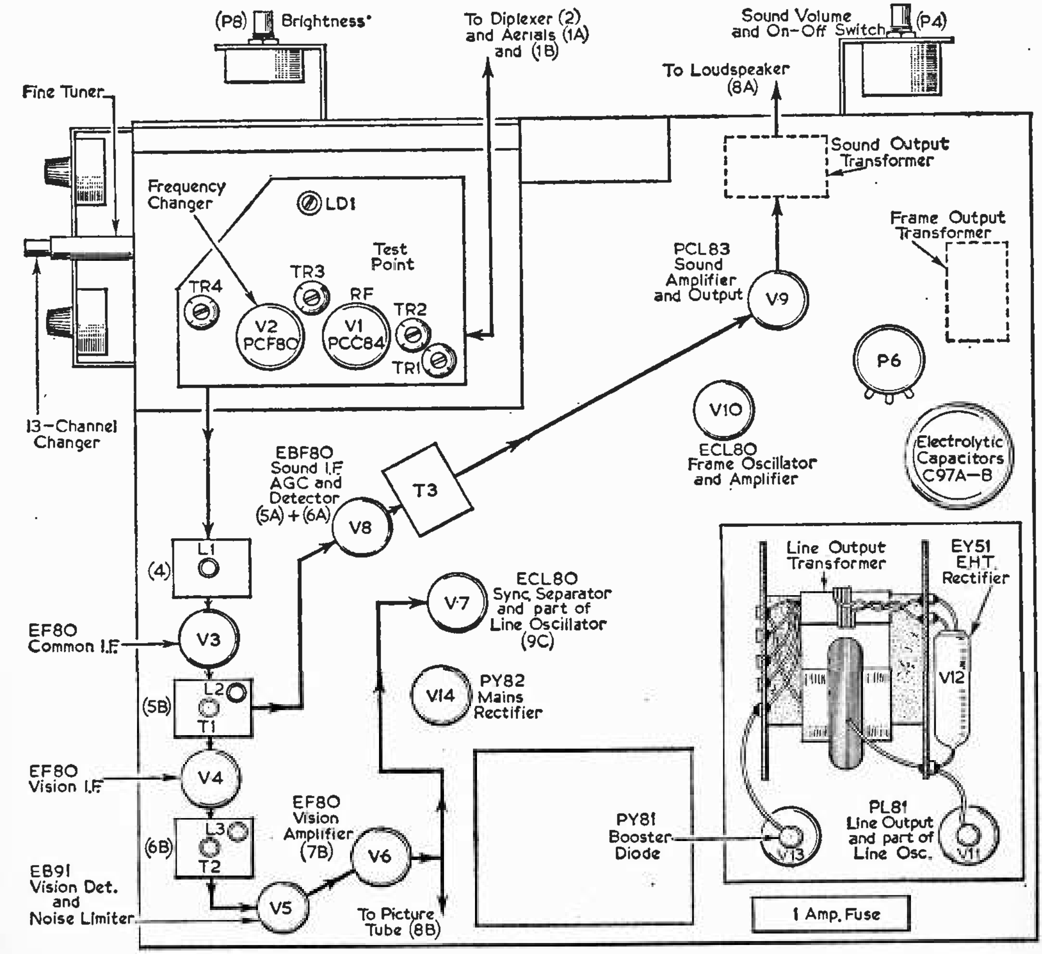


Fig. 2.—The above-chassis view of a typical receiver showing the various stages and signal paths in accordance with the block diagram in Fig. 1.

internal structure clinches the matter. If in doubt about any particular valve, its type can be looked up in a valve data booklet.

Similarly, the line output valve and booster or efficiency diode can quickly be located. These are close to the line output transformer, which itself cannot be missed as it carries the EHT rectifier valve and is highly insulated with a plastic material. It will usually be quite dusty, since the high electrostatic charges forming on its winding act on dust as a magnet acts on iron filings. Insulated leads from tappings on the line output transformer go direct to the top caps of the line output valve and booster diode. In a large number of sets, the EHT rectifier is of the wire-ended variety and is wired direct to tags on the line output transformer. More recent sets, however (or very old ones) may feature a plug-in type of EHT rectifier, but, again, it will be very close to the line output transformer and will be plugged into a highly insulated valveholder, possibly moulded in plastic on to the insulation of the line output transformer.

Tuner

The channel tuner is obvious, and its two valves indicate which ends are concerned with R.F. amplification and frequency changing. The triode-pentode (such as the Mullard PCF80) is the frequency changer (the pentode acts as the mixer and the triode acts as the local oscillator), and the double-triode (such as the Mullard PCC84) is the R.F. amplifier, the two triodes being wired in a "cascode" circuit. Very recent tuners use a single-triode R.F. amplifier in an "earthed grid" stage.

In Fig. 2 is given the above-chassis view of a typical receiver, on which is marked the functions of the various valves and also the stages and signal paths to tie up with the block diagram in Fig. 1. The features already described, such as the H.T. rectifier, line output valve, booster diode, tuner, etc., can be seen clearly.

Common I.F. Amplifier

The signal from the tuner goes to the common I.F. amplifier (V3), at the output of which the signal splits to sound-only and vision-only paths. The vision signal goes to the vision I.F. stage (V4), to the vision detector and noise limiter (V5), to the vision amplifier (V6) and then on to the picture tube (stage 8B—see Fig. 1). The sound signal, from the common I.F. stage, goes first to the sound I.F. amplifier (V8), to the sound detector (also in V8 in this set), to the sound amplifier and output stage (V9) and then to the speaker via the sound output transformer (stage 8A—see Fig. 1).

It should be noted that designers often employ various devices to reduce the number of valves and components, and they often make one valve do more than one job. Stage V8 in Fig. 2, for example, is concerned not only with sound I.F. amplification, but also with sound detection and sound automatic-gain-control (AGC). The EBF80 valve employed is a double-diode pentode. The pentode section serves as the sound I.F. amplifier in the normal way, while one of the diodes gives sound detection and AGC. In this particular set, the other diode section gives vision AGC of the mean-level type, the signal being picked up from the sync separator.

Other Circuits

In other sets, the sound I.F. amplifier may be a straight pentode valve, with detection and AGC being accomplished either by a separate double-diode valve or by semiconductor diodes (germanium diodes) possibly housed in the can of the final sound I.F. transformer.

Similarly, a triode-pentode valve is almost invariably used as sound A.F. amplifier and output, and this is often of the PCL83 or ECL80 class. Other double-valves are found in the frame timebase and line timebase circuits. In the frame timebase, a triode is often used as blocking oscillator and the associated pentode as frame output, feeding the frame scanning coils. In the line timebase, a double-triode may be used in a multivibrator arrangement, or the pentode of a triode-pentode valve may be used as sync separator, and the triode as part of the line oscillator, the other part being the line output valve, as in stages V7 and V11 in Fig. 2. Vision detection is nearly always accomplished by a double-diode valve, one diode acting as the detector and the other diode as an interference limiter.

(To be continued)

USING A SIGNAL GENERATOR *(Continued from page 599)*

The modulator, for amplitude modulation, should preferably allow the radio frequency carrier to be modulated either from the internal or an external audio generator. A fixed depth, usually 30per cent, is standard on the cheaper instruments, but it can be very helpful if the modulation depth can be varied.

Deviation

The frequency modulator, which works on the oscillator directly, should allow of deviation of up to ±200kc/s from the internal audio generator, for testing F.M. receivers, and deviations up to 5Mc/s from an oscilloscope timebase for displaying the response curve of I.F. stages.

An output level meter is a very useful device for the output can vary quite considerably over the frequency range and with variations in the mains. Usually this meter has only one calibration mark. known as the set carrier level, and the oscillator power output can be adjusted by a knob usually marked "set carrier level" to give a power output corresponding to this level. There is thus always a definite known value of voltage going into the attenuator.

The Attenuator

The attenuator is usually of the resistive type. It is stepped usually in dB steps, which are also calibrated in terms of the output voltage developed across the end of the output cable when it is terminated in impedance equal to its characteristic impedance.

Underneath the Dipole

A MONTHLY COMMENTARY

By Iconos

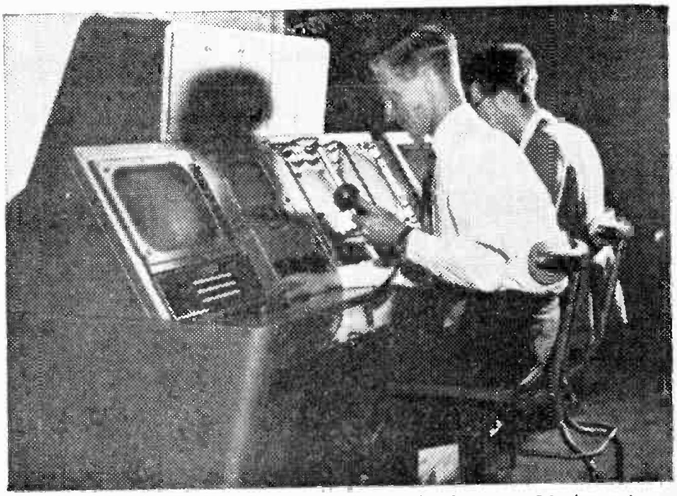
STATEMENTS by both BBC and ITV spokesmen that television coverage has now been achieved to a very high proportion of the population of the country—not far off 100per cent—will be received with scepticism in a good many localities. At a guess, I would estimate that really good reception is only achieved by little more than 60per cent, the remaining viewers' pictures being subject to interference troubles and ghosting, often aggravated by very weak signals. There must be hundreds of towns and villages in valleys and particularly along our coastlines, behind cliffs and downs, which are effectively screened from their nearest BBC or ITV transmitters. Geographically cut off from their programme sources, only drastic and quite impossible measures, such as bulldozing a hill away, could give satisfactory improvements to reception in these places, particularly on the ITV channels. The surprising thing is the contented way in which these unfortunate viewers sit before their sets and watch a picture full of "noise" and grain, interference patterns and static. They become so "drugged" with these imperfect pictures that they come to accept them as the inevitable. Nevertheless, they are included in the set-counts of both services.

Alternative Signal Sources

Country-wide reception, good, bad and indifferent, having been more or less achieved, BBC and ITV are now trying to do something about these patchy areas, the Cinderellas of TV. An increasing number of low-power booster relay stations will be erected and linked with main parent transmitters by microwave transmitters or other means. Much progress has been made with the design of unattended and entirely automatic relay transmitters for picking up good signals from the top of a hill near the screened district and re-radiating them on a different frequency and with different aerial polarisation. The number of such relay stations has been limited up to now and the BBC paved the way with such relay stations near Brighton, Dover, Peterborough, Douglas (Isle of Man) and in the remote parts of Scotland, where relatively large populations received little or no signal at all. This train of events has followed the pattern of early BBC radio stations, when sound relay transmitters were erected at Sheffield, Plymouth, Leeds, Edinburgh, Liverpool and six other main centres of population that were out of crystal-set range. Now the BBC are continuing this policy in areas where a TV signal can be received, though not well. Hence the erection of a booster relay of North Hessary Tor's transmissions at a point near Redruth and new proposal for a relay transmitter at Walthwaite, near Barrow-in-Furness, which will pick up and relay the transmissions from Holme Moss. In the latter area, a surprisingly large population—2,250,000—will receive a much improved picture. Similarly, ITV are opening a relay transmitter at Strabane in Ulster, one near Bedford, one near Selkirk (which is a satellite of the new Border Television transmitter at Caldbeck, Cumberland), and have several others under consideration.

Wired Television

The ultimate number of television relay transmitters is necessarily limited, and though ITV and BBC will compete for the untapped pockets of population in many places, there will be many more places which still require help. The best alternatives to a booster station are the wired television systems, L.F. or R.F. The L.F. system, such as that installed by Rediffusion, Relay Vision and others in large towns and cities, requires networks of special cable, usually laid under-



This Tabular Display unit and combined Radar/Synthetic Display unit, made by Marconi, will be shown at the S.B.A.C. exhibition in the near future. Of special interest is the closed circuit television screen, which is used to give an updated display of meteorological information.

ground, which distributes television and sound signals picked up at a good receiving site on a hill nearby. The signals are converted into comparatively low frequencies for easier sending over underground cables, aided by distribution amplifiers at strategic points. A special type of television receiver is hired as a part of the service, obtainable only from the relay company.

On the other hand, the R.F. system converts the incoming signals to channels 1, 2 and 4, which are sent on coaxial lines, frequently overhead, which run behind houses attached to electrical or telegraph poles, for easy connection to viewers's own sets. These sets can be of standard type, purchased from any TV shop. Naturally, the radio dealers prefer the R.F. system, and in some districts where reception is patchy, dealers have formed syndicates to construct and operate wired television services, therby saving themselves headaches with aerials (and the customers complaints about poor pictures). By providing good, strong signals in these places, moreover, they have promoted the sales of their TV sets. There are dozens of such systems in the valleys of South Wales, Devon and Cornwall, where so many towns and villages are situated at the estuaries of rivers, screened by hills from BBC and ITV transmitters. Even East Anglia has its quota of awkward reception spots which are now admirably served with a comprehensive choice of programmes which include BBC and two ITV transmissions, VHF radio on the Home, Light and Third programmes.

In Devon, Sidmouth, Seaton, Beer and Lyme Regis are served by the Viewline R.F. system, whose wired television service was first established at Branscombe when the BBC's London transmitter was the only television signal available. One of Viewline's hill-top receiving stations has a high mast with a sixty-four element aerial array directed at Southern's Chillerton Down transmitter in the Isle of Wight. It produces a very fine picture, seen by a thousand subscribers who live in houses strongly devoid of the usual aerial ironmongery. The unencumbered chimney stack and roofs are a strange sight.

The Burden of Proof

I do not go to the cinema so often these days, like many others. I "shop" for my films instead of making regular visits week after week, whatever is on. Sometimes, during the fifteen to twenty minutes of advertising filmlets and exortations to buy ice-cream, trailers of forthcoming films entice me to make a return visit the following week—that is, if the trailer is well-presented and not cluttered up with too many superlative adjectives. The same applies to the trailers or "promotion material" put out by the BBC and ITV companies. If the announcements and preview pictures are not very attractive, they serve as a warning *not* to view the subject advertised. I very nearly formed a wrong opinion in advance of Anglia's superb play, "The Burden of Proof", owing to the rather drab series of still photographs and spoken patter which were the "promotion material". I formed the opinion that it was to be just another kitchen-sink drama of unrelieved gloom—until I noticed that George More O'Ferrall was to be the director. So, in spite of the "promotion", I switched on for "The Burden of Proof" and was rewarded with about ninety minutes' realistic and gripping "whodunit" entertainment which kept the tension up from the starting sequence of an identification parade to the highly satisfactory dénouement at the end. Richard Pearson had another very meaty role as the man who volunteered for an identification parade at the police station, only to be picked out as the wanted man—and around whom circumstantial evidence seemed to build a strong case that he was, in fact, the guilty party. So well was the play constructed and developed by George More O'Ferrall that the majority of viewers probably supported the growing suspicions of the police.

With superb technical work and realistic settings, the actors had good backgrounds to help the atmosphere. All the players were first-class, the unfortunate victim, Lionel Bellows, being played by Richard Pearson, the detectives by Basil Dignam and Richard Walton, Mrs Bellows by Annette Carrell and Milly, the barmaid—the only person who believed in his innocence—by Pauline Jameson. Many other players in large and small parts made contributions to the success of this TV play by Gerald Savory. Lastly, the background music was sparingly used and unobtrusive, which is as it should be. James Clarke was the composer.

Anglia have made a lot of excellent contributions to the ITV network, more than any other regional station, and "The Burden of Proof" was proof indeed that they intend to sustain their high reputation in the drama field.

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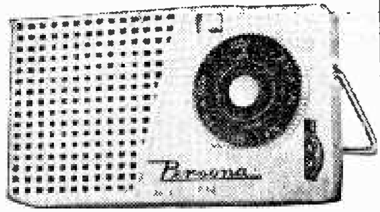

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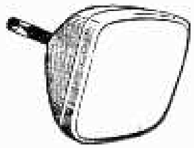

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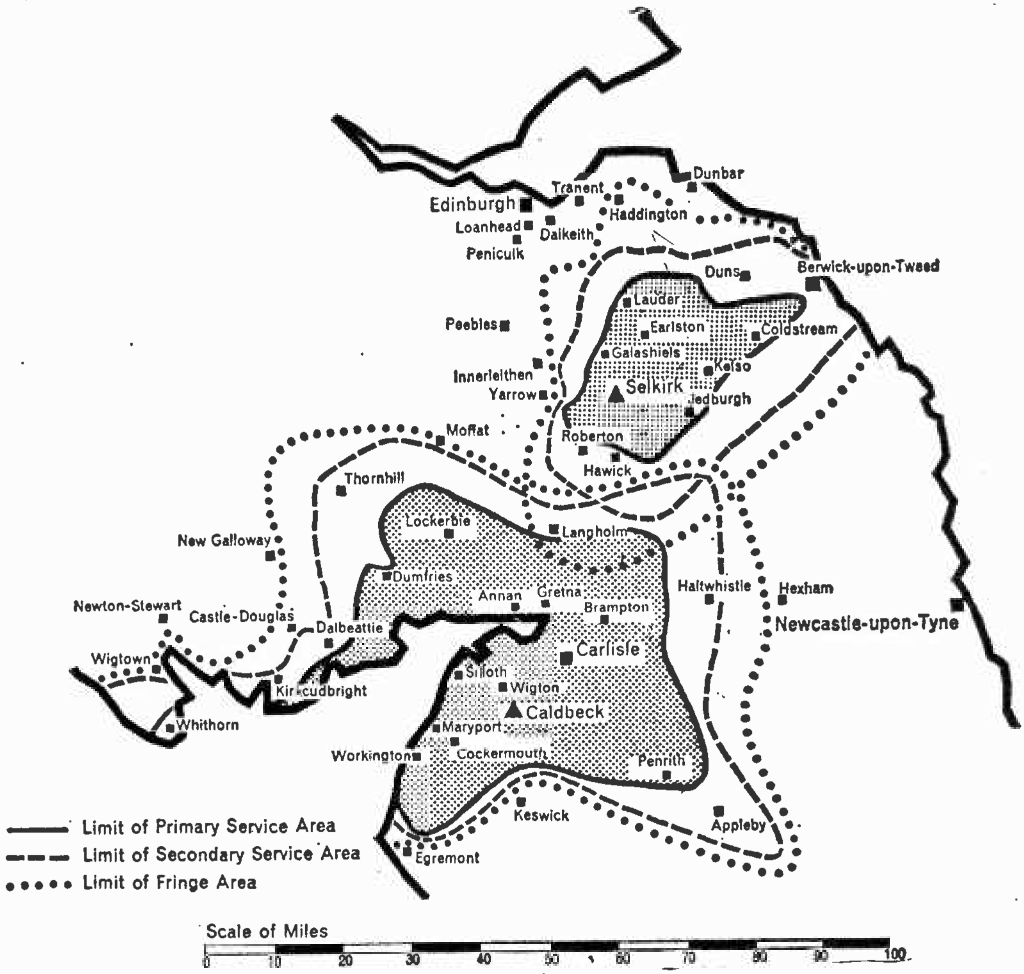

The estimated coverage of the new mast.

TRADE test transmissions from the Independent Television Authority's Caldbeck station in Cumberland began in July, and programme transmissions will commence on 1st September. Signals will be sent out on Channel 11, horizontally polarized.

The Selkirk station will be a fully automatic unattended satellite and will rebroadcast the signals radiated from the Caldbeck station. Transmissions from this station will start around the end of 1961 and the signals will be on Channel 13, vertically polarized.

The aerial height above sea level of the Caldbeck station will be 1,900ft and that of the Selkirk station 1,644ft.

The effective radiated power from the Caldbeck site will be: 100kW to the North-East and South-West, 70kW to the North-West and 20kW to the South-East. The vision frequency will be 204·74Mc/s and the sound 201·25Mc/s.

The Selkirk station will have an effective radiated power of 25kW over a semicircular arc to the East. Its vision frequency will be 214·723Mc/s, and its sound frequency will be 211·223Mc/s.

The estimated number of people who will be able to receive transmissions from the Caldbeck station is 392,000, and from the Selkirk station 121,800.

Letters to the Editor

The Editor does not necessarily agree with the opinions expressed by his correspondents.

SPECIAL NOTE: Will readers please note that we are unable to supply Service Sheets or Circuits of ex-Government apparatus, or of proprietary makes of commercial receivers. We regret that we are also unable to publish letters from readers seeking a source of supply of such apparatus.

AERIAL SCREENING

SIR,—I believe, some time ago, I saw in your pages a note about the effects of screening an aerial (unwanted) and I would like to point out that I experienced a spot of trouble which might be of interest to others who become similarly placed. When my aerial was installed by the local radio shop it gave what appeared to be perfect results and has done so for two years. Recently I felt that the performance of the receiver was not up to standard but did not do anything about it. A friend who is radio-minded came to see me one day and told me that the picture was inferior, naming a lot of faults which I could only see when they were pointed out. He adjusted one or two controls on the rear and then asked to see the aerial and feeder. When we went into the attic he said "There's your trouble," and pointed to the large water cistern, and after rerouting the down-lead he suggested that the aerial would be much better in another position. I eventually made this move and the set has, as a result, been rejuvenated. The cistern was below the aerial level, but definitely had a marked absorption effect. I imagine the aerial was just put in the most easily accessible position and no real tests were made to see whether it could be improved. The progressive deterioration of the receiver has now shown that the position chosen was not the best.—F. J. KING (Gloucester).

PICTURE DETERIORATION

SIR,—In your issue of May you replied to a query by a Mr. Glover of Leicester who had the same trouble which I experienced some time ago. I had tried several things unsuccessfully, and eventually replaced the tube, which promptly cured the trouble. I firmly recommend Mr. Glover to do the same, when I am certain that he will find his worries at an end. Incidentally, I note that your expert recommended that he should do this, and it is not worth while experimenting with boost volts and transformers.—F. R. YOUNG (Blackheath).

SYNC SEPARATOR

SIR,—Mr. Slingen in the April issue asks about the differences in the method of taking out the frame and line pulses, and enumerates different systems as found in commercial receivers. I have carried out many experiments in this direction, and find that there is very little actual difference in the split anode or separate cathode and anode feeds. What I have found, however, is that better results are obtained when the *frame* is fed from the cathode circuit, and diodes are employed in the limiting circuits. This does seem to be a more stable method of obtaining frame working, but is more complicated.—F. R. BENBOW (York).

LINE SLIP

SIR,—From time to time you publish details of faults and I have just cured a most annoying defect which did not answer to any of the accepted tests, etc. The trouble was line slip in the form of gradually increasing tearing at the top of the picture. This occurred after about one hour's viewing, and from a start of a strip about half an inch deep it gradually increased to three or four inches, and no amount of valve replacement or component changes would get rid of it. I decided one day to clean the set out as it had become very dusty, and accordingly carefully removed the complete chassis with tube (which was bolted to the chassis), and started dusting. I was surprised to find two fair sized washers firmly adhering to the scanning coils. apparently due to the strength of the focusing magnet. I removed these, not thinking they would have any effect on the line trouble, but when the set was replaced, the trouble did not occur again and reception has been perfect for three months. How could these washers on the coil assembly cause a fault of a variable nature? Perhaps one of your expert readers may be able to offer a solution.—F. N. HUMBERSTONE (N.W.).

HOME CONSTRUCTION SETS

SIR,—I started taking an interest in home-made apparatus when looking through some back numbers of P.T. I came across a very interesting aspect as a result of this research and wonder if there is any explanation of the following points. All I.F. transformers which I have seen so far, have their trimming cores at top and bottom, with the result that the chassis has to be turned over when lining up. Why cannot the adjustment be made from the side? Surely the two coils could be wound on two formers situated side by side, to avoid the above disadvantage. When testing a set, access must be had to the valveholder terminals, and this necessitates access to the underside of a chassis. The tube connections are accessible only from the rear, and thus one would apparently have to be continually turning a heavy set end to end and over and over. What happened to the old idea of using a standard type of chassis standing vertically? It would appear to be ideal, if only the valves could be placed on the undersurface, but I do not think this would be a bad point and it would certainly give access to every part which one needs to test in a modern television receiver, and the coils would be out in the cool and ventilation would surely be at its best. Perhaps you would bear this idea in mind in your next design for the home constructor—if only some manufacturer would make available I.F.'s of the type above suggested. —B. NEVILLE (Northolt).

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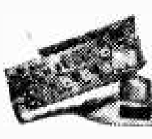

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Your PROBLEMS Solved

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. 631 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

EKCO T161

I can obtain sound and vision separately on this set but not together. I have realigned with two Avo 8s and signal generator following the makers' instructions. What is the purpose of the capacitor across the pins of the tube? It seems to be going back to the sync separator.—A. Phillips (Swansea).

Your symptoms are those of a weak signal and may be due to faulty decoupling in the I.F. stages. The condenser on the tube base is a 0·25μF and is part of an anti-flutter circuit connected to the anode of the video amplifier.

PYE 17 21/5

This set has a dull picture. The sound is fine and all valves and the tube are in order. The brightness and contrast controls are in order and also the sensitivity control. Can you help please? —J. Whiteside (Co. Armagh).

The usual causes of a dull picture are a faulty tube or a low PCC84 in the tuner. Assuming that you have checked both of these items by substitution, try replacing the vision detector diode, a CG12E crystal in the compartment at the underside end of the vision I.F. strip.

PHILIPS 115UF-45

The tube suffered from uncontrolled brilliance and the wiring was altered and the fault corrected. The picture is now going up or down, and is very difficult to lock. It does lock in the middle of the frame hold travel but is very critical and after a few minutes the picture starts to slip again. I suspect the ECL80 V16 or one of the resistors.—J. Coltham (Long Ashton).

The suspect resistor is R81 (2·2M) in the makers' sheet but as you seem to have a trade service sheet this is given as R83. Also check sync separator and video components if necessary.

K.B. RV60

There is trouble on sound on this receiver. This is in the form of distortion, mainly on BBC. Some days the sound is completely free of this distortion. Can you give me an indication of the trouble? —R. Cash (Weymouth).

The trouble appears to be due to a defective resistor associated with the sound noise limiter circuit. As the receiver is fairly new, we would advise you to allow your dealer to rectify the fault.

MURPHY V240

Can you assist me in replacing the volume control on this set? What replacements do I need? Also, can you tell me the cause of the following faults. The raster is cut off at the right, top, left and bottom. The scanning lines are very weak and the line hold is critical in its setting. The setting is in the centre of the control. There is very bad arcing from the outer coating of the tube to chassis members and coil assembly. This only starts on heating up from cold. What adjustments do I need to make to the line drive if the line output valve is replaced?—E. Connor (Camberwell, S.E.5).

The volume control is a 250k with double-pole switch and an extra large "flat" on it to accommodate the knob. Your other symptoms indicate low gain and suggest a low 30L1 in the tuner, a low emission tube, or a faulty 20P3 frame output valve. The "current" control should be set to read 95mA cathode current with a new 20P4 fitted.

ULTRA W84L

I wish to fit a 13-channel tuner to the above set. Can you advise me as to the type best suited and how to fit it into the television set?—G. Hammond (Edgware).

There is only one type of turret tuner which is immediately adaptable to your receiver. This is the Cyldon E162 which may be ordered through our advertisers. It is supplied with R.F. and mixer plugs which replace the R.F. amplifier and frequency changer 6F1 valves.

COSSOR 933

This set was repaired some time ago when a new line transformer and valve SU61 and 21A6 were fitted. When the set was switched on, it did not give a very clear picture as I had the aerial on a short pole but recently I had it placed on the chimney and the picture is still poor and can only be seen with the room light off. When I tried to adjust the receiver it developed a flash in the top right hand corner of the screen. This only happens when it has been switched on for about half an hour and continues to flash at intervals of about five minutes. When this happens there are sparks underneath the earthing clip on top of the tube.—V. Dowling (Hanley).

The main fault is similar to a faulty C.R. tube and we suggest that you check that you have not disturbed the ion trap magnet when repairing the set. The flashes can be due to a poor contact of the metal strip on the graphite coating or to flash-over inside the EHT box due to a faulty SU61 or ragged soldering of its wiring.

FERGUSON 968T/978T

This receiver has been giving interference in the form of corona discharge, but I cannot find any fault with it: the picture is good and the sound

perfect. When trying to trace the interference I placed alongside it a Murphy 240 and when the Ferguson was switched on there was corona discharge on the other set but this only lasted while my own set was warming up, but the Ferguson screen stays clear of corona discharge.—R. Godfrey (Chatham).

This is probably caused by poor insulation in the line output transformer causing internal corona (within the windings) during the line flyback. In this event, transformer replacement represents the only cure. However, also check the PL38 and PY31 valves.

H.M.V. 1826

After receiving normal sound and picture for five minutes the sound disappears completely. By switching off and on quickly it returns. For the next few minutes the process is repeated and the set will then settle down for the rest of the evening without further trouble.—C. Riches (S.E.20).

You should check the 0·1μF audio coupling capacitor under the R.F. unit (connecting to the screened cable which goes to the volume control) and the 0·022μF which connects to the noise limiter diode. In the June and July 1960 issues these were shown as C44 and C42 in "Servicing TV Receivers". Check the Z152 valves (including V9 on front left) and the 0·001μF capacitor between L15 and L16 if necessary.

PORTADYNE T237

When I switch on there is a curved black line about 3in. wide on the left side and a 2in. black line on the right. I have changed valves ECC82 and EF80 but the fault still persists. I would be pleased to have your comments.—A. Dyan (Romford).

You should check valves PY32 and PL81. If these are in order check the PY81 and the 120pF 6kV capacitor from the PY81 top cap connection to the width control.

VIDOR CN4225

The PY81 booster diode anode glows very red and at the same time the H.T. line voltage falls off to about 80. I have replaced the PL81 line output valve but the fault remains. I suspect that there is an H.T. short in the line output stage as the glowing in the PY81 ceases when I remove the PY81 top cap.—F. Erridge (York).

You will probably find that one of the leads passing through a hole in the chassis near the transformer and PY81, PL81 valve bases is touching due to its insulation having been impaired. This is not unusual on this model.

DECCA D17

The trouble is lack of width with correct height. I have changed the PL81, PY81, EY51 valves but with no improvement. Sometimes the picture creeps in or goes wider and adjusting the two metal rods that are under the line transformer helps. The set was not used for a week and on switching on the width was correct. I wonder if the line transformer needs replacing?—J. Pringle (Edinburgh 9).

We would advise you to replace the 14A97 metal rectifier which is on the front right side near the fuses.

BUSH TV33

Is it possible to replace a 14in. tube with a 17in? The present tube in the set is a MW36-24 and as I have a MW43-69 to hand this is the tube I wish to use.—J. Wetherall (Newbury).

The electrical modifications are very minor; merely ensure that pin 7 is connected to pin 10 or to pin 11.

The snags are in the mechanical alterations necessary to accommodate the larger tube.

DYNATRON TV38

This set has developed a fault in vision and sound. There is no vision on ITV and the sound is weak. Vision on BBC is weak, moderate sound. Contrast control works from no picture to weak picture but any further advance of the control gives no further strengthening of the picture. This is a television receiver with F.M. sound. No sound is obtained on the Third Programme and it is just audible on the Home Service and weak on the Light Programme. I have checked the contrast variable resistor and the two 33k resistors soldered to it, they all seem satisfactory with an ohmmeter. —R. Beagle (London N.W.4.).

You should first check the tuner unit valves, 30L1 (PCC84) and 30C1 (PCF80). If both are in order, check the 27k resistor in the tuner unit connecting from H.T. via a choke and series 1k resistor to the front leaf connection or tag.

INVICTA 136

Frame linearity is causing me trouble with this set. The top is expanded and the bottom cramped and this cannot be rectified by the frame controls, only the top half of the raster responds sufficiently; the bottom half fails to open out enough.—H. Malton (Plymouth).

You should change the PCL82 frame output valve. This is on the rear of the chassis just behind the fuses, mains droppers etc.—to the left of the PY32 H.T. rectifier. If necessary check its 390Ω cathode bias resistor (pin 2 to chassis).

McMURDO CR52

Sound and vision are good on this receiver but the brilliance or contrast is unstable. I have recently fitted a new 12in. tube to the set. The brilliance slowly increases with black horizontal lines following whites. Cutting back the brilliance corrects the picture, but I have to balance contrast frequently. I have changed 12AU7, 12AT7 and several EF91's and also the brilliance control.—W. Chester (Barnsley).

We are of the opinion that the new tube is defective and that the effect will gradually worsen until the brilliance will be excessive in the minimum position. The tube should therefore be returned to the suppliers before the expiry of the guarantee.

PETO SCOTT 17-22

Recently I replaced the PY81 valve because of severe arcing, then I replaced the PL81 because of a narrow picture. Another fault has now developed. When the set is switched on and allowed to warm up, the picture appears smaller than the screen with a 1½in. black margin around it, after a few minutes it fills up the screen but appears rather grainy and never in completely sharp focus.—C. Evans (Wolverhampton).

You should replace the PY32 H.T. rectifier and reset the ion trap magnet on the rear of the tube. If the picture is still unsatisfactory, check the PCF80 video amplifier and associated components.

ENGLISH ELECTRIC T.41

I had an open-circuit in the H.T. (not EHT) winding of the line output transformer of my set. This proved to be easily located and I effected the repair myself but on re-assembly find extreme cramping on the right-hand side of the picture. I feel this is due to not knowing the correct gap to introduce when fitting the ferrite core back into place. If you consider this to be so I would be grateful for your advice and suggestions to any other possible causes of their non-linearity. PY81 and PL81 valve changes appear to have no beneficial effect.—C. Carter (London W.3.).

If the cramping was not there previously it would appear that the transformer has been incorrectly reassembled. The gap should be closed as much as possible but this is not unduly critical. Shorted turns are a distinct possibility and it may be necessary to replace the transformer.

MURPHY V200

This is a second-hand receiver to which I fitted a new tube, 12/B. The raster is good and all controls work but there is no picture and flyback lines are visible. The sound is working perfectly.—W. Glover (Darfield).

Your trouble could be anywhere in the vision I.F. stages which are on the bottom left chassis as viewed from the back and which run from front to back along the edge closest to the tube. The regular faults to cause no vision are the burning out of the 10k video amplifier anode load, and a break in the contrast control.

A TV VALVE TESTER

(Continued from page 609)

cathode bias feeds are taken to three terminals on a panel at the rear of the instrument. A fourth terminal is connected direct to chassis.

Heater supplies consist of 4V, 5V, and 6·3V windings, taken to three pairs of terminals on the rear panel. Approximately 12V can be obtained by linking the 5V and 6·3V winding in correct phase. This is marked on the panel. An additional winding for higher heater voltages was considered but this was found unnecessary when the tester was put to use.

Seven common valve bases are wired in parallel —the nine wires from the bases are fitted with spade terminals which are then connected to the appropriate supply voltages.

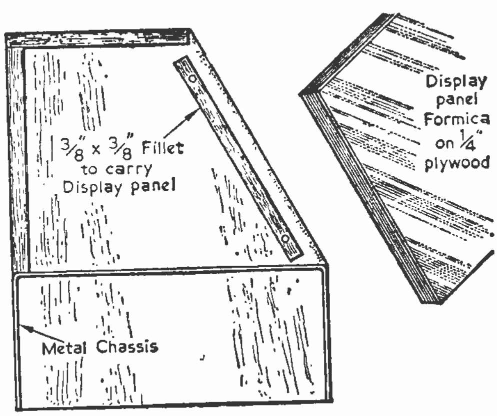

Fig. 2.—Construction of the case and front panel.

Using the Tester

The necessary base connections and data are obtained from a valve data book. The heater leads are connected to the corresponding voltage terminals and the lead from the correct pins to the anode, screen and bias terminals. All other leads are clipped on to the chassis terminal. Switch on, and set up voltages as given in the valve data. The bias can be varied to test Gm of the valve and the readings checked from the data.

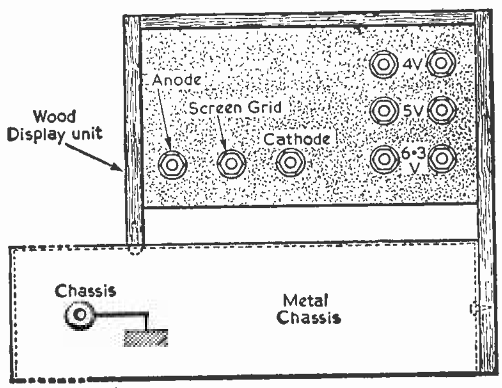

Fig. 3.—Rear view of the terminal panel.

Constructional Details

The chassis is an old radio chassis which was very conveniently drilled with several holes for bases in a small area. The chassis size was 12in. x 5½in. The display unit (Fig. 2) consists of a small hardwood box, one side of which sits on top of the chassis and is screwed from underneath, and the other longer side is screwed on the end of the chassis. The display panel with meters and controls is removable, and is made of ¼in. ply covered with a suitable material, and measures 6¾in. x 5¾in. It rests on two small bearers glued to the sides of the box (Fig. 2). A signal lamp of the midget variety is set in the panel between the meters. The mains on/off switch is affixed to the horizontal chassis.

QUERIES COUPON

This coupon is available until SEPTEMBER 22nd, 1961, and must accompany all Queries sent in accordance with the notice on page 627.

PRACTICAL TELEVISION, SEPTEMBER, 1961.

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D77	2/6
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U31	2/6
U251	2/6
UF42	2/6
UU7	2/6
V827	2/6
VP4	2/6
VP4B	2/6
W77	2/6
X81	2/6
Z63	2/6
Z66	2/6
Z77	1/3
Z90	1/3
Z719	2/6
2D4A	2/6
4TPB	2/6
6AL5	2/6
6AM6	1/3
6BW7	2/6
6BX6	2/6
6C6	2/6
6D2	2/6
6D3	2/6
6D6	2/6
6F12	1/3
6F13	1/3
6J5	2/6
6J7	2/6
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