Practical TELEVISION

MARCH 1963

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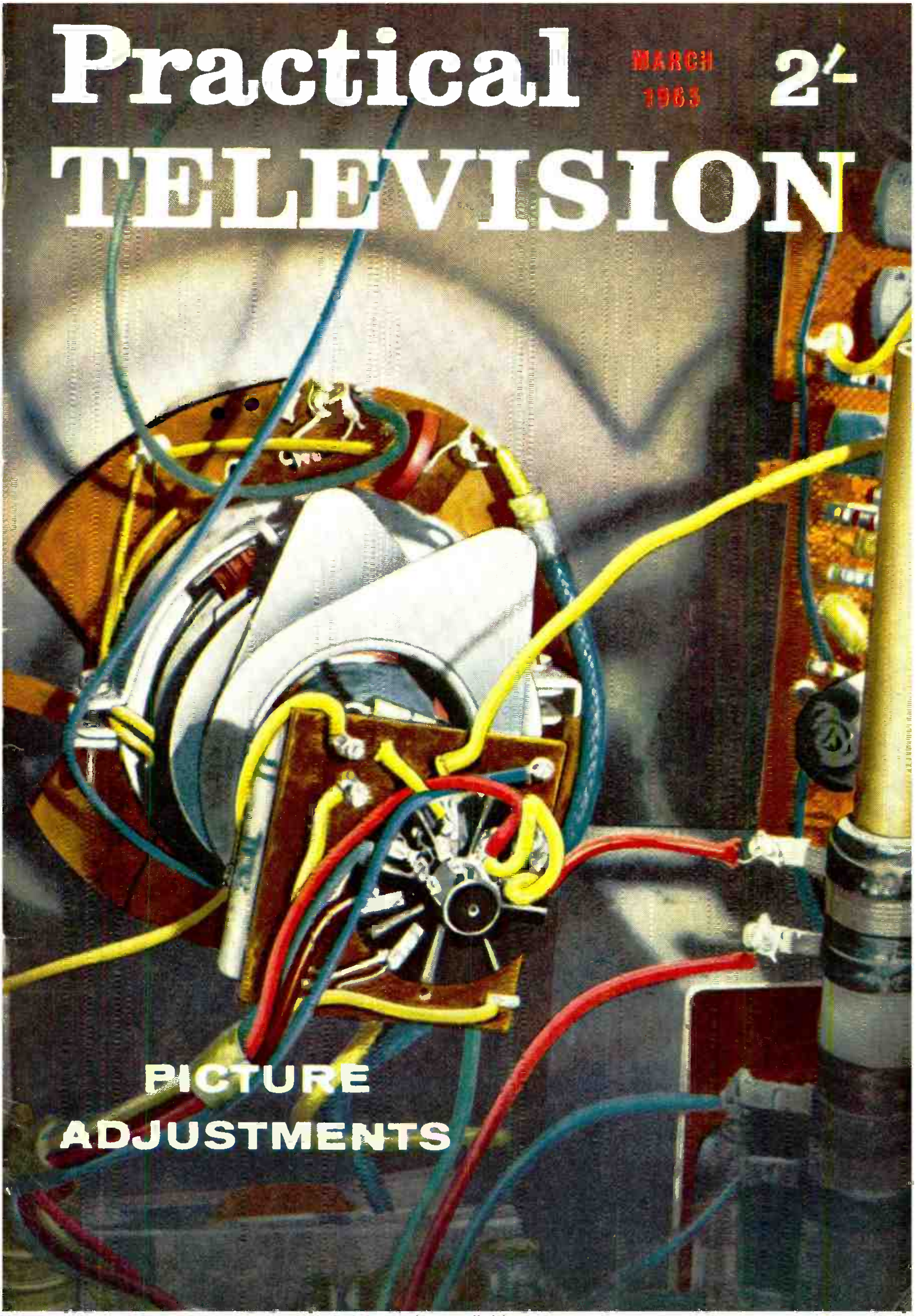

Practical Television

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Contents

How Vital are Statistics?

FOR many years, considerable amounts of time, energy and expense have been expended in trying to assess the appeal of various TV programmes and in formulating who turns to what channel at which time.

To some extent answers to these questions have been determined, but like all findings based on proportionately small random samplings, there is bound to be controversy concerning the accuracy and significance of the findings, so that while one authority challenges the figures quoted by its rival, it is, tacitly, admitting that its own figures are suspect!

However, we are at the moment more interested in another aspect of this business of programme research for which we will assume that broadly speaking the audience figures are somewhere near reality.

For the first few years of its existence, commercial television undoubtedly commanded the bigger viewing audiences. During these years its detractors grouped the people switching to the Band III channel collectively as "the admass" and considered those prefering the BBC programmes to be on a somewhat higher plane.

Since then, however, the BBC has been making steady progress in winning over (or getting back) considerable numbers of viewers so that we come to the position when the latest figures published actually claim that the BBC audience has jumped from 39 to 52% of the viewers in the past two years.

If these figures are correct, then the BBC now has a bigger viewing audience than the ITA. The boot, so to speak, is on the other foot. And this, to say the least, is most interesting and provocative!

For although fashions *do* change, it is highly unlikely that over the past two years a great multitude of viewers have undergone a fundamental cultural change. Therefore, one is led to the conclusion that if the viewing public has not materially altered its basic tastes then the programmes, or their presentation, have changed.

One point that springs to mind is this: if the trend continues, will the erstwhile detractors of commercial TV programmes now become their champions, seeing that they are in the minority, and will they condemn the BBC for putting out programmes which appeal to the "mass" audience?

These implications are, perhaps, somewhat frivolous, yet they are worth thinking about. But there is also another aspect which bears consideration: is programme planning becoming too impersonal?

Viewers are considered less as persons than as units in a set of statistics. The battle of the channels is won or lost, seemingly, by sheer weight of numbers. If a broadcasting authority estimates that 51% of all viewers switched to his particular programme this is hailed as a victory. Even assuming that the figures are correct (which they are probably not) it seems a hollow sort of victory.

Our next issue dated April, will be published on March 22nd.

Telenews

Television Receiving Licences

THE following statement shows the approximate number of Television Receiving Licences in force at the end of December, 1962, in respect of television receiving stations situated within the various Postal Regions of England, Wales, Scotland and Northern Ireland.

Region	*Total*
London	2,034,585
Home Counties	1,732,398
Midland	1,807,932
North Eastern	1,936,033
North Western	1,617,637
South Western	1,056,069
Wales and Border Counties ..	732,124
Total England and Wales	10,916,808
Scotland	1,119,824
Northern Ireland	194,355
Grand Total	12,230,987

O.B. Vehicles for New Zealand

EARLY this year a new outside broadcast vehicle was shipped to New Zealand from London. This vehicle was the third to be delivered within a year to the New Zealand Broadcasting Service and, like the other two, was made by Marconi's Wireless Telegraph Co. Ltd.

The delivery date arranged for this third vehicle made possible the use of all three units to cover the visit of H.M. the Queen in February.

Closed-circuit TV at U.S. Health Symposium

ONE of the smallest closed-circuit television cameras in the world, an EMI Electronics minicamera, linked with a powerful microscope was used to help demonstrate latest teaching methods when 100 members of faculties from medical colleges throughout the United States of America attended the recent Symposium on Medical Education and National Defence sponsored by the U.S. Public Health Service at Cincinnati, Ohio.

Delegates heard discussion by Public Health Service experts on many aspects of nuclear health and observed slides blown up on television monitor screens as they appeared under the microscope.

Tracks left by alpha particles embedded in light-sensitive emulsion, when processed into slide form, reveal emission patterns which enable scientists to identify atomic characteristics of a number of alpha active isotopes and to assess the degree of radioactivity. The minicamera television system enabled large groups to study these atomic structures with considerable clarity.

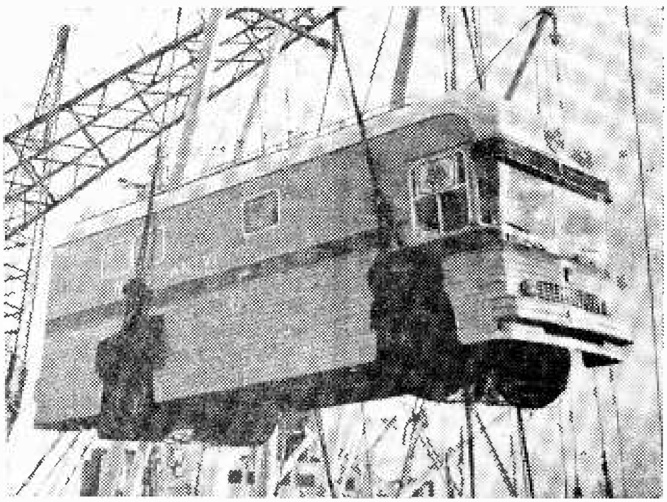
Goonhilly Contacts Relay Satellite

THE 10kW transmitter supplied by Standard Telephones and Cables Ltd. to the GPO's radio station at Goonhilly Downs came into action for the first time in January.

Television test card signals were transmitted to the Project Relay satellite and received at the Nutley, New Jersey, U.S.A., ground station of the International Telephone and Telegraph Corporation's laboratories there. The pictures received were described as "very good and extremely clear".

At the same time the ground station operated at Fucino by Telespazio, the Italian space communications agency, reported that it had received the Goonhilly transmissions very clearly. The Fucino station was also being operated for the first time.

Earlier in the month very successful transmissions were accomplished from Nutley to Goonhilly using the relay satellite.

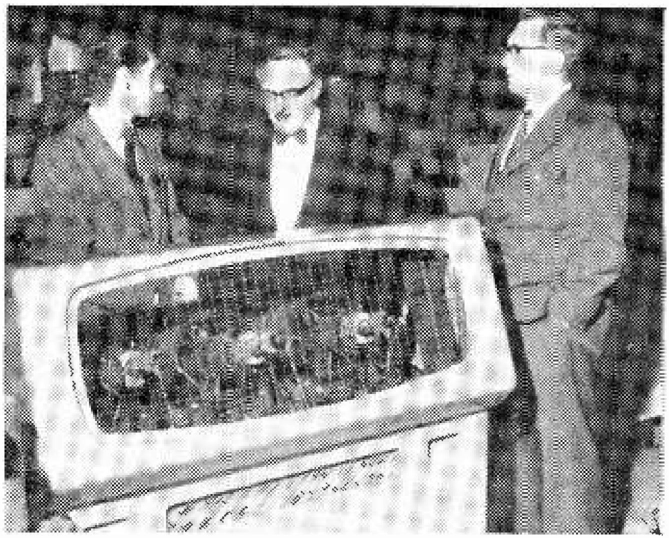


A Marconi television outside broadcast vehicle being hoisted above the Oswestry Grange at the Royal Albert Dock, London, en route for New Zealand.

Science Masters' Conference on Colour TV

MORE than a thousand science masters and mistresses in Manchester recently saw one of the biggest demonstrations of "live" colour television staged in Britain.

Using a £25,000 colour camera and two projection screens 9ft by 7ft, the demonstration was staged by the Rank Organisation at the Manchester College of Science and Technology, where delegates to the annual conference of the Science Masters' Association saw the president's address televised in colour from the main conference room to two overflow lecture theatres.



Dr. B. V. Bowden (centre) examines the Rank Cintel large screen TV equipment which was used to televise his address, in colour, at the Manchester College of Science and Technology.

Retirement of Sir Harold Bishop

THE BBC announces that Sir Harold Bishop, Director of Engineering since 1952, will retire on May 10th, 1963, the fortieth anniversary of the date on which he joined the BBC. He is the first man to complete 40 years' service with the BBC. In 1923 Sir Harold joined the British Broadcasting Co., which in 1927 became the British Broadcasting Corporation. He was Senior Superintendent Engineer from 1923 to 1929, Assistant Chief Engineer from 1929 to 1943 and Chief Engineer from 1943 to 1952, when he was appointed to his present post.

Sir Harold will be succeeded as Director of Engineering by Mr. F. C. McLean, who is at present Deputy-Director of Engineering.

Community TV for Army's Married Quarters

WAR OFFICE architects who designed the newly-constructed married quarters in the Army garrison town of Tidworth, Wiltshire, have solved the problem of unsightly rooftop aerials for radio and television reception.

As houses and flats were built the 604 married quarters were wired for community television.

Aerial arrays, supplied and erected by EMI Electronics Ltd. on a block of flats on the estate, obviate the need for the usual maze of individual rooftop arrays. From this one central receiving point signals are passed to EMI head-end equipment for the amplification of signals, which are then relayed along coaxial cable to television receivers in personnel's homes.

TV at the Boat Show

UNDERWATER television equipment was demonstrated at the International Boat Show held at Earls Court during January.

Two closed-circuit television minicameras supplied by EMI Electronics Ltd. transmitted pictures from the bottom of the Deep Lagoon. The minicameras were housed in underwater pressure cases.

A mobile camera was used by a diver moving around in the tank to televise the undersides of moored boats and demonstrations of dinghy capsize drill.

The second camera, fixed at the bottom of the tank, transmitted general pictures of the underwater scene. Visitors viewed the events on four closed-circuit television receivers.

Broadcast Vehicle Units for Belgium

THE Belgian agents of Marconi's Ltd. have received a large order for outside broadcasting vehicles from Radio-diffusion Television Belge, a considerable proportion of which will be supplied by the Marconi company.

The order comprises four complex outside broadcast units —eight vehicles in all—consisting of four technical and four programme prime movers.

Marconi's have been responsible for planning and designing all the O.B. units and are supplying all the vision equipment. The contract is particularly interesting in that all the specially designed, custom-built equipment will be designed in England and manufactured in Belgium.

The technical vehicles are to embody four Mark IV camera channels with 4½in. image orthicons manufactured by the English Electric Valve Co. Ltd. Each camera channel will be remotely controlled from its associated programme vehicle. They will be capable of operating on either 625 or 819-line standards.

BBC Morecambe Bay Relay Station

THE new BBC television relay station at Stewnor Park, near Barrow-in-Furness is now fully operational. Transmissions will continue to be radiated on Channel 3, with horizontal polarisation. Viewers who wish to take advantage of the improved service should use horizontal aerials designed for Channel 3; vertical aerials previously used for reception from Holme Moss on Channel 2 are not suitable.

SERVICING TELEVISION RECEIVERS

By L. Lawry-Johns

No. 87: PETO SCOTT 1726 and 1729

Picture Faults

The frequent complaint of good BBC but poor ITA (except in regions of high ITA signal) normally indicates a low emission PCC84 (V1). A 30L15 may be fitted to increase the sensitivity if required.

Inability to switch to a particular channel without moving the channel switch a little on either side of the proper "click" position normally indicates that the turret coil biscuit, silver-plated, studs require cleaning. It is only necessary to spring off the bottom cover of the tuner to gain access to the biscuits and the switch can be rotated to expose each section in turn for cleaning. Normally there is no need to clean or adjust the bow-spring contacts and these should not be tampered with at all unless absolutely necessary.

Another common complaint is Band I (BBC)

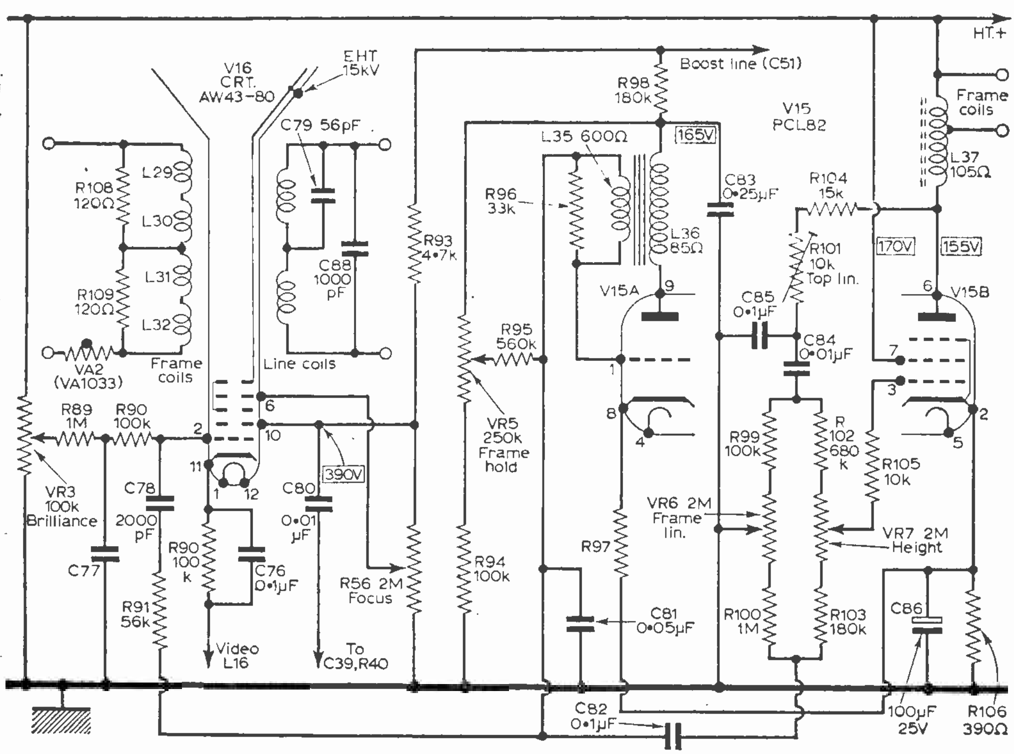


Fig. 4—The frame timebase and cathode ray tube circuits.

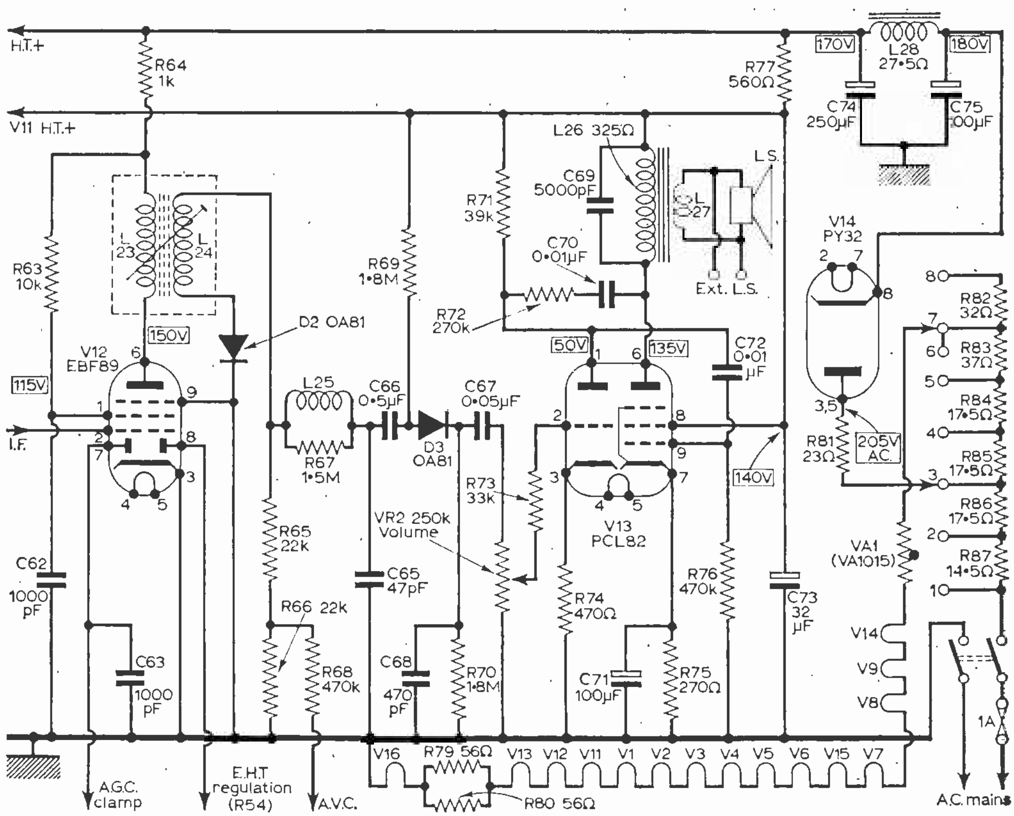


Fig. 5—The sound section and the power supply circuitry.

reception in order but no ITA Band III. This is nearly always due to a defective PCF80 (V2) and, of course, this is often the cause of no reception of either channel. In brief, if a raster is present and some indication of life can be heard from the loudspeaker, the tuner valves should always be the first to receive attention.

The a.g.c. line is fairly trouble free due to its simplicity, but if the contrast is lacking and the control has little effect check R33 (10MΩ), which feeds a standing positive bias to the contrast control.

Sound and Raster OK
No Picture

If the sound is quite normal and advancing the brilliance resolves a raster on the screen check V3, V4 and stage components. The presence of about 155V at pins 7 and 8 and 1·7V at 1 and 3 (V3, 2·5V) will indicate normal operation.

The detector diode D1 (OA80) should next be checked. This should, when disconnected, show a fairly high reading when the ohmmeter is applied with the leads to either end and a low reading when reversed. If the same reading is obtained (high or low) when the leads are reversed the diode is defective and requires replacement.

Generally an upset in the V5 stage will also upset the normal working of the brilliance due to the resulting alteration in the cathode (pin 11) voltage. Expected normal voltages are shown in Fig. 3. Deviation from these should direct attention to V5 itself (6BW7) and R27, R28, R30.

If V5 appears overheated and the raster overbrilliant check the decoupling of V3 and V4, particularly C27 and C30 (0·001µF) from pin 8 to chassis, and, if the sound is affected, the tuner decoupling.

Sound Faults

There are two sound i.f. stages, V11 (EF80) and V12 (EBF89). V11 normal voltages are 135V at pins 7 and 8 and 1·5V at pins 1 and 3. Complete absence of sound at the loudspeaker should immediately direct attention to V13, PCL83. This valve is prone to complete failure. If in the unlikely event of a replacement not restoring the sound check h.t. voltage at pin 6. If voltage is absent check at pin 8. If h.t. is present here the sound output transformer will be at fault. If the voltage is also absent here, however, check R77, 560Ω and this sub-h.t. line for shorts.

If the sound is absent but a response of some

— continued on page 249

HIGH VOLTAGE SUPPLY
FOR SMALL CATHODE RAY TUBES

by A. Sydenham

Obtaining a Final Anode Voltage from a conventional Power Unit

EXPERIMENTERS desirous of building simple oscilloscopes are faced with the problem of obtaining a suitable first anode potential without involving undue expenditure. Small diameter c.r. tubes such as the 1½in. E4103/B4 or CV320 are comparatively inexpensive and operate surprisingly well and with a sharply defined trace at a final anode potential of 500 or so volts.

Although this could hardly be described as a e.h.t. voltage it is, nevertheless, approximately twice that usually required for valve circuits and is not generally available from ordinary sources.

Fortunately such a potential can be obtained from a standard mains transformer intended for full wave rectification and with a secondary winding voltage rating of 250-0-250V. At the same time normal voltage supplies may be taken off for other uses.

Perhaps the simplest system is that shown in Fig. 1 where two separate half-wave rectification circuits operate from T1. The lower half of the transformer, T1, secondary winding associated with V1 provides a d.c. potential at X suitable for application to the normal h.t. rail of equipment, whilst at Y a d.c. potential of approximately 2X is available due to use of MR1 and the whole secondary winding.

Loads connected to either X or Y adversely affect the voltages, which fall sharply as current demands are increased. Although only negligible current is required from point Y this cannot be said of point X, where some 60mA or more might be demanded. The system is useful only where low current demands must be met and where regulation is of minor importance.

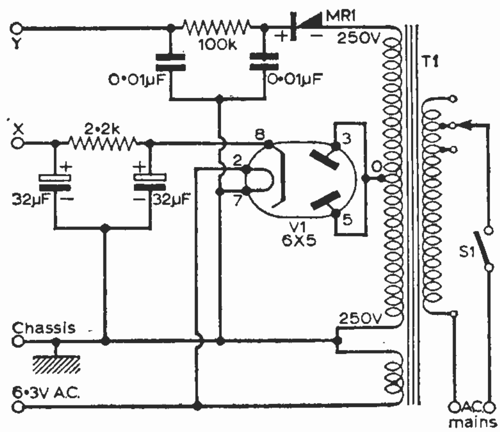


Fig. 1—Simple arrangement of two separate half-wave circuits.

COMPONENTS LIST
(For circuit of Fig. 2)

Resistors:
R1 2·2kΩ 1W — R3 100Ω, 1W
R2 100Ω, 1W — R4 100kΩ, ½W
(All 10% tolerance)

Capacitors:
C1A/B 32 x 32μF electrolytic, 350V
C2 0·01μF, 1000V
C3 0·01μF, 1000V
C4 0·1μF, 1000V

Valve: 6X5GT (or see text)

Rectifiers: K3/25 (2)

Mains Transformer:
A.C. Mains Input. Secondaries: 250-0-250V at 60mA, 6·3V at 2A

Switches: Toggle type, 250V D.C. (2)

Valve Holders: International Octal (2)

Miscellaneous:
Panel Lamp 6·3V, 0·04A and holder, lens, etc., fuse bulb, 0·15A.

Improved Arrangement

By adding a few more items to those given for Fig. 1 considerable improvements can be made. Experimenters' workshops frequently feature a mains power unit used to drive miscellaneous gear as required.

It is not usually difficult to add the few "extras" shown in Fig. 2 and here again two rectifying systems are used, these being of better design, since one—V1 and associated circuitry—operates in "full-wave rectification" mode, whilst the other —MR1, MR2, etc.—functions as a voltage doubler.

Since this circuitry together with a c.r. tube, "Y" amplifier and timebase can easily be accommodated on a chassis no larger than 8 x 4 x 2in. it will be appreciated that the "powering" items require but little space.

By fitting a suitable output socket (a standard international octal valve socket will do nicely) supplies for external gear can be made readily available. The high-voltage output will not normally be connected to the output socket.

The full-wave circuitry around V1 is conventional but it may be noted that the centre tap of T1 secondary winding is connected to chassis and via a small fuse (a torch bulb will usually suffice) which would rapidly burn out should a fault cause excessive current flow.

The actual voltage available at the output will depend upon the actual transformer used and also on the load connected. The load will, however, not have such an adverse effect here as in the circuit of Fig. 1, for the reservoir capacitor C1B gets "topped up" twice as often and the regulation is better.

The Voltage Doubler

When S2 is closed, alternating current is fed to this section, the rectifiers MR1 and MR2 being connected in such a way that they conduct in turn on the alternate half-cycles. Referring to the simplified diagram of Fig. 3 it is convenient to assume that MR1 is "open circuit" on one half-cycle, C4 being charged via MR2.

When MR2 cuts off on the next half-cycle MR1 conducts and accepts not only the supply potential but in addition that existing on C4. Virtual doubling of the supply potential from T1 thus occurs and since only a very small current—perhaps less than 1mA—is required from the high-voltage output there is no need to employ a separate transformer. One half of the normal mains transformer secondary winding may be utilised, the switch S2 being useful in that it minimises shock hazards when the normal power output socket only is in use.

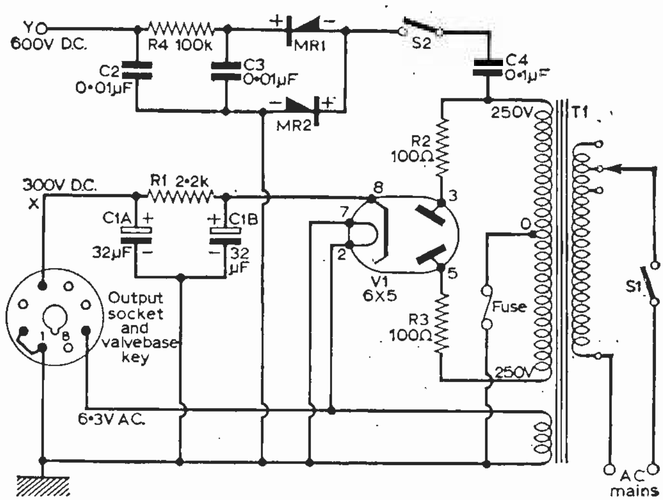
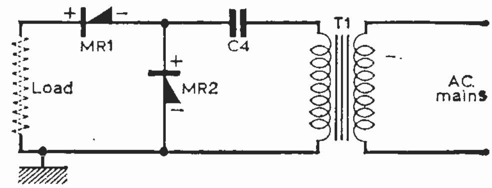


Fig. 2 (above)—An improved version of the basic arrangement, using full-wave rectification.

Fig. 3 (below)—Simplified circuit of the voltage doubler.



Conclusion

Minor problems can arise in actual construction and although a normal toggle type switch may be used for S2 it should be adequately insulated from chassis, etc. If preferred a EZ80 or EZ81 may be used in place of V1, but in this case attention must be given to the basing differences.

Any rectifier valve in which the cathode is tied to the heater must not be used in the circuitry shown unless arrangements are made to feed such a heater from a separate l.t. winding. The capacitors C2, 3, 4 must be adequately rated and a panel lamp and associated warning lens are desirable inclusions.

It should be noted that under no circumstances should a unit built along the lines suggested be run at any time with no load connected. ■

SERVICING TV RECEIVERS

—continued from page 247—

sort (soft hum) can be heard when the volume is turned up check V12 and stage voltages (Fig. 5), V11 and stages D2 and D3 in that order.

Low and Distorted Sound

Check R69 (1·8MΩ), V13, C67, C72 and R71 in that order.

Chassis Removal

Remove back cover screws (6). Remove the front knobs, which are secured by recessed grub screws. Remove the two screws from the side control panel and pass through hole in cabinet to rest on chassis. Unplug speaker leads and aerial panel. Remove two rear chassis screws from the rear flange or runner and slide out chassis and tube complete.

Failure of Power Supplies

Should the receiver appear completely dead ensure that the mains is being applied and check the 1A fuse. If this is blown fit another, switch on and observe the PY32 closely. If there is evidence of sparking inside the valve replace it. If the valves heat normally until the line timebase warms up and then the PY32 lights brightly replace the PY81, V9.

If there is no sign of the heaters warming up check the mains through the fuse—on-off switch—mains dropper VA1 thermistor (VA1015) and thence through the valve chain as depicted in Fig. 5, first V14 pins 2 and 7, V9 pins 4 and 5 and so on to the c.r.t. pins 1 and 12.

Shorted Turn Linearity Sleeve

This is on the neck of the tube and its purpose is to effect changes of line linearity when inserted or withdrawn into or from the scanning coils. This sleeve should not be pushed in too far and should not be rotated. Violent sparking sometimes results when the covering of this sleeve becomes punctured and shorts to the line scan coils, causing severe disturbance on the screen.

(Series to be continued)

The PRINCIPLES and PRACTICE of TELEVISION

By G. J. King

THE VIDEO CIRCUITS OF DUAL STANDARD RECEIVERS

(Continued from page 200 of the February issue)

PAST articles in this series have made it clear that a dual standard receiver may exist in one of three stages of development. Firstly, the true dual standard switchable set, embodying both v.h.f. and u.h.f. tuners Secondly, the true dual standard model as above but fitted only with a v.h.f. tuner, though having facilities for the simple installation of a u.h.f. tuner at a later date. And thirdly, the so-called convertible-to-switchable model. This latter as it stands is only suitable for the immediate reception of 405-line signals, and although it incorporates a standard-change "405/625" switch this is not fully wired and as it exists in circuit it may or may not change the speed of the line timebase oscillator, depending upon the exact design of the model—as detailed in last month's article.

To make the convertible-to-switchable into a true dual standard model it is first necessary to fit an extra sub-chassis or printed circuit section and wire this to the standard-change switch. Such receivers are designed to take these extras, including a u.h.f. tuner, as with the true dual standard model.

The true dual standard model has a sufficiently wide passband in the vision i.f. stages to do full justice to the higher definition CCIR signal, while the passband is reduced to suit the requirements of the 405-line signal by tuned filters which are introduced by the standard-change switch.

The convertible-to-switchable, on the other hand, has an existing vision i.f. channel which is optimised for the 405-line standard, while the extra sub-chassis or printed circuit section to be fitted is optimised for the wider passband of the 625-line signals. The circuits here follow fairly conventional practice, but while the 405-line vision i.f. section incorporates sound rejectors, the 625-line section is designed to let through a little of the f.m. sound signal along with the vision signal.

The reason for this is to allow the vision and sound carriers to beat together at the vision detector, and because the two carriers are spaced by 6Mc/s, a 6Mc/s signal is produced owing to the beat effect. This signal is called the intercarrier sound signal, and since it is frequency-modulated with the sound, as is the original sound i.f., it can be used in exactly the same manner as an ordinary sound i.f. signal. It is also amplitude-modulated with the vision signal, but this is of little consequence provided the circuits are correctly adjusted, because an f.m. sound detector is not responsive to amplitude-modulation anyway. There may also be a form of amplitude limiter in some receivers.

Extracting the Intercarrier Sound Signal

Let us first look at the basic vision detector in the condition for responding to the 405-line vision signal. This is shown in Fig. 26(a). Here the vision i.f. signal at approximately 34·5Mc/s (the "standard" i.f.) is applied to the signal grid of the final vision i.f. amplifier valve. The vision detector diode is connected in the secondary circuit of the final vision i.f. transformer, and the video signal is developed across the detector load R1. Note that R1 is connected in the positive (or cathode) circuit of the vision detector and that the negative side (or anode) of the detector is connected to chassis through the secondary of the i.f. transformer.

The conditions are thus arranged for positive-going vision modulation (waveform A), and a vision signal which rises positively from the sync pulses will occur across the detector load (waveform B).

Now look at Fig. 26(b). This is exactly the same circuit, but with the detector diode reversed with respect to the load R1. This time the load is connected to the negative (or anode) side of the diode through the secondary of the i.f. transformer, while the positive (or cathode) side is connected to the chassis through the filter choke.

Here the conditions are set for negative-going vision modulation (waveform C) so that a vision signal which *falls* positively from the sync pulses will occur across the detector load (waveform D).

In circuit (b) the final vision i.f. amplifier valve receives in addition to the vision signal at the 625-line i.f. of 39·5Mc/s the natural sound i.f. signal at 33·5Mc/s. Both of these signals are thus present at the vision detector diode and due to the non-linearity of this component the two signals are inter-modulated. This means that two more signals are created—a 6Mc/s signal equal to the difference between the sound and vision i.f.'s and a 73Mc/s signal equal to the sum of the sound and vision i.f.'s.

The original i.f. signals and the sum signal are filtered out of the detector circuit by means of r.f. chokes and filter capacitors so that all that remains

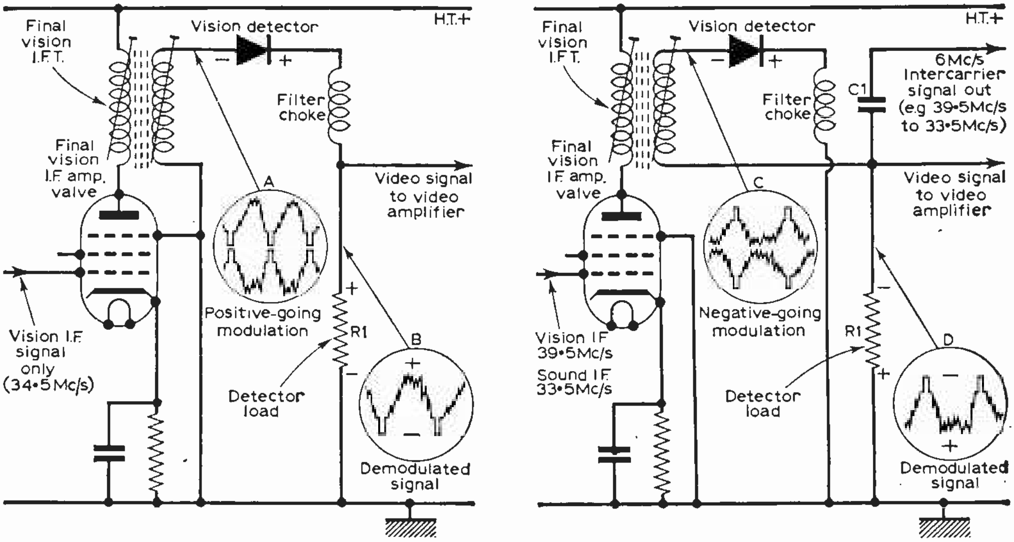


Fig. 26—The vision detector at (a) for 405-line positive-going modulation and at (b) for 625-line negative-going modulation. The positive- and negative-going modulation are shown at waveforms A and C respectively, while waveforms B and D reveal the demodulated signals. Note the sense of polarity of the demodulated signals in each case. The vision and sound i.f. signals applied to the signal grid of the valve in circuit (b) differ in frequency by 6 Mc/s. This produces a 6 Mc/s intercarrier signal which is fed to the 625-line sound channel through C1.

is the video signal with components extending up to 4·5 to 5Mc/s and the intercarrier sound signal at 6Mc/s. The intercarrier sound signal is conveyed to the 6Mc/s sound i.f. channel when the set is switched to 625 lines, via the coupling capacitor C1, while the video signal is fed to the control grid of the video amplifier valve in the usual manner.

Polarity Factor

At this stage we must fully understand the polarity difference between the 405 positive-going vision modulation and the 625 negative-going vision modulation. While we are exploring this we must always have in the back of our minds that the picture tube requires a negative-going video signal at its cathode, so that the beam current and scanning spot brightness rises as the signal increases negatively at the cathode (bearing in mind, of course, that a negative-going signal at the tube cathode is the same as a positive-going signal at the tube grid).

It is safe to say that all modern receivers—including the new dual standard models—are arranged so that the video signal at the anode of the video amplifier valve is applied to the cathode of the picture tube and *not* to the grid. Thus, on both standards the video amplifier valve must receive a positive-going video signal at its control grid, since the natural phase reversal of the valve will give rise to a negative-going signal at the anode.

With this in mind, therefore, whatever else happens the detector must produce a positive-going picture signal. Now, with the 405-line system the vision carrier is modulated with the picture information so that the peaks of the modulation represent the picture signal—as shown by waveform A in Fig. 26(a). The troughs of the modulated waveform are then the sync pulses. The normal demodulation process rectifies the modulated carrier and produces one half of the modulated waveform relative to the base of the sync pulses, so that the signal rises from zero modulation at the base of the sync pulses to a maximum value as determined by the white content of the picture information.

But as the picture information must rise positively the positive side of the vision detector is connected direct to the detector load resistor R1, thereby ending up with the required signal for feeding to the video amplifier valve grid, as shown by waveform B.

Inverted Waveform

On the CCIR 625-line system the vision carrier is modulated with the picture information so that the troughs of the modulation represent the picture signal and the peaks represent the sync pulses. Thus, following demodulation the waveform is inverted with the sync pulses at the top and the picture signal at the bottom. If the circuit at Fig. 26(a) were used with such a signal the polarity would be wrong for feeding to the video amplifier valve. The signal would, in fact, rise positively from the peaks of the picture information to the tips of the sync pulses; or in other words, the picture signal would rise *negatively* from the base of the sync pulses—the opposite of the 405-line signal. This would really cause trouble, for then the video amplifier would receive a negative-going picture signal at its control grid and produce a positive-going picture signal at its anode. The picture tube cathode would be swung positively on white signals (e.g., negatively on white signals at the tube grid) and instead of the scanning spot becoming brighter with increase in brightness of the picture elements it would become darker! The reproduced picture would, in fact, appear as a negative—with the blacks white and the whites black. Synchronising would also be affected.

This problem is overcome simply by reversing the diode of the 625-line system, so we end up with the same waveform but with a reversal of polarity—waveform D. Now, so far as the video amplifier control grid is concerned, this electrode " sees " on both systems a positive picture signal (in terms of absolute polarity), but on the 625-line system its signal is rising *less* positive towards the tips of the sync pulses, as distinct from rising *more* positive towards the peaks of the picture information on the 405-line system.

This is the same as saying that minimum picture modulation depth on the 405-line system produces a minimum (black level) signal *voltage* at the video amplifier control grid, while on the 625-line system minimum modulation depth produces a maximum (peak white) signal *voltage* at the video amplifier control grid. This reversal of *drive* is accommodated on both systems by a slight alteration to the biasing of the video amplifier valve.

Video Amplifier Biasing

Fig. 27 depicts the circuit of the video amplifier stage used in some switchable models. The basic elements of the stage are conventional, with R1 as the anode load, R2 the screen dropper, C1 the screen bypass capacitor, L1 and L2 filter chokes and/or peaking coils, R3 damping resistor to avoid ringing, R4 and R5 the cathode bias resistors and C2, C3 and C4 bypass capacitors.

The signal is applied to the control grid from the vision detector, and on the "405-line" position switch S1 is in the position illustrated. This means that the voltage dropped across R4 and R5 in series is used to bias the video amplifier valve.

L3 and L4 in series tune to 3·4Mc/s (with L4 as the controlling element) to suppress the 3·5Mc/s beat between the 405-line sound and vision i.f.'s (note here that on high definition receivers the 3·5Mc/s beat can break the scanning lines up into small dots and impair the overall horizontal definition).

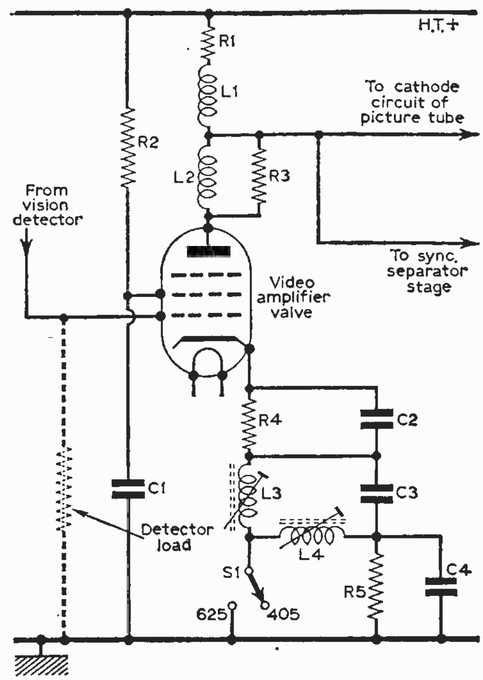


Fig. 27—Video amplifier stage used in some switchable receivers. On 405 lines the stage is biased for the positive signal drive by the voltage dropped across R4 and R5 in series, but on 625 lines the bias is reduced to cater for the negative signal drive by switch S1 short-circuiting R5.

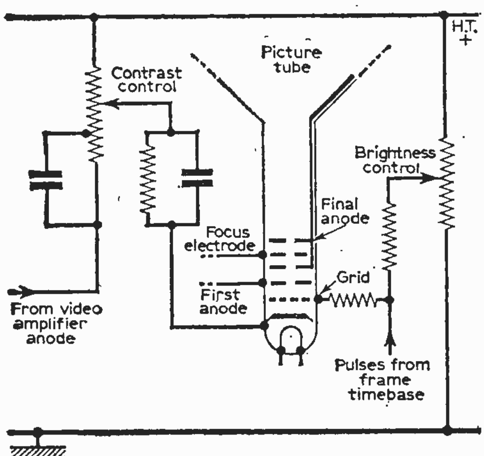


Fig. 28—The brightness and contrast controls of a switchable receiver. Note that the contrast is controlled by a "video drive" control in the cathode circuit of the picture tube. The brightness control is conventional and the flyback lines are suppressed by a signal from the frame timebase being fed into the control grid circuit.

Thus, on the 405-line standard the positive-going picture signal causes the anode current to rise and the voltage across the load R1 to fall, and in that way reflects a negative-going picture signal to the cathode of the picture tube, as we have already discussed. Note, however, that the anode current is at a minimum at signal black level, and that it rises in proportion to the rise in white signal level.

This means that the valve requires a reasonable bias to cater for the positive-going excursions of the signal. If the bias was insufficient the positive signal on the grid would cause the valve to saturate on peak white signals.

Now, on the 625-line standard S1 changes over and shorts out R5 and L4. Under this condition the valve bias is reduced since it is now proportional to the voltage dropped across R4 only. L3 remains in circuit, however, and this by itself tunes to the 6Mc/s intercarrier signal, and thus avoids interference from this source.

It is important at this stage to remember that the change of modulation and detector (from 405

— continued on page 257

PART I

405-625

The New Dual Standard Television Sets

by S. F. R. KINGSFORD

THE new dual standard receivers, whether factory-designed for immediate reception of both 405- and 625-line transmissions or dealer-converted to switchable models, are all engineered to a common pattern—that is, in addition to providing the normal 405-line functions the receivers embody circuits which supplement and/or replace certain 405-line circuits when the "standard change" switch is turned from the "405" to the "625" position.

In the "405" position all dual standard models behave exactly the same as ordinary 405-line-only models and the circuits intimated above are rendered quiescent. The way in which the 625-line circuits are brought into effect and the way in which they actually perform tend to vary a little in detail between receivers of different make and model—as do the circuits differ in detail between the various 405-line-only sets—but the requirements are ultimately satisfied in one way or another.

ELEVEN BASIC STAGES

All television receivers must have a minimum of 11 basic stages. These are given below, where it is also revealed how they are affected by a change of standard:

(i) *Tuner*—changed from v.h.f. (Bands I and III) on 405 lines to u.h.f. (Bands IV and V) on 625 lines.

(ii) *Vision i.f.'s*—passband increased from approximately 3Mc/s on 405 lines to approximately 5·5Mc/s on 625 lines. In addition the various filters and rejectors are rearranged to provide the required tailoring of the 625-line response in relation to a sound i.f. of 33·5Mc/s and a vision i.f. of 39·5Mc/s, as distinct from the normal 405-line response, where the "standard" sound and vision i.f.'s are near 38Mc/s and 34·5Mc/s respectively. Note that the 625-line response also permits the passage of the sound i.f. (at approximately 30dB below the vision signal) for inter-carrier sound (see later), while the sound rejectors on the 405-line standard eliminate the sound i.f. in the vision i.f. stages to avoid sound-on-vision interference.

(iii) *Vision detector*—switched from the normal 405-line mode to handle the reversed polarity of the 625-line signals. Note that on 405 lines the vision signal is positive going, while on 625 lines it is negative going. The detector thus has to be switchable to cater for both types of signal.

(iv) *Video amplifier*—bias changed to suit the vision signal drive from both positive- and negative-going standards. This will be described in greater detail later.

(v) *Sound i.f.'s*—designed to respond to both the 405-line sound signals centred on an i.f. of 38Mc/s and the 625-line inter-carrier sound signals at 6Mc/s. The 6Mc/s signal here is created by the 625-line sound and vision i.f. signals beating together.

(vi) *Sound detector*—switched from a.m. on 405 lines to f.m. on 625 lines, having in mind that the 405-line sound signal is amplitude modulated and the 625-line sound signal is frequency modulated.

(vii) *A.F. stages*—these are not usually altered at all, being responsive to the audio whether a.m. or f.m. derived. The a.f. is applied via a switch from either the a.m. or f.m. detector but on f.m. the signal is passed through a de-emphasis filter.

(viii) *Sync separator*—usually common to both standards but in some models flywheel line sync may be incorporated with the line timebase generator as the sync pulses are more susceptible to the impulsive interference on a negative-going picture signal than a positive-going signal. Other models may employ flywheel line sync on both standards. Note that on the 625-line system impulsive interference produces grey or black spots as opposed to the white ones of the 405-line system.

(ix) *Line timebase*—switched from 10,125c/s on 405 lines to 15,625c/s on 625 lines. The line generator often features two line hold controls, one for 405 and the other for 625. Also note the flywheel line timebase possibility in (viii). The line output stage is also switched in terms of third-harmonic tuning and loading so that optimum performance is maintained at both line frequencies.

(x) *Frame timebase*—remains the same on both standards at 50c/s.

(xi) *Power supply circuits*—are generally unaltered but switching may be adopted in the line output stage and in the first anode feed to the picture tube essentially for equalising purposes over the two standards.

BLOCK DIAGRAM

Now that we have a clear-cut and definite idea of what is actually switched it will be instructive to look at a block diagram of a typical dual standard switchable receiver. The model chosen is the Pye V700D, for it will be recalled that this firm was one of the first to introduce the true switchable models.

The block diagram is given in Fig. 1, from which will be seen that on 405 lines the v.h.f. tuner supplies signals to both the first sound i.f. amplifier V5 and the first vision i.f. amplifier V14. The vision signal passes through the second vision i.f. amplifier V15 to the vision detector V16, the output of which at the correct polarity, as determined by S4, then feeds the video amplifier V17A. The white spot limiter V17B is also associated with that stage. In accordance with normal practice the video amplifier drives the picture tube.

The sound signal at the "standard" i.f. passes through the second sound i.f. amplifier V6 and thence to the a.m. sound detector V7. The resulting audio is fed via S2 to the sound amplifier V10A and then on to the sound output stage V10B and so to the loudspeaker.

The composite picture signal is also fed to the sync separator V19B. The resulting frame sync pulses are shaped by the vertical sync interlace filter V19A before being applied to the vertical oscillator V18B. The vertical oscillator drives the vertical output stage V18A, which in turn feeds frame scanning power into the frame coils.

The line sync pulses are compared with a horizontal reference pulse in the horizontal sync discriminator V20 and the resultant output ensures that the horizontal oscillator V21 is locked to the signal. S5 alters the line timebase frequency and introduces the appropriate horizontal hold control, while the horizontal output stage V22 receives the correct signal from V21. S6 changes the characteristics of the line output stage to match the 405- or 625-line signal.

The efficiency diode V23 and the e.h.t. rectifier V24 operate in the conventional manner, as also does the h.t. rectifier V11/12. A.G.C. is applied to the sound i.f. stages on 405 lines only and to the vision stages on both standards via the overload diode V26 and the delay diode V13, the latter ensuring that the noise performance of the tuner is not impaired on weak aerial signals due to the application of unnecessary negative a.g.c. derived bias. The tuner is thus biased from the a.g.c. system only when the aerial signal exceeds a certain predetermined value.

625-LINE OPERATION

On 625 lines S1 switches out the v.h.f. tuner and introduces the u.h.f. tuner. Both sound and vision signals (at the 625-line i.f.'s) are then applied to the first vision i.f. amplifier V14. These pass in correct level—as determined by the response shape of the stages—through V15 and V16 and S4 switches the detector to suit the negative-going signal. The output is applied to the video amplifier V17A which, again, drives the picture tube in the normal manner.

S3 picks up the inter-carrier 6Mc/s beat signal (this being the difference between the sound and vision i.f.'s) and conveys it to the first sound i.f.

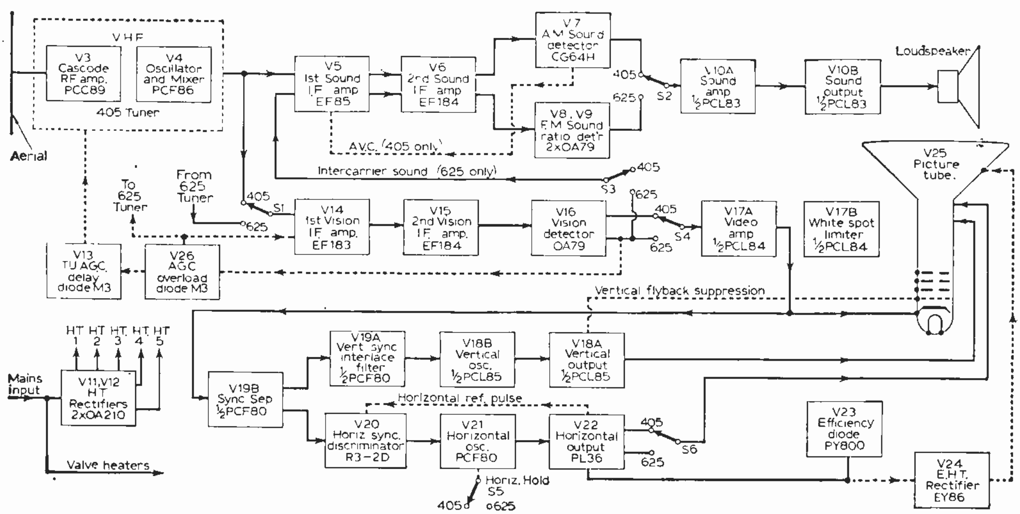


Fig. 1—Block diagram of the new Pye switchable Model V700D. Note that the stage references here correspond to those on the circuit sections.

Fig. 3—The a.f. and output stages of the Pye switchable receiver. Tags 4, 5 and 71 correspond with those so numbered in Fig. 2.

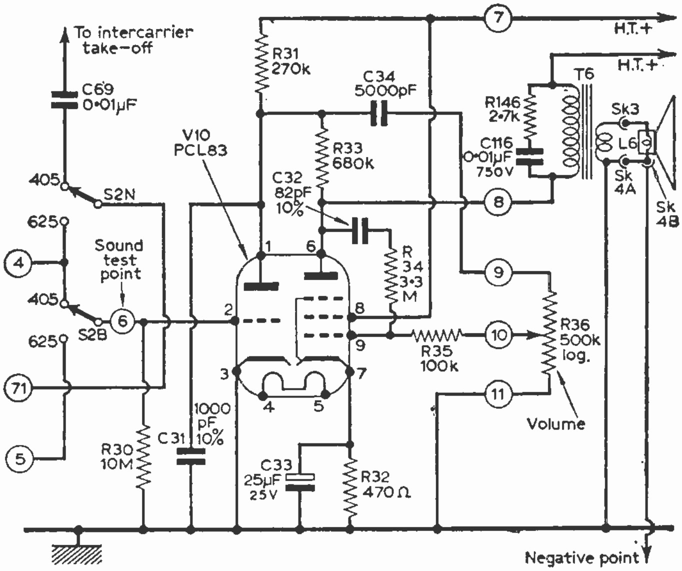
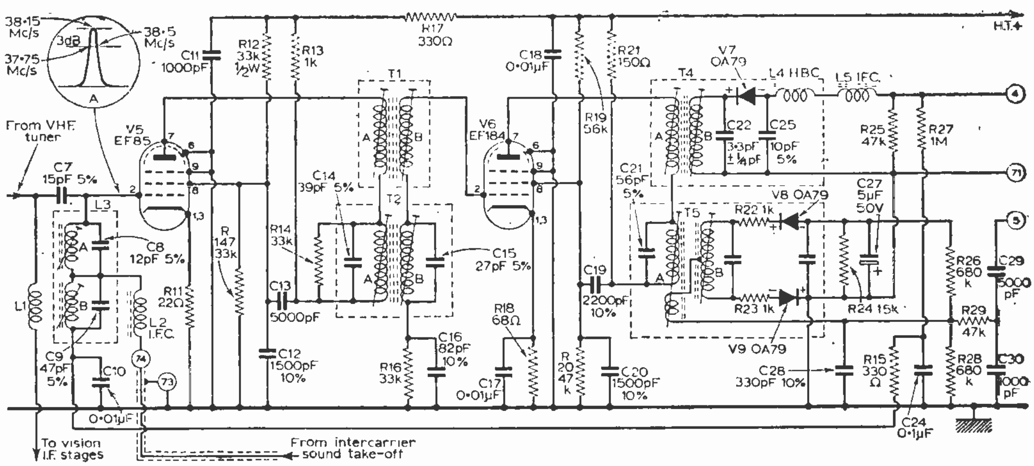


Fig. 2—The sound i.f. stages of a switchable receiver. These are designed to respond equally to the 6Mc/s 625-line inter-carrier sound signal and the 38·15Mc/s "standard" 405-line sound i.f. An ordinary a.m. detector is featured for 405 lines and a ratio detector for 625 lines. A.G.C. is applied to V5 via R27 and R15 from the a.m. detector only.



amplifier V5, from whence it is fed to V6 and to the f.m. ratio detector. S2 now selects the f.m.-derived audio and passes it to the sound amplifier and output stage, the latter driving the loudspeaker as before.

Various other things happen, as we have already seen, for example: S5 introduces the 625 horizontal hold control, S6 alters the horizontal output stage and the video amplifier biasing is modified, though this is not shown on the block diagram.

SOUND CHANNEL CIRCUIT

Fig. 2 depicts the combined 405 and 625 sound channel circuit. This is rather like the i.f. stages of an a.m.-f.m. sound receiver in that both the control grid and anode circuits are loaded with series-connected tuned windings. For example, the upper winding (that connected direct to the control grid) of L3 is tuned to the 405 sound i.f. (38·15Mc/s in this set), while the lower winding is tuned to the 625 inter-carrier signal (e.g., 6Mc/s). Similarly the upper windings of T1 are tuned to 38·15Mc/s and the lower windings to 6Mc/s.

The upper windings of T4 are connected to a conventional a.m. detector circuit with V7 as the diode, while the lower windings form a ratio detector transformer, feeding diodes V8 and V9 in an ordinary type of ratio detector circuit.

Thus it will be appreciated that the sound channel is responsive equally to a 6Mc/s f.m. signal and a 38·15Mc/s a.m. signal. The considerable difference between the two tuned frequencies avoids interaction between the various series-connected tuned windings.

The a.m. detector load is R25, giving its **a.f.**

output at tag 4, while the f.m. detector load (signal load) is C28. The signal across this reactance is fed to tag 5 via the coupling C29 and the de-emphasis network R28, R29 and C30. Tag 71 is the common earth for both signals.

The d.c. load on the ratio detector is R24 with C27 as the stabiliser. R22 and R23 assist in balancing the diode circuits under varying conditions of signal.

The response at the input to the sound channel is given at "A".

A.F. STAGES AND SWITCHING

The a.f. amplifier and sound output stage are given in the circuit section of Fig. 3. This connects up at tags 4, 5 and 71 to the circuit of Fig. 2. The switches S2N and S2B select the appropriate detector output with position "a" corresponding to 405 lines and position "b" to 625 lines.

Thus, in position "a" as illustrated the a.m.-derived audio at tag 4 is fed through S2B to the grid of the triode a.f. amplifier. At the same time S2N bypasses the inter-carrier take-off point via the earth tag 71 and C69.

In the 625-line setting (position "b") the f.m.-derived audio at tag 5 is applied to the triode grid, while the bypass on the inter-carrier take-off line is removed and the a.m. detector output is shorted to earth.

The selected audio goes through the a.f. stages in the normal way. R31 is the triode anode load and the amplified a.f. is fed to the volume control through C34, from whence it is applied to the control grid of the pentode output valve section. Negative feedback is provided by R33 and frequency-selective feedback by C32 and R34.

VISION I.F. STAGES

The circuits in Fig. 4 show the vision i.f. stages and the switched input arrangements. S2A simply switches h.t. voltage to either the v.h.f. or u.h.f. tuner (e.g., to that tuner which is in use at the time). This is accomplished by the h.t. supply being fed in at tag 12 and taken out at tag 77 via S2A. A.G.C. is applied only to the v.h.f. tuner from tag 16 (note, however, that a.g.c. is applied to the vision i.f. stages on 625 as well as 405 lines). It will be seen that the white spot limiter is removed from the h.t. circuit on 625 lines because, of course, impulsive interferences on this standard show up as grey or black spots anyway!

The 405 vision i.f. signal is applied from L1 (Fig. 2) and is fed to the input filters L8, L11 and L12. These filters help narrow the overall response to suit the 405-line signal characteristics. The signal is extracted from these filters via S2C and fed to the control grid of the first vision i.f. valve V14 through further filters L13 and L15. These provide the final touch-up of the 405-line response so that it appears as shown at "B" on the control grid of V14. The signal is coupled to the second vision i.f. amplifier V15 by L16, L17 and L18, which then gives the response as shown at "C" at the control grid of V15.

T7 and L19 couple the vision i.f. signal to the vision detector V16 and points "A" and "B" on Fig. 4 circuit couple to the corresponding points on the vision detector load and video amplifier circuit of Fig. 5. In the "405" position S2F earths point B and the video signal in correct polarity occurs across the load R72 (Fig. 4)—at point "A". This then is coupled through S2E to the control grid of the video amplifier (the pentode section of V17) via R80. The bias for the video amplifier is given by the voltage dropped across R81 and R83.

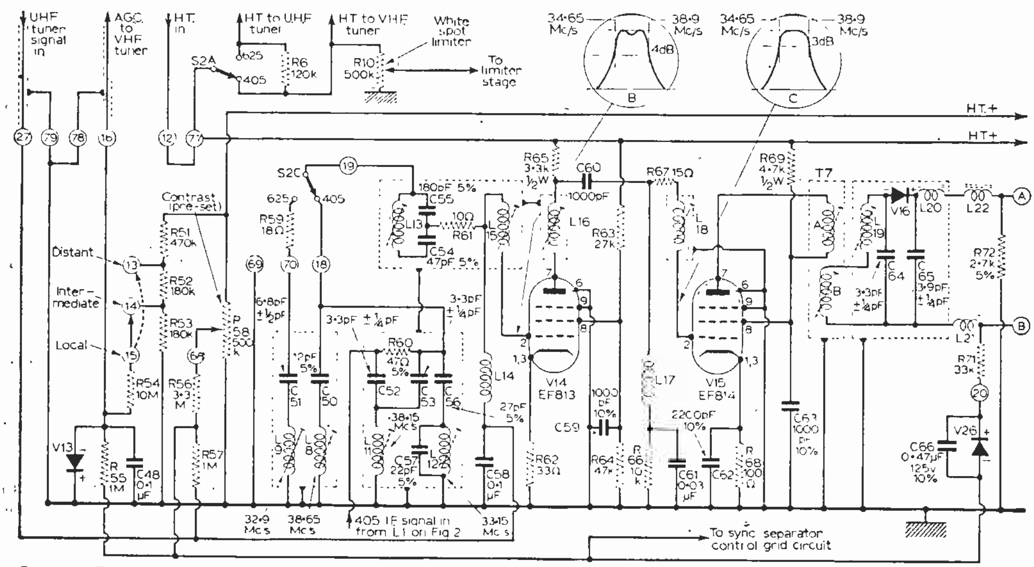


Fig. 4—The vision i.f. stages and vision detector circuit and the tuner switching arrangements. The i.f. stages are designed for the required 625-line passband and filters are switched into circuit to restrict the passband on 405 lines. The "distant", "intermediate" and "local" tappings alter the delay of diode V13.

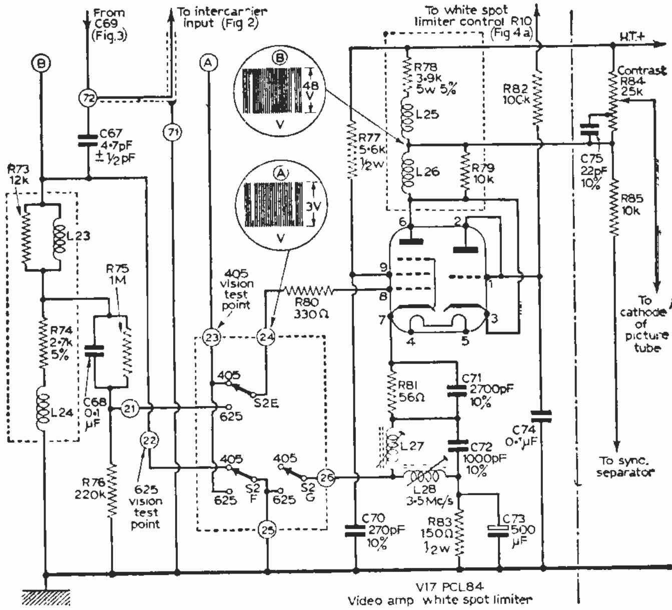


Fig. 5—Showing the vision detector "reversal" switching and the video amplifier stage. Note that the triode section of V17 is used as the white spot limiter valve on 405 lines only. Points A and B correspond with those similarly identified in Fig. 4.

Now in the "625" position the "earth" is removed from point "B" and applied instead to point "A". The detector load then comprises R74 (Fig. 5) and, after filtering by L23 and L25, the video signal is applied in reversed sense to the control grid of the video amplifier valve via S2E—which is now in position "b".

S2G also changes over and short-circuits R83, thereby modifying the video amplifier valve biasing to suit the 625-line signal. It will be seen that the 3·5Mc/s inter-carrier beat suppressor L28 is short-circuited at the same time and the 6Mc/s rejector then functions.

Other points to note here are the inter-carrier sound take-off from the output filters of the vision detector when set for 625-line operation via C67 and that the contrast control operates in the anode circuit of the video amplifier valve. Signal to the sync separate is fed from the anode of the video amplifier valve in the usual way. Waveforms A and B associated with Fig. 5 show the composite video signal at the output of the detector and at the anode of the video amplifier respectively.

The remaining circuits of the new switchable receivers will be discussed next month.

PART 2 FOLLOWS NEXT MONTH

PRINCIPLES AND PRACTICE

— continued from page 252 —

to 625) results in maximum video valve anode current at signal black level (the converse of the 405-line condition), and that the anode current decreases as the signal white level increases. Therefore a smaller bias is required to permit the valve to handle the negative *drive* of the 625-line signals.

Contrast and Brightness Controls

On both systems the tube is biased to beam current cut-off on black level, and this is accomplished in the usual manner with the brightness control connected to the grid circuit, as shown in Fig. 28. At picture black level a nominal positive voltage (relative to chassis) is present on the tube cathode from the anode of the video amplifier valve. The grid is also positive of a value which is adjustable by the brightness control. Thus, the brightness control is adjusted so that the raster just disappears. Now, when the picture has white content the voltage at the cathode of the tube falls (as also occurs, of course, at the anode of the video amplifier valve), which means that the grid rises positively with respect to the cathode, and in that way the scanning spot brightness varies in sympathy with the white elements of the original picture. The scanning function results in the formation of the picture upon the screen.

A rather interesting feature of Fig. 28, however, is that the video drive applied to the tube cathode can be adjusted, and the effect is that of a variation of picture contrast. This control is appropriately labelled "contrast", and differs somewhat from the conventional contrast control which alters the gain of the vision channel. Nevertheless, on this type of receiver the gain of the vision channel is automatically adjusted to suit the signal conditions by the automatic gain-control system in the vision channel.

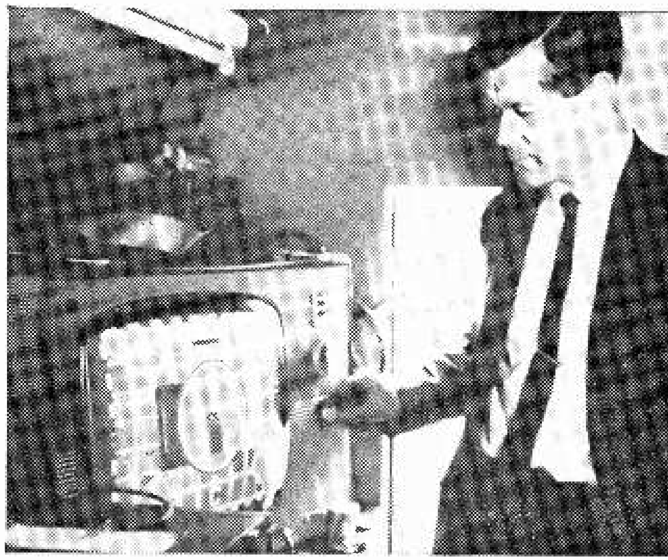
Next month we will consider further features of the dual standard receiver.

To be Continued

U.H.F. TESTS

ON BBC 625-LINE TV TRANSMISSIONS

These tests were carried out by Peter Jones, chief designer of Aerialite Ltd. to provide information on reception conditions in a wide variety of locations, many of them regarded as difficult reception areas on Band III.



This photograph, taken by the "Reading and Berkshire Chronicle" shows Mr. Jones adjusting a test card picture at Caversham, nearly 40 miles from Crystal Palace.

THE following notes were compiled from the results of experiments made on test transmissions from the BBC experimental transmitter on channel 44 (vision 655·25Mc/s, sound 661·25Mc/s) with an e.r.p. of 160kW. It should be borne in mind that power will be increased to 500kW when programmes eventually commence.

EQUIPMENT USED

Field measurements were made with the Aerialite mobile unit during the first week of operation in more than 20 locations within a radius of 25 miles from the transmitter and in some cases up to 50 miles distant. Two receivers were used: an Eddystone 770S with a Hatfield calibrated attenuator and a standard production K-B VV20 dual standard television receiver.

Tests were made with a variety of u.h.f. aerial arrays in selected locations, but for the purposes of field strength measurement, a single aerial (a type 45/11 Yagi with folded dipole and mesh reflector) was used at a height of 30ft with a fixed downlead of 50ft of fringe area coaxial cable.

This aerial, which is regarded as a typical "standard area" u.h.f. model, was sufficient to obtain good quality reception in most of the areas tested, even though it was not always possible to raise it to roof height and to clear local obstacles.

The tests very clearly confirm that transmitters coverage on u.h.f. bands is not likely to be restricted to line-of-sight paths, nor to locations situated within a radius of 10-20 miles from the transmitter.

In general, the pattern of u.h.f. reception followed that of channel 9, often of better quality and less subject to interference. In some badly screened localities, signals were proportionally below the channel 9 level but this was rare and only in low-lying parts of Luton and Sevenoaks was it impossible to resolve a picture or to reject ghost interference.

FRINGE AREAS

Good reception has been achieved at places more than 50 miles from Crystal Palace and the following are notes on some of the areas tested.

Didcot

Housing estate on flat ground at an elevation of less than 200ft a.s.l. and less than 12 miles from the Chiltern Hills rising in the signal path to more than 600ft. Quality of picture was at least equal to that of the Band III transmissions on channel 9. Distance from transmitter, 50 miles. Signal, 250μV.

Reading

Tests were made at two locations, (a) in a residential area on fairly high ground (270ft) and (b) in the town, less than 150ft. There was surprisingly little difference between the picture quality at (a) or (b), recorded signal levels being 300 and 250μV respectively. Distance, 39 miles.

Caversham

The picture was good enough to allow a press photograph to be taken and reproduced quite well in the local weekly news.

Luton

Distance, 36 miles. Reception was variable because the town is very hilly and signals in the lower areas, particularly those on the southern side, lying in the lee of hills, were very weak. Tests in residential areas south of Luton gave good picture

quality but lower down in places where ITA reception was very poor, weak u.h.f. signals were received. On a housing estate on the Hitchin Road (400ft a.s.l.) signals in excess of 1mV were received.

In the areas mentioned above, a single eleven-element array will be practicable in favourable locations but these are fringe areas and in general bigger arrays (for example, double elevens or larger multi-element Yagis) will be more frequently required.

MEDIUM FRINGE AREAS

Guildford and Godalming

At moderate elevations in these areas good pictures were obtained with very little noise at 25 and 29 miles respectively. Signal levels averaged 500μV but dropped appreciably in lower lying areas.

Aldershot

Similarly, in estates south of the town, signal levels of the order of 1mV were recorded.

In the Guildford, Godalming and Aldershot areas, standard and medium fringe aerials will suffice for recepion of full power broadcasts on u.h.f.

Dorking, Sevenoaks, Westerham

Tests were made to measure the screening effect of the North Downs, in whose shadow these places lie. Reception of somewhat noisy pictures was found possible even in Dorking (18 miles distant) while in Sevenoaks (16 miles) good reception was possible in the lower towns. There were some patches of very weak signal where local screening added to the overall effect of the hills.

At Westerham (12 miles) also in a badly screened location, good signals at 220μV level were obtained, giving good quality pictures.

Woolwich

Reception here on channel 9 is unsatisfactory because of multiple interference. In three areas of Woolwich reasonable signal levels prevailed (200-400μV) considering the very effective screening of the locality by Shooters Hill and it was found that the single eleven-element aerial was quite effective in eliminating all ghost interference. In the Woolwich area generally, u.h.f. reception seems to be more easily achieved than on channel 9.

STRONG AND MEDIUM SIGNAL AREAS

St. Albans

Distance, 26 miles. Despite local screening, excellent pictures were received free from ghosts and interference. Level 500-800μV.

Maidenhead

At Bray (27 miles) on low-lying but unscreened ground, signal levels in excess of 4mV were received and it became necessary to attenuate the receiver to prevent overloading.

Leatherhead

Here (14 miles) signal level was above 1mV and ghost rejections from gasometer and overhead pylons was excellent.

N.W. London

In Kentish Town, in a heavily built-up area (10 miles) extremely strong signal levels of 6mV were recorded. But at Golders Green (12 miles) the level was only 200μV. Golders Green is badly screened by Hampstead Heath and is a difficult area on channel 9. U.H.F. reception was quite reasonable and subject to less interference and ghosting than the channel 9 transmissions.

AERIAL SITING

Tests made to determine the effect of aerial position and siting on received signal levels confirmed very positively that large variations in level will occur with small aerial movements of less than 1ft in places where standing wave fields are prevalent.

This is particularly likely where fascial mounted aerials are in use or where aerials are in close proximity to other aerials or to wall surfaces, roofts, etc. The differences in level amounted to 6-9dB in the worst places tested and they indicate the great importance of site-probing in any other than strong signal areas.

Aerial siting at u.h.f. requires much closer attention to be given to the accurate directing of arrays towards the transmitter. The acceptance angle in the horizontal plane of the 45/11 aerial used is less than 25° and very small angular movements are sufficient to affect the response significantly.

The practice of vertical stacking for double arrays is to be recommended to avoid the narrowing of response angle which would accompany horizontal stacking.

During the test period, signals were frequently interrupted and varied both in regard to picture content and power level. The signal levels quoted are based on Test Card C modulation, but it was not always possible to estimate whether the transmitter was operating on full power (160kW) or on reduced power, since a wide range of different power levels were being used from hour to hour.

Because of this variation, some of the lower quoted signal levels may be improved when consistent transmissions are being made.

At some locations, the main transmitter was obviously not powered while tests were being made. It was possible, however, to receive a signal from the transmitter drive circuits whose power was obviously leaking through to the aerial. These very low power signals were received at Baldock (40 miles) and at Stevenage (35 miles), indicating that reception is quite likely to be satisfactory in these areas, though it is not possible to quote full power signal levels. ■

UNDERNEATH THE DIPOLE

A MONTHLY COMMENTARY

BY ICONOS

BEFORE the advent of commercial television, the British radio and television industry made steady and not very spectacular progress. The pace was set by the BBC as a monopoly in the technical means of broadcasting, entertainment, instruction and public information. Artistic and technical developments were adequate, if rather slow. Everybody knew what was going to happen, both inside and outside the radio industry. The enormous power and funds of the BBC enabled it to inaugurate the first public television service in the world, without their engineers or producers developing high blood pressure in the effort! At least, not many of them! Everything was taken in its stride.

Colour Standards

In 1936, the interlaced 405-line standard adopted for television seemed well in advance of anything else in the world. After the war, it still seemed to have many advantages, and the equipment was all ready and there had been a ten-year guarantee to viewers of the continuance of this standard. I know that it is easy to be wise after the event, but what a lot of grief and pain, trouble and expense would have been avoided if the pause after the war had been longer and some kind of television common market had then been established with the other countries of Europe, including line standards.

With only about 50,000 owners of pre-war television sets to consider, the Government of the time could easily have compensated owners of pre-war television sets in order to opt out of the existing British Standards. America adopted the 525-line 60 fields interlaced standard, which was more appropriate for their 60 cycle electricity mains supply. And later on, after several international conferences, countries in Europe adopted the 625-line 50 fields standard, which was suitable for a 50 cycle mains supply. Meanwhile, we were "fixed" on the 405 lines.

The same situation mustn't arise again, which might happen if Britain decided to "go it alone" in colour TV. It will be the best possible insurance policy for the future if the BBC colour tests carry on for a long time yet. However, I think that the BBC is unlikely to repeat the impulsive action of establishing its own standards unilaterally. Let us hope that the engineers will not allow themselves to be panicked into making decisions which might be out of step with the rest of the world.

Artistic Progress

On the artistic or so-called creative side, progress has accelerated enormously since commercial television started in this country. American forms of presentation, informality and possibly standards of taste have been injected not only into ITV programmes but into the staid, safe and (in some programmes) slightly amateurish style formerly favoured by the BBC. The boot is now on the other foot, with a powerful ITA keeping the commercial programme companies to heel, while the BBC drops its dignity and breaks the old unwritten rules. In so doing, it has broken new ground and titivated the jaded appetites of viewers satisfied with routine programmes.

Standards of tastes now have to be considered. The late Saturday night show, "That Was The Week That Was", has aroused many viewers to write or telephone praise or anger at the satirical content of this programme, which sneers at the monarchy, the church and many individuals and organisations. Satire doesn't go down very well with the masses, though it may be highly successful in a smart night-club cabaret with an audience who have dined well, if not wisely. Satire which gently pulls a few legs, like the goon programmes with Michael Bentine, Peter Sellers or Peter Jones, have warmth behind the craziness. Satire which is rude, crude and often based on inaccuracies is intolerable. Attacking individuals who are unable to reply is sadistic. I think it highly unlikely that a programme like "TWTWTW" would be permitted on ITV.—What's gone wrong with the BBC?

Sound with (or without) Vision

It is delightful to have both "Steptoe and Son" and Tony Hancock back again with us. The famous rag-and-bone firm has marked a new high in situation character comedy, and the extremely good actor Harry H. Corbett, who plays Harold, well deserves the tributes and awards that are coming to him.

The sound of some of the earlier "Steptoe" programmes has been transferred to discs, and these are achieving great popularity. Hearing one of these long-playing records, I was impressed more than ever with the superb timing of the dialogue between father and son. Both actors are superb, but without the aid of vision it seemed to me that Wilfrid Brambell, who plays the father, came over as a slightly better performance than son Harold. Whichever way you hear it, however, with or without the aid of the television picture, it is a classic, a first rate example of team work with script, direction, settings, camera work, and sound all making their contribution to a show which can be repeatedly replayed without boring viewers.

Tony Hancock, too, is very well served by script, supporting players and direction. But somehow I have a nostalgic feeling about the earlier Hancock series, in which Sidney James was his foil. Sidney now has his own programme, which is excellent, though not reaching the heights achieved in the most famous partnership in television comedy —'Ancock and Sid.

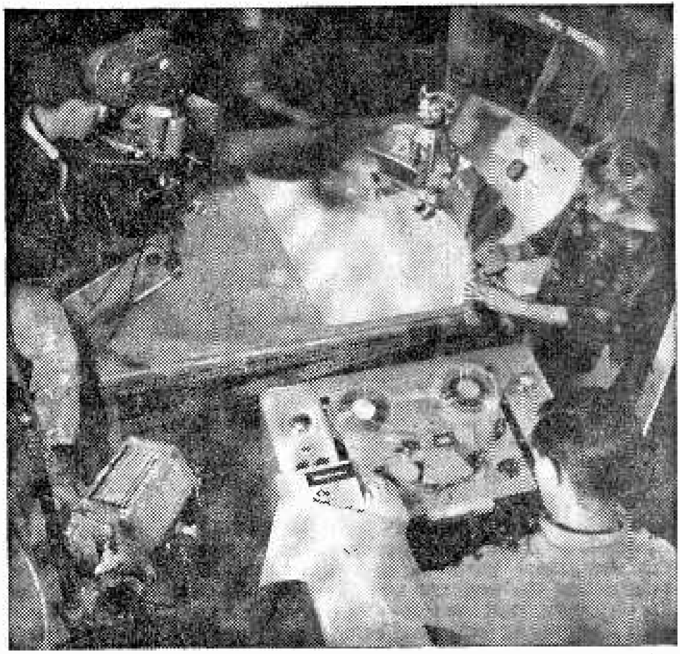
Sound Perspective

Miming of artists to play-back of musical numbers is a production subterfuge that has long been used in film studios. A vocalist will sing with a full orchestra or, alternatively, with a "quiet piano" backing, to which a full orchestral accompaniment will be added later. The resultant sound on disc, film or tape is played back when the musical scene is photographed. Thus, a first-class musical balance is achieved, and the camera has the freedom to photograph numerous shots from all angles and distances—the sound for which is always in perfect synchronism.

In films for the cinema, some directors take a great deal of trouble to create the illusion that the sound is "real"—that it was taken at the same time as the picture. Obviously, with a musical number being performed in a street or other exterior location, this method requires rather special treatment. A main requirement is that the miming of singing should not be merely the opening and closing of mouths without uttering a sound. The artist who is photographed may have to mime to someone else's voice, which sometimes makes things more difficult. He must sing out, even if he sings out of tune, to get the appearance of the correct breathing and movements in the picture.

On television, the BBC made early experiments with miming opera to play-back, which were partially successful. Here, the fault at that time was a lack of appreciation of the need for matching the perspective of sound to the perspective of picture. This has now been overcome to a large extent, thanks to various artificial echo devices which can be varied in accordance with the distance of the artist from the camera, and the type of setting.

The newest sound mixers made by the television equipment manufacturers are of a most advanced and complex character, with dozens of microphone inputs and a variety of types of echo. There are mechanical and electrical delay devices for creating echo or reverberation in addition to the straightforward echo room, first used by the BBC at Savoy Hill.



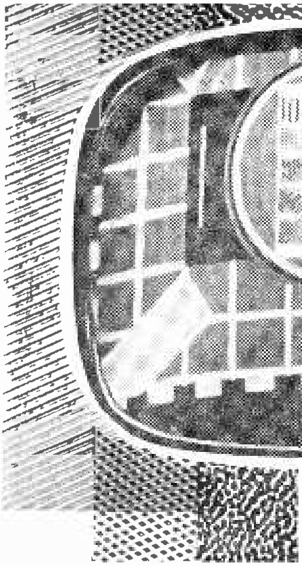
A production team shooting an episode of the popular children's series Fireball XL5 at A. P. Films, Ltd. Special electronic synchronisation for character voices (super marionation) is achieved by using E.M.I. TR90 tape recorders and special electronic lip movement equipment. All the characters' voices are recorded and then played back in conjunction with electronic mouth movement. The voices are transferred to 35 mm film and the tapes replayed to maintain quality and avoid variation in sound.

Second Programme Costs

Alarming reports have been in circulation of the astronomical costs that would be incurred by the establishment of a second BBC programme. One Press report stated that the licence fee would have to increase to £9 per set, to cover sound radio and two BBC TV programmes, plus the "free" ITV programmes. If this estimate is true, then the major increase will probably be attributable to fantastic cost of equipment and operating colour television. It must be remembered that the adaptation and equipping for colour of an existing medium size black-and-white television stage will be of the order of £100,000 in capital equipment alone. Engineering operation costs are also very much higher than for black-and-white TV.

A much more economical method to transmitting colour television is to use a motion picture camera and colour film. The resultant negative or a print from that negative can then be played-off on a high-quality colour telecine machine.

There are now methods of running film cameras in the same way as TV cameras, switching them on and off on a vision mixer, with the director looking at a group of monitors, which pick up a picture from so-called electronic view-finders. These are really vidicon cameras patched on the side of the film camera and picking up exactly the same picture that is being filmed via a beam splitter. Consistency of colour balance between cameras is much easier to maintain or correct by using film. This system is in use for black-and-white recording of films for television in several German and Italian studios.



Picture

Part I

UNDERSTANDING AND USING YOUR PRE-SET CONTROLS

A PICTURE tube can be considered as an electronic combination of a projector and a screen; the component parts in and round the neck representing the projector and the phosphor coating on the inside of the face representing the screen, with electrons in a vacuum being used instead of ordinary light.

It is not proposed to delve deeply into the theory of the picture tube, but one or two basic things must be understood before we can deal intelligently with the problems of picture adjustment.

THE GUN

The electrodes in the neck of the tube form an assembly called an "electron gun" which, as its name implies, shoots electrons at a high velocity at the phosphor coating on the screen. The electrons are produced in exactly the same manner as in a thermionic valve: that is, they are emitted from a cathode whose temperature is raised by a heater.

The cathode is coated with a special material which encourages electron emission, and it often helps to visualise electrons "boiling off" the cathode when it is heated. Electrons are minute, negatively-charged particles which are highly attracted to an opposite-positive-potential. However, if there is nothing positively charged in proximity to the cathode, the "boiled off" electrons return again to the cathode, as shown in Fig. 1.

Now, the gun assembly—which may be a triode, tetrode or pentode—contains cylinders through which the electrons can pass, and these electrodes are given a positive potential so as to attract the electrons from the cathode. The idea is shown in Fig. 2. Here is the basic gun assembly of a tetrode tube. We have the heater in the cathode, the latter which is surrounded by the grid, followed by the first and second anodes. The first anode is given a potential of between 300 and 500V, while the second anode (sometimes called the final anode) is taken up to as high as 18kV positive.

These positive values—especially the highly positive final anode—cause the electrons to become greatly accelerated so that they leave the final anode at very high speed, and are thus directed towards the screen of the tube.

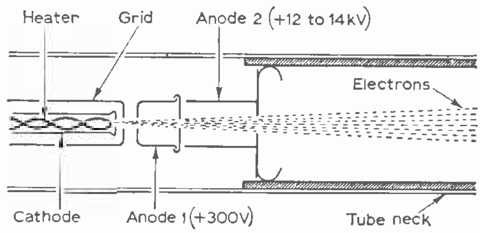


Fig. 2—This diagram illustrates the electron gun assembly of a tetrode picture tube.

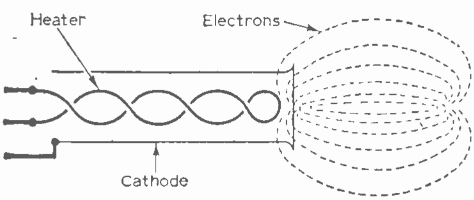


Fig. 1—When heated by the heater the specially coated cathode produces electrons which fall back to the cathode if not attracted by a positively charged anode.

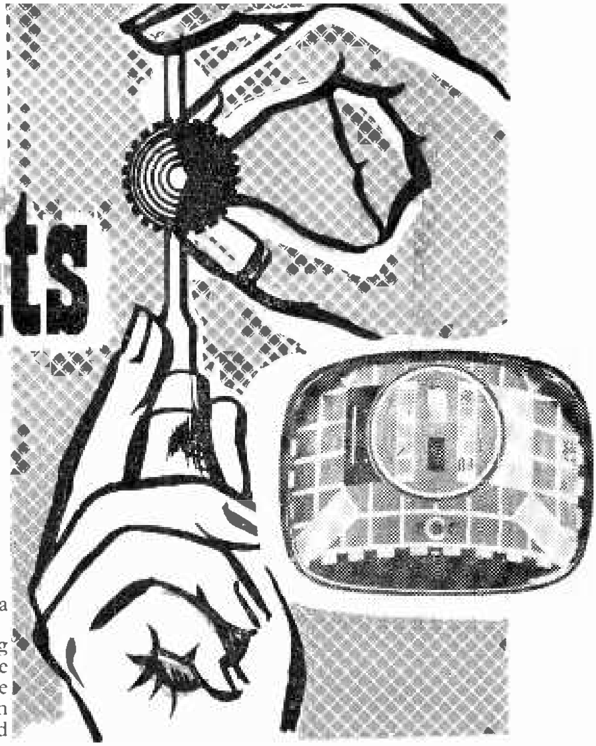
FLUORESCENCE

When the high-speed electrons hit the screen phosphors, energy is released from them since, even though extremely small, they possess mass and mass accelerated leads to kinetic energy. The sudden release of such energy causes the screen phosphors to fluoresce, and a bright glow is visible from the front of the screen.

This glow is the embryo of the scanning spot, but before it develops into a practical spot the beam of electrons has to be focused to a sharp point on the screen, as shown in Fig. 3. The focusing is either achieved by a magnetic field or by electrostatic means, but in each case, the end result is the same

djustments

by T. S. Smith



and the beam of electrons converge to a point of focus on the fluorescent screen.

A magnetic field can be used for focusing the electron beam because electrons are deflected by a magnetic field in rather the same way as they are deflected by an electrostatic field (e.g., electrically charged bodies). The movement of electrons is, indeed, the same as a flow of current and the same attraction and repulsion relative to a magnetic field occurs whether the electrons are conveyed through a conductor or accelerated through a vacuum.

Thus, Fig. 3 shows that the electrons in the beam undergo a twisting force as they pass through the magnetic field, and it is that action which results in their focus.

THE GRID

There are two more things that we should look into, and one of them is the grid (see Fig. 2). This acts in the same way as the grid in a thermionic valve, and serves as a "tap" for adjusting the *density* of the electrons in the beam and hence the the brightness of the scanning spot on the screen.

The grid is connected to a source of adjustable *negative* potential via the brightness control, and the more negative it is made, the more it repels the electrons from the cathode and the smaller the quantity of electrons that pass into the accelerating field of the anodes.

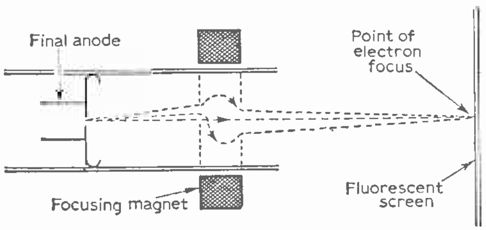


Fig. 3—The electron beam is brought to a point of focus at the fluorescent screen either by a magnetic or electrostatic field. This diagram shows the twisting effect imparted to the electrons by a magnetic focusing field.

E.H.T. VOLTAGE

The remaining important factor is the e.h.t. voltage applied to the final anode. The degree of acceleration given to the electrons depends upon the value of this voltage—the greater it is, the greater the acceleration. To a certain limit, the brightness of the scanning spot also depends upon the e.h.t. voltage; but—more important—as the e.h.t. voltage is increased so the electron beam becomes effectively "stiffer", and thus requires a greater electrostatic or magnetic field for beam focus and, similarly, a greater magnetic field for scanning.

Modern picture tubes employ electromagnetic means for vertical and horizontal deflection of the spot, these taking the form of the line and frame scanning coils which are mounted on the neck of the tube and energised by suitable current waveforms from the line and frame timebases.

The scanning spot is deflected so that a synchronised raster of 405 or 625 lines appears on the screen; and upon the raster the picture is built due to instantaneous changes in the brightness of the spot of light as it traces out the lines of the raster. The changes in spot brightness are incited by the picture signal which operates between the grid and cathode of the tube.

PICTURE TILT

Having in mind the basic factors leading to the formation of the picture on the screen, we shall be able to appreciate the various adjustments now to be described. As the raster is effectively controlled

continued over

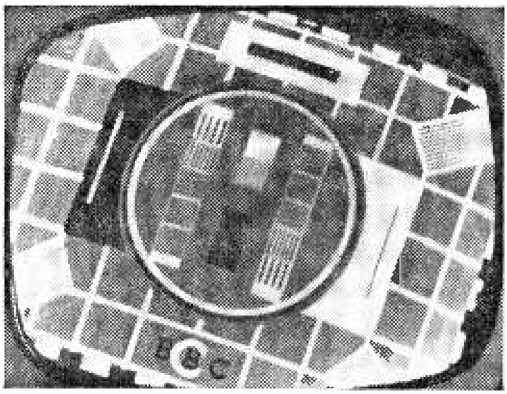


Fig. 4—Excessive picture tilt due to incorrect scanning coil adjustment.

by the scanning coils, and as the picture is built upon the raster, it follows that the scanning coils themselves will have quite an influence of the formation of the picture. Indeed, the scanning coils are akin to the "frame" or "slide-carrier" of an optical projector, and as a projected picture would tilt by rotating the slide, so a television picture tilts by rotating the scanning coils on the tube neck. The effect is clearly shown in Fig. 4.

The scanning coils must be pushed as far as possible towards and against the flare of the tube to avoid corner shadowing, a symptom which is caused by the electron beam fouling the neck of the tube, as shown in Fig. 5. The effect is rather like the corner shadowing at the top of the picture in Fig. 6, but here the picture is also badly out of centre.

All receivers have some means of adjusting the scanning or deflector coils, as we shall see.

FOCUS ADJUSTMENT

The electron beam is focused in the majority of models by a mechanical arrangement which alters the magnetic field at right-angles to the axis of the tube. The focus is also affected by the position of the focusing magnet along the neck of the tube, and in some receivers a form of "rough" focusing is provided by moving the magnet a little up and down the neck.

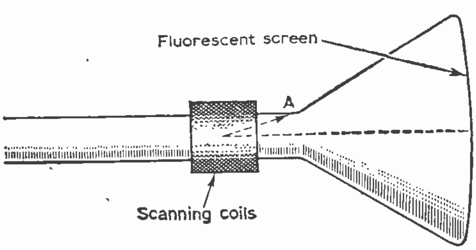


Fig. 5—Corner cutting often occurs due to the electron beam striking the neck of the tube when the scanning coils are removed from the flare of the tube—also see Fig. 6.

Very early receivers used solenoids energised from the receiver's h.t. current for providing the focusing field. A variable resistor or potentiometer was arranged in the circuit so that the solenoid current could be adjusted—and hence the magnetic field. The focus control performed that operation, and it was often brought out as a main control.

Recent trend is for the employment of electrostatic focusing. A special picture tube, of course, is required for this, and an extra "focusing electrode" is incorporated in the gun assembly. This is connected to a "flying lead" which can be connected to one of several sockets ranging from zero up to 400 or 500V positive. Adjustment is made for the best overall focus on a Test Card.

PICTURE SHIFT

While the scanning coils influence the axial position of the picture (or raster) on the screen, the focus unit has a large influence on the horizontal and vertical disposition of the picture. By twisting the focus unit up and down or sideways about the axis of the tube the picture will move likewise on the screen. This is rather like moving the lens system relative to the slide in the optical projector analogy.

Actually, this is not the correct way by which the picture should be centered on the screen, for to avoid "astigmatism" the focusing unit should be carefully adjusted until the field is perfectly at right-angles to the axis of the tube.

Note that astigmatism shows up an inability to focus verticals and horizontals in the picture simultaneously, because the scanning spot is elliptical with the direction of its major axis dependent upon the degree of error of the focusing field.

Models which employ magnetic focusing generally have a picture shift adjustment on top of the focusing unit. This works in conjunction with two discs of diameter approaching that of the focusing magnet. The discs are punched in the centre to take the neck of the tube with some to spare and

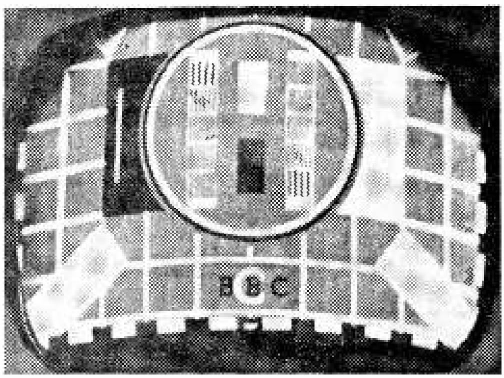


Fig. 6—This effect is caused by maladjustment of the picture shift controls. Note the corner shadowing at the top. This is similar to that caused by the scanning coils being too far along the tube neck—see Fig. 5.

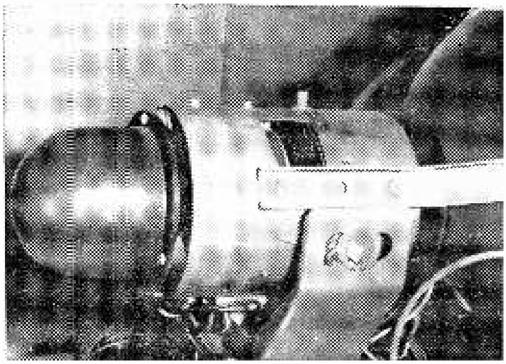


Fig. 7—Picture adjustments on a Murphy receiver—see text.

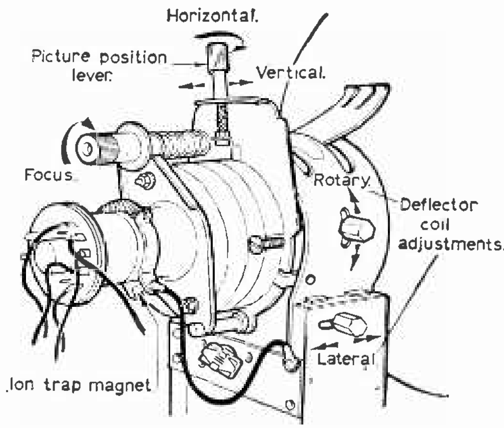


Fig. 8(b)—Picture adjustments provided on other Ferguson receivers.

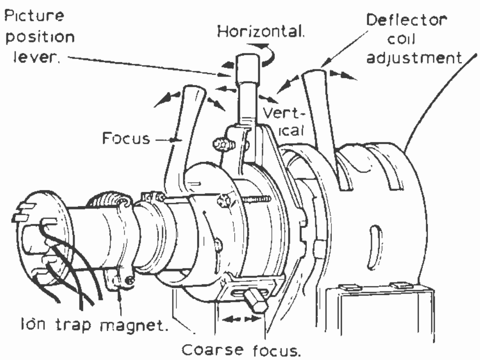


Fig. 8(a)—Sketch showing picture adjustments provided on some Ferguson models.

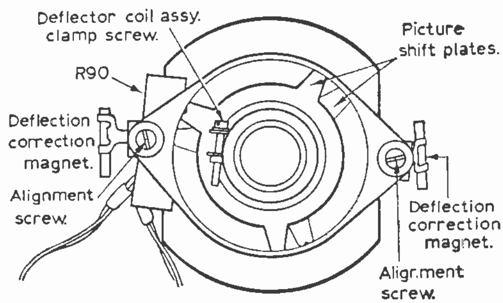


Fig. 8(c)—Picture adjustments provided on some Bush receivers.

are held on to the face of the magnet pole piece in such a way that they can be adjusted vertically and horizontally by means of the picture shift control.

These discs, in fact, slide over the pole piece and in that way alter the major axis of the focusing field. The complete picture and raster can thus be shifted both vertically and horizontally until they are centralised. Some shift arrangements operate in conjunction with a single disc of ferreous metal.

The discs described are sometimes called picture shift plates, and are always best adjusted with the picture reduced slightly in width and height so that the edges can be seen. Severe maladjustment of the picture shift controls would give a picture as shown in Fig. 6.

METHOD OF ADJUSTMENT

Fig. 7 shows the various adjustments detailed in the foregoing as fitted to a Murphy receiver. The focus is adjusted by rotating the dome which encloses the base of the picture tube, while picture tilt can be corrected by loosening the locking nut shown on top of the assembly which then allows the scanning coils to be rotated on the neck of the picture tube within the range of the slot in the cowling.

The two discs whose edges protrude through the square cut in the cowling provide picture shift—one moves the picture horizontally and the other vertically, as already described.

The adjustment, which is associated with the screw securing the neck assembly to the chassis support, allows the scanning coils to be pushed as far as possible against the flare of the tube and it also provides a degree of lateral movement to the focus unit to minimise astigmatism.

Other methods of adjustment are shown in Fig. 8, and these are self-explanatory. The diagrams at (a) and (b) relate to Ferguson models and that at (c) to Bush models. Note that at (b) the focus field is altered by the use of two ring magnets, arranged so that their spacing can be varied by the focus control. This gives a range of field interaction and thus varies the total field applied across the neck of the tube.

On receivers with electrostatically focused tubes a special unit is used for picture shift control. This will be looked into next month, as also will the ion trap magnet and the picture phasing control which is often incorrectly used as a horizontal shift control.

PART TWO FOLLOWS NEXT MONTH

The ABC of TV Circuits

AN ANALYSIS OF THE DEVELOPMENT OF TELEVISION CIRCUITS

By T. L. May

(Continued from page 219 of the February issue)

TO conclude this present series we will look at some of the circuits which are to be found in the very latest dual standard receivers. A very interesting circuit is the interference-cancelling sync pulse separator, employing the Mullard ECH84 triode-heptode "jungle" valve. This valve is designed specifically to supersede the older ECH81 in the sync separator application. The earlier type was intended primarily for use as an oscillator-mixer (frequency changer) valve in a.m. radio sets and was only subsequently adopted as a sync separator. The ECH84, on the other hand, was developed specifically with television in mind and thus has several advantages over the ECH81.

On the negative modulation of a 625-line CCIR transmission an interference pulse appears as shown in Fig. 36. It will be seen that the pulse rises in the opposite direction to the picture signal and, in fact, enters the blacker than black region along with the sync pulses. The great advantage of this, of course, is that the interference pulse fails to produce the classic white spot on the picture. A study of Fig. 36 shows that the interference causes a small gap to appear in the picture signal, so that in effect a gap appears on the picture proper, thereby giving a small black or grey spot depending upon the amount of light falling upon the screen.

From the picture aspect, therefore, negative modulation has the advantage over positive modulation with regard to impulsive interference. There is, however, the great disadvantage of the interference badly affecting the synchronizing performance, since it "looks" to the sync separator rather like an overgrown sync pulse of somewhat smaller duration.

Fortunately, as the 625-line CCIR system is presently transmitted on the u.h.f. channels, the problem is not so bad as it could be, for impulsive interference troubles diminish with increase in channel number. Interference is generally worse on the Band I channels, considerably less disturbing on the Band III channels and, under certain conditions, barely noticeable on the channels of Bands IV and V.

Initially, however, there will be quite a lot of fringe area u.h.f. viewing where the strength of the signal relative to that of the interference is likely to be low (poor signal/interference ratio), thereby partly counteracting the u.h.f. interference attribute.

Moreover, the noise contribution of the first stage circuits tends to be greater at u.h.f.—a factor which could cause very ragged vertical edges upon a picture of negative modulation due to the noise signal getting into the sync separator stage and causing random "firing" of the line oscillator.

Eventually, of course, negative modulation and 625 lines will be used on the v.h.f. channels so the problem will occur in almost all areas at some time or other.

The ragged vertical edge effect is eliminated in the main by the use of flywheel line synchronizing circuits which are insensitive to noise and bursts of impulsive interference. Dual standard sets, therefore, either incorporate flywheel line sync on both systems or switch it in on 625 lines only, with direct sync on 405 lines.

Blocking

An ordinary type of pentode sync separator receiving a signal of negative modulation operates essentially in the same manner as when such a stage is receiving a positively modulated signal. That is, the sync pulses cause the valve to pass grid current, thereby charging the grid capacitor so that the valve is held at cut-off during the picture signal.

In that way the anode circuit responds only to the sync pulses which are developed across the anode load resistor, while the picture signal is suppressed.

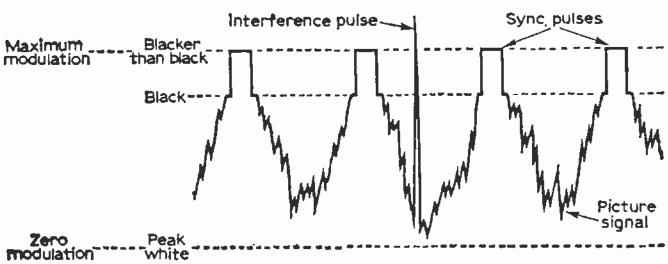
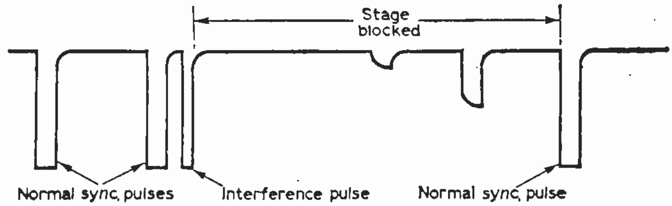


Fig. 36—Showing how an interference pulse appears on a negatively-modulated television signal. Note that the pulse rises in the direction of the sync pulses.

Fig. 37—A conventional pentode sync separator stage is likely to "block" as this diagram shows when an interference-laden negatively-modulated signal is applied to its control grid. The blocking effect results from the grid capacitor charging to a higher than normal value due to the positive-going interference.



Now on a negatively-modulated signal interference pulses "look" to the valve like extra large sync pulses and thus cause the grid capacitor to charge to a higher than normal value. This means that the valve is held at cut-off for a longer than normal period, depending upon the time-constant of the grid capacitor and resistor combination, so that subsequent to a burst of impulsive interference the valve is "blocked" until the extra charge of the capacitor is exhausted.

This blocking cuts off the sync pulses as well as the picture signal at the anode, meaning that directly following a burst of interference the line and frame timebases are removed from the control of the synchronizing signals, as shown in Fig. 37.

The flywheel line sync handles the situation from the line timebase aspect, but something in addition is needed for the frame timebase, since flywheel sync cannot be used here.

Interference Gating

The interference-cancelling sync pulse separator circuit using the Mullard ECH84 triode-heptode is shown basically in Fig. 38. This circuit avoids the blocking effect of Fig. 37.

The heptode section of the valve is employed as the sync separator proper, while the triode section is arranged as a pulse clipper. V1 is the ordinary final vision i.f. amplifier valve which feeds the vision detector via T1 in the usual manner, bearing in mind that in a dual standard set this would be switched over on 405 lines to suit the positively-modulated signal.

The output of the vision detector feeds both the video amplifier and the inter-carrier sound transformer T2, as is made on 625-line CCIR and dual standard sets, while the output of the video amplifier feeds the cathode of the picture tube and the sync stage, as is conventional practice.

The problem is to prevent grid current blocking at the sync separator valve on bursts of impulsive interference. This is solved by utilising both the first and second control grids of the heptode. To the second is applied the composite video signal—as, for instance, is applied to the control grid of a conventional pentode sync separator. To the first grid is simultaneously applied the interference pulses only. Thus, each grid receives the interference pulses, but only the second grid receives the video as well.

Noise Detector

The isolated interference pulses are derived from a noise detector, arranged so that the pulses as applied to the first control grid are negative-going. The noise detector is energised from the anode of the final vision i.f. amplifier valve, via the buffer resistor R1 and the isolating capacitor C2 (Fig. 38).

The tuned circuit L1, C1 serves to separate the interference pulses from the sync information—an operation which is important for correct operation of the circuit. Frequency-selective discrimination of noise and sync is possible because interference pulses have a distributed spectrum extending over a very wide frequency band, while the sync information is contained in a relatively narrow 1Mc/s band (approximately). The tuned circuit is thus aligned for minimum low-frequency output from the noise detector. The negative-going pulses are developed across the load R2 and fed to the first control grid through the r.f. choke and C3.

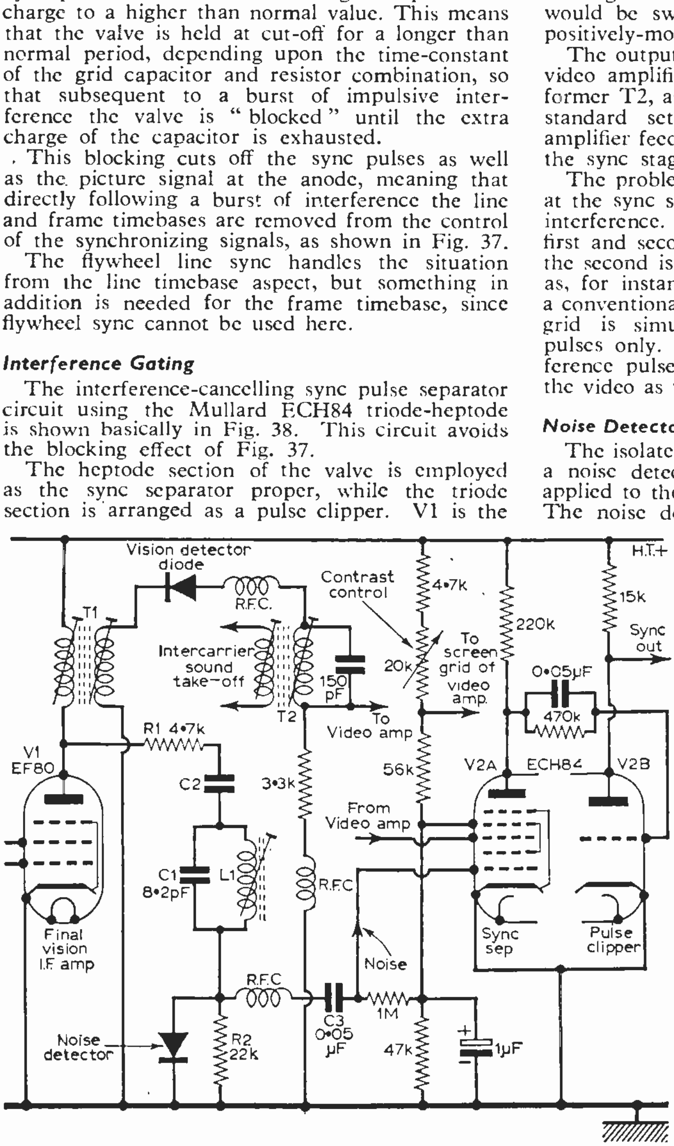


Fig. 38—An interference-cancelling sync separator circuit based on the Mullard ECH84 triode-heptode valve (see text).

Circuit Operation

The first control grid is connected to a source of positive potential to maintain a flow of grid current, and under that condition the sync separator works in the usual manner from the composite video applied to the second control grid. Now when a burst of interference occurs, the first control grid is pulled away from its standing positive value, since the isolated pulse applied to this electrode rises heavily negative.

This happens at the exact moment when the pulse from the same burst of interference, which is superimposed upon the video signal proper, is applied to the second control grid. At that instant, therefore, the valve cannot run into heavy grid current (because the first control grid is heavily negative), meaning that the sync coupling capacitor cannot acquire a "blocking" charge. The circuit is thus immune from the shortcoming of the conventional pentode sync separator under conditions of negative modulation. In effect, the valve is "gated" by the specially derived interference pulse, and the gating action prevents the valve from running into heavy grid current during a burst of interference, which in turn prevents the blocking trouble.

So that the circuit will operate adequately at all video input signal levels, the positive potential applied to the first control grid is derived from the contrast control circuit. Here the contrast works by varying the screen grid potential of the video amplifier valve, so that when the contrast is decreased the potential applied to the first control grid of the heptode is decreased proportionally. This keeps the circuit in balance over the normal range of contrast control.

Locked-Oscillator F.M. Detector

Another heptode, the Mullard EH90, is finding its way into the new dual standard models. This valve, however, is replacing the ratio detector in the 625-line CCIR sound circuit. It acts as an excellent f.m. detector, gives adequate amplitude limiting and also gives sufficient audio to drive the output pentode direct!

The circuit is given in Fig. 39, a study of which will show that the sound i.f. signal is applied to the first control grid, while the second control grid is connected to a 6Mc/s tuned circuit. These two circuits are coupled due to a space charge between the two grids within the valve and the signal applied to control grid one is induced into the tuned circuit of control grid two, the latter having a voltage which lags behind that of the former by 90 deg.

The coupling also produces oscillation and over a limited range of frequency the oscillatory voltage across L1 (Fig. 39) locks to the frequency of the signal applied via T1. The signal via T1 is, of course, the intercarrier CCIR sound signal at 6Mc/s (being the difference between the sound and vision carrier frequencies), so then if L1 is adjusted to 6Mc/s the intercarrier sound signal will "lock" the oscillation at that frequency.

Now, if the applied signal is changed in frequency, as occurs due to frequency-modulation, the oscillation still remains locked provided the frequency deviation does not fall outside the control limits, but the phase angle between control grid one and control grid two voltages changes from 90 deg. by an amount depending upon the change in frequency.

The anode current of the valve is governed by the phasing of the voltages, and as the phasing

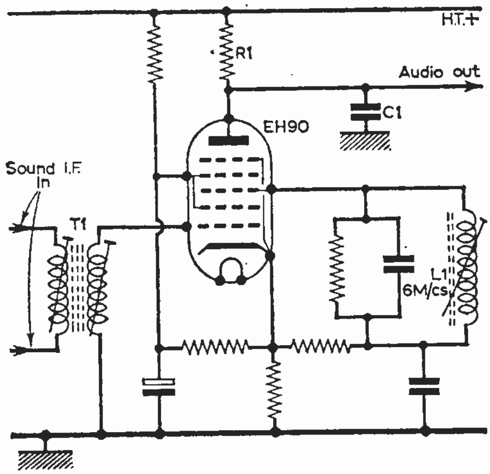


Fig. 39—Circuit of the locked-oscillator FM detector using the Mullard EH90 heptode valve.

changes due to the frequency modulation so the anode current of the valve changes in a corresponding manner. This, then, means that the voltage across the load resistor R1 also changes and produces an audio signal which is a replica of the audio used at the transmitter to frequency-modulate the carrier.

The correct degree of de-emphasis is provided by R1 and C1, the value for the British f.m. system being 75 microseconds, as distinct from the American 50 microseconds.

In conclusion, the author wishes to convey his sincere thanks to the various firms and manufacturers for supplying technical information for this series, and to Mullard Limited for the information contained in this particular article.

SERVICING DATA AND MODIFICATIONS

By D. Elliott

(Continued from page 228 of the February issue)

IT sometimes happens that a frame or line timebase is operated towards one of its limits of tolerance due either to the tolerances of the various associated components all adding up in one specific direction or because of a definite fault condition.

K-B Model OV30 (New Queen Special)

In some of these models the symptom of only-just-enough-height is apparent even with the height control fully advanced. This means that there is no margin for component and valve wear, so that even a slight drop in the emission of the frame output valve or mains voltage puts the frame somewhat below correct height and outside the range of adjustment of the control.

This can often be corrected by replacing the frame amplifier valve and always ensuring that this is at peak performance—but is expensive. The best thing to do is to achieve a wider margin of tolerance. This is possible by reducing slightly the frame linearity negative feedback capacitor. The original value is 0.05μF and this can be taken down to about 0.025μF, but in most cases it will be found that a value of 0.04μF gives a good compromise of height and linearity in relation to the controls (see Fig. 55).

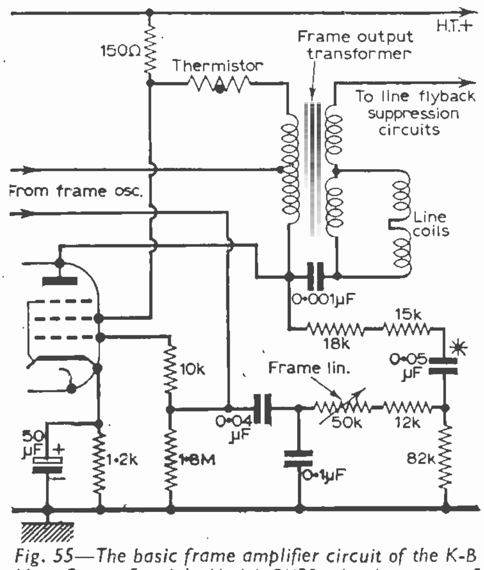


Fig. 55—The basic frame amplifier circuit of the K-B New Queen Special, Model OV30. In the event of limited picture height, the capacitor marked thus can be reduced from 0·05μF to 0·025μF (see text).*

Failing PL81 Valves

In the line timebase a decrease in value of the screen grid resistor of the line output valve (often a PL81) can produce two symptoms, one very bad overheating of the valve itself, often with the screen grid glowing red hot, and the other excessive picture width which cannot be corrected by the width control.

Apart from these things, however, the fault can result in premature failure of the valve. The initial symptom is lack of width—eventually followed by total failure—and when it is found that width is restored simply by replacing the valve and that the valve is, in fact, low emission, further analysis of the circuit is not usually undertaken until, perhaps, several valve replacements have been made in the same number of months.

Screen feed resistors originally valued at, say 4.4kΩ have been found as low as 1.5kΩ. This drop in value results in a rise of screen voltage and current and anode current; the screen often rising 50 or 60 volts, while the corresponding rise in anode current may well cause the line output transformer to run hot and eventually fail due to the higher current in the primary and the higher pulse voltage across it.

Readers often write and ask what they should check before replacing the line output transformer and/or line output valve. The answer is, of course, the line output valve screen feed resistor. This resistor controls the operation of the whole stage, and if of incorrect value can severely impair the performance. An increase in value, which is probably more frequent than a decrease, not only reduces the width but also incites the symptom of poor e.h.t. regulation, where the picture "blooms" and fades as the brightness is turned up beyond a certain point.

Not all sets have a screen feed resistor, though, and one should *not* be fitted as a safety measure. Such models may incorporate a line drive control, and this should be adjusted in accordance with the service manual or sheet, for if this is well out of adjustment the picture may not exhibit any abnormality but the line output valve and line output transformer may be badly strained, exactly the same as with a decrease in value of screen grid feed resistor.

Buzz on Sound

We still get many readers seeking information for reducing the background buzz or hum on sound

It must be remembered that this kind of disturbance arises essentially from one or more of three causes —ordinary residual mains hum, pick-up of the frame timebase signal by the audio stages and breakthrough of the lower frequency components of the composite picture signal into the sound channel.

Residual mains hum can be proved by pulling the aerial plug from the set and turning down the volume control. If the hum remains attention should be directed to the smoothing electrolytics on the h.t. line. It is unlikely that one will be completely open-circuit as this would put a heavy hum bar across the picture and reduce the h.t. voltage, but a decrease in value may not affect the vision overmuch, though may well introduce an extra loud mains hum on sound.

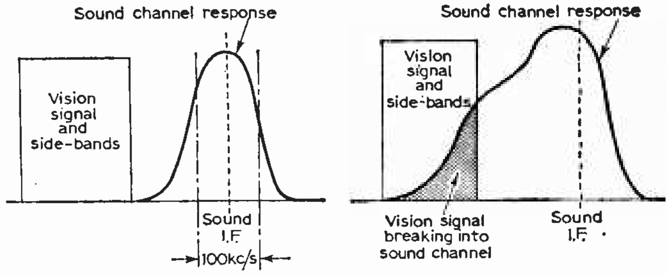


Fig. 56—Ideal passband characteristics of the sound channel (a). These allow for simple limiting of impulsive interference (note that a narrower passband would tend to widen interference pulses and thus make it more difficult to discriminate between them and the audio in the interference limiter circuit of the set), cater for oscillator frequency drift and, of course, adequately handle even the very highest audio sideband. At (b) is shown how misalignment of the sound i.f. channel may distort the characteristics and allow breakthrough of the vision signal.

If the hum or buzz appears only when the volume control is turned up—still with the aerial disconnected—then it is almost certainly caused by breakthrough of the frame timebase. This is conclusive if the buzz alters in pitch as the frame hold control is rotated. Usual causes are low value electrolytic bypass on the h.t. line feeding the frame circuits and unwanted coupling between the frame timebase and audio sections of the set.

In the latter event, check that the braidings of any screened audio connecting leads in the set are adequately bonded to the chassis, that the metal part of the volume control is connected to chassis and that the leads on the volume control are dressed well clear of the frame sections of the set.

Vision breakthrough into the sound channel is responsible if the buzz occurs only with the aerial connected and the set operating in the normal way with the volume control turned up for normal sound. The symptom is typified by the buzz altering slightly in volume (and possibly in pitch) with changes of picture content.

The symptom usually means that the sound i.f. channel is somewhat misaligned so that instead of the passband being just wide enough to cater for the sound sidebands, to allow for slight short-term frequency drift of the local oscillator and to avoid undue widening of the interference pulses—see Fig. 56(a)—it extends into the zone of the vision signals—Fig. 56(b). This means, of course, that the frame sync pulses and the lower vision frequencies are then permitted to enter the sound channel where they produce the characteristic picture buzz effect.

Sound Alignment

Provided the picture is not in any way affected, the trouble can be cleared simply by realigning the sound i.f. channel. This is best done with a wobbulator and oscilloscope, the latter giving a display of the sound channel response curve during the whole course of adjustment. But if this sort of equipment is not available, the circuits can be aligned on a signal—preferably Test Card C.

The receiver should be set up and the fine tuning control (and other controls) adjusted for the best possible picture—forgetting about the sound at this time. The volume control should then be turned up until the background buzz is clearly heard, and starting from the secondary of the final sound i.f. transformer, each core should be very carefully adjusted in turn for maximum sound and **minimum** background buzz. As the circuits are brought into tune it will be necessary to turn down the volume control to avoid overloading.

A non-metallic trimming tool must be used when making core adjustments and the final touches are best applied during a period when there is no sound modulation on the transmission. The volume control should, however, be turned full on until the carrier hiss can be heard, upon which is superimposed the buzz, and it is then a relatively simple matter to give the final touches to the cores for maximum signal/buzz ratio. Remember not to touch the fine tuning control during the adjustments and to wait until the set is thoroughly warm before making any adjustments at all.

On 625-Line Transmission

On 625 lines, the effect is often called intercarrier buzz, and is somewhat more difficult to eliminate. The cause can arise in the vision i.f. channel, as the result of a bad valve or misalignment here, as distinct from the sound channel proper. It can, however, also arise in the intercarrier sound channel again due to misalignment as in the 405-line case already considered, or can be caused by unbalance in the f.m. detector circuit.

Remember that in dual standard receivers switched to the 625-line CCIR system, the vision i.f. channel carries, in addition to the vision signals, the sound signals at a strength about ten times below that of the vision signals. Also that it is the beat between the sound and vision carriers at the vision detector which gives the 6 Mc/s intercarrier sound signal.

Thus, on the 6 Mc/s intercarrier signal amplitude-modulated vision signals are present as well

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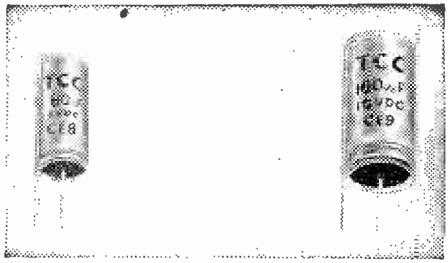

These capacitors are ideal for miniaturised transistor circuits such as in pocket radios. Each is available with wires at opposite ends for horizontal mounting ("H"), or at one end for vertical mounting ("V").

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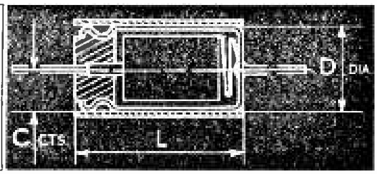
	D	L	C	3V.	6V.	10V.	15V.	25V.	50V.
CE.8 ..	$\frac{1}{4}$	$\frac{3}{4}$	0·14	100	80	60	40	25	8
CE.9 ..	$\frac{3}{8}$	$\frac{3}{4}$	0·2	250	200	160	100	60	20



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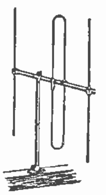

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6AL5	3/9	7S7	9/-	DAF96	7/6	ECL82	9/-	PCL82	9/-	UCC85	7/6
6AM6	3/6	7Y4	6/-	DCC90	9/-	ECL86	10/-	PCL83	10/6	UCF80	14/6
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6K7GT	5/-	20P3	18/9	DL94	7/-	EL42	9/-	PY80	7/6	UY85	6/6
6K8G	5/-	20P4	20/-	DL96	7/6	EL84	6/6	PY81	7/-	VP4B	9/6
6K8GT	9/-	20P5	15/9	DM70	6/6	EM34	7/3	PY82	6/6	VP41	5/-
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as f.m. sound signals, so it follows that the f.m. detector must be endowed with good a.m. rejection properties to avoid vision buzz. The intercarrier amplifiers are often arranged as a.m. limiters to help with this a.m. rejection problem, but for optimum results it is essential that the vision channel, the intercarrier channel and the f.m. detector are all aligned and balanced accurately.

On both systems the trouble can be aggravated or, indeed, caused solely by overloading in the tuner or common stages due to a too-strong aerial signal. In most cases, however, the a.g.c. circuits will handle the heavy signal, but in areas close to a transmitter the signal may be outside the dynamic range of the a.g.c. system.

When this happens the sound and vision signals become intermodulated one with the other in the overloaded stages, and then it is impossible to get rid of sound buzz by the methods described. Sound-on-vision interference may also be present, and the only solution is to reduce the signal applied to the set by means of an attenuator.

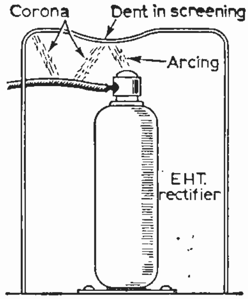

Fig. 57—Arcing from the anode of the e.h.t. rectifier can be caused by a dent in the screening can or shield, as this drawing shows. Corona produces a bluish ray from the discharge point usually to a chassis member, and is accompanied by a hissing sound. Corona may need a darkened room to display itself, while arcing is far more vigorous; it sounds like sharp, staccato cracks and is clearly visible even in daylight.

Arcing and Corona

According to the query department it seems that some readers are not too clear as to the difference between corona and arcing in the e.h.t. circuits. Corona is essentially a mild form of discharge caused by conditions which are not quite bad enough to incite a more vigorous display. The very high electrical pressure in e.h.t. circuits is rather like very high water pressure in a hose pipe, for example. If there is a small leak in the hose pipe the water will spray out in all directions accompanied by a hiss. However, if there is a major leak the water will discharge as a powerful jet

So it is with electricity. A small insulation leak produces corona. There is a hissing noise, as with water, and if the e.h.t. section is examined in a darkened room a bluish ray will be seen radiating from the discharge area often towards the metal screen of the e.h.t. section (Fig. 57).

On the other hand, a more severe leak develops into an arc. This no longer sounds like the gentle hiss of water but more like sharp, staccato cracks, especially if the discharge is on the d.c. side of the e.h.t. rectifier circuit (e.g., on the e.h.t. lead or circuit to the picture tube anode). On the pulse side of the e.h.t. rectifier (anode) the arc discharge tends to be more constant, and owing to its greater power here it can well cause the line output transformer to burn out or even catch alight to the associated wiring.

Both corona and arcing can be aggravated by a dent in the e.h.t. section screening cage, for example, as shown in Fig. 57. In this case the trouble would almost certainly be cleared by removing the dent and re-fitting the screen. It sometimes pays to bend the screen so that there is greater-than-normal clearance between it and the e.h.t. point.

It should also be noted that dirt and dust in the e.h.t. section can promote an insulation leak, as also can a damp or humid atmosphere. The latter is one of the reasons why a slight hiss may be heard in a receiver which has been switched on after standing several days during the winter in an unheated room. Mild corona is not usually harmful and clears in most cases when the set is properly warm. However, steps must be taken to clear it if it persists under normal viewing conditions, for it could develop into more serious arcing which is definitely harmful.

Remember that both corona and arcing are encouraged by sharp points on e.h.t. connections. Care should, therefore, be taken to round off the connections with a soldering iron or file. Anti-corona grease is obtainable from radio dealers, and this is handy stuff for clearing corona around the tube e.h.t. point.

It sometimes happens that the e.h.t. voltage rises due to a fault in the line amplifier circuits, and this should be suspected if sparks appear to jump over distances which have previously been far too great for discharges, but bear in mind the possibility of bent screening. ■

Your Problems Solved

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modyifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 283 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

EKCO T184

I wish to replace an ageing RM4 metal rectifier in this receiver, with a silicon diode. Would you please inform me of a suitable type, and also if it is necessary to shunt it with a resistor?—F. Breakwell (Kidderminster, Worcestershire).

The Mullard BY100 will replace the RM4, and it is advisable to fit a 20Ω, 5W resistor as a surge limiter. We cannot trace an Ekco T184 in our manuals, and therefore are not absolutely sure if the conversion will be satisfactory.

MURPHY V230

On BBC the picture is satisfactory, but the ITA picture lacks contrast. The signal from my aerial gives a very good ITA picture when connected to a neighbour's set.—P. Scoone (Weymouth, Dorset).

The usual cause of this trouble is a faulty 30L1 r.f. amplifier. If the ITA signal is weak in your district, a 30L15 fitted as a replacement may improve matters.

MURPHY V114

When the set is first switched on the foldover, which is present on the picture, is not very prominent, but after about an hour there is a full inch of foldover and the picture does not fill the screen.

Adjustment to the frame hold or picture height controls only temporarily cures the fault.

I have replaced the valves T41 and Pen 45, also C82, C83, C52, C53, C68 and R83.—A. R. Elliott (Harrow, Middlesex).

This fault is probably caused by a faulty 0.25μF grid coupling capacitor or 8μF screen grid decoupler, both of which are on the Pen 45. Also suspect poor pin contacts on the valveholder. The sound output valve is a Pen 45 and this can be used as a check. It is unlikely that the T41 is faulty.

EKCO T221

The picture on this set, when switched to ITA has very poor contrast and is subject to much line pulling.

I have substituted the tuner valves, cleaned the contacts and studs and have adjusted the ITA oscillator coil, all without success.

Also could you suggest a way in which I could operate this set out of its cabinet?—E. Whibberley (Matlock, Derbyshire).

These symptoms indicate a faulty capacitor decoupling the second grid of the PCC84. This is below the chassis between the dividing wall and the sixth switch contact spring.

It is usually possible to operate the T221 "unboxed" by turning the chassis on its side with the voltage selector panel near the tube and extending the loudspeaker and e.h.t. leads.

H.M.V. 1841

The picture fails to fill the screen by about half-an-inch at the top. The top part of the picture is cramped with thin lines permanently across this portion.

I have checked C51 and R62 and have substituted the PCL83 but with no improvement in the situation.—H. Cormell (Birmingham).

The trouble lies somewhere in the frame section of the set. If the frame timebase valves are in good order, check the capacitor on the control grid of the frame amplier valve. This may be leaky (e.g., poor insulation). Also check the components associated with the frame linearity control and ensure that this control is set correctly in relation to the height control (adjust on Test Card C). If the trouble persists, examine the components in the frame oscillator, particularly the anode resistor which may have increased in value. If the trouble is now still present, it could be caused by a fault in the frame output transformer.

PHILCO 1000

Recently the sound on ITA has become poor, even though the tuner is correctly adjusted. The picture on both ITA and BBC is good and the sound on BBC is also satisfactory. The PCC84 valve is new.—F. L. Morais (Dudley, Worcestershire).

This seems rather like aerial trouble, for if there was a sound fault in the set, both BBC and ITA would be affected. Similarly, if there was a tuner fault the pictures would also be affected. We suggest that you first check the ITA aerial system and diplexer if used, for something may be attenuating the sound signal—such as a stub effect due to a mismatch.

FERGUSON 204T

Just recently the fuses in this receiver are continuously blowing, and although I have checked for a short, I can find nothing at fault.

Also, I recently replaced the PY32 h.t. rectifier with a PY33 with the result that the picture now fills only about half the screen. I was informed that the PY33 is a direct replacement for the PY32.—K. Arnold (Bromley, Kent).

Fuse failure should first lead to replacement of

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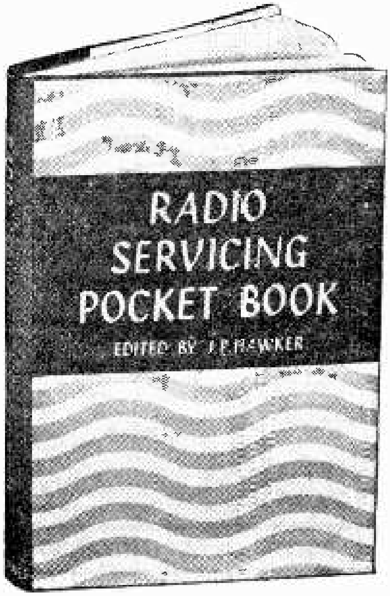

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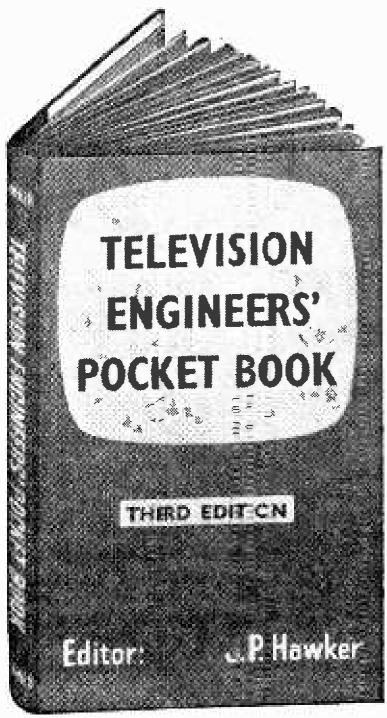

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the 0.1μF 300V a.c. working capacitor connected between a tag on the on/off switch and chassis. Also suspect trouble in the 400+100μF electrolytic unit connected to the cathode circuit of the h.t. rectifier. This may also have a bearing on the lack of width.

FERRANTI T1415

The frame hold has recently become very critical on this receiver, and very often it is impossible to lock the picture at all, and it then either "judders" or rolls downwards continuously.

In attempts to cure this fault, I have replaced the following valves: PL81, EY51, EF80, ECL80, ECC84 and ECF80. Other associated valves have been tested by substitution and the metal rectifier renewed.—C. H. Lennon (Chelmsford, Essex).

The cure for this fault is to replace the frame blocking oscillator transformer.

ENGLISH ELECTRIC T40

The picture quality is good but there is a thick black border at the bottom of the screen. When the height control is adjusted to correct this, the frame hold control will not function to hold the picture steady. — R. A. Gray (Southampton, Hampshire).

Check both the frame linearity controls in conjunction with the height control. If the low frame amplitude persists, check the PL82 frame amplifier valve by substitution.

McMICHAEL MP17

The vision is generally very good, but the sound on BBC is very often distorted.—A. Green (Middleton, Lancashire).

There are three holes in the tuner giving access to the oscillator cores. With the fine tuning control at the centres of its range, one or two cores may be visible through the holes mentioned above. If only one core is visible (when the channel selector is switched to the required channel), this should be adjusted for maximum sound consistent with minimum sound-on-vision. If two cores are visible with the channel selector switch in the required position, the core nearest to the fine tuner spindle should be adjusted as described. If the set is in its cabinet, this will be the core inside the lowest access hole with the set placed the correct way up.

BUSH TUG12B

The fault with this set is that the width of the picture has been reduced to only 3in. although the height remains correct. The sound is still present. —R. T. Smith (Leicester).

These symptoms suggest that the line output transformer inside the round can has shorted turns. You could also check the 2μF feed capacitor to the line scanning coils socket, but the transformer is almost certainly at fault.

BUSH T85C

When first switched on the picture is normal, but between approximately 8.30 p.m. and 10 p.m. each evening, the picture loses both height and width. After 10 p.m., however, it returns to normal.—R. Williams (Colwyn Bay, Denbighshire).

The reduction of picture size is almost certainly due to a drop in the mains supply voltage. Check the normal mains voltage and if this is much lower than the right-side mains adjustment is set for, it is quite in order to set the plug down one position, i.e. to the next lower voltage range.

Check the LW15 metal rectifier and PL81 and PY81 valves is necessary.

H.M.V. 1840

The raster and sound is present on both BBC and ITA but I can obtain no picture at all. All the controls seem to be working correctly.—M. Swift (East Herrington, Co. Durham).

You should check the voltage supplies to V5 (PCF80) if this valve has already been found to be in working order. V5 is the next valve down from the N153. Check the h.t. to pins 3 and 6 (via the 4.7kΩ dropping resistor). Next check the crystal diode detector (OA70 or equivalent) between the PCF80 and N153.

K.B. LVT30

I am unable to get the full picture width on the screen. I have replaced both the e.h.t. rectifier and RM4, the line output valve 6CD6 and the diode 6U4. The actual picture width varies during an evening's viewing.—E. Robinson (Halifax).

Check the 5kΩ screen (pin 8) dropping resistor of the 6CD6G and the 12AU7 line oscillator. Also check the 0.1μF boost line capacitors. If the 5kΩ (R133) is found damaged also check C117 0.1μF decoupling capacitor.

PYE FV1C

I have a fairly decent picture on each programme but when figures appear they are accompanied by repeat figures in the form of shadows. What is the cause of this double-figure effect?—F. H. Perkin (Greenford).

Your symptoms could be due to a faulty c.r.t., especially if the halo disappears as brightness is reduced, or due to misalignment of the i.f. stages. Also check that the focus magnet produces optimum results, and if necessary fit a few soft iron shunts around it to reduce its strength.

PYE VT7CD

On switching on, the picture rolls vertically and it cannot be locked. After 1-1½ hours, the picture suddenly breaks down as if the horizontal control had been turned. There is also some trouble with the tuner on this set which shows itself in the fact that optimum vision and sound do not coincide with the variation of the fine tuning adjustment. —B. H. Connorton (London, S.E.15).

Your horizontal hold trouble should clear up if you replace the ECL80 valve just in front of the "black box". Picture rolling is usually due to a slow heating PL82 frame output valve, which is just in front of the ECL80.

As regards your tuner problem, since the fine tuning control is an oscillator adjustment, and the sound and vision signals are on different carrier frequencies, the position of optimum sound does not coincide with the position for optimum vision. It is necessary to strike a compromise between picture quality and adequate sound.

PHILIPS 1200U/15

This set has, during the past month, developed the following symptoms: (a) top of picture cramped and gradually creeps down ½in. with height control at maximum, (b) brightness control requires raising after 1½-2 hours, this causing the images to go whitish, (c) very occasionally the picture breaks up and horizontal hold is lost. I am preparing to replace the PL82, ECL80 and PL81. From item (b) the tube is probably failing.—J. P. Boasden (Plymstock).

General wear in the timebase and video circuits is almost certainly responsible for most of the symptoms given. A worn h.t. rectifier could be aggravating the troubles, especially if the voltage falls within the time that the set is switched on. The frame troubles should lead to a check of the ECL80 valve, as you suggest, and the same may apply to the line breakup. A low emission tube *could* be causing the focus drift, but bear in mind that a fall in h.t. or a drift in one of the line timebase valves may give similar effects.

PHILIPS 1114/U/15

Recently the frame sync has become unreliable and the hold control has to be turned to the full extent. Slowly, however, the period of time during which the picture remains steady has become shorter and now, after changing around the PL82's and ECL80's (which made no difference), I have three pictures!—A. H. Potten (Lymm).

Firstly, we would suggest that you have the ECL80 valve (nearest the PL82 in the timebase section) checked for emission and replaced if low, for just interchanging valves of similar type may not reveal the actual fault as the interchanged valves may also be low! If the valve is in order, replace the resistor connected to the centre tag of the frame hold control.

K-B HV40

The picture suddenly breaks up, sometimes after being on for a few hours and at other times as soon as the set is switched on, often after a few minutes. Sometimes the line hold adjustment will put matters right, and sometimes the frame hold, and sometimes it will suddenly right itself only to break up again for no apparent reason. I have tried replacing valves.—W. Bateson (Skipton, Yorks.).

If both frame and line break up, then the trouble is almost certainly in the sync separator stage or in the circuits which feed the signal from the video amplifier anode to the control grid of the sync separator valve. Firstly, check the valve by substitution if possible; making sure that it is seating correctly in its holder and is making good electrical connection with the sockets. Secondly, check the resistor and capacitor connected to the control grid tag of the valveholder.

PILOT PT450

Approximately a quarter of the track of P8 will lock the frame, but after two hours frame sync is lost but can be regained by adjustment of the control. The set then remains normal until switch off. No other picture faults exist. At first it was thought that either the 30PL13 (V13) or a component changing in value due to the closeness of the mains dropper was responsible but a new valve and the replacement of C96 (0·005μF), C101 (0·03μF), C95 (0·1μF, this one looked "cooked") R88 (180k) and R94 (180k) did not improve matters. The new and the replacement V13 had a slight blue glow and loss of frame lock could be triggered off after a few hours by rotating the turrent tuner.

This trouble is definitely caused by a drift in value or characteristics of a component related to the frame oscillator section. Check that the mains voltage tapping corresponds to the applied voltage, for if the frame oscillator valve is under (or over) run, characteristic drift is aggravated and the condition as described is bound to occur.

FERGUSON 306T

The trouble is a loud buzz on sound on certain scenes. A change of camera seems to either increase the buzz or cut it out altogether. Also the trouble is more pronounced on Band III than Band I. There is no sound-on-vision and one day the picture may be perfect while the next day it may be weak and watery with line tearing. I receive my signals via a "piped" system.—W. Houldsworth (Keighley, Yorks.).

This is piped TV trouble. Have the relay firm correct the fault on the system.

PHILIPS 1768U

Trouble is cramping at the bottom of the picture. I replaced the 100μF capacitor to the PCL82 as it had broken away from the chassis but this only improves matters slightly. Also, the picture continually jumps and stretches very slightly as if to correct this fault. The line hold control is at the end of its travel.—J. Strugnell (Walsall, Staffs.).

Replacing the 100μF capacitor should have made a great improvement in frame performance. Check that the replacement is fitted correctly; if it is, then suspect it being of low value. The stretching effect may be tied to the 100μF capacitor or it could be caused by trouble in the coupling capacitor connected to the control grid of the PCL82 pentode section. The line symptom should lead to replacement of the resistor connected to the slider of the line hold control. This has probably increased in value.

K-B HF40H

On switching on, the height is correct but after four minutes running the height is reduced from the bottom by ¼in. On Band III reception at all times there is no contrast control; to brighten or darken takes the picture contrast beyond satisfaction.—E. Brown (Guisborough, Yorks.).

Bottom compression should lead you to check the front left 6BW6 valve and associate components. For the contrast fault, check the r.f. amplifier on the tuner unit. This could be an ECC84 or a PCC84. As the contrast, when properly connected via the V1 valve base, only controls the gain of this valve it is essential for it to be in order.

BUSH TV24

Some time ago you suggested that I needed a new tube. This I obtained and all went well until recently. The set was going perfectly the night before and the next day only sound could be received and a thin white line appeared across the screen. I had the ECL80 frame valve tested and it was OK, but I still put in a new one. I then had sound only, and no white line.—Y. F. L. Young (Manchester).

Check the line timebase and e.h.t. at the c.r.t. anode. If the e.h.t. is present, check the setting of the ion trap magnet on the rear neck of the tube. This often breaks after a new tube has been fitted as the fibre becomes brittle. When the white line has been restored you will have to check the h.t. voltages applied to the ECL80 at pins 1 and 6. Absence at pin 6 should direct attention to the frame output transformer primary winding. If present, check at pin 1, through the oscillator transformer to the 220kΩ resistor and 0·1μF capacitor.

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PRACTICAL TELEVISION, MARCH, 1963

FERRANTI 17T6

The trouble is insufficient height, with a one-inch blank band at the bottom of the screen.—R. Kirkwood (Glasgow).

This symptom is almost certainly caused by a weakened ECL80 (V13). Check by substitution if possible. If the symptom persists, replace the 50μF electrolytic capacitor connected to pin 3 of this valve.

TEST CASE -4

Each month we are going to provide an interesting test case of television servicing to exercise your ingenuity. These are not trick questions, but are based on actual practical faults.

? *A receiver working normally suddenly developed the following symptom. It was found impossible to achieve full height even with the height control at maximum and cramping could not be removed from the bottom of the picture by adjustment to the vertical linearity control.*

What is the most likely cause of the trouble?

See next month's PRACTICAL TELEVISION for the solution.

SOLUTION TO TEST CASE—3
(Page 236, last month)

The symptom of sound-on-vision can be caused by four main faults: (i) misalignment of the vision i.f. channel or local oscillator, (ii) misalignment of a sound rejector in the vision i.f. channel or sound take-off circuit, (iii) microphony in the frame output valve and (iv) a common impedance between the sound output stage and the vision channel.

Since the fault is present on both channels the possibility of local oscillator frequency drift can be ruled out where the receiver features a turret tuner, since it is unlikely that the drift would occur consistently on two channels and be outside the range of fine tuning control correction. This could happen with incremental tuners, but then the picture quality and the sound output would both suffer and such accompanying symptoms are not present.

Similarly, misalignment of the vision i.f. stages would considerably impair the picture quality, so this can also be ruled out. Misalignment of a sound rejector is possible provided the sound-on-vision is present even with the sound turned right down.

If the symptom is present only with the sound turned up towards maximum, however, microphony in the frame output valve or a common impedance between the sound output stage and the vision channel are equally possible.

Microphony can be proved by turning the sound down and tapping the frame amplifier valve with the handle of a screwdriver, when microphony would be revealed by a series of dark, horizontal bars appearing on the picture. In this event replacement of the frame amplifier valve would effect a cure.

Otherwise the trouble would be caused by value decrease, deterioration or breakdown of an electrolytic capacitor which is common to both the sound output stage and vision channel h.t. filtering. This can be proved by bridging suspect electrolytics with a test component of suitable value and rating. Note also that a small decrease in the value of the main smoothing electrolytic capacitor may be sufficient to incite the symptom without introducing excessive hum in the sound channel.

Misalignment of a sound rejector could result from a broken dust-iron core, alteration in the position of the core in the coil former due to vibration from the speaker and open-circuit, short-circuit or value alteration of the fixed capacitor connected in parallel with the sound rejector coil.

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Letters to the Editor

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

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

DISC TELEVISION

SIR,—I recently became interested in the theory of disc television and I would now like to do some practical work on this subject.

I would therefore be grateful to any reader who would lend or sell me the circuit and constructional diagram of such a piece of apparatus. — C. L. VIGGARS (17 Allen Street, Hartshill, Stoke-on-Trent, Staffs).

FREAK RECEPTION

SIR,—I wonder if any of your readers have either experienced or have reasons for what is apparently freak television reception?

I experienced this on Sunday, 2nd December, from about 8 o'clock when it was first noticed until the close-down of the received stations.

The stations were, I believe, Mendlesham on channel 2 and a Northern and Midlands station on channel 10, both of which were received with good sound and vision. Both channels were received along with our usual two which are Pontop Pike channel 5 and Burnhope channel 8, giving us a choice of four channels in all. On the following evening sound was received faintly on channel 11 but disappeared later on. The aerial this was received on was a simple dipole with reflector, the common H aerial.—R. LANGDOWN JNR. (Ashington, Northumberland).

VERTICAL LINES

SIR,—Mr. L. Pearson, Liverpool (Your Problems Solved, November issue), complains of vertical lines on his Ferguson 992T. If after checking PY81 efficiency diode, and PC81 horizontal scan output valve, fault is not cured, I would suggest the replacement of R35 (910Ω) across line linearity inductor, also check or substitute C29 which is also across this inductor. These components are easily replaced without removing the chassis. Remove screws securing the bracket on which linearity coil is mounted, the coil together with resistor and capacitor can then be withdrawn on their leads. The noise-like interference could be caused by arcing in a faulty line output transformer.—S. WHITTON (Buckingham).

FRAME CRAMPING

SIR,—Referring to the letter entitled "Mysterious Fault" from R. W. T. Horne, published in your January 1963 issue, I would beg to suggest the following explanation of the need for different settings of the linearity control for BBC and ITA reception when this control is used to combat the effect of hum in the frame timebase.

The crux of the matter is that the frame synchronising signals of the two programmes are not mutually in phase. While, to minimise the stringency of design of receivers, the frame repetition frequency is locked to the power-grid frequency by both BBC and ITA, the frame synchronising pulses are not simultaneous. It must be borne in mind that the phase of the power-grid cycles will not in general be co-phased at the two video-generation points owing to the phase-shift which occurs in power transmission lines.

At your correspondent's location, hum in the frame time-base distorts the frame scan. Whether this hum stretches the bottom of the raster or compresses it depends upon whether the mains are positive-going or negative-going when the bottom of the raster is being formed. This depends on when the formation of the raster was initiated by the sync-pulse, and in turn depends on the phase of the sync-pulse generated at the video-generation point.

Any attempt to combat the effect of hum by use of the linearity network is almost certainly doomed to failure on one programme unless, by sheer luck, the two sets of sync-pulses are temporarily co-phased.—F. P. MASON (Sutton, Surrey).

SIR,—In reply to R. W. T. Horne's query in your January issue, requesting an explanation to frame cramping at bottom of ITA picture with extended top and the reverse effect on switching to BBC, i.e., cramping at top with extended base. His logic is quiet sound and he almost succeeded in answering his own question!

These peculiar symptoms are, in fact, caused externally in transmission by the BBC and ITA locking their generators on different half-cycles of the mains supply. Therefore, faulty smoothing or a heater cathode leak will show fault symptoms in reverse on respective channels.—D. J. COLWELL (Bury St. Edmunds, Suffolk).

PUBLIC TELEVISION

SIR,—I do not understand why obstacles are being put in the way of public television in cinemas and theatres. As you say (p.195, February issue), there are many events of national interest which lend themselves to wide-screen showing.

Suitable televised events could be inserted to form part of a normal three-hour cinema programme. This would demand flexible planning, geared to happenings of the moment, but I imagine that many cinema managers would welcome this as a challenge, offering a more inspiring future than that of becoming an administrator of a bingo hall! —F. HAYES (Perivale).

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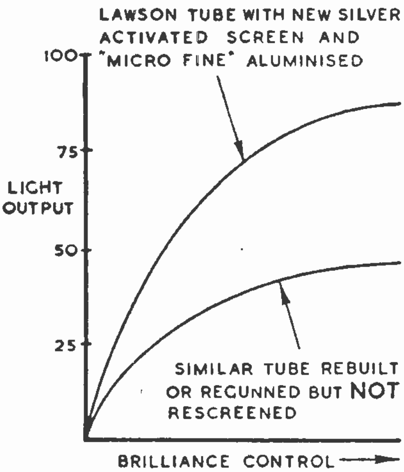

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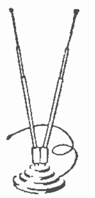

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