Practical TELEVISION

JULY 1964

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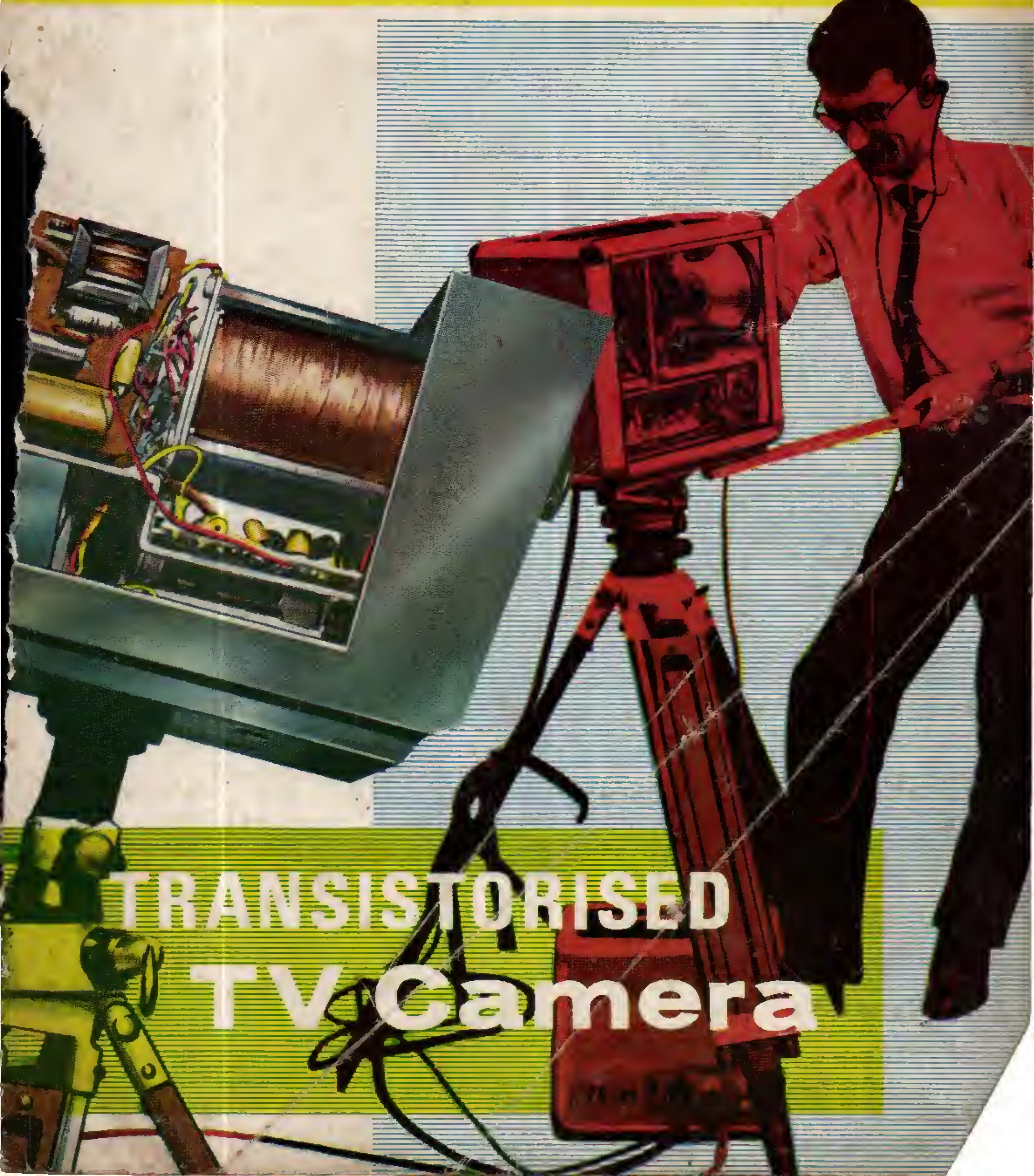

Practical Television

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Contents

To pay or not to pay

THE subject of Pay-TV is not a new one but whenever it comes up for discussion, it engenders the kind of controversy and argument to be expected when some break with tradition, or some new approach, is in the air.

Following the decision in the second Government White Paper on the Pilkington Report to permit a restricted and experimental period of Pay-TV, the subject has largely been pushed to one side, except for those intimately concerned with the development of the systems.

But now that the experimental systems are nearing completion, Pay-TV once again assumes a degree of topicality. These pilot schemes are being installed in selected areas to provide, overall, a reasonable cross-section of a potential nationwide coverage. They will be operating on an experimental basis for a nominal period of three years. After this time—or perhaps even before—the decision will be taken whether to give the green light for the development of Pay-TV (and in what form) or to conclude that such a system would serve no useful public service.

Many people will ask the obvious question: do we really *need* Pay-TV anyway? Considering that practically every viewer now has the choice of two regular programmes, that many now have three programmes and that ultimately it is planned to provide a national coverage of two BBC and two ITA programmes, this is a fair enough comment. Particularly so in view of the poor standard of many programmes and the fear that, with eventually four programmes to fill, the strain on both economic and production resources will mean that these standards may deteriorate further.

But Pay-TV programmes, as envisaged, should be sufficiently different to attract the right customers. Typical offerings will be recent films, sporting events, musical concerts and other selective audience programmes; shows that in the normal way would cost considerably more than a few shillings for Pay-TV viewing

They must, in the main, be programmes not generally available on the normal TV channels. Pay-TV would not be for the endurance-record viewers but for those wanting to see perhaps one or two special shows each week. And there are other advantages inherent in certain Pay-TV systems, one of which will be described in some detail in the next issue.

An interesting development comes from America where similar systems are now running. Owing to the poor quality of certain local programmes, the FCC has intimated that unless this quality improves they may re-allocate the channels to Pay-TV services!

This has sown the seed here for a suggestion to press the PMG to eventually give Pay-TV the u.h.f. channel earmarked for the second ITA programme, thus giving viewers the alternative of two commercial channels—one carrying advertising and one not carrying advertising but paid for selectively. If nothing else, this is certainly a bold and controversial idea!

Our next issue dated August will be published on July 22nd.

TELETOPICS

C.R.T. FACTORY PREPARES FOR COLOUR

IN spite of delays in decisions on the introduction of a British colour TV system, Thorn-AEI Limited intend to be ready for its arrival when the go-ahead finally is given. Towards this end, they have allocated one of the new factory blocks at their Brimsdown plant, for the production engineering and pilot production of colour television tubes.

Here at Brimsdown, the engineers and technicians working in the new unit will be in close liaison with the industrial and black-and-white picture tube development laboratories and the picture tube appraisal and colour sections of the applications laboratory.

When the first colour TV tube comes off the Thorn-AEI mass production line, much of its design will have been dictated by the set-manufacturer's requirements, but until then the new Brimsdown unit will be making sure that when the time comes, these requirements will be met.

More BBC-1 Relay Stations

THREE more areas of poor BBC-1 reception—two in Scotland and one in the Isle of Wight—are to be served by relay stations which will be sited to receive strong signals from the local BBC television transmitter and then re-transmit the signals into the affected areas. The two Scottish stations, which are now under construction, will also transmit the three v.h.f. radio programmes in their respective areas. One of these stations will serve an area including Grantown-on-Spey, Boat of Garten, Carrbridge, Aviemore and Nethybridge and will be sited at Laggan Hill, about two miles west of Grantown-on-Spey. Here two masts will be erected, one of 110ft. to carry the transmitting aerials and another of 60ft. for the receiving aerials. By the end of the year, this station should be relaying BBC-1 programmes from the Rosemarkie transmitter.

The second new relay station being built in Scotland will provide improved reception in the Burgh of Perth area and for this the station has been sited at Kinnoull Hill, one mile east of Perth.

In the Isle of Wight, the new relay station serving about 7,000 people in the Ventnor and Bonchurch area, came into service on May 4th. The station has been built just north of St. Boniface Down where it re-radiates the television signals of the Corporation's Rowridge transmitter, from which the area is shielded by high ground. The relayed signals are on channel 5 (vision 66·75Mc/s, sound 63·25Mc/s) and are horizontally polarised.

Selenium Rectifiers take over from Valves

OUT of all the different makes of television receivers now made in Britain, 17 brands use a new miniature selenium rectifier in place of the 16kV e.h.t. rectifier valve. This was announced recently by Standard Telephones and Cables Limited who manufacture this new component.

Known as the X80/150, the rectifier is made up of 150 selenium discs, each only two millimeters in diameter, stacked inside a 3in. long tube. Used in conjunction with a more compact line output transformer, three of these rectifiers are needed in the normal black-and-wh..e receiver.

TELECINE EQUIPMENT FOR PAY-TV

ONE of the firms scheduled to begin pay-television schemes in the autumn, Telemeter Programmes Limited, has recently placed a contract with EMI Electronics Limited for the supply and installation of electronic film scanning equipment. The equipment will be installed at the Company's two control centres at Merton Park, Surrey and Billingham, Co. Durham Three telecine machines and a control console have been ordered for Merton Park, and two telecine machines and a control console for Billingham.

It is from these two centres that Pay-TV programmes will be relayed by wire to subscribers in the surrounding areas. The equipment will be able to accommodate both 16 and 35mm films.

Improving Reception of Welsh Transmissions

THE BBC's television service for Wales is to be reinforced in the area of Carmarthen, by a new relay station being built about one mile north of the town. When completed by the end of 1964, this station will provide improved reception of the service and of the three v.h.f. sound programmes which it will also transmit, for the 13,000 people living in the area.

The new station calls for a 120ft. aerial mast which will be erected on the site.

NEW SYSTEM OF COLOUR TV

TECHNICIANS and engineers attending the 95th Technical Conference of the American Society of Motion Picture and Television Engineers, held recently in Los Angeles, U.S.A., heard a description of a simplified and more economical system of colour television. Dr. Guillermo Gonzalez Camarena, who developed the system and gave the description, is the chief technical adviser for Telesistema Mexicano, Mexico City, and at the conference the system was demonstrated using video tape and adapted American receivers.

In essentials, the bicolour field-sequential Camarena system consists of a modified black-and-white camera, a standard monochrome transmitter and a black-and-white receiver modified to take a three-gun colour tube. The camera uses a synchronised rotating disc, holding red-orange and green-blue filters. In the transmission of the colour information, the odd-number fields correspond to the red-orange and the even-number to the green-blue.

This system it is claimed, delivers an adequate colour signal at minimum cost and is compatible with black-and-white television. According to Dr. Camarena, receivers designed for the system would cost only one-half of the present cost of colour TV receivers made in the U.S.A.

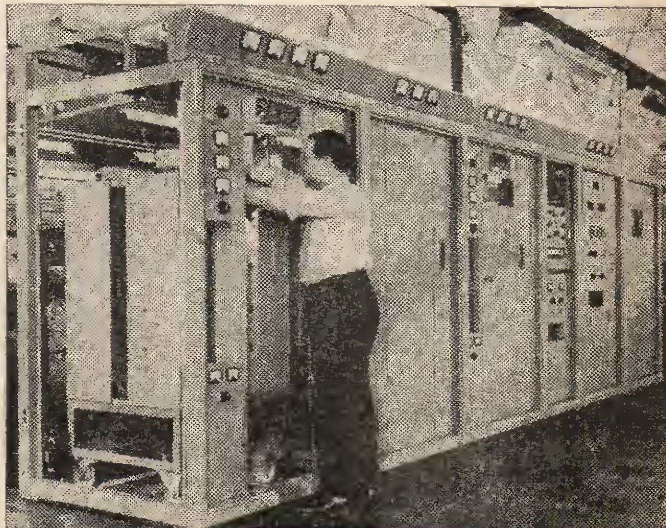
BBC-2 TRANSMITTERS & TRANSMISSIONS

A NEWS item in last month's "Teletopics" stated that BBC-2 trade test transmissions were continuing even though regular programmes had been commenced. Now it has been decided by the BBC, that these test transmissions shall be extended and from May 11th the new schedule has been effective, providing transmissions from 0930 to 1300 and 1400 to 1800, Monday to Saturday.

The transmitted material will remain as before, a test card with or without music or a 440c/s tone.

The Corporation gives as reason for the longer transmissions, the fact that the "increasing demand for the installation of BBC-2 aerials and receivers" has made it desirable for the radio trade to have more time during which setting up procedure can be carried out.

Below, an engineer performs pre-delivery checks on the first of twelve u.h.f. television transmitters, with associated sound transmitters, which are being supplied by Pye TVT Limited to the BBC for the second programme. These 25kW transmitters, whose total cost is about £600,000, will be installed at main television station sites throughout the country.



TV Installation for New London Hotel

IN each of the 300 bedrooms of London's new Europa hotel (Grosvenor Square), guests will find a remotely controlled television receiver and a control panel mounted in the bed-head. From this control panel, the guest will be able to select any one of three television channels, three radio programmes or a continuous selection of music. He will also be able to adjust the level of the output from the loudspeakers which are concealed in the ceilings.

This extensive installation was provided by Central Rediffusion Services Limited under contract from the hotel's owners. All the programmes are relayed to the bedrooms by wire and the necessary standards switching from 405 to 625 lines, or vice versa, is carried out automatically when selecting ITA, BBC-1 or BBC-2.

The system also incorporates an automatic device which adjusts the audio volume level throughout the hotel at predetermined times, so that late night viewers and listeners cannot disturb other guests.

The contract also included two closed television systems, one linking the kitchen and the manager's office with the banqueting rooms, the other providing the manager with a continuous view of the foyer.

Antiference Remains Independent

IN "Teletopics" for May '64, a news item announced the acquisition by British Relay Limited, of the issued share capital of Antiference Installations Limited. While this statement is correct, it was felt that the heading accompanying the item—"British Relay Acquire Antiference"—might prove misleading since Antiference Installations Limited was only a small subsidiary company within the Antiference Group, which remains quite independent of British Relay Limited.

A sound-only RECEIVER

BY G. J. KING

Modifying a television receiver audio stages, to provide a good quality output of TV sound.

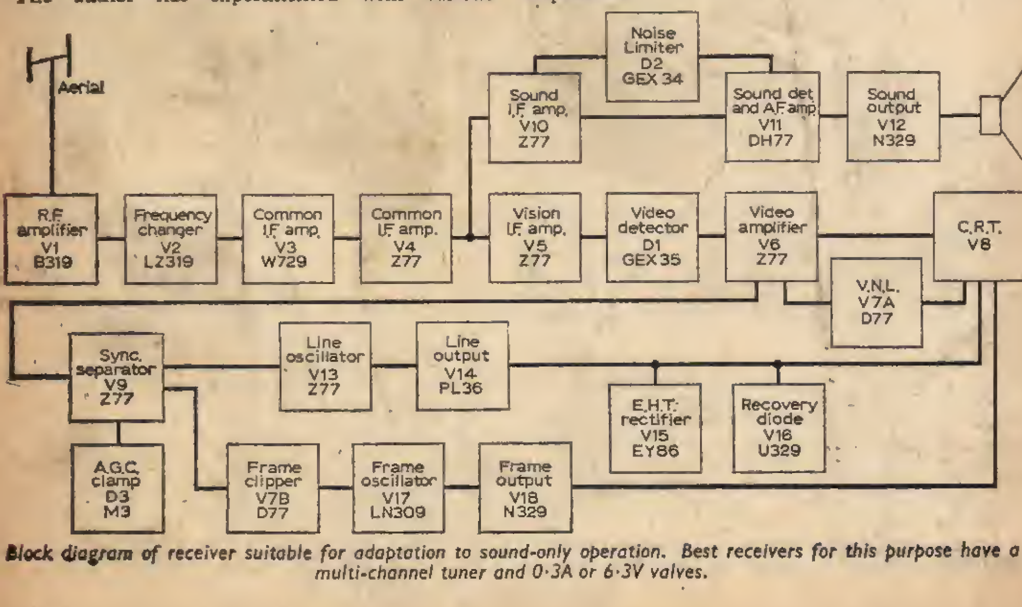
THERE are two main occasions when a sound-only receiver is required. One is when sound reproduction of a better quality than that provided by the sound section of the ordinary domestic receiver is needed, probably to feed into a hi-fi amplifier, and the other is when a tape recording of the sound accompaniment of a television programme is needed for later replay or for storing.

It is not an unduly difficult matter to pick out the sound of a television transmission. This can be done by a relatively simple type of receiver. Tuned radio-frequency (t.r.f.) receivers have been designed for this purpose, as also have intermediate-frequency strips into which is fed the i.f. signal obtained, for instance, from a turret tuner.

The detector in either case can consist of nothing more elaborate than a germanium diode, across the load of which appears the audio signal. The level of this is usually high enough to feed into a triode-pentode type of audio amplifier and output stage and loudspeaker or into the "radio" input sockets of a hi-fi amplifier.

The author has experimented with various designs of t.r.f. receiver for this purpose, "straight" circuits and "reflexed" circuits. These work quite well but have two main and costly problems to solve. One is to ensure that the vision signal always remains clear of the sound passband (to avoid vision-on-sound interference, which manifests as a "buzz" of changing pitch as the picture material changes) and the other is to have some arrangement which can tune the sound of both the BBC and ITV programmes. Soon, of course, the sound accompaniment of the BBC-2 programmes will be needed and this cannot easily be derived via t.r.f. means owing to the nature of the transmission frequencies involved.

It is relatively easy to obtain the sound from the v.h.f. channels through a t.r.f. receiver but as the frequency rises (towards the higher Band III channels) it becomes more difficult to keep the vision out while maintaining reasonable quality without adding a relatively large number of tuned circuits (stages). At ultra-high-frequency channels, which are those used for the 625-line standard carrying BBC-2, a t.r.f. receiver is virtually impossible.



Block diagram of receiver suitable for adaptation to sound-only operation. Best receivers for this purpose have a multi-channel tuner and 0·3A or 6·3V valves.

MAINS ISOLATED SUPERHET

We thus need a superhet, and to obtain channel selection attributes we also need a teletuner of some kind, v.h.f. for BBC-1 and ITA-1 and u.h.f. for BBC-2 and the later ITA-2 programmes.

Moreover, since we may wish to connect the receiver to a hi-fi amplifier or tape recorder it must also be thoroughly isolated from the mains supply.

To make such a receiver from scratch could prove a costly exercise. Fortunately we have everything we need in a television receiver and as there are so many very reasonable models now available on the surplus market there is virtually no point in starting from " square one ".

tion due otherwise to possible loading capacitances and so on.

CATHODE-FOLLOWER OUTPUT

This is easily accomplished by the use of a cathode-follower, using one of the valves and valveholders abandoned in the conversion. The author undertook to examine several receivers with multi-channel tuners which are now readily available on the surplus market as an exercise in converting for sound-only applications.

Almost all of the sets examined were "convertible" in this respect without a lot of trouble, but it was found best to select a model in which the valves

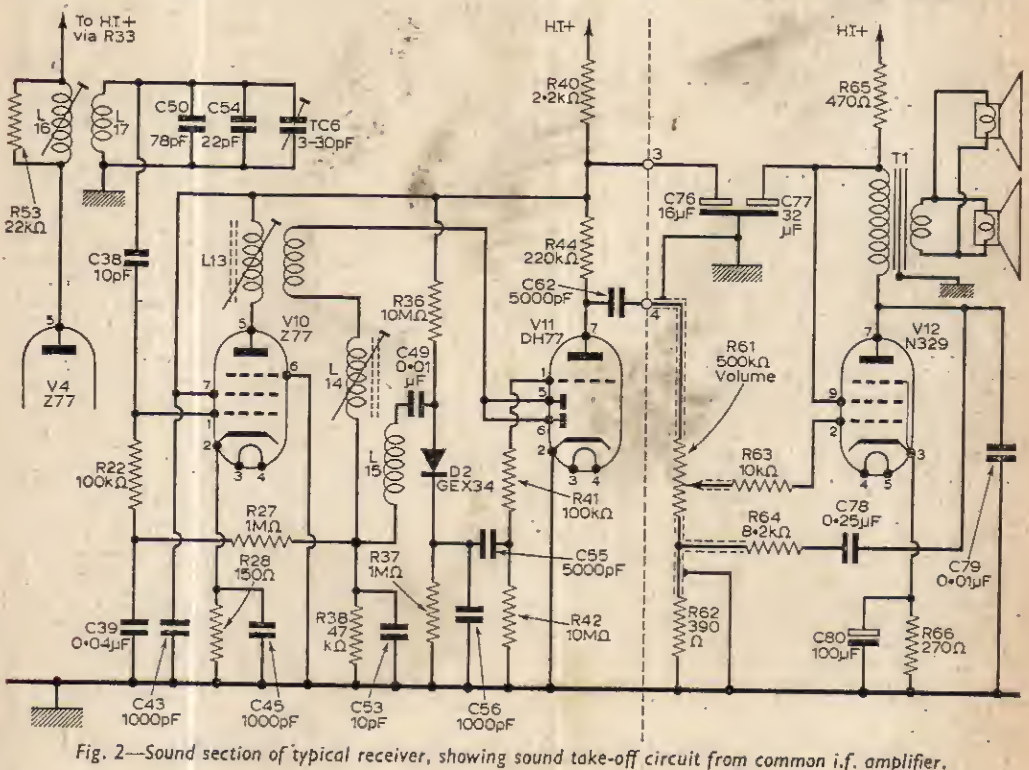


Fig. 2—Sound section of typical receiver, showing sound take-off circuit from common i.f. amplifier.

One thing about this idea is that we are not interested in the vision side of the set, so we can probably pick up just what we want for a pound or so—less than the cost of the valves required for the sound section!

We shall have to arrange the isolating from the mains, though, as the majority of models of recent years are so-called a.c./d.c. receivers, having no mains transformer but series-connected heaters, a mains dropping resistor and the chassis connected to one side of the mains supply. Clearly not a desirable piece of equipment for inter-connection.

Since we shall need to connect the sound signal to a hi-fi amplifier, control unit or tape recorder we shall also need an arrangement which isolates the detector circuit and prevents frequency distor-

have 0·3A heaters (or preferably 6V heaters, for then the isolation represents less of a problem as we shall see).

TYPICAL RECEIVER

The block layout of a receiver typical of the type that will be chosen is shown in Fig. 1. This is of the multi-channel variety with a 14, 17 or 21in. picture tube. Let us trace this circuit out to see exactly what we shall need to retain on the chassis to keep sound while deleting the whole of the vision section.

Valves V1 and V2 are in the tuner, so we obviously need to keep those. Valves V3, V4, V5 and V6, along with the germanium diode D1, are in the vision signal channel and are not required.

Valves V10, V11 and V12, along with the germanium diode D2, are in the sound channel and are kept.

The remaining valves are in the timebase and synchronising circuits and, of course, have no place in a sound-only receiver. This also applies to the booster diode and the EHT rectifier. In the receiver under examination h.t. is provided by a metal rectifier, MR1. This may or may not be useful in the sound receiver. depending upon the type of power supply adopted.

To summarise, therefore, we keep valves V1, V2, V10, V11 and V12, along with the associated circuits and components, and possibly the h.t. rectifier as well. We can thus strip the chassis right down apart from those stages required for the sound receiver. The components should be removed carefully, since they have value and could probably be incorporated in some future design or as servicing replacements.

FOLLOW THE SIGNAL

At this stage it would be as well to trace out the sound stages signalwise in case the receiver chosen for the conversion differs from that shown here.

The signal as picked up by the aerial is fed to the tuner via the aerial socket and the required BBC or ITV programme is selected by the channel selector control. The signal is amplified by the r.f. amplifier (cascode stage) V1 and is then applied to the frequency changer stage V2. This beats with the received and amplified signal, a locally generated signal (derived from the local oscillator-triode section of V2) and the vision and sound intermediate-frequency (i.f.) signals are produced across the i.f. output coil in the tuner.

Now the tuner i.f. output is normally connected to the common i.f. amplifier valve V3, where both the vision and sound signals are amplified together. In the receiver of Fig. 1, however, the two signals are further amplified in V4 and the sound/vision output is split in the anode circuit.

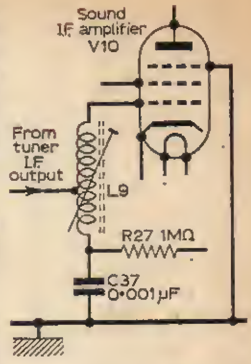
Since we are concerned only with the sound signal we shall not normally require the two common i.f. stages (or even one stage for that matter). This means then that we can connect the tuner output direct to the control grid circuit of the sound i.f. amplifier valve V10. But we must do this at the correct impedance, as we shall see.

After the sound i.f. signal has been boosted by V10 (see Fig. 2) it is applied to the diodes (two connected in parallel, though there may be a crystal diode in some receivers selected for the conversion —but see later) which serve at the sound detector. The detector load is R38 and it is across this resistor that the audio signal is developed. C53 is the detector reservoir capacitor which is featured across all detector loads.

The audio signal at the "live" side of the load is coupled to the sound interference suppression diode D2 via the i.f. filter L15 and the coupling and isolating capacitor C49. All sets have an arrangement similar to this, though a thermionic diode may be used as the suppressor valve in some models.

The interference diode is biased by R37 on its "cathode" and by R36 on its "anode" and the interference-free audio signal is redeveloped across R37 and time-constant capacitor C56, from whence it is coupled direct to the grid of V11 triode section via C55. R41 is effectively a grid stopper and R42 the grid leak. The high value of the latter biases the triode by virtue of a grid current action which the high value promotes, thereby making a cathode resistor unnecessary.

Fig. 3—This circuit shows how the sound i.f. amplifier valve is rearranged at its control grid to accept the tuner sound i.f. signal. L9 and C37 are from V3 input circuit, while R27 is the original sound a.g.c. feed resistor at V10 stage.



The amplified audio is then developed across the anode load R44 and fed, via the coupling capacitor C62 and the volume control R61, to the control grid of the output valve V12. In some sets a triode-pentode valve will be found in this section with the triode acting as the audio amplifier and the pentode as the output valve. The detector and noise limiter then usually feature either a pair of germanium diodes or a double-diode valve. The action of the circuit, nevertheless, is very similar to that described above.

In fringe areas and where an exceptionally high level of detector audio is required the common i.f. stages can be retained. In that event valves V3 and V4 would be retained, along with the other sound valves, and the vision circuit would be disconnected at V4 anode circuit. The sound signal could then be boosted even well above the level initially catered for simply by tuning the circuits associated with V3 and V4 to the sound i.f., bearing in mind that under normal sound/vision operating conditions the tuning is virtually a compromise between the sound and vision signals.

TUNER COUPLING

However. if it is decided not to use the common stages, the components at the control grid of the sound i.f. amplifier V10 should be disconnected and the tuner coupling circuit transferred from stage V3, giving the arrangement shown in Fig. 3.

Now, apart from being able to hear the sound of the TV programme in the set's original loudspeaker via the audio stages, some means must be made available to feed the detector signal out through a cathode-follower stage.

One of the redundant pentodes (strapped as a triode) or the triode section of a triode-pentode may be used for this service. A valveholder should be positioned in one of the original valveholder chassis holes as near as possible to the detector and this should be wired in accordance with the circuit in Fig. 4.

We now come to the power supply arrangements. This can be tackled in one of two ways, but whichever way is finally chosen, complete isolation from the mains supply is essential.

One method is to employ an isolating transformer of 1-to-1 ratio for connection between the mains supply and the power input of the sound receiver. Since the vision sections of the set have been disconnected and removed the total power loading will rarely exceed 60W, so a relatively small isolating transformer can be employed. A suitable component is the 75W isolating transformer which is marketed by Radiospares Ltd. This sells for about 56s. and is well worth it. It is available through any radio dealer.

HEATER CHAIN BALANCING

If this method is adopted, however, it is obvious that the heater chain must be rebalanced, for since two-thirds of the valves have been removed, considerably more heater chain resistance will be needed to ensure a chain current of 0·3A. Moreover, the heaters will need to be joined together again on the valves which are used.

The heaters of the valves remaining should be joined in series and any relevant filtering retained along with the existing mains dropping resistor. Now the valves whch have been extracted (all of

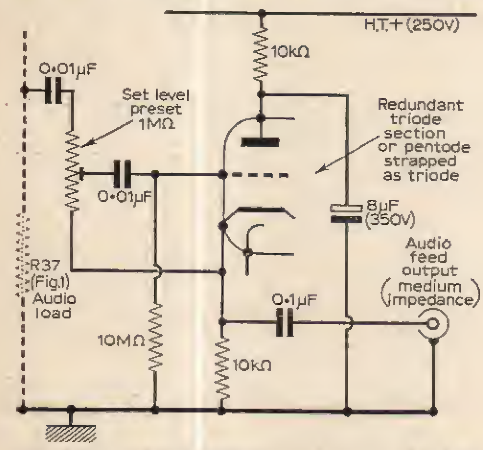


Fig. 4—The cathode-follower stage. This feeds high quality TV sound to a tape recorder or amplifier and works independent of the audio stages in the sound-only receiver.

them, including any pilot bulbs, if fitted) should be looked up in valve data books to find the heater voltages of them.

All the voltages should be added together and the figure obtained should then be divided by the heater current of the valve series (remember we suggested 0·3A series valves). The answer to this little sum gives the value of resistance necessary to include in addition to the mains dropping resistor to compensate for the valve heaters which have been removed from the circuit.

Let us look at a practical example. Suppose that the total heater voltage of the valves removed comes to 60V and that the valves are of the 0·3A series. Then all we do is to divide 60 by 0·3. This works out to 200, which is the extra heater ballast in ohms.

To find the wattage rating for the resistor we simply *multiply* the current by the voltage. In the above example this 60 times 0·3, which works out to 18—that is 18W. A 25W, 200Ω heater ballast would be fited in this example. Connection would be between the original mains dropper and the first heater in circuit (e.g. that first in line of the pruned chain).

The ballast should be mounted on the chassis as close as possible to the existing dropper and well clear of any components as it runs fairly hot, as does the mains dropper.

Power resistor sections which can be built up to any required value are also available from Radiospares Ltd., through a dealer or from our advertisers (mention the current of the valve series when ordering).

Should this method of power supply be used there is no reason why the existing h.t. rectifier and associated circuit cannot be retained. The current required for the sound-only sections is far below that required for the set as a whole but the small consequent rise in h.t. voltage does not usually cause a great deal of trouble. To be on the safe side, however, an extra surge limiter element of 40Ω 10W wire-wound can be connected between the mains input and the rectifier "anode". Such a resistor will keep the voltage on the h.t.-line to about the same value as it was when the receiver worked both on sound and vision.

The alternative arrangement is to use a small heater transformer to energise the series-connected heaters (if one equal to the total voltage of the retained valves can be obtained) and a fully isolated mains transformer to provide the h.t. supply either via a half-wave rectifier (such as the set's original rectifier) or via a full-wave or bridge rectifier suitable for the transformer employed.

If the valves are of the 6·3V series (which is unlikely as the number of sets—essential early Kolster-Brandes—employing 6·3V valves is small) the power supply may be isolated fully from the mains. But this should be thoroughly checked as some early models just used a transformer to supply the 6·3V heater power and kept the chassis-connected mains arrangement for the h.t. supply with half-wave rectification.

The separate mains transformer idea and full-wave or, preferably, bridge rectification may appeal to the hi-fi enthusists as the ripple level with this type of circuit is somewhat less than that with half-wave rectification.

FINAL POINTS

If the on/off switch is incorporated with the brightness control on the original receiver this assembly should be abandoned and a volume control with on/off switch used instead. Some sets have two or three chassis and it is often possible to eliminate one or two of the units, using one only for the sound receiver.

On many models it is often possible to use the cabinet, redesigned, as the housing for the sound receiver.

The alignment presents no problem at all, it being necessary simply to switch to the required channel, adjust the fine tuning control for maximum sound (ensure that this happens at the centre of the range of the control by adjusting the oscillator slug in the tuner turret) and finally adjust

—continued on page 461

a stable PULSE GENERATOR

A USEFUL INSTRUMENT FOR THE ADVANCED CONSTRUCTOR

BY N. MEARS

THE serious experimenter in pulse techniques will often have felt the need for a source of supply of accurately timed pulses of known and stable width, good square shape and of known and almost negligible rise-time.

The television signal, as broadcast, affords such a supply but unfortunately it has some disadvantages. The pulses are of two frequencies only, and have fixed characteristics. They also have to be extracted from a composite signal, and in the process may suffer such distortion that only the pulse recurrence frequency is known.

The generator to be described may be of use to such workers, and also may be of interest in that in a relatively simple way an approach is made to the ideal pulse source. It should, in fairness, be said that the simplicity is only relative. This is not an instrument for the beginner to tackle—not because the circuitry is too complex, but because v.h.f. techniques have to be used and some experience of work at the high frequencies is almost essential.

The Circuit

Figs. 1a and 1b show the circuit diagram and Figs. 2a and 2b provide details of the switching of S1A and S1B respectively. It will be seen that in order to achieve the desired results some unusual features have been incorporated in the design. In the first place, two delay lines are used, and in the second a secondary-emission type of valve is utilised.

These components need cause no alarm; the delay-lines are easily enough constructed, using standard parts, and the valve, type EFP60, is readily available either through one's local dealer (on order) or through at least one advertiser in this journal. The price is very moderate.

These components enable pulses to be produced which not only have a very small rise-time—of the order of 8nS—but also a very stable width, since the latter depends on only the geometry of a delay line. The pulse recurrence frequency depends only for its accuracy on the signal generator used to supply the triggering signal.

Mode of Operation

The mode of operation is as follows. V1 is a straightforward pentode video amplifier which is arranged to give amplification of up to 100. Thus an input of 50mV will suffice for the triggering of the succeeding stage, which requires some 5V.

The second valve V2 operates in a Schmitt trigger circuit. From the anode of the second half of the valve a positive pulse is obtained, of rise-time about 0·5μS at an amplitude of about 10V. The output pulse is passed to V3, a double cathode follower valve which provides a positive output pulse at low impedance. This pulse may be used for any desired purpose, but its intended function is to provide a sync pulse for triggering an oscilloscope time base.

From the second cathode follower the signal passes into a delay line with little distortion, and is picked off after an appropriate delay to trigger the main pulse generator V4. This valve is an interesting one, and its method of action in this circuit wll be described more fully later.

The pulse generated by this valve has an exceedingly small rise-time—of the order of 5nS—and is of the high amplitude of some 30V. Its width depends on the delay line in the anode circuit, and is adjustable as required from a maximum of about 2μS in steps down to about 50nS.

The pulse is next limited by V6, to remove its rather irregular "top", and is passed on to V7 which is the output valve. The amplitude of the pulse is controlled by the bias on V5, and this is under the control of the user.

V7 is a pentode of the small power video output type, capable of passing a heavy anode current if required. It is held near cut-off by its bias, but when the signal arrives from V4 it is pulsed into heavy current. By making the cathode and effective anode loads equal, and of low value, the pulse output is obtained at low impedance suitable for feeding into any desired circuit through a 75Ω coaxial cable properly terminated at the remote end. This further stage of valve amplification somewhat increases the rise-time and fall-time of the output pulse, but the effect is small.

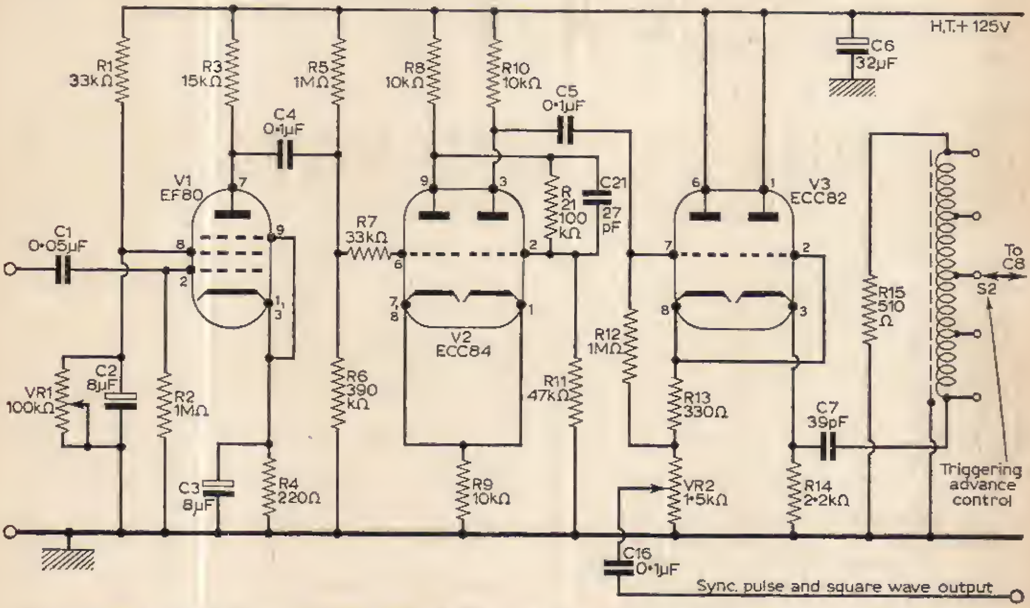
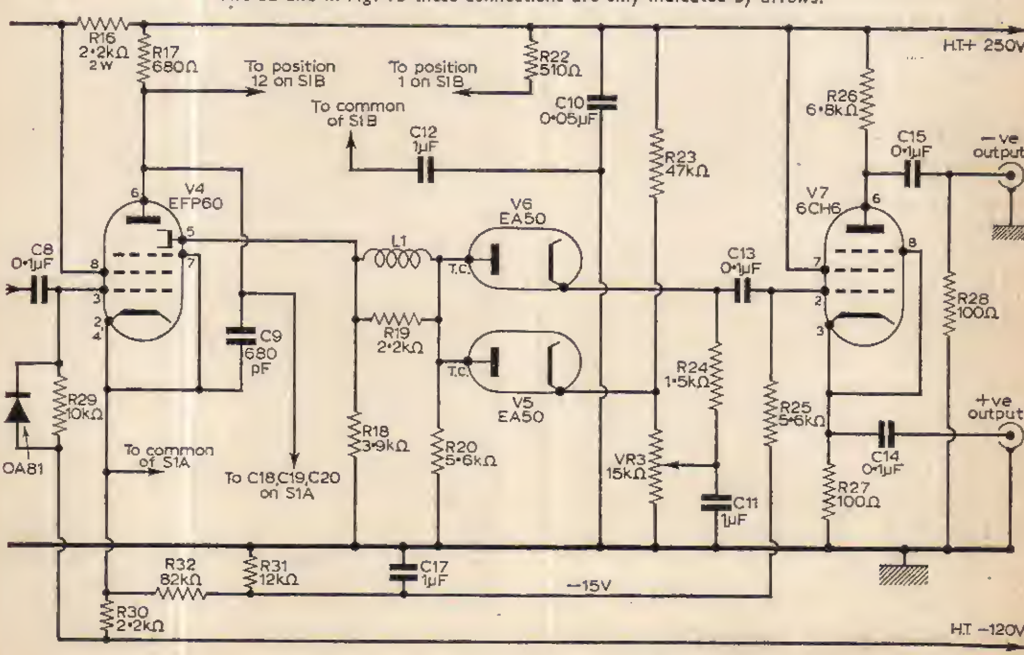


Fig. 1a (above) and b (below)—The circuit. The delay lines referred to in the text connect to the circuit via S1 and S2 and in Fig. 1b these connections are only indicated by arrows.



It will be seen that because of the delay line in the cathode circuit of V3b the output pulse from V7 is delayed with respect to the sync pulse from the cathode circuit of V3a. Thus, if the latter is used to trigger an oscilloscope time-base, the leading edge of the output pulse will always be visible providing the time-base generator is running at an appropriate speed. The actual delay may be altered from zero to 1μS, so providing for most practical contingencies.

The Sub-circuits

The less familiar sub-circuits of this instrument will now be described in more detail.

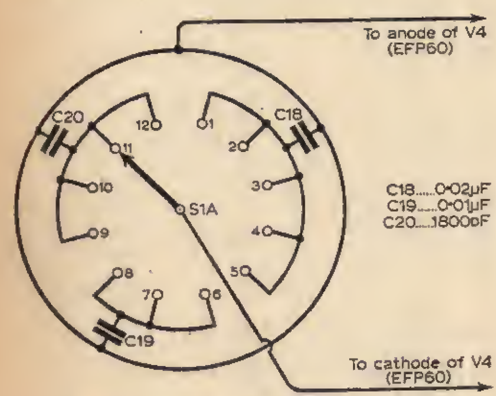


Fig. 2a (above)—Wiring details of S1A.

Fig. 2b (right)—Details of S1B. The 12 switch-position tags connect in both cases to the delay lines.

The secondary-emission valve may be unfamiliar to some readers, and will be dealt with first. Fig. 3 shows the diagram of the valve. The type used in this circuit is the EFP60, a Mullard valve similar in external appearance to the well-known EF50. In construction it is similar to a receiving pentode, but between the suppressor and the anode is placed an electrode termed the "dynode".

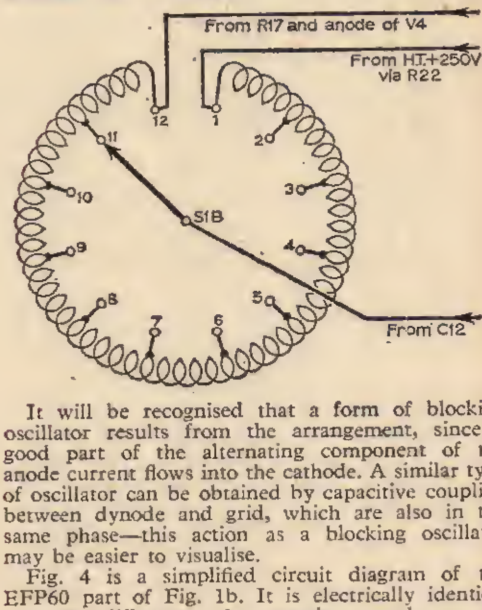
This electrode is maintained at a positive potential with respect to the cathode but negative with respect to the anode. Electrons passing from cathode to anode impinge on the dynode at a high speed, and the surface is treated chemically (in some types of valve, with potassium chloride) so as to emit copious secondary electrons, several for each electron striking the dynode.

These secondary electrons nearly all reach the anode. Thus when the valve is passing current the cathode current may be 6mA, the anode current 20mA, the dynode current 15mA, with screen current of 1mA to make up the difference. This set of currents would apply if the valve were used as a linear amplifier. Under pulse conditions currents are much heavier, but similar proportions will hold good.

The result of this electron-multiplcation is that the mutual conductance between control-grid and anode is much higher than in an ordinary pentode, while the interelectrode capacitances are about the same. Thus the gain-bandwidth product of the valve is greatly increased—with the EFP60 the figure is about 250 between grid and anode, compared with about 130 for the EF91.

The dynode has not quite such a high figure-of-merit (around 150) but it is still high. A further result of the action of the valve is that a signal in antiphase with the anode signal can be obtained across a resistor placed in the dynode circuit. Thus the valve could be used as a source of push-pull signals, for a single-ended grid input.

In this circuit the high figure-of-merit is very advantageous. In addition, the fact that the anode current is much higher than the cathode current is made use of. Inspection of Fig. 1b will show the capacitive coupling is provided between anode and cathode. Such feedback in a pentode would not, of course, cause regeneration; in the secondary-emission valve it does so.



It will be recognised that a form of blocking oscillator results from the arrangement, since a good part of the alternating component of the anode current flows into the cathode. A similar type of oscillator can be obtained by capacitive coupling between dynode and grid, which are also in the same phase—this action as a blocking oscillator may be easier to visualise.

Fig. 4 is a simplified circuit diagram of the EFP60 part of Fig. 1b. It is electrically identical and the difference—the negative supply to the cathode in Fig. 1b—is purely a practical one. Flow of current through the bleed resistor RB and the cathode resistor RK develops enough voltage across RK to hold the valve cut off.

When a voltage appears at the control grid greater than this bias voltage the valve takes current. Immediately the anode voltage drops, and the drop is passed via Cc to the cathode where it drives the cathode negative (and thus, relatively, the grid positive). This action is cumulative, and continues until the valve is passing heavy anode current—the valve is saturated—and the capacitor Cc has charged up.

The anode current now ceases to rise, Cc begins to discharge, and the anode potential begins to rise. The cathode is now driven positive cumulatively until the valve is again cut off, when it is ready for the next triggering impulse.

By itself this forms a very effective pulse generator, in that the rise-time is extremely fast—about $0{\cdot}005\mu S$, or 5nS. The pulse width is however somewhat variable and the " top " of the pulse is not very flat. However, with a trigger frequency of about 20kc/s the harmonics of the oscillator can readily be picked up on a receiver at least as far up the scale as 200 Mc/s! This oscillator can therefore cause serious interference on all bands, and very good shielding is required.

In the complete instrument, the pulse width is fixed rigidly by the delay line in the anode circuit, as will now be shown, while the extremely fast rise-time is maintained. As already mentioned, provision is also made for slicing the irregular " top " off the generated pulse.

When the valve is triggered and conducts heavily the anode potential drops rapidly by up to a hundred volts, and a negative step is generated in the delay in line connected to the anode. As this happens, a similar voltage step, but positive, appears at the dynode, of amplitude about 40V.

The anode voltage step passes down the delay line, taking time equal to $\sqrt{LC}$ and is reflected in reversed phase from the point at which the delay-line is short-circuited. The positive voltage step now passes back to the anode and on arriving there the anode again reaches a high positive voltage, causing the dynode to pass heavy current.

The result is that the dynode drops in potential and the dynode pulse is terminated. The width of the pulse depends therefore on the part of which the delay-line is short-circuited, and on the distributed inductance and capacitance of the line up to that point.

The delay-line has a characteristic impedance of $\sqrt{L/C}\Omega$ where L and C are the inductance and

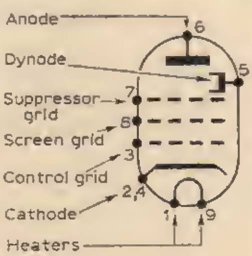


Fig. 3—Details of the EFP60 valve circuit symbol.

capacitance per unit length. The anode load resistor must match this accurately, or reflections in the delay-line will occur at the anode as well as at the short-circuit. These may cause multiple pulses to appear at each triggering.

The match is best arranged by trial and error, since individual construction will not be able to reproduce precisely the characteristics of the delay-line now to be described. This applies also, though with less urgency, to the delay-line in the cathode circuit of V2b.

V4 Anode Delay-Line

This delay-line is constructed from a 10in. length of ⅜in. O.D. paxolin tube. A strip of thin copper foil is obtained 10in. long and 1in. wide, and, if too thick to flex easily, is reduced in thickness to about 0·002in. by etching in ferric chloride solution or, more quickly, in warm dilute nitric acid.

When it has the texture of the aluminium foil used in the kitchen it is washed carefully and allowed to dry. This process may be used to clean copper foil of the right thickness, if dirty. From the foil a strip is next cut 0·2in, wide, and from this strip are cut 16 pieces each $\frac{15}{32}$in. in length.

These small pieces are maintained as flat as possible; the cutting is best done with a razor blade or sharp penknife, so as to get the burrs all coming on the same side of the foil.

The piece of foil remaining, now 0·8in. in width, is softened by carefully heating over a small gas

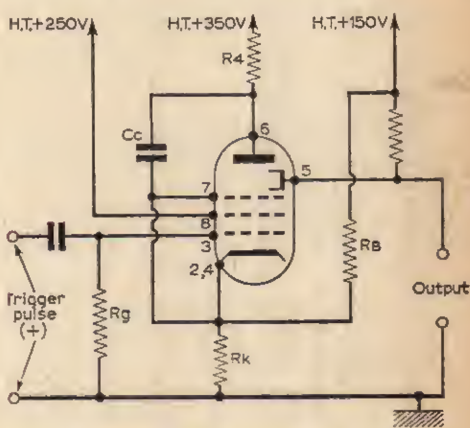


Fig. 4—A simplified representation of the EFP60 stage of the circuit.

or spirit flame, and is given a clean surface finish by a quick etch in the acid solution. Preferably it is now silver-plated, but this is not absolutely necessary. This strip is now folded lengthwise round the paxolin tube, taking care that the edges are parallel to the axis of the tube. When the foil is mounted on the tube gentle working with the fingers will harden it enough for it to keep its shape when slipped off the tube, which is the next step.

The tube is now given a coat of clear contact adhesive diluted with acetone; this is best done with a brush. The " inner " of the foil is also given a similar coat. Before the coats are quite dry the foil is placed on the tube and adhesion secured by pressure. There is now visible a strip of tube 0·38in. wide, covered with drying contact adhesive. The 16 small pieces of foil are now pressed, burr-side down, on to this surface, spacing them $\frac{1}{32}$in. apart. If adhesion is not good, a few drops of acetone will help.

Finally the whole of the foil is covered with a thin layer of adhesive, very evenly, and the whole allowed to dry thoroughly. Fig. 5 shows the finished tube.

Beginning at point A the tube is now wound evenly and closely with No. 40 gauge enamelled copper wire, making a tap at the points listed in Table 1. Exactly 8in. of winding is required, covering sixteen " patches ". The associated delay and the corresponding pulse width (which is twice the delay) is given for each point.

TABLE I

Distance of tap from A	*Delay*	*Pulse width*
0·2in.	25nS	50nS
0·4in.	50nS	100nS
0·6in.	75nS	150nS
1·0in.	125nS	250nS
2·0in.	250nS	0·5μS
3·0in.	375nS	0·75μS
4·0in.	500nS	1·0μS
5·0in.	625nS	1·25μS
6·0in.	750nS	1·5μS
7·0in.	875nS	1·75μS
8·0in.	1,000nS	2·0μS

It will be seen that all taps except the first three are arranged to coincide with the gaps between the patching strips; but if because of slight inaccuracies in placing this does not happen it is better to stick to the distances accurately and neglect the patches.

The cathode delay-line is similarly constructed except that the taps are two inches apart. These correspond to relative advance of the pulse of 0, 0·25, 0·5, 0·75 and 1μS.

These delay lines are conveniently mounted between angle brackets fixed to the chassis. It is necessary to ensure that there is no coupling between them, an objective achieved by mounting the cathode delay-line on one side of the chassis and the anode line on the other. The full-length copper foil is earthed to chassis at each end; in the case of the cathode line this causes no insulation difficulties but the anode line will carry the h.t. voltage together with the anode pulses, and care must be taken to see that the insulation between

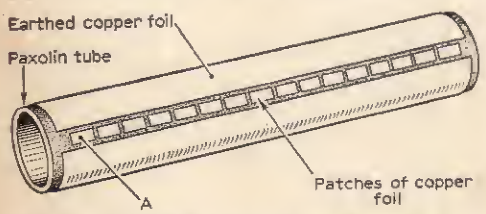


Fig. 5—The completed former of the V4 anode delay line.

the winding and the earthed foil is effective everywhere.

A slightly thicker coating of contact adhesive may be desirable. The "patches", which are added to couple adjacent sections of the winding, are left unconnected.

Characteristic Impedance of Lines

The characteristic impedance of these lines is 510Ω, but variations from 490 to 530 are likely in hand-winding to the specification. These are of little consequence. However, intentional divergencies from the specification will cause the impedance to alter markedly, and should not be attempted unless equipment is available for measuring the

COMPONENTS LIST

Resistors:

R1	33kΩ	R17	680Ω
R2	1MΩ	R18	3·9kΩ
R3	15kΩ	R19	2·2kΩ
R4	220Ω	R20	5·6kΩ
R5	1MΩ	R21	100kΩ
R6	390kΩ	R22	510Ω
R7	33kΩ	R23	47kΩ
R8	10kΩ	R24	1·5kΩ
R9	10kΩ	R25	5·6kΩ
R10	10kΩ	R26	6·8kΩ
R11	47kΩ	R27	100Ω
R12	1MΩ	R28	100Ω
R13	330Ω	R29	10kΩ
R14	2·2kΩ	R30	2·2kΩ
R15	510Ω	R31	12kΩ
R16	2·2kΩ	R32	82kΩ

All ±10%, ½W carbon unless otherwise stated

Potentiometers:

VR1	100kΩ	VR3	15kΩ
VR2	1·5kΩ		

Capacitors:

C1	0·05μF paper
C2	8μF electrolytic 250V
C3	8μF electrolytic 25V
C4	0·1μF paper
C5	0·1μF paper
C6	32μF electrolytic 350V
C7	39pF mica or ceramic
C8	0·1μF paper
C9	680pF mica or ceramic
C10	0·05μF paper
C11	1μF paper
C12	1μF paper
C13	0·1μF paper
C14	0·1μF paper
C15	0·1μF paper
C16	0·1μF paper
C17	1μF paper
C18	0·02μF paper
C19	0·01μF paper
C20	1800pF mica or ceramic
C21	27pF mica or ceramic

Valves:

V1	EF80	V5	EA50
V2	ECC84	V6	EA50
V3	ECC82	V7	6CH6
V4	EFP60		

Miscellaneous:

S1 2-pole, 12-way Yaxley type switch
S2 One-pole, 5-way switch
Delay lines—see text. OA81 germanium diode

characteristics actually achieved. This warning also applies to the delay and pulse-width, both of which will alter if the windings are altered.

The layout is by no means critical in general, but it must be appreciated that the very sharp pulses generated include harmonics of frequencies up to several hundred megacycles per second. Thus, the usual v.h.f. techniques must be employed in all the circuitry from V4 to the optput stage. Connections should be as short as possible, and made by means of strips of copper foil ¼in. wide, or ¼in. diameter braid if possible.

This does not apply of course to the heater leads

—continued on page 455

A MONTHLY COMMENTARY

Underneath the Dipole

BY ICONOS

WHEN one considers the enormous television communication distances covered by Telstar and the other satellites circling around the earth, the differences in distance between London, Paris, U.S.A. and Japan seem relatively small. None the less, the first of the relays from Japan to England, via the French receiving station and, of course, Telstar, was an exciting event. Variable in quality, particularly when views from a helicopter were used, the interview with the President of Japan and others came over quite well and followed the usual opening pattern of references to "hands across the sea", etc. This reminds one of similar speeches made in U.S.A. when the first TV pictures came here via Telstar. One of the interesting consequences of the special facilities required by the Post Office to get the signals from the English receiving station at Goonhilly Down, Cornwall, to London has been the reverse combination of microwave links between Goonhilly and Bristol which have been contributed partly by the five repeater links and aerial towers used in the south-westerly direction to Westward Television, whose studio is at Plymouth. By injecting a signal from Plymouth to the repeater station just north of that city West Country newsreel items can be sent up to Independent Television News at short notice, and it is possible in the same way to supply to the network special local items or programmes of general interest. Independent Television News has installed three R.C.A. television tape recording equipments which can be used for pre-recording news items from any part of the ITA network, to which can be added greetings from U.S.A., Japan and almost every television-minded country in the world—if the Post Office provide the appropriate links via coaxial lines, microwave transmitters and repeater stations and, of course, satellites circling around the earth, including Telstars and Syncoms. Whether viewers will be comfortably in bed or at work in the morning is a moot point when considering the precise time when special events are taking place at the Olympic Games in Tokyo. The resultant picture could be taped for later transmissions, of course, but there may be occasions when filmed recordings can be sent all or part of the way to suit the transmission times in Britain.

Standards Conversions

How mixed-up can you be when you try to deal at short notice with 405, 525, 625 lines (or what have you?) TV pictures? For some years the answer has been to put the picture of one TV standard on a high-class monitor the master of which is picked up by a TV camera on the other standard. The resultant quality on most conversions has varied from fairly good to fairly bad, usually the latter; but the news or novelty value of the subject matter has justified the trouble and expense. The BBC has had plenty of headaches in sorting out the different line standards for BBC-1 and BBC-2 in operation in their studios and equipment, sorting out the appropriate signals to their appropriate destinations with the ingenuity of the Great Western Railway when it mixed up its narrow and broad gauges.

Cameras, control units, monitors and what have you have all had to be convertible to both line standards, and BBC-2 has played its part in hurrying up the design of line conversion equipment of an entirely new type which operates like a computer and avoids the losses in picture quality which occur when the traditional method of shooting a TV camera to a monitor is used.

The BBC have made great progress with computer equipment which will examine the 625 lines horizontally at 576 different points along each line and interpolate the 405 lines at varying points between the original 625, thereby compressing the original information in a novel way, free from the distortions often present in the old line monitor-cum-camera converters. This is indeed a startling new method of which the BBC already have two versions, one of which is readily adaptable to reversing from 405 to 625 if reouired. I have seen tests with this equipment and have been much impressed. In the course of time these line store standards converters will be made available to the ITV companies to be used for Continental news and later on, in years to come, no doubt, for the expansion of the 625-line standard in parallel with 405 lines.

Love Story

There seems to be no future for the television play as an *ad hoc* presentation. The same play seems to be accepted and sorted out into its own appropriate series whether it is *Armchair Theatre* or *Love Story*, for instance, or any other series we specially look at week-by-week. In *A Future Holiday*, one of the *Love Story* series, the title filled one with apprehension in this day and age when the down-beat story seems to be more up to date than the happy ending one.. Nevertheless, a play that is well produced and well acted often keeps viewers on the right channel, even if it carries with it the depression which has become as fashionable as the kitchen sink. The principal characters in *A Future Holiday* are a married couple who were formerly ball-room dancing champions but who became thoroughly bored with one another and their suburban life. The story develops into the usual triangle when the lodger, a student, catches the eye of the wife while the husband is out and attending a night school. Michael Bryant and Rosemary Leach play the former dancing partners with conviction, and one can anticipate that in real life many students with odd-looking beards, as presented by Alexis Kanner, make quick exits with their luggage when almost caught in an awkward situation by their landlady, the wife. *A Future Holiday* was produced and the exteriors filmed by Douglas Fisher, whose work for ATV I had not previously seen.

"A Nice Little Business"

In a rather different category was ATV's *A Nice Little Business*, in which the background was the novel one of a beauty parlour for dogs—which was the appropriate subject of the title. The principal characters were husband, wife and the partner in the business. Nevertheless, the triangle of most love stories reappeared again and seemed to develop into a complicated plan in which the partner proposed to murder the husband, a plan which somehow worked out the other way with the husband as murderer. With this brief reference to a basic story which was not very strong it once more held the viewer mainly because of the convincing acting of William Franklyn, Anthony Bate and Diana Dors. Technically the sets and the production were good excepting for the extraordinary facial cosmetics adopted by Diana Dors. White shiny lips and heavyweight eye-lashes ruined the close-ups in several scenes which were otherwise very well lit. What is happening to make-up departments these days? Fortunately the low-temperature (yellowish) lighting of most TV studios seems to suit men's faces without need for make-up, but the pale shiny lipstick used by the ladies adds nothing to their attractiveness, to say the least.

Impressionistic TV

Far less entertaining, in my opinion, was the exchange of views of satirical revue companies from Chicago and London. Playing their parts on the other's ground, so to speak, the Second City Revue from Chicago saw (but did not conquer) London in spite of repetitive scenes of the changing of the Guard, visits to East and West, flats, houses and shops. Crossing the Atlantic in its exchange visit was a revue company from the Establishment Club, London, which, equally critical of Chicago, contrived to ridicule its home town, country and constitution. By the time they started to make references to the Monarchy I reached for the knob of my TV set and switched off. Presented as a new formula in television technique it seemed to me to be an example of down-beat in its most unpleasant form.

Pay-TV

The larger cities of the U.S.A. have so many TV channels available now that u.h.f. has been introduced in a big way, that there must be some of the channels which are poorly patronised when big stars are appearing on the others. To a smaller extent this effect is noticeable in the London area in homes which are faced with the decision of switching to BBC-1, BBC-2 or ITV. The advent of Pay-TV in some of the London areas already being fitted up with piped television as an addition to piped radio sound will further complicate matters, but in this case viewers will have to pay anything from 2s. 6d. to 7s. 6d. to see a film programme. There is at least one Pay-TV organisation in London which is going ahead with the installation of equipment, including three of the latest type of telecine machines, with provision for cutting, editing, rehearsing and announcing.

Gold, Silver and Bronze

There seems to be dozens of film and television festivals held each year in various parts of the world, of which the most important from the TV point of view is at Montreux. Britain has achieved many awards during years past, winning the golden, silver or bronze "Roses", but this year failed to win any of them. The BBC's series *The Good Old Days* was a highly regarded entry, but the Golden Rose was won by Swiss Broadcasting Corporation, whose *Happy End* mixture of music, dialogue and comedy achieved distinction by its very original concept and presentation. I haven't seen this prize-winning product yet but am not surprised to hear that, like other entries, it was filmed for television rather than recorded electronically on tape. This gives the producer much greater flexibility in editing, not to mention the fact that it gives him the opportunity of having second thoughts or retakes. The BBC's polished production of old music hall in *The Good Old Days*, videotaped at the City Variety Theatre, Leeds, is restricted by the techniques used but is none the less a good entertainment with the right atmosphere created by the appropriately dressed audience.

Another festival which concerns both film and TV is the International Advertising Film Festival at Venice, which has gained in importance because of the growing exports of filmed commercials between the countries of Europe. Anglo-Scottish Pictures, of Halliford Studios, near Shepperton, have provided commercials for Germany and Austria, quite apart from their considerable output for the British networks, and have ventured into other countries for exterior shots. The whole idea of these competitions was started in Hollywood many years ago when the first presentations of "Oscars" were made, important awards which were won this year by British film makers, notably with *Tom Jones*.

BY H. W. HELLYER

STOCK FAULTS

PREVALENT TROUBLES IN COMMERCIAL RECEIVERS

CONTINUED FROM PAGE 402 OF THE JUNE ISSUE

PART 3 THE SOUND CHANNEL

OF the various sections of a television receiver, the sound separation and amplifying portion should be the easiest to service. And so it would be, if the circuits were entirely conventional. After all, the signal has been amplified to a manageable extent before the sound section takes over, and the narrower bandwidth of the sound channel presents no more problems than that of the average radio receiver. (This is rather begging the question, for whereas the radio may have an intermediate frequency of 470kc/s and a bandwidth of 9kc/s, the television receiver uses an i.f. of 38·15Mc/s and the bandwidth, though still very much narrower than the vision channel, is some 50 kc/s.)

There is, it is true, the rejection factor. Some circuits were described and their action discussed briefly in Part 2 of this series. There is no need to enlarge upon this further. The only other special point about the television sound channel is the inclusion of interference limiting, which usually takes the form of a simple, biased diode just after the detector. Then why waste space on the sound channel? asks "Disgusted" of Carping, Bucks.

The reason is implicit in our second sentence. There is hardly such a contraption as the "conventional" television receiver. Manufacturers have thought up all manner of traps for the unwary, and some of these departures from the convention bring their own, regular, stock faults. Others have peculiar, often misleading symptoms, which are also worth noting.

Beginning with the i.f. circuits: mention was made in the last article of the combined vision and radio receiver. As the intermediate frequency used on Band II is recommended to be 10·7Mc/s, the i.f. stage which handles both television and frequency-modulated radio signals sometimes has two sets of tuned circuits, one resonant at the f.m. frequency and the other at the 38·15Mc/s employed for TV. There are not so many of these receivers about now and manufacturers have abandoned the principle, for various economic as well as technical reasons. However, it is worth mentioning the peculiarities of one or two old favourites that are still giving satisfactory results in many homes.

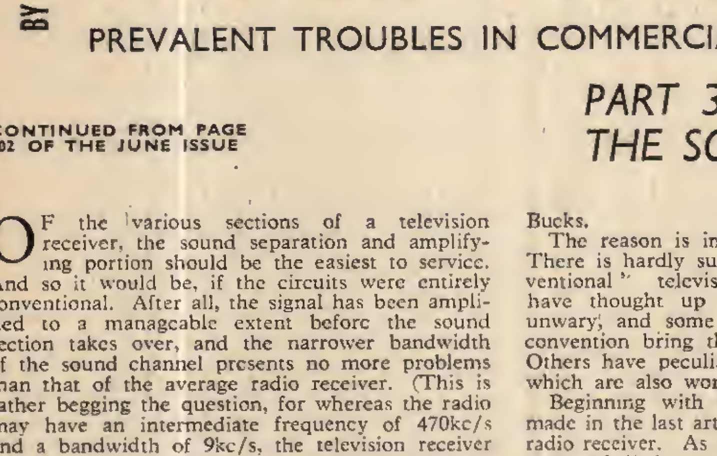


Fig. 12—Sound i.f. stages of a Bush TV77, with supply, etc., components omitted. Separate coils are tuned to the intermediate frequencies, TV 38·15Mc/s, f.m. 10·7Mc/s.

Combined I.F. Transformers

The combined i.f. transformer is typified by the circuit of Fig. 12, which is the two i.f. stages of the Bush TV77.

The aforementioned reference to economic factors can be weighed when we consider that in this receiver a separate f.m. tuner was used and individual tuned circuits for the two intermediate frequencies.

By the time the TV97 had come out, the TV tuner unit had been modified to take Band II channels by shunting additional inductance across the Band I coils, retaining their familiar permeability tuning method, but the i.f. circuits are basically the same.

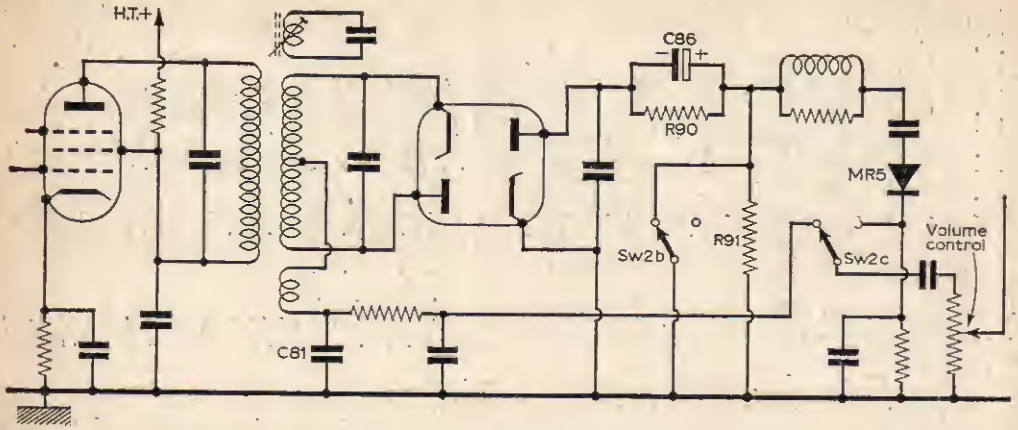


Fig. 13—Foster-Seeley discriminator for f.m. reception, switched to series detector function when used on TV channels, as in the Sobell TPS173.

At the TV intermediate frequency, the f.m. coils become virtual chokes, while the TV coils present a practical short-circuit to 10·7Mc/s, the f.m. intermediate frequency. Thus, a great deal of switching is eliminated. And it is the switching that gives most trouble on these sets.

Examples of this may be found in the Regentone and Alba models that incorporated f.m. The slide wafer switch is mounted at the rear of the tuner unit on distance pieces, and a cam on the tuner selector spindle pushes a brass bush on the wafer slide upward for the three f.m. channels. The return action is effected by a spring which is rather difficult to remove and re-tension. A common mistake is to attempt to oil the switch slider, which immediately becomes "gummed-up". In such cases wash off with methylated spirit—*not* switch-cleaner.

To illustrate the switch functioning, Fig. 13 shows the Foster-Seeley discriminator circuit as used in the Sobell TPS173, T178, and T23 receivers.

On f.m., the audio output across C81 is fed, via the filter, and SW2c, to the volume control. SW2b takes R90, C86, the DC load, to chassis, and short-circuits R91. This short-circuit opens for TV, and SW2c changes over, taking the volume control to the detector via the limiter diode MR5.

But before we get involved with detectors, etc., it may be appropriate to take another look at the sound i.f. stage used in more modern receivers. Here, the frame grid amplifier comes into its own. The much higher slope gives greater gain but imposes more restrictions on the associated components and wiring to reduce the chance of instability. Thus, special decoupling capacitors will often be employed at C in Fig. 14a, to bypass the combined screen and anode, and these are critical, as is the length of their connecting leads —or more precisely, their shortness.

Another method of neutralising the i.f. stage is by fitting a choke from suppressor grid to chassis, as in Fig. 14b, Defiant 7109, 2109, later version. Both this method and the previous one have their disadvantages in that if the decoupling becomes even slightly less than optimum, quite severe faults can occur; intermittent over-loading, vision on sound, patterning or even, on some models, a raster going to complete white in bursts.

The tendency of these valves, operating under stringent conditions, to develop inter-electrode short-circuits, has been noted. The alternative circuit of the Ultra 100C, 1980C and 1984C, with a common resistor for both anode and screen grid voltage dropping, decoupled by a 1,500pF capacitor, is shown in Fig 14c. A control-to-screen grid short-circuit causes the anode resistor and the 120Ω cathode resistor to overheat and perhaps change value. Both valve and resistors must be changed or the fault will recur.

A further complication crops up with the later model, Ultra 6620, where weak and distorted sound, perhaps intermittent, occurs on 405-line operation, but disappears when switched to 625 line working. The trouble is that the second sound i.f. amplifier develops an inter-electrode short-circuit (screen to suppressor, in this case), excessive h.t. current is drawn and the potentiometer feed network becomes damaged. But this valve operates as a limiter for the f.m. sound on 625 lines, an additional 330Ω is switched in to operate the valve about 22 volts screen potential, and the short-circuit does not occur. The moral is: test under the most stringent conditions of power, heat, volume, etc., when looking for these obscure faults. The old-fashioned method of cooking the set gently under a blanket has its merits—just so long as you don't walk off and forget it!

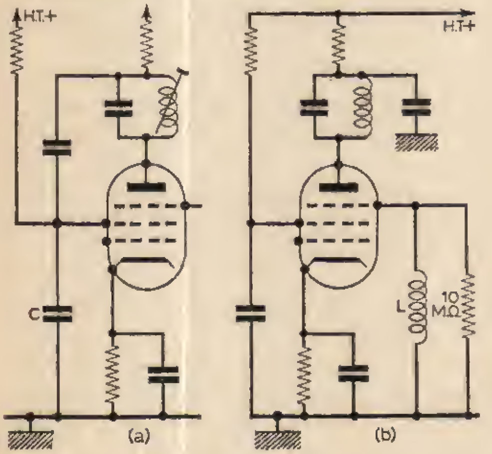
Before leaving the Ultra range, it may be wise to mention that the tolerance on these voltage dropping resistors is less than of old. The Ultra 1984 has a 1kΩ resistor common to anode and screen of the i.f. stage. If this becomes damaged and reduces in value, an annoying treble boost seems to occur. It is a queer fault that can lead one a fruitless dance around the output and driver stages. A 1 watt resistor is a wise precaution when replacement is made. A circuit in which higher wattage resistors are already fitted, and which incorporates several of the points previously

made, is the Defiant 9A50 and 9A51, the sound i.f. stage of which is shown in Fig. 14d.

Sound Detectors

Sound detectors used at one time to be mainly sections of double diode valves, such as the EB91, 6AL5, D77, 6D2, etc., or one diode of a combination valve such as the DH77 or EBF80. Then there was a swing to crystal diodes, OA70, OA81, GEX34 and so on. Now, with the incorporation of f.m. detector circuits, the double-diode is again obtaining preference.

Fig. 14—Methods of neutralising frame-grid i.f. valves: a (below) by common r.f. decoupling; b, by phase-linear choke from suppressor grid to chassis; c (right) by common d.c. load and r.f. decoupling, anode and screen grids; and (d) the Defiant 9A50 circuit.



Principal fault with the older models was deterioration of the high value load resistor, or the resistor from h.t. which provided bias. An example is the HMV 1918, where the EB91 has a 3·9MΩ anode load, which can increase to 10MΩ and cause distortion and intermittent sound breakthrough. Loads on TV sound detectors tend to be lower than on radio receivers, with smaller reservoir capacitors, because of the higher frequency i.f.

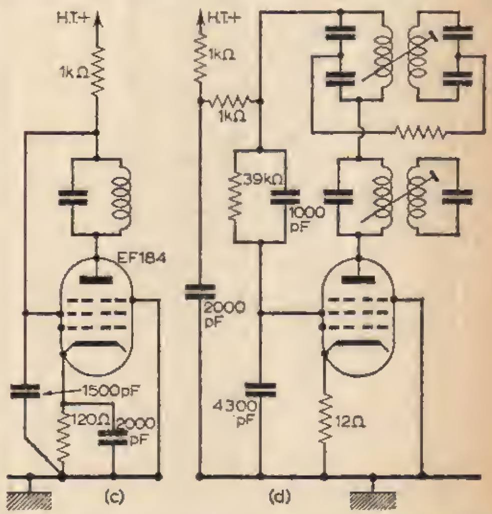
A circuit which shows a combination of valve and semiconductor in the detector/noise limiter stage is the Decca DM1, DM3, DM4 and DM5 sound strip. The stage is illustrated in Fig. 15.

It will be noted that the detector is a crystal, the load is only 50kΩ and the reservoir capacitor 47pF. A fault that has occurred here was heater-cathode short circuiting of the valve with consequent distortion that appeared to emanate from the output stage. (There were other faults, actually in that stage, as we shall note.)

The favourite trouble with the semiconductor is the noise and distortion that can occur when it develops a low forward resistance. This is aggravated when a bias is applied through a high value resistance from the h.t. line.

A typical circuit which employs two semiconductors, a crystal for detector and miniature metal-type for noise limiter (series-type), is the Cossor 948, 948F range, with only slight variations in the wired versions, 945B and 949. Note that W6 is fed from the h.t. tapping on the sound output panel, via two resistors which are on the i.f. panel, as is the detector and its associated components. The harness wiring goes via the top run, taking in the variable resistor used for setting the sound limiting, and acting, in effect, like a top-cut control.

First clue that this is a noise limiter fault is the lack of control by R60. The rectifier W6



is easily short-circuited to prove the fault, and, indeed, many sets must be operating with that "temporary" short-circuit left in place.

From Fig. 15, a further point may be noted. With a series interference limiter, if there is some doubt about the fitting of a crystal in either position, an inspection of the circuit will reveal that the diodes are in opposition. This is the most common type of circuitry, but before we go round gaily short-circuiting diodes, it is as well to note that alternative circuits have been used.

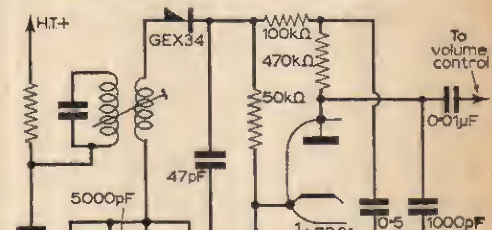


Fig. 15—Decca DM4, etc., detector and noise limiter, using both thermionic valve and semiconductor diode.

One of these was the Dickert noise limiter, which shunted the detector, biased to conduct on noise pulses, shunting the signal. Another form was the limiter placed later in the circuit, for example, between driver and output valve, as in some Ferranti receivers.

The a.g.c. circuits are generally quite simple, and the faults much as can be expected on radio receivers. One example is the difficulty of an over-biased sound i.f. valve, the result of the feed resistor in the a.g.c. line going open-circuit.

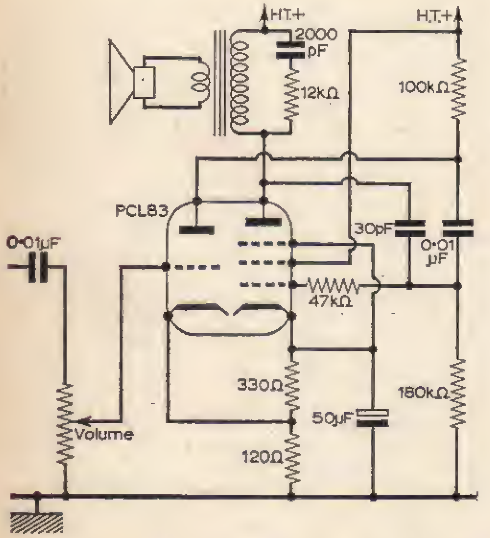


Fig. 16—Typical sound output stage (Ferguson 306). Note tapped cathode bias, correction components across output transformer primary and 30pF compensating capacitor from anode to control grid of pentode section.

Faulty decoupling causes a similar effect on the Murphy V410. The effect here is that application of the meter to the circuit apparently clears the fault. (It is a general rule that only a high ohms/volt meter should be employed around the a.g.c. circuits.) This fault was met with on the Marconi VT157 and associated models, where the a.g.c. is fed to the sound i.f. valve via two 1MΩ resistors, and the link between these on the tag strip adjacent to the valve opens.

Other intermittent faults can be found on these sets which use a basic printed circuit and a multitude of wired links and component boards—almost as if the designer woke up in the night with an after-thought that just screamed to be incorporated in the finished receiver.

The driver stage, often a triode portion of a multiple valve, such as the PCL82, 83 or 85, and now the PCL86, has one peculiarity. The anode load is usually quite high, and there is too often a tendency to fit a resistor that is just within tolerance. This goes even higher, with a resultant hum, noise, and weak audio. The grid load is also commonly high, often as much as 10MΩ, and although there is not the strain on this component due to current flow, under normal conditions, there is the possibility of damage if a valve has developed a fault, or if soldering has been clumsy. The dimensions of modern components, plus the restriction of lead length when they are mounted on printed circuit boards, gives rise to this kind of fault.

Where the driver section of a common output valve such as the PCL83 has a bias tapping of the cathode resistor taken to a point on the pentode bias resistor, as in Fig. 16, a faulty decoupling capacitor will cause a quite alarming howl due to the positive feedback.

Typical of this type of circuit is the Ferguson 306T. Remember, when replacing the resistors, that the lower resistor has to take the common current of both valve sections. An example of the use of a small resistor which quickly suffers if a valve develops a fault is the 120Ω cathode bias for the pentode section of the PCL86 sound output valve in the KB VV10 later models.

One disturbing factor that may be met in some Philips, Stella and associated makes, is the apparent absence of a cathode bias resistor! In the Philips 19TG112U, a short-circuit in C107, which is a 10µF section of a triple electrolytic, will cause overheating of the resistors at the top of the i.f. panel, and the 330Ω which feeds h.t. to the sound output transformer may also be found absent—or, more accurately, rolling about in the bottom of the cabinet. This is the result of melting solder and the position of the resistor. This also happens to the 300Ω, 1 watt resistor just above the PCL83 in the Stella 1033A.

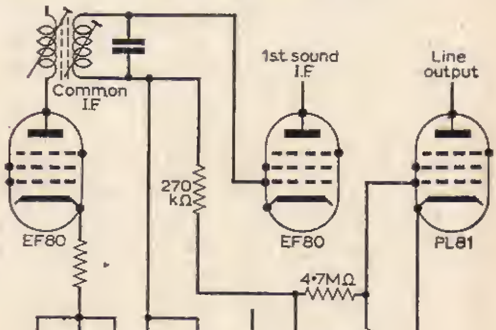


Fig. 17—Alba 988; volume control varies bias applied to sound i.f. amplifier grid. The negative bias voltage is derived from the control grid of the line output valve. Fixed a.g.c. is applied to the cathode of the common i.f. amplifier.

The cathode bias circuit of the 17TG100U is worthy of reproduction, and may be seen, with the frills omitted, in Fig. 17. The peculiarity here is that a fault in the volume control, which causes it to go open-circuit puts a high positive voltage on the grid of the PCL83. Applying the meter again tends to reduce the fault condition, and the first suspect is the 0·015µF coupling capacitor from the anode of the triode section. The valve tends to glow red and the sound becomes first strangled then practically non-existent A look at the circuit shows that the biasing of the whole sound channel is inter-dependent.

Another feature of this circuit is the derivation of h.t. supply from various sources, and the odd results when failure occurs in apparently unrelated parts of the circuit. For example, the anode feed of the driver section comes from the boosted h.t. line, the anode of the pentode receives its voltage from the main h.t. line while the i.f. valves get their supply via a further 47Ω resistor. In the 19TG and some Peto Scott models, the output stage has a separate line and a fuse just above the PCL83 affords protection. Tracing the circuit with no reference means dodging from board to board, following the h.t. trail.

The incorporation of "slow-warming" circuits, etc., and the derivation of bias from, for example, the line output stage, can lead to complications. Typical of this kind of circuitry is the Alba range, especially the 766 and 988. A fault that puts uncontrollable sound about one's ears when the set is first switched on may well be a low emission line oscillator!

The volume control of the latter model is in a remote control section, with a bias voltage from the line output valve variably controlling the grid bias of the second sound i.f. valve. A fault in the line output stage removes this bias and allows the sound i.f. valve to over-run.

The 766 has its volume control, bypassed with a 50μF electrolytic, in the cathode of the second sound i.f. amplifier, with the positive voltage obtained from a potentiometer across the 180V h.t. supply to this and the output stage. The first i.f. stage in the sound channel has a separate source of supply, common to the vision strip and timebases.

Another common Alba model, the 655, has the 500k volume control as grid load for the triode section of the PCL83. The cathode conditions are as we saw in Fig. 16. As this volume control is the plastic spindle and knob type, held together by a spring clip, some intermittent hum troubles can occur at this point. Intermittent increase in the residual hum may be caused by a leak developing in the 47pF correction capacitor from anode to grid of the pentode section of the PCL83.

This article began with the observation: "What is there to say about the sound channel?" The foregoing notes far from completely exhaust the subject. We have had no space to discuss the curious circuits whereby the constant current characteristics of a pentode output stage are put to use in controlling other functions, such as focus, not to mention the "obvious" sound faults of hum caused by electrolytic failure. The latter fault, on a television receiver, is usually accompanied by vision defects, as, for example, when the 1Ω resistor across the frame coils of the HMV 1910 goes open-circuit, or when the common electrolytic of the Decca DM45 develops an inter-section leak. But these faults will be self-evident.

Let us conclude with one remotely caused fault that can be tricky at first. A whistle super-imposed on the sound, much as harmonics of the line radiation of a television receiver beat with the 200 kc/s Light Programme of a radio signal. This is the clue, and on one receiver, the Murphy 430, this has happened at times because the anode decoupling of the U191 has gone open-circuit. This is a 0.01μF, 450V working capacitor. In other circuits, a 1,000pF may be found decoupling the take-off line that supplies the h.t. for the sound section of the receiver, and this should be suspected if line breakthrough is diagnosed.

PART 4 WILL APPEAR NEXT MONTH

A STABLE PULSE GENERATOR

—continued from page 446

to the valves, nor to d.c. connections—for example, to the pulse amplitude control. Capacitors should be of the non-inductive variety, of mica, ceramic or silver-mica as indicated by the capacitance value.

When carefully constructed the instrument has the following performance.

Input triggering signal 50mV, minimum waveform unimportant; frequency up to 15kc/s for longer pulses to 150kc/s for shorter pulses. For frequencies below 200c/s the shortest pulses are barely visible on a normal oscilloscope, since the rise-time is so short.

Pulse width - from 50nS to 2μS.

Pulse rise-time - less than 12nS.

Pulse fall-time - less than 20nS.

Pulse amplitude - about 8V max. into 75Ω cable, a little higher into 100Ω cable.

Output polarity - positive or negative.

Pulse delay related to triggering pulse output:—in steps of 0, 0·25, 0·5, 0·75 and 1·0μS.

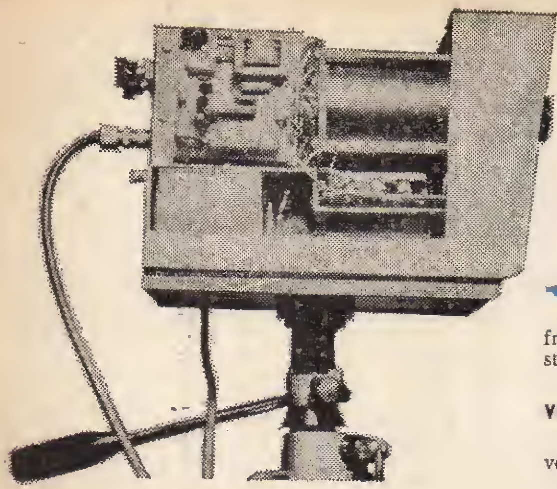
Sync pulse:—12V max. positive polarity, into 10k: rise and fall times less than 1μS (normally about 0·6μS).

Pulse width, rise-time and fall-time are unaffected by variation of mains voltage, but the maximum output pulse amplitude is affected slightly.

A few practical points about construction are worth noting. The valve type EA50 is specified as limiter and pulse amplitude control, and it was found much better in the prototype than the type EB91. Owing to the fact that the inductance of a delay-line per unit length falls off towards the ends, the 50nS position on the anode delay-line may not be found to be very accurately located. It may be better to label this position "40nS" rather than "50nS".

The potentiometer affording amplitude control (15kΩ) should be selected to have as nearly true a zero as possible, otherwise it may not be possible to reduce pulse amplitude to zero. Care should be taken in this part of the circuit to minimise stray capacitances, otherwise pulses may still appear at the output even if the control potentiometer zero is above reproach.

The inductance of wiring should be reduced to the minimum by using the shortest possible leads. This avoids stray couplings, which can be a nuisance in any v.h.f. circuit, but is absolutely necessary if "ringing" on fast leading edges is to be avoided. Grid stoppers are of very little help and have not been included as they tend to degrade the shape of the pulses a little, as might be expected. ■



TRANSIST
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from a Zener diode MR4, which provides a stabilised voltage similar to a neon stabiliser.

THE camera to be described is complete in itself and does not require a pulse generator or other similar equipment. The vision output is positive composite at about one-third of a volt peak-to-peak, the only extra equipment needed being a TV monitor which will take a vision line feed.

Only a short length of coaxial cable can be used between the camera and monitor; however, a combined aperture correction amplifier and 1V vision distribution amplifier can be used for longer cable runs up to 1,000ft. Aperture correction is a refinement to the video bandwidth response to correct for the vidicon electron beam diameter at the tube target and involves a boost at frequencies around 2Mc/s and above, giving crisper pictures.

For ease of description the camera will be divided into three sections: power supply and tube requirements. video amplifier and timebases.

The Power Supply

Power requirements for the camera unit are as follows:

+300V	at about	8mA
−100V	,, ,,	1mA
− 25V	,, ,,	120mA
− 6·2V	,, ,,	20mA

6·3V a.c. at 0·6A (vidicon heater).

All the above supplies are obtained from one transformer T1 (see Fig. 1). One tapped winding is used to supply the two low-current, high-voltage rails from the half-wave rectifiers MR1 and MR2. Note that since capacitive smoothing is used the transformer a.c. voltages are 100V r.m.s. and 230V r.m.s. only for the −100V and +300V ratio respectively.

The −25V supply also uses half-wave rectification by MR3, again the a.c. output is 35V r.m.s., although nearly 50V d.c. are across C5, the 500μF smoothing capacitor. R3 drops this voltage to 25V required by the timebases. C6 is a 2,000μF capacitor and provides the very low power supply impedance necessary to drive the scanning circuits.

The −6·2V for the video amplifier is obtained

Vidicon Tube Supplies

The vidicon camera tube requires the following voltages:

The anode runs with +300V which is obtained via an RC smoothing network; current taken is only in the order of tens of microamps.

The supply to the wall anode is made variable from about +40 to +300 by VR3 and focuses the electron beam on to the target. This focus voltage depends on the magnetic focus field from the focus coil. The greater the magnetic field the higher the focus voltage for correct focus and also, incidentally, the more scan power required to scan the target mosaic.

THE C

Resistors:

R1	10kΩ	R16	1kΩ	R32	470Ω
R2	68kΩ	R17	100Ω	R33	100Ω
R3	50Ω 5W	R18	15kΩ	R34	1kΩ
R4	1k ½W	R19	270kΩ	R35	3·9kΩ
R5	100kΩ	R20	1kΩ	R36	10kΩ
R6	100kΩ	R21	47Ω	R37	180kΩ
R7	100kΩ	R22	1kΩ	R38	1kΩ
R8	15kΩ	R23	10kΩ	R39	8·2kΩ
R9	68kΩ	R24	4·7kΩ	R40	100kΩ
R10	100kΩ	R25	270kΩ	R41	270Ω 1W
R11	39kΩ	R26	1kΩ	R42	10kΩ
R12	270kΩ	R27	100Ω	R43	8·2kΩ
		R28	10kΩ	R44	3·9kΩ
R13	100kΩ	R29	2·7kΩ	R45	10kΩ
R14	10kΩ	R30	27kΩ	R46	180Ω 1W
R15	270kΩ	R31	27kΩ	R47	39Ω ½W

All ⅛W except where otherwise stated

Potentiometers:

VR1 1kΩ carbon, miniature pre-set
VR2 100kΩ ½W carbon, linear
VR3 100kΩ ½W carbon, linear
VR4 100kΩ ½W carbon, linear
VR5 500Ω carbon, miniature pre-set
VR6 500Ω carbon, miniature pre-set
VR7 500Ω carbon, miniature pre-set
VR8 500Ω carbon, miniature pre-set

Inductors:

L1 High impedance focus coil for vidicon
L2, 3 Low impedance deflection coils for vidicon (F.S.T. Electronic Consultants Ltd.)

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B. W. SMITH G3LGJ/T

The vidicon is scanned orthogonally, i.e. the electron beam always lands on the target perpendicularly to the plane of the target. This orthogonal scanning is achieved by putting a focus coil over the scan coils.

The cathode is normally earthed but in this circuit is fed with positive frame blanking pulses to cut off the beam during the frame flyback period.

The grid is variable from 0—100V and VR2 is used to increase or decrease the beam current of the vidicon. Negative line blanking pulses are also coupled to the grid and suppress the beam current during line flyback. The frame and line suppression of the vidicon beam during flyback periods is most important, otherwise whole or partial discharge of the target visual image might occur during the beam flyback.

The beam current of the tube is always set as low as possible while still completely discharging the picture white highlights (picture whites on the target require the most electrons to discharge them). The greater the beam density the poorer the focus, thus giving poorer definition.

The target or mosaic is variable (via VR4) from 0 to +75V; the supply itself is stabilised by a neon V2. A two-stage RC smoothing network is used to completely decouple the target itself from any stray voltage variations. This precaution is necessary because any fluctuating voltage at the target will be amplified together with the video signal, in the video amplifier, and be seen on the picture.

R11 is the target load and is coupled to the video amplifier via C12.

Video Amplifier

The tube output is a current source output, hence the output voltage depends on the load impedance. The load impedance is made up of R11, R14 and Tr1 input impedance, all in parallel. This impedance will be about 5kΩ. A typical tube output current on peak whites is 0·1μA, so that the vidicon output voltage will be approximately 0·5mV. The white output voltage will be negative with respect to the picture black, i.e. a negative video output. This will require an odd number of phase reversals of the video to provide the standard positive video output.

OMPLETE CAMERA COMPONENTS LIST

Capacitors:

C1 8μF electrolytic 450V
C2 8μF electrolytic 450V
C3 16μF electrolytic 250V
C4 0·1μF polyester 150V
C5 500μF electrolytic 50V
C6 2,000μF electrolytic 25V
C7 5,000μF electrolytic 6V
C8 0·1μF polyester 400V
C9 0·1μF polyester 400V
C10 0·1μF polyester 400V
C11 0·1μF polyester 150V
C12 0·1μF polyester 150V
C13 16μF electrolytic 10V
C14 16μF electrolytic 10V
C15 1,000pF disc ceramic
C16 16μF electrolytic 10V
C17 1,000pF disc ceramic
C18 16μF electrolytic 10V
C19 1,000pF disc ceramic
C20 16μF electrolytic 10V
C21 0·8μF electrolytic 25V
C22 0·1μF polyester 150V
C23 16μF electrolytic 10V
C24 16μF electrolytic 60V
C25 125μF electrolytic 25V
C26 16μF electrolytic 60V
C27 1,000μF electrolytic 15V
C28 0·01μF disc ceramic
C29 3,000pF disc ceramic
C30 0·1μF polyester 150V
C31 64μF electrolytic 40V
C32 64μF electrolytic 40V
C33 16μF electrolytic 10V

Transformers:

T1 Mains transformer. Tapped primary. Secondaries: 0-100-230V 10mA; 0-35V 200mA; 6·3V 0·6A. (F.S.T. Electronic Consultants Ltd.)
T2 Line blocking oscillator transformer (Radiospares L.B.51)
T3 Frame blocking oscillator transformer (Radiospares F.B.5)

Diodes:

MR1 Silicon 250V 500mA (Radiospares REC51)
MR2 Silicon 250V 500mA (Radiospares REC51)
MR3 Silicon 200V 500mA (Lucas DD003)
MR4 Zener (G.E.C. SX62)
MR5 Germanium (Mullard OA86)
MR6 Silicon 50V 500mA (Lucas DD000)

Transistors:

Tr1 OC171 (Mullard)
Tr2 OC171 (Mullard)
Tr3 OC171 (Mullard)
Tr4 OC45 (Mullard)
Tr5 OC171 (Mullard)
Tr6 OC45 (Mullard)
Tr7 DT1520 (Lucas)
Tr8 OC45 (Mullard)
Tr9 DT1520 (Lucas)

Valves:

V1 1in. vidicon, second grade (F.S.T. Electronic Consultants Ltd.)
V2 Miniature neon (Radiospares)

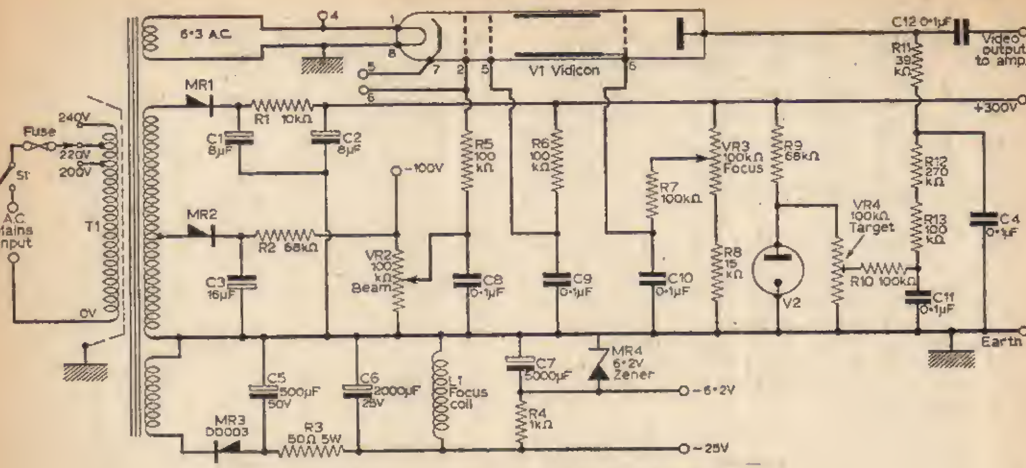


Fig. 1—Circuit of the camera power supplies.

A three-stage amplifier was chosen (comprising of Tr1, Tr2 and Tr3), giving a total gain of about 50dB or 400 times voltage gain and is shown in Fig. 2. The three-phase reversals at each stage will provide the normal positive video waveform at the output.

The vision part of the composite output will only be approximately 0·2V, which is a little short of the normal 0·7V of a 1V composite signal. It was decided that the output would be sufficient for most needs; further amplification would require two extra stages in order to keep the phase correct.

The three stages are all very similar in design and examination of Tr1 circuit will suffice. Simple d.c. stabilisation is provided by R15 coupled between base and collector. High-frequency boost is provided by the emitter resistor R17 and capacitor C15. This form of compensation is used on all stages and provides both aperture correction and equalisation for the capacitive loading on the tube output load. Tr1 stage is decoupled from the 6·2V power rail by R18 and C13; this is to ensure amplifier stability and provides a very low voltage for the first stage to minimise noise generation in this transistor.

Tr4 has negative frame sync pulses coupled into its base and in turn is coupled to the emitter of

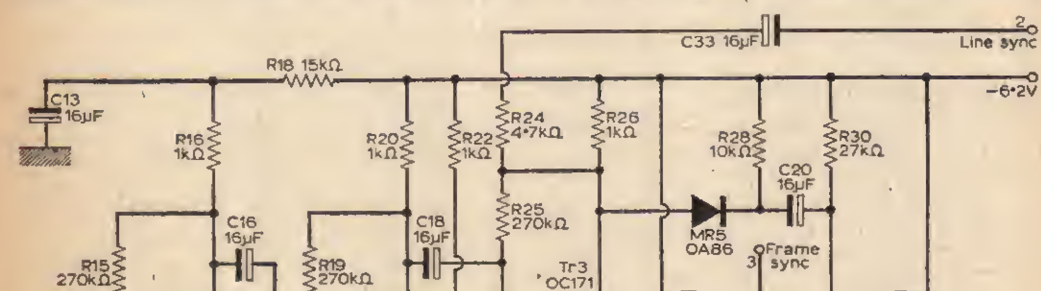


Fig. 2—The video amplifier circuit.

Tr3. The frame sync pulse switches off Tr3 during the sync period, VR1 varies the bias on Tr3 and this varies the standing current through Tr3.

Negative line sync pulses are resistively mixed at Tr3 collector and combined with the signal current from Tr3 to form the composite video signal current from Tr3 to form the composite video signal. The sync pulse amplitude can be varied by adjusting the setting of VRI which and this varies the standing current through Tr3.

MR5 couples the output from Tr3 collector load to R28, the sync bottoms are clipped level and to the correct amplitude controllable by VR1. After mixing and clipping the video is then coupled by C20 to the base of the output emitter follower Tr5 which provides a low output driving impedance. This output can then be coupled through a short length of coaxial cable, left unterminated, to the video monitor.

efficiency diode of the normal TV line scan circuit.

The line deflection pulses from C31 are used as beam blanking pulses on the vidicon tube grid, to blank out the line flyback. They are also used as line sync pulses, which are mixed in the video amplifier.

The frame scan circuit is very similar to the line circuit. Tr6 is a p-n-p transistor. The transformer T3 provides feedback and the circuit oscillates at 50c/s, the frequency being adjusted within fine limits by VR5 the frame hold control.

This oscillator is locked to the 50c/s mains frequency, the 6·3V vidicon heater supply being used for this purpose. The oscillator need not necessarily be locked to the 50c/s supply, but if a 50c/s mains video monitor is used for viewing, any mains ripple present on its scan or vision circuits would be seen as wriggles rolling through the picture. When the timebases are locked to

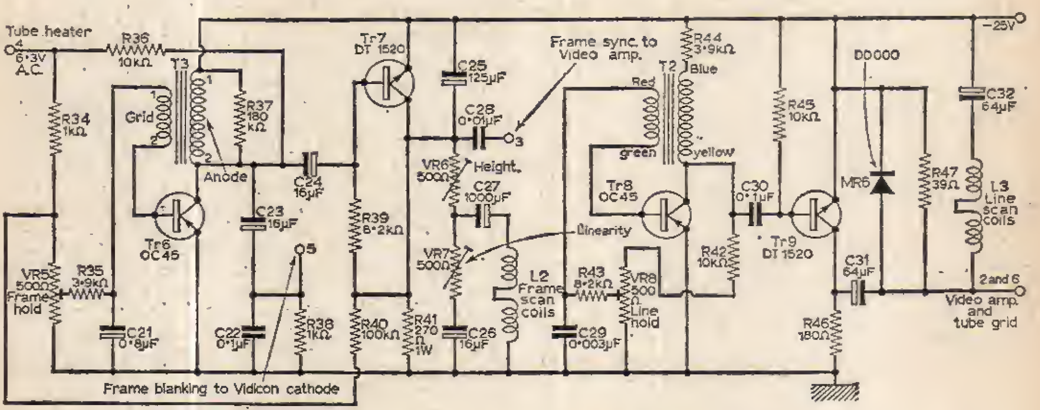


Fig. 3—The timebases and sync stages of the circuit.

Timebases and Sync Pulse Generation

There are two independent circuits, one for frame scan and pulses and the other for line scan and pulses. The circuit diagram appears in Fig. 3.

In the line timebase circuit Tr8 is a p-n-p blocking oscillator, the transformer T2 provides the feedback. The line speed is controlled by the variable voltage as set by the line speed control potentiometer VR8. The circuit is free running and is set to approximately 10kc/s. This type of free running oscillator gives a sequential or random interlace pulse generating system. The interlace generation of sync pulses requires the line and frame sync pulses to be tied together numerically by a divider chain.

Tr8 collector output is coupled to Tr9 base via C30; Tr9 is the n-p-n power output transistor which produces the line scan. The output of Tr9 collector is coupled to the scan coils via C31, this prevents d.c. current through the coils which would otherwise produce a shift of the scan area, probably right off the target.

The diode MR6, which is connected across the deflection coils, improves the scan efficiency, and can be considered the equivalent of the boost or

50c/s any distortion is fixed with respect to the picture and can be tolerated.

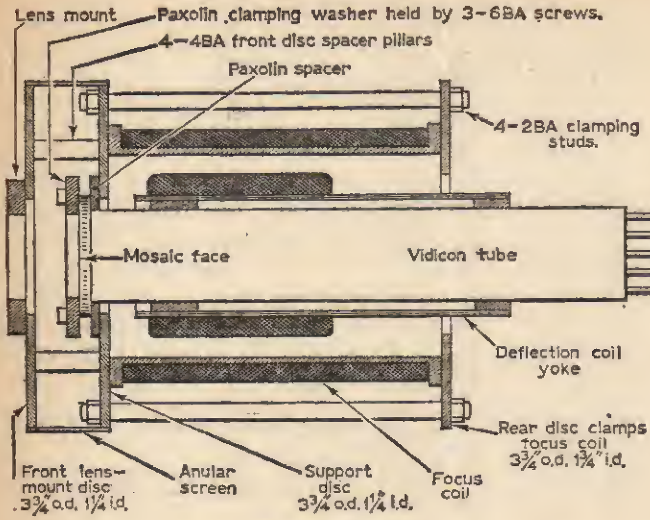
Tr6 collector is coupled to the scan output stage Tr7 which is an n-p-n transistor. Note that the emitter of the n-p-n stage is always more negative than the collector, which is the opposite of p-n-p transistor operation. Tr7 output is coupled to the scan coils via the height control VR6, and C27 which again is used to isolate the scan coils d.c. wise.

Frame sync pulses are obtained from Tr7 collector via C28 and R29. C28 is coupled to VT4 base in the video amplifier. The frame sync pulses are only about two lines wide, i.e. 200 micro-seconds, and the line sync pulses are missing during this frame sync period. The television monitor line synchronising is not unduly affected, since only two line pulses at the most will be missing.

Coil Assembly

The most important part of the camera is the coil assembly, and poor camera results can often be attributed to badly designed coils and assembly.

The assembly is in two parts: the deflection coil



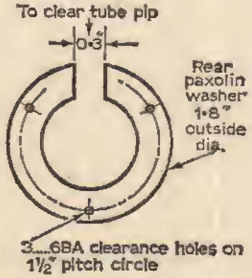
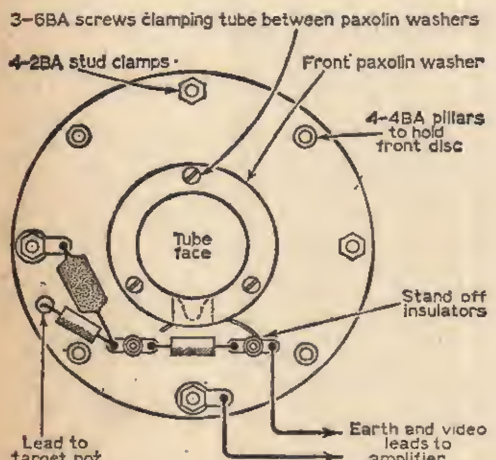


Fig. 4 (above)—A cross-section of the coil assembly.

Fig. 5a (right)—The rear Paxolin washer.

Fig. 5b (below)—Details of the tube support disc.



yoke, and the tube mount and focus coil. Fig. 4 shows a cross-section of the whole assembly. Note that the vidicon tube is supported only at the mosaic take-off ring at the front of the tube; this ensures a flat optical surface to the lens. The deflection coil yoke is a slide fit on the tube neck, which is its only support.

The camera tube is clamped onto the support disc by two paxolin washers, held by three 6BA screws to the disc (see Fig. 5). The video is taken from the target ring by a phosphor-bronze spring pick-up. C4, R11 and R12 are also accommodated on the front support disc, using stand-off insulators.

The target of the tube has to be well screened from electrical pick-up and stray light. This is arranged by having another disc the same diameter as the support disc spaced away from the support disc by four pillars. This front disc also takes the lens mount and the spacing is adjusted to allow correct optical focusing of the lens onto the camera tube. An aluminium band, similar to a large capacitor clamp, is fitted round the two screen discs to provide complete screening, electrically and optically, except for the lens mount hole.

A third disc, also with a hole in the middle, and the same diameter as the other disc, is used to clamp the focus coil between it and the middle support disc. The hole in this disc must be large enough to allow the deflection coil yoke tube to protrude. The rear disc is clamped onto the focus coil, using four 2BA pillars between the middle and rear discs. There is a slight amount of room for sideways movement of the focus coil in the mount, and normally this should be mounted concentrically with the vidicon, but the sideways movement can provide a small amount of scan shift if necessary.

The focus coil is a standard high impedance vidicon focus coil which needs about 25mA of focussing current. Impedance of the coil is approximately 1 kilohm d.c. measurement.

Mumetal Screen

A mumetal shield or screen wrapped round the focus coil is highly desirable, to provide magnetic screening for the deflection assembly.

The deflection coils used are standard low impedance one-inch vidicon deflection coils and can be obtained from several manufacturers.

The coil assembly is the major mechanics of the camera and the electronics can be conveniently built around it. Exact mechanical details have not been given, since individual constructors will have their own ideas and methods of construction.

MORE CONSTRUCTIONAL DETAILS WILL BE GIVEN IN NEXT MONTH'S ARTICLE

ACKNOWLEDGEMENT

The Author and the Editor of PRACTICAL TELEVISION *thank F.S.T. Electronic Consultants Ltd., Birmingham 6, for their permission to publish this article.*

Unwanted Reflections

ELIMINATING GHOSTS

BY E. SHIELLS

MOST of us from time to time come up against the trouble of ghosting on our TV sets. Nowadays the London area, with many tall buildings going up, is becoming progressively over populated with " ghosts ".

Band I is the chief offender in this respect. The aerials for this band are cumbersome and do not lend themselves easily to additional elements being fitted to increase the front-to-back ratio.

The usual method of approach to this problem is to " swing the aerial ", that is to rotate the aerial assembly round its axis. The snag here is that any movement out of the direct path of the transmitter causes a loss of signal strength of the wanted signal, and the best position is only a compromise between a weaker signal and a weaker ghost—a very unsatisfactory state of affairs.

Another approach to this problem has been made by the writer, and the results were really startling.

For this method, a mobile aerial is a must to achieve satisfactory results, also an assistant is essential to watch results on a TV set.

The first move is to get an idea from which direction the reflection is coming. This can be done by swinging the aerial round its axis and observing the maximum signal strength of the ghost.

When this has been established, the aerial should be moved bodily along this path i.e. either nearer or farther from the offending reflection. Phase differences will then become apparent. At one point a *black* ghost will be observed, and by moving the aerial a half wavelength in either direction, the ghost will change to *white*. By careful placing of the aerial the shading of the ghost can be adjusted until it is more or less concealed by the overall brightness of the receiver.

There is no aerial on the market at the moment which allows a final adjustment of this nature to be carried out easily, but with a little ingenuity it can be performed by making liberal use of universal clamping brackets and 1in. tubing. With these items a universal joint can be arranged.

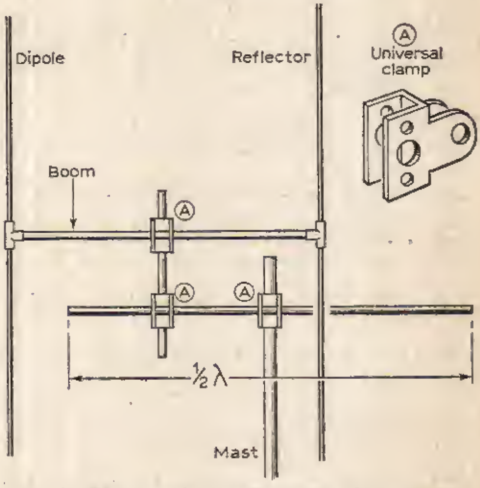


Fig. 1—The simple construction of an aerial recommended by the author of this article.

The illustration (Fig. 1) will help to give ideas for the construction of such an aerial.

Troubles like ragging and line tearing caused by close images are often minimised to a very agreeable extent.

A lot of patience is required especially if the aerial is in an awkward position. Initial tests should be carried out in the most convenient position available, in order to make the final erection easier.

Phasing will not be changed by moving the aerial in the vertical plane, thus by testing immediately underneath the proposed position an approximation of the relative setting can be arrived at, without the need to perform repeated experiments at a height above ground. ■

Sound-only Receiver

—continued from page 441

the tuner i.f. and the transformers in the sound i.f. channel also for maximum sound consistent with minimum vision buzz.

When the receiver is to be used for conveying a sound signal to a hi-fi amplifier or tape recorder it usually pays to connect the metal chassis to a good earth point (note that this is why adequate mains isolation is required. Never be tempted to earth any equipment which is connected direct to the mains supply). Hum can be considerably reduced by this means.

The ordinary volume control will control the volume of sound from the loudspeaker but will not affect the cathode-follower output signal. The level of the latter is independently adjustable by the " set level " preset, shown in the circuit of Fig. 4.

The freedom from frame buzz and line whistle is remarkable on a sound-only receiver as described and the real high quality of the television sound system can be fully exploited through a good quality amplifier.

For receiving the sound of BBC-2, of course, a u.h.f. tuner will be needed instead of the v.h.f. tuner. An f.m. detector will also be needed instead of the a.m. detector, and to facilitate changing from one system to the other some sort of switching is desirable. Suggestions along these lines will be given at a later date in these pages. ■

SERVICING TELEVISION RECEIVERS

No. 103: G.E.C. BT2155 and BT8149

By L. Lawry-Johns

CONTINUED FROM PAGE 418 OF THE JUNE ISSUE

WITH the fault symptoms of no picture but normal sound, turn the brilliance control up and if there is no raster listen for the line timebase whistle. If this is smooth and even it is likely that e.h.t. is being applied to the U47 e.h.t. rectifier but that the heater of this valve is open circuited.

If there is no heater glow but there is a high pulse voltage to the anode it is reasonable to assume this is the case and a new U47 (or U25) may be fitted. Quite often this valve may be seen glowing blue and again it should be replaced.

Sometimes the line whistle may be absent or faint and the N308 may itself have a purple glow indicating that this valve is in need of replacement.

If however all is well in the line output stage and e.h.t. is present at the c.r.t. anode, voltage checks should be made at the c.r.t. base socket.

The voltage read at pin 10 will depend to a large extent upon the sensitivity of the meter employed

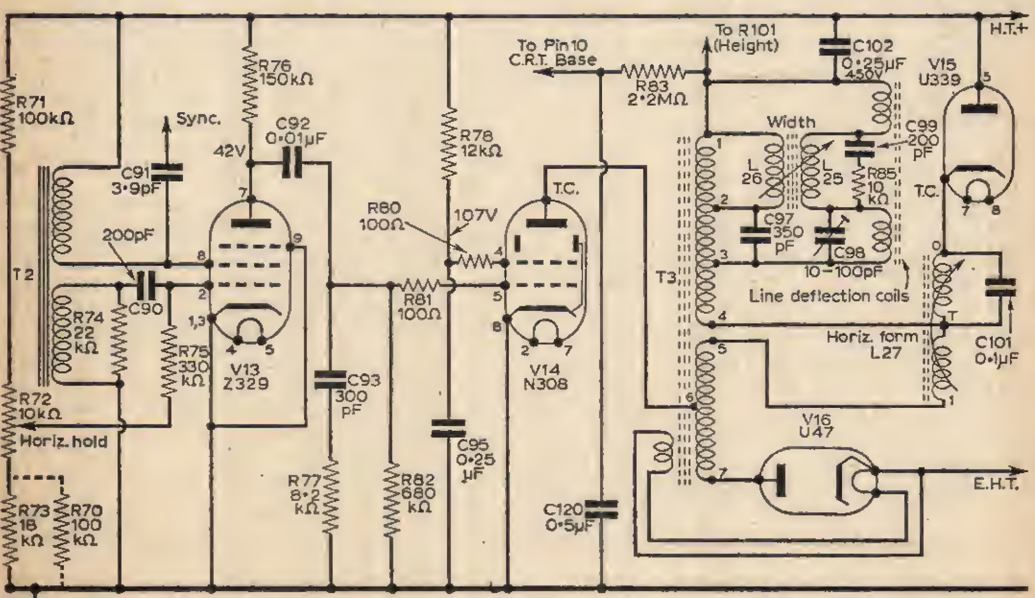


Fig. 4a—The line timebase section of the circuit.

as there is a 2·2MΩ (R83) series resistor. A good quality meter should record about 400V.

If there is no voltage at this point at all check C120 0·5μF which does tend to short. A replacement should be rated at 500V or more and a 0·1μF 1,000V can be used if desired.

The voltage at pin 11 should be about 150V and that at pin 2 should vary from 0—170V as the brilliance is operated. Failure to record this voltage should direct attention to the brilliance control itself C96 (0·1μF and R87 (27kΩ).

Check the position of the ion trap magnet on the tube neck. If this is firmly in position and has not been altered there is no need to alter its position, as this may result in confusion when the real fault has been located and remedied.

Line Hold

If the line hold is at the end of its travel check V13 (Z329) and R75 (330kΩ). Disconnect or connect (as required) R70 which is a 100kΩ available to be shunted across R73 18kΩ.

Frame Hold

If the control is at the end of its travel check V17 B729 and R104 220kΩ. If the control is not at the end of its travel but the locking pulses are too weak to hold a reliable picture check C105 0·005μF, C104 0·01μF, V7 (D77), C103 0·01μF and R95 68kΩ.

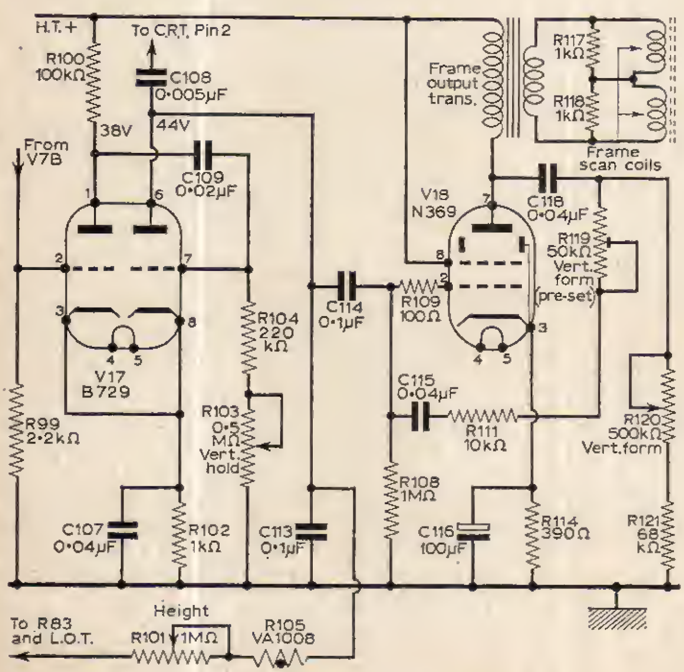


Fig. 4b—The frame timebase.

If the line sync is also weak check R95, C100 0·5μF, R50 and R53, particularly if contrast is lacking. MR2 (GEX35) the video detector should also be checked if the sync is weak and contrast poor.

Lack of Height

If the loss is even top and bottom, check R105 which is a VA1008 thermistor.

Bottom compression should direct attention to V18 (N369), R114 390Ω and C116 100μF. If the fault persists check C115 0·04μF and if the bottom is folded check C114 0·1μF and R114 for consequent damage.

White Horizontal Line

Check V17 and V18. the voltage at pin 7 of V18 (nearly 200V) and if there is no voltage at this pin, the continuity of T4 primary. If these points are in order check V17 pin 6 voltage which should be about 44V. If absent check the height control (R101 1MΩ), R105 and C108.

Weak Picture

If advancing the contrast or brilliance causes the picture to turn negative or the highlights to assume a silken effect without the picture actually brightening it can reasonably be assumed that the tube is losing emission and is in need of replacement.

If however the brilliance control can be advanced to show a bright clean well focused raster but the contrast is fully advancing without producing the required tonal values, it can usually be assumed that the tube is in order.

In this event the vision i.f. valves, MR2 detector and associated chokes and the video amplifier (V6) and resistors R50, R53. etc., should be checked. This assumes the picture although weak is reasonably free of grain. If the picture is grainy or noisy, however, check the aerial input and V1 (B319; V2 (LZ329) if necessary.

Distorted Sound

If the sound is weak and distorted, particularly on a strong signal, check R34 10mΩ which may have "gone high" and MR1 (GEX34). Check V11 (DH77) and R44 220kΩ if necessary and note whether V12 (N369) is overheated. If it is

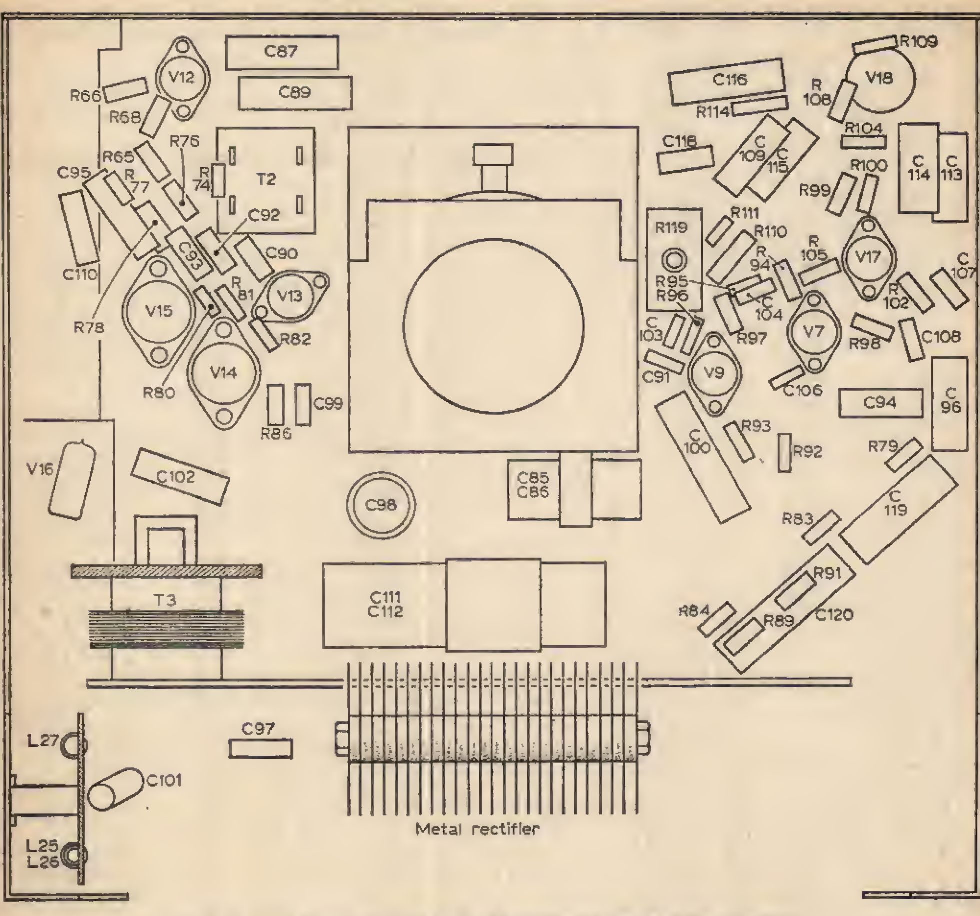


Fig. 5—Looking at the front of the chassis with the tube removed.

running into grid current check C68 0·005μF and the valve (V12) itself.

Reduced Volume and Vision Buzz

If this is not due to incorrect tuning (fine tuner should be about midway for maximum volume if the oscillator core is set correctly) and the i.f. alignment has not been disturbed, check C85 and C86 (16 + 32μF).

No Sound Signals

Check V11 by replacement and then V10, C84 and C50, MR1 etc., if there is a slight hum in the loudspeaker. If there is no hum at all check V12 and the voltages to pins 7 and 9. If both are absent check R67. If this is burned out check C86 and V12 for shorts.

If there is about 180V at pin 9 or more but none at pin 7 check T1 primary for continuity, also C88 for shorts. If C88 has shorted R69 and R65 will probably be found to be damaged.

Sound on Vision

If the oscillator coil cores are properly aligned maximum sound should occur at approximately the mid-point of the fine tuner's travel, without disturbance of the picture. It often happens, however, that pronounced interference of the pictures occurs on loud sound passages. This is often due to misalignment of C67 and to an extent C65. These are the "Beehive" type rotary capacitors on the left side of the i.f. plate. Correct alignment of these trimmers is absolutely essential and is best done (in the absence of a signal generator) on the constant tuning note, where traces of sound-on-vision are seen as a constant rippling of the picture.

C65 should be tuned (with the insulated sleeve or trimming tool) for maximum sound and C67 for minimum interference with the picture. Slight adjustment of C65 is permissible to clear any remaining traces provided the sound signal is not seriously attenuated by such adjustment. L17 should not be disturbed.

DX-TV

A MONTHLY FEATURE FOR DX ENTHUSIASTS

by Charles Rafarel

THE DX/TV season for Sporadic E reception seems at last to be under way, and reception should now be in full swing once again. Already, here, good reception has been obtained from Poland (Bydgoszcz Ch OIRT 1) and on the same channel from Ostrava and the USSR. But the "star" performer has been Hörby (Sweden E2) which this year has been better than ever.

Madrid on E2 has also been good, and other readers report RAI Italy, from Monte Nerone Ia, and Monte Penice Ib, although so far these have not been received here. This only goes to show that if your DX pal in another part of the country telephones to say such-and-such a station is "roaring" in, and you get just nothing, it is no good being disheartened. It is just "patchy" conditions, and your turn will come!

Mystery Test Cards

I am receiving a number of reports of "Mystery" test cards, and I have seen some myself. This always happens after the winter lull; stations are found to have altered their test cards in some cases, and in other instances we find that we have a new country.

I would like to ask already established DX-ers, that if they see any "new" cards, please write to me via PRACTICAL TELEVISION with details, so that we can try and sort them out! An example of what I have in mind is the Test Card of the Telefis Eireann type reported on Ch. E3, and not emanating from the Gort transmitter in Eire, via the CCIR transmitter. Does anyone know anything about this one?

We can help each other a good deal in this way. Last month we mentioned reception by Mr. MacNamara in Dublin of a "mystery" Union Jack motif on his local signal. Mr. J. W. Graves of Liverpool suggests that it is the closing caption used by ITA Preceli on the adjacent B8 channel. Mr. Graves who can view Preceli knows this is used and his explanation fits the case.

Band II DX

This month I want to mention something that I hope may be of special interest to our more experienced DX/TV readers. I refer to the possibilities of DX/TV reception in Band II, since the USSR and Italy use this band on channels OIRT 3, 4 and 5, and Ic.

Band II, from time to time, under exceptional reception conditions, affords Sporadic E reception for TV signals, and I have heard f.m. sound signals from Italy in Band II, but more important is that other amateurs have picked up TV images from both USSR and Italy in this band.

I have not, as yet, had any TV on Band II, but I felt that one should get organised, and this is what has been done here: I managed to acquire a Russian made turret tuner which filtered its way westward via Czechoslovakia! It is curious to note that its design is exactly the same as a well-known British make—which came first, the chicken or the egg?

This tuner, with biscuits for all USSR channels, including those in Band II, has a low impedance output which has been linked to the vision strip of a Bush TV62 receiver via a switch, and now a 3-element aerial array and preamplifier have been installed. We only wait for good conditions.

The interesting point is that on changing the Russian biscuits for standard British ones the set continued to work well on British channels. This gives food for thought, for all we need to do if we have a British turret and want to try for Band II TV is to rewind the biscuit coils. This is relatively elementary except for assessing the number of turns on each coil, and though we can do it experimentally by reference to the f.m. band, if any reader would like to know the exact answer I will be pleased to "fillet" the USSR tuner for details. I hope I do not end up in the Siberian Salt Mines for infringement of Russian patents!

It may well be that for Band II results we may not have to rely on Sporadic E propagation alone. It would seem from my own Italian f.m. sound reception that this arrived via the Troposphere, as it did not have the usual Sporadic E flutter.

General Note:

For the beginners, now that the season is underway, may I again suggest that they either leave their receivers running on, say, E2 or R1 channel or carefully note any traces of patterned interference on BBC domestic viewing channels.

Just a word about DX reception and logs. It is a distinct advantage to keep an accurate log of reception, noting in particular details of test cards and times; this is useful on a future occasion for checking if a certain station is on the air.

Some of our ex-SWL types may feel that they have only to rush a letter off to receive confirmation of their DX reception from the station of origin but

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CONTINUED FROM PAGE 416 OF THE JUNE ISSUE

CHANGING CATHODE RAY TUBES

PART 4: MURPHY MODELS

By H. Peters

THIS month we deal with Murphy Receivers. Three main basic chassis arrangements have been produced in the period under review, and these have been incorporated in a number of different cabinet stylings.

To find the instructions applicable to your own set, look up its model number (stamped on the cabinet back) in the index, and read the detailed instructions in the text for the basic chassis removal and tube replacement given in adjacent columns. together with the numbered notes also applicable.

The provisional instructions for the V849 can also be used in conjunction with the current 1963 Bush range, which employs a similar chassis.

V350 Chassis Removal

Switch to " BBC " and " off ", remove two side knobs by unscrewing grubscrews accessible via back of cabinet. Lay face down, on a platform just smaller than the safety glass (e.g. book), remove two back chassis fixing screws, and ease off cabinet, pressing down on the brightness and contrast knob to assist. To assist refitting, French Chalk around the rubber mask.

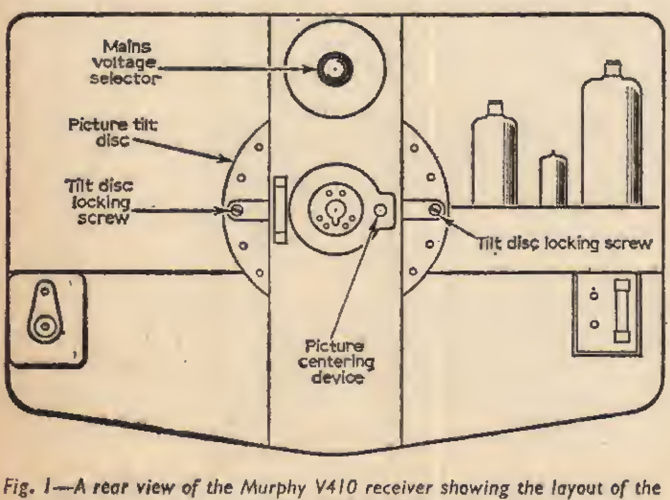


Fig. 1—A rear view of the Murphy V410 receiver showing the layout of the major components.

V350 Tube Removal

Remove base connector, e.h.t. cap, and ion trap magnet. Stand face down, remove the four screws holding tube clamp to side supports and lift chassis off tube. Remove old tube from mask and fit new one with mould line registering to line indicated on mask. Reassemble in reverse order adjusting ion trap magnet for maximum brightness.

V410 Chassis Removal

Unplug and lay set face down on a soft cloth. Remove two fixing bolts at back and lift cabinet off chassis.

V410 Tube Removal

With set face down, disconnect e.h.t. and tube base connectors. Remove the two 4BA nuts and two hexagon headed screws at the corners of the moulded frame, and lift tube and chassis off mask. Rest the tube face on a soft surface, slacken the clamping ring, and lift the chassis off the c.r.t. Clean and replace in reverse order.

If corner shadowing is prevalent, rotate c.r.t. to its other position 180° away. The earthing spring must also be moved.

V410C Chassis Removal

Remove the chassis fixing bolts at rear of set, and withdraw chassis from front of cabinet, taking care not to drop the runners on the cabinet front.

V480 Chassis Removal

Remove trim from the Cabinet front, and lay set face down on a soft platform smaller than the safety glass, so that the glass takes the entire weight of the chassis. Remove the two chassis screws at the back of the cabinet and ease the cabinet off.

When refitting the trim, slide on the top edge after the corners and other edges are engaged. An application of French Chalk on the rubber mask may help.

V480 Tube Replacemen.

Unplug e.h.t. and base connectors, take out safety glass, loosen the clamp screws and ease old tube out of the mask from the front. Ease new tube in similarly. Check that ½in. space exists between tube face and safety glass. Replace safety glass.

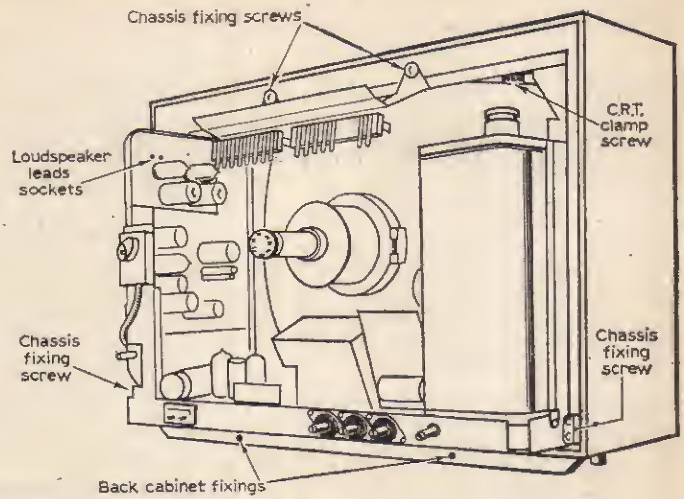
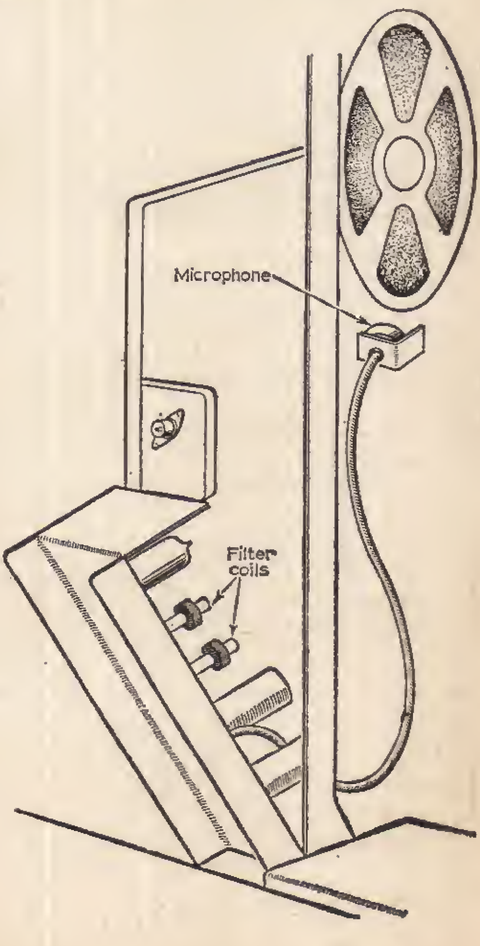


Fig. 2—A V659 series receiver viewed from the rear.

Fig. 3—The "Astral" receiver with remote control unit showing the route of the microphone cable, taken to avoid instability.



When chassis is in cabinet, the front of the tube can be centralised by two mushroom shaped supports on the bottom of the cabinet, which can be adjusted from beneath to raise or lower each side of the tube as required.

V470 Tube Replacement

Lay chassis face down. Remove four screws holding the moulded frame to the front supports. Lift chassis and tube off mask assembly. Disconnect e.h.t. and base connectors. Loosen the four tube shackles from the clamping ring corners, slacken clamping ring and remove tube.

Check before refitting that the six plastic cushions are on the clamping ring. Lower the chassis on to the tube ensuring that the support arms are ⅛in. above the bench. (A 4BA nut under each will give the right spacing). Clamp up the tube and tighten the shackles before replacing in reverse order.

V530C Chassis Removal

Unplug, remove card back, remove two chassis fixing screws, and withdraw chassis backwards out of cabinet, keeping it straight.

V530C Tube Removal

Leave c.r.t. front assembly on main chassis. Remove e.h.t. and base connectors, loosen the tube clamp and withdraw the old c.r.t. Ease the new tube in position, checking that the face of the tube is 2¼in. in front of the two side supports.

V659 Chassis Removal

Remove cabinet back. Unplug loudspeaker. Remove the four chassis bolts and withdraw the chassis from the cabinet.

WARNING ! !

When removing and refitting the cabinet back, care must be taken not to tilt it greatly from the vertical, as there is a danger that the dome which fits over the tube neck will press upon it, and implode the tube. The risk is greater on the 600 series, with the fixing screws at the bottom of the cabinet, than on the 700 range.

V659 Tube Replacement

Remove e.h.t. and base connectors, slacken clamping screw on scan coils, and slide scan coils off tube neck. Slacken tube clamping ring screws, and withdraw tube forward. Fit new tube and position it so that the front edge of the cushion inside the clamp coincides with the front mould mark on the tube. Loosen the four screws holding the clamping ring to the chassis member, and tighten the two clamping rings so that the gaps are equal at either side.

Tighten the four screws holding the clamping ring to chassis. Refit the scan coils and tube connectors, and return set to cabinet. If a gap appears between the tube and the mask, move it forward by slackening the four screws holding the clamping ring.

If a 6·3V tube is fitted, the resistor R14 at the right hand end of the mains dropper must be in circuit. If a 12·6V tube is used, this resistor should be shorted out.

On receivers with a linearity sleeve fitted behind the scancoils, this should be refitted with the peg of the adjusting ring lined up with the gap on the

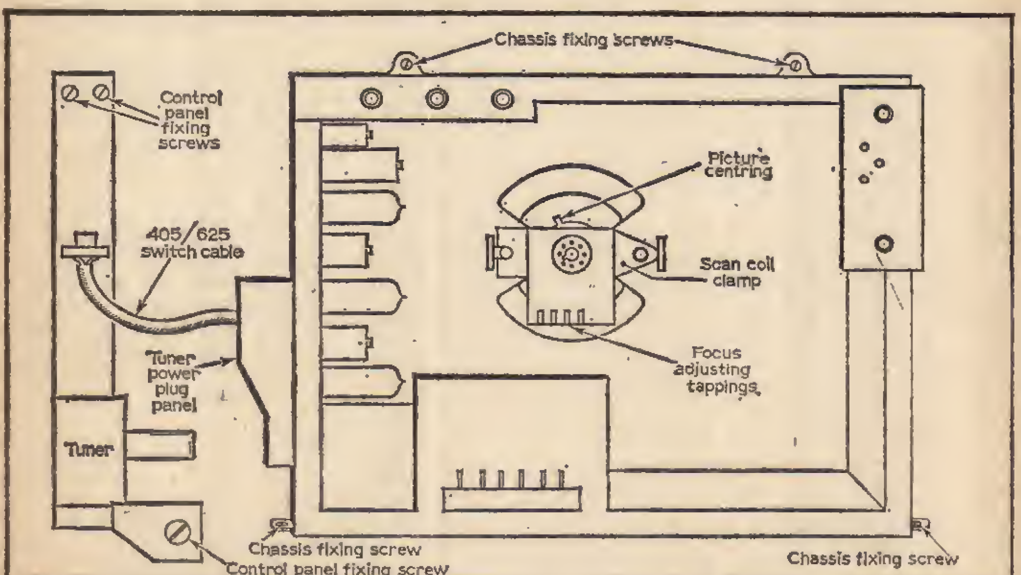


Fig. 4—A V873 series receiver viewed from the rear, showing the component layout.

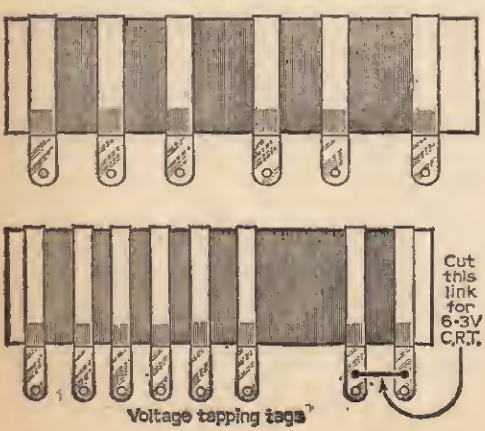
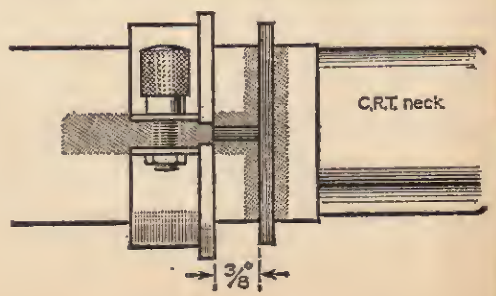


Fig. 5 (left)—The mains resistors of the V600 and V700 models.

Fig. 6 (below)—Showing the correct adjustment of the line linearity sleeve (where fitted).



INDEX FOR PART 4

Model	Chassis Removal	Tube Removal	Notes	Specification	C.R. Tube
V350	V350	V350		14" P.	CME141
V410	V410	V410	1 & 2	17" T.	CME1702
V410K	V410	V410	1 & 2	17" L.	CME1702
V410C	V410C	V410	2	17" C.	CME1702
V420	V410	V410	1, 2 & 3	21" T.	CME2101
V420K	V410	V410	1, 2 & 3	21" L.	CME2101
V430	V410	V410	1 & 2	17" T. v.h.f.	CME1702
V430C	V410C	V410	2	17" C. v.h.f.	CME1702
V430K	V410	V410	1 & 2	17" L. v.h.f.	CME1702
V430D	V410C	V410	2	17" C. v.h.f.	CME1702
V440	V410	V410	1, 2 & 3	21" T. v.h.f.	CME2101
V440D	V410C	V410	2 & 3	21" C. v.h.f.	CME2101
V470	V410	V470	2	17" P. (Rexine)	CME1705
V470W	V410	V470	2	V470 with wood finish	CME1705
V470WA	V410	V470	2	F. version of V470W	CME1705
V480	V480	V480		21" T. (Rexine)	CME2101 (early) CME2104 (late)
V490	V480	V480		21" T. (Wood)	CME2104
V500	V410	V470		17" T.	CME1705
V510	V410	V470	1	17" T.	CME1705
V519	V410	V410	4	19" T.	CME1901
V520	V480	V480		21" T.	CME2104
V530	V410	V410	1 & 4	17" T. v.h.f.	CME1705
V530D	V410C	V410	4 & 5	17" C. v.h.f.	CME1705
V530C	V530C	V530C		17" C. v.h.f.	CME1705
V539	V410	V410	4	19" T.	CME1901
V539B	V410	V410	4	19" T.	CME1901
V540	V480	V480		21" T. v.h.f.	CME2101
V540D	V410C	V410		21" C. v.h.f.	CME2101
V649D	V410C	V410	4 & 5	19" C. v.h.f.	CME1901
V653X	V659	V659		23" T.	CME2301
V653XA	V659	V659		23" T. F.	CME2301
V659	V659	V659		19" T.	CME1901
V659A	V659	V659		19" T. F.	CME1901
V659X	V659	V659		19" T.	CME1901
V659XA	V659	V659		19" T. F.	CME1901
V659XS	V659	V659	6	19" T. R./C.	CME1901
V683X	V659	V659		23" T. v.h.f.	CME2301
V683XDS	V659	V659	6	23" C. R./C. v.h.f.	CME2301
V689	V659	V659		19" T. v.h.f.	CME1901
V689X	V659	V659		19" T. v.h.f.	CME1901
V739	V659	V659		19" T.	CME1903
V739A	V659	V659		19" T. F.	CME1903
V753	V659	V659		23" T.	CME2301
V753A	V659	V659		23" T. F.	CME2301
V759	V659	V659		19" T.	CME1901 or CME1903
V759A	V659	V659		19" T. F.	CME1901 or CME1903
V849	V849	V849		19" T.	AW47/91
V873	V849	V849		23" T.	CME2303
V879	V849	V849		19" T.	AW47/91

Key to model identification: C.=Console, F.=Fringe Model, L.=with legs, P.=Portable, R./C.=Remote Control, T.=Table model, v.h.f.=Band II f.m. radio.

NOTE ON CONVERTIBILITY

All receivers in the V600 Range suffixed "X", and all receivers in the V700 range are convertible to 625, by the addition of a plinth containing the tuner and i.f. strip, which fits below the cabinet.

V800 series receivers are 625-ready, and require only the u.h.f. tuner kit for conversion.

left of the scancoil clamp, and with the adjusting ring ⅜in. away from the back of the scancoil moulding.

V849 Chassis and Tube Removal—Provisional

Remove back, pull off volume knob, and release control panel (two small screws at the top, and one large one at the bottom rear). Unplug scancoil leads at chassis end, disconnect tube base, e.h.t. connection and loudspeaker leads. Remove two screws at top of chassis and two more at bottom corners. Chassis will withdraw complete.

Lay cabinet face down, release two large screws at top of tube cradle and two more beneath the cabinet. Remove tube and cradle, remove scancoils. Measure distance from clamping band to front face of tube before releasing clamping band.

Note 1

When re-boxing, leave the loudspeaker lid open. This will ensure that the on/off switch lever engages the slider on the chassis.

Note 2

Picture positioning is accomplished by means of two concentric magnets behind the deflector coils. On 90° models, these are rotated by a small knurled spindle which is moved in or out to engage with each ring in turn. On 110° models a slotted lug is provided on each magnetic disc so that it may be rotated by a screwdriver.

Picture tilt is adjusted by moving the large aluminium disc attached to the scan coil mounting springs. Holes are drilled in the periphery to enable a screwdriver to be used. The disc should be locked after adjustment by the two 4BA screws on either side of the central pillar.

Note 3

Sometimes a steering magnet is fitted at the back of the tube neck to improve the focus and definition. This may be found to be unnecessary when a new tube is fitted.

Note 4

On later models the position of the tube in its clamp is determined by lining up the mould mask on the tube with the front edge of the clamping ring cushion.

Note 5

Remove plastic trim around c.r.t. frame before unboxing.

Note 6

If the remote control unit is fitted, the microphone must be unplugged at the same time as the loudspeaker when unboxing. On re-assembly the microphone lead must be routed clear of the filter coils to prevent instability.

Next month Part 5; British Radio Corporation models

LETTERS TO THE EDITOR

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.

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

NEW FAULTS

SIR,—I recently bought two brand-new dual-standard television sets (Peto Scott TV960) and have been presented with one or two interesting "running-in" faults, the details of which your readers may find useful as these sets have only recently appeared on the market.

The first fault was poor line linearity, the picture being cramped in the middle. This suggested (a) the booster diode had gone low emission, (b) the booster capacitor had gone low in value, (c) the operating conditions of the line output valve were incorrect due to low emission or incorrect electrode potentials or (d) incorrect line drive.

However, none of these diagnoses proved correct. After much searching, a circuit similar to the TV960 (Defiant 9A48F) was found in the Radio and TV Servicing book and it was found that the line scan coils were fed via two different capacitors, one for each line standard, and sure enough the 405-line capacitor, C470 (0·33μF), was found to be short-circuited. When this component was replaced, excellent linearity was once more obtainable.

The other fault resulted in intermittent field lock, the picture being perfectly locked for about five seconds, then rolling wildly for another five. This only happened on 625 lines and, bearing in mind that transmissions are asynchronous, I expected hum on the h.t., and when measured on an oscilloscope there were the 15V of hum. This set uses half-wave rectification and when this was temporarily replaced by a heavy-duty stabilised power supply the fault and, incidentally, bad hum bars had disappeared. I am now obtaining h.t. transformers to supply just the h.t., leaving the heaters a.c./d.c.

I hope other readers will at least find these faults interesting.—P. WALSH (Beckenham, Kent).

SIGNAL BOOSTERS

SIR,—An unusual amount of activity in one section of the TV aerial trade prompts me to ask why all the sudden fuss over aerial signal boosters? Manufacturers up and down the country are advertising signal boosters for television aerials as though they have just been invented, but in fact, as most of your readers will know, these devices have been on the market for the v.h.f. bands for a number of years.

What I think has actually happened is that transistors of suitable performance are now becoming available, so that these aerial signal boosters for u.h.f. and v.h.f. can be produced much more economically and in a much more compact form.

The advantage of a masthead amplifier, of course, is that the maximum signal available from the aerial is applied, since the signal has not been attenuated by the aerial downlead. As the transistors designed for u.h.f. operation have the edge on valves for noise performance, their introduction at the front end of the set can, in areas of reasonable signal strength, produce a very good picture, and in fringe and weak signal areas can boost an almost "unviewable" picture into something acceptable, without producing any adverse side effects such as "snow" on the picture.

Transistor masthead amplifiers are not new either. Apart from amplifying v.h.f. signals, they have been used in coaxial relay systems to get the best signal-to-noise ratio at the outset.

Many of the companies now manufacturing u.h.f. masthead amplifiers do so because—and we should realise this—the comparatively recent introduction of transistors that work adequately around the 1,000Mc/s frequency range has made it easy for them.—P. KEELING (Woodford Bridge, Essex).

HOLLAND'S TV GIANT

SIR,—I was surprised to read in the March issue of PRACTICAL TELEVISION that the television towers to be built at Emley Moor and Winter Hill would be Europe's highest. The tower in Lopik, Holland, is at least 1,263ft. high with superstructures possibly reaching a height of 1,300ft.

By the way, your DXers might like to know that the channel 27 transmitter placed at 1,182ft. on this tower, and now duplicating the channel 4 NTS-1 programmes, started carrying, on Wednesday, March 4th, a second Dutch programme to be televised several nights a week.

Contrary to expectations, reasonable reception on this channel reaches even further than the co-sited channel 4.—W. BERSSENBRUGGE (St. Niklaas, Belgium).

FRAME PULSE BAR

SIR,—I was interested to read in the March issue of PRACTICAL TELEVISION Mr. Peters' article on how to eliminate the frame pulse bar appearing near the top of a television screen. The author suggested increasing the flyback speed by reducing the frame multivibrator cathode resistor. This resistor on my home-constructed TV was already 2·5kΩ, and I overcame the problem by reducing the value of the anode discharging condenser to 0·01μF.

Hoping that this information will help other readers who have experienced similar trouble.—W. H. GODFREY (Abingdon, Berkshire).

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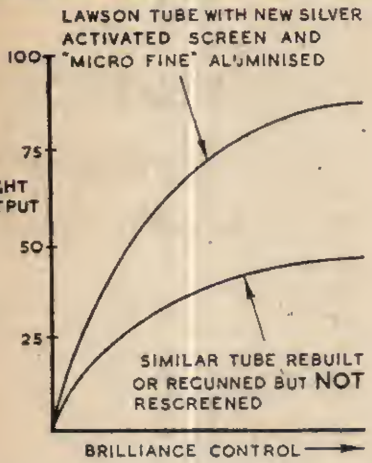

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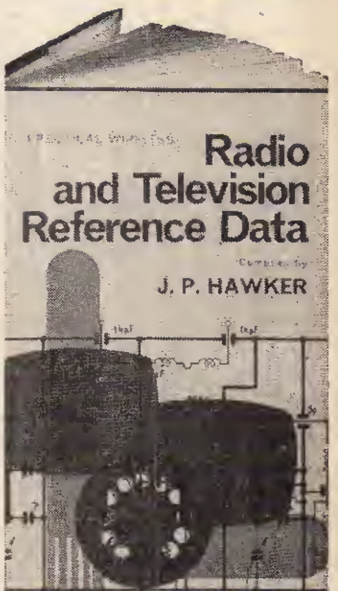

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