Practical TELEVISION

APRIL 1962

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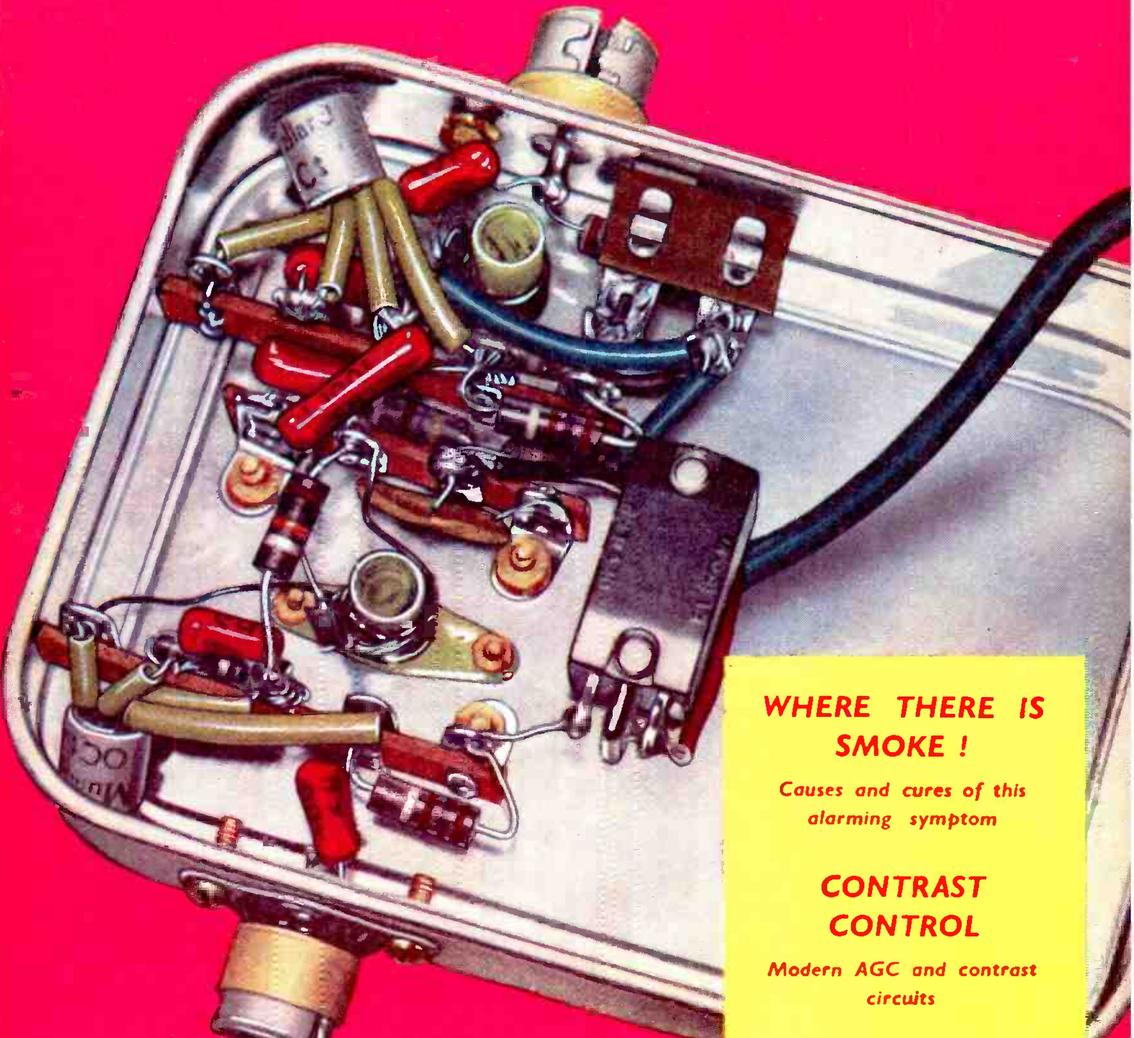

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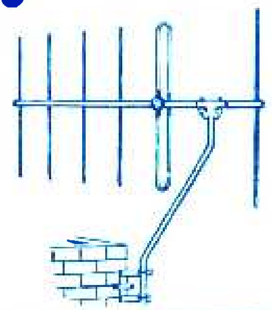

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Practical Television

AND TELEVISION TIMES

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Contents

	Page
Editorial	317
Telenews	318
Interlacing Problems	320
Where There Is Smoke ...	323
Servicing Television Receivers	326
Contrast Control	328
Servicing Data and Modifications	333
Transistorised Pre-Amp ...	336
How TV Sets Work	339
Underneath the Dipole ...	341
Television Filters	343
Letters to the Editor	347
Your Problems Solved... ...	348

Closed Circuit Television

SOON after television became a popular medium for domestic entertainment, activities in certain quarters were directed to making commercial use of the many facilities which were obviously provided by "seeing at a distance". The possibilities are endless, although in some cases the costs may be out of proportion to the advantages offered. Besides simplifying some tasks, the use of closed circuit TV can result in the saving of life —or at least reduce the risk of loss of life. For instance, a small truck, carrying a TV camera, and containing its own power supply may be sent into burning premises or other danger areas and a picture picked up on a monitor will show the best way of attacking the fire or other danger. The latest uses of CCTV, in missiles, for sending back to earth views of the earth or the moon, for example, will also avoid the risk of danger to a human being, in many cases being more speedy and sometimes more reliable.

Traffic control using CCTV has already been introduced in this country, where suitably sited cameras transmit to a control point the traffic conditions existing at any "trouble spot", and thus the police can keep a visual check on the flow of traffic and take steps to prevent any imminent jams.

There is no doubt that CCTV, linked with electronic devices such as are now being employed on bus routes, will enable traffic speeds to be increased, although we rather doubt whether the reliability of some pieces of modern equipment will permit of their full-time use for such purposes.

P.W. BLUEPRINTS

The April issue of *Practical Wireless*, which was published on 7th March, contained a free, double-sided blueprint giving full constructional information for the International Short Wave Two and the Regency. The short wave receiver is a two valve battery-operated type and the Regency is a four transistor portable for medium and long waves.

In the May issue of *Practical Wireless*, there will be another free double-sided blueprint. The two designs will be the Britannic Two—a two-valve, mains operated set for medium and long waves—and the Mercury Six, which is a six transistor battery-operated superhet using a readily available plastic cabinet. The May issue of *Practical Wireless* will be on sale on 6th April—order your copy now!

OUR FILM SHOW

Nearly four hundred readers attended our annual film show held in February at Caxton Hall, Westminster. This event was arranged as in previous years in association with Mullard Limited.

The film show was enjoyed by all who attended, many having travelled many miles in order to be present—the meeting closed with the hope that a similar film show will be held next year.

Our next issue, dated May, will be published on April 19th.

Telenews

Television Receiving Licences

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

Region	Total
London	1,952,782
Home Counties	1,642,594
Midland	1,744,448
North Eastern	1,869.917
North Western	1,528,326
South Western	1,003,424
Wales and Border Counties	709.053
Total England and Wales	10,450,544
Scotland	1,069,231
Northern Ireland	173,670
Grand Total	11,693,445

US Frozen Food Plant and British TV

THE problem of most busy supervisors — how to be in several places at once—has been solved in the new £600,000 food distribution plant at Meletio Seafoods, St. Louis, Mo., USA, where executives are able to watch every phase of production throughout the orginisation without leaving their office desks.

Seven EMI Electronic cameras, which have been installed as part of a Fairbanks-Morse closed-circuit television system transmitting pictures from key-points to viewing monitors installed in executive offices, provide the answer. Supervisors need only flick a switch to obtain the view they require. A special enclosure protects a camera placed in the freezer area — where some 50,000,000 pounds of frozen foods can be stored—against the low temperature.

Compact, high-definition EMI cameras are being used throughout the installation. The equipment has been specially designed for industry, to give trouble-free service under varying extremes of heat and cold. It operates on the 525-line standard and produces high-quality pictures without special lighting facilities.

Colour Television Receivers

THE first comprehensive British range of colour television receivers of different standards for professional use was announced recently by G.E.C. (Electronics) Ltd.

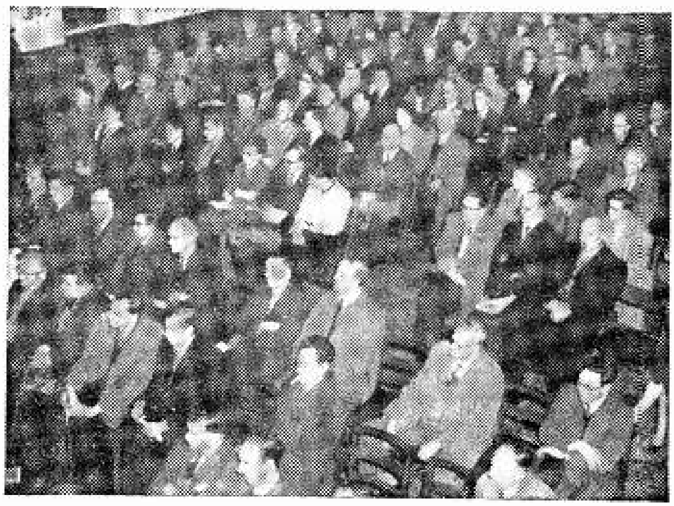
The models include the first British small-screen 625-line colour receiver which uses a 17in. tube and a receiver with a 21in. tube that will receive the VHF colour transmission being broadcast regularly by the BBC. The new receivers are essentially professional units and are built to extremely high standards of television engineering.

G.E.C. (Electronics) Ltd. is the first company anywhere in the world to make a firm commercial offer of receiving equipment for all the leading colour television systems. Enquiries already received from abroad indicate that colour television could be an important area for British exports in the years ahead.

Microwave Link Contract

A CONTRACT has been awarded to Pye Telecommunications Limited of Cambridge by the British Post Office for a three-hop microwave link between Plymouth and Goonhilly in Cornwall — the United Kingdom terminal for the transatlantic satellite communication experiment planned to take place later this year.

The link will take television programmes from the existing G.P.O. network at Plymouth and transmit them over the Pye 7,000Mc/s equipment to Goonhilly—a distance of 60 miles. From Goonhilly the programmes



A section of the audience at our film-show, held recently in London.

will be transmitted via satellites "Relay" and "Telstar" to the American Satellite Ground Station at Andover, Maine, and thence into the American television network.

The equipment is similar to that currently being supplied to the BBC, ITA programme contractors and many other users. It is suitable for 405, 525 or 625-line transmission.

Beckley Station

THE television transmitters at the BBC's new television and VHF sound station at Beckley, 4½ miles north-east of Oxford, were brought into service on Monday, 29th January.

This new station is one of several that the BBC is building to extend and improve the coverage of its television and VHF sound services. The television station will improve reception for some 300,000 people who have hitherto received a fringe area service from the BBC's high-power television stations at Crystal Palace or Sutton Coldfield. The areas served will include Oxford, Witney, Woodstock, Bicester, Thame and Abingdon.

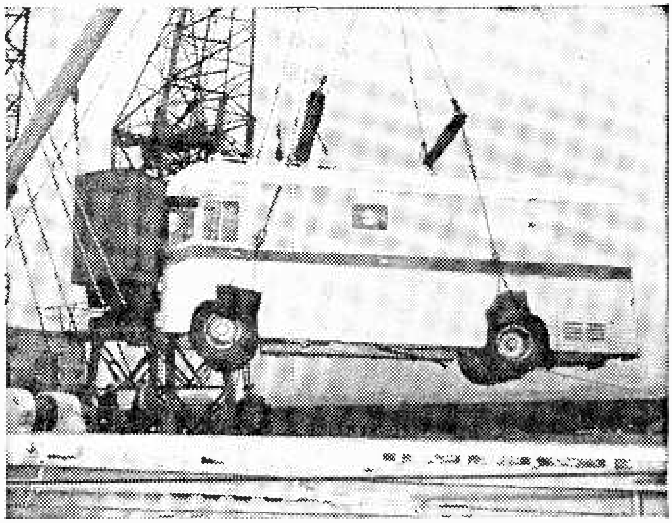
The Beckley station, which is designed to work unattended, receives its television programmes by radio from the BBC station at Sutton Coldfield. It transmits them on Channel 2 (Vision 51·75Mc/s, Sound 48·25Mc/s) with horizontal polarisation, which means that receiving aerials should be mounted horizontally.

The VHF sound transmitters at the Beckley station will be completed during the spring when a further announcement will be made.

Piped TV in Northern Ireland

PHASE one of the piped television system at Newtown Abbey, Belfast, is already serving more than 200 subscribers. Installed in mid-December by Northern Ireland Multivision Limited using "Belling-Lee" equipment, this system enables users to receive BBC and ITV programmes as well as F.M. radio.

Designed and planned by "Belling-Lee" engineers, this installation is one of the latest examples of how co-operation between the Company on site and "Belling-Lee" can provide, by means of a single aerial mast, a uniformly high standard of reception throughout any locality at an economical cost. In difficult reception areas the picture quality obtainable from such a system is many times better than most viewers could achieve with the most expensive type of aerial they could erect on their premises, there are no aerial maintenance worries, and yet every subscriber has complete freedom of choice of the make and type of receiver he wishes to have.



An order to supply to the New Zealand Broadcasting Service a television outside broadcast vehicle, has recently been received by Marconi's Wireless Telegraph Company Limited. This illustration shows it being loaded on board ship at the start of its voyage from London.

Closed-circuit TV at Textile Machinery Conference

OVER 300 managers and chief engineers of large textile organisations in France, Belgium and this country have applied for the 150 seats at a Conference on Textile Machinery, to be held at Huddersfield College of Technology on Wednesday, January 31. Closed-circuit television and film will bring them close-up views of machines operating in the college and in other parts of the town.

The main feature of the Conference will be a lecture on a new type of ring frame spinning machine, of which three slightly different variations are being manufactured in England and Belgium.

Two English machines are installed in the College's textile workshop and a Belgian machine in a mill 500 yards away across a canal. A closed-circuit television system, supplied by EMI Electronics Ltd., will transmit pictures of these machines in operation to the lecture theatre at the College.

New Service for EEV/US Agent

THE representation of the English Electric Valve Company Limited in the USA, for the marketing of television camera tubes is most successfully carried out by Visual Electronics Corporation.

As a backing to this American sales force, a complete duplication of the testing facilities at EEV premises at Chelmsford, England, has been installed in the New York offices.

RCA Colour for BBC

IT has been announced by RCA Great Britain Limited that the BBC have ordered an RCA Colour Monitor type TM21C and a quantity of RCA Colour TV receivers to operate on 625-line standards. This equipment will be used in connection with the BBC's future plans for experimental colour television transmission.

In addition, the BBC has ordered an RCA Colour TV receiver to operate on the US 525-line standards.

Interlacing Problems

ATTENTION TO THE INTERLACE OF THE PICTURE ON A RECEIVER CAN LEAD TO IMPROVED VIEWING

THERE are 405 lines to the whole of each picture produced on the existing British television system, and each picture takes one twenty-fifth of a second to complete. However, each whole picture is made up of two half-pictures, called "frames," which means that each frame takes one fiftieth of a second to complete. That is, there are twenty-five whole pictures and fifty half-pictures produced each second.

Scanning

Each half-picture is complete in itself on 202½ lines, and the two half-pictures are "interlaced" one with the other to form a whole picture on 405 lines If something happened to the system so that there were only a half-picture, or just a single frame, each twenty-fifth of a second, a picture would still be seen, but it would have only half the detail and definition of a whole picture. The interlacing principle is shown in Fig. 1.

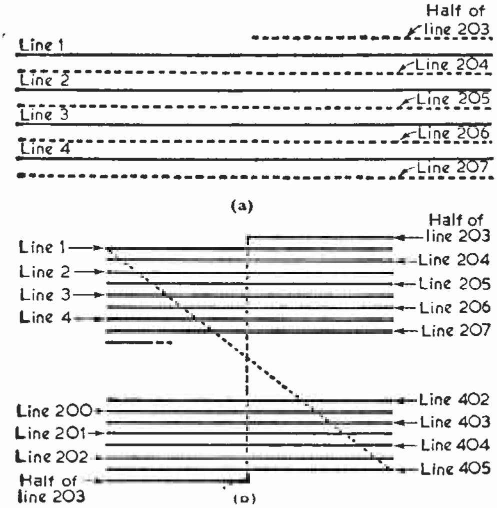


Fig. 1—How the interlaced picture is produced: (a) the first few lines of a picture with the lines of the "odd" frame shown dotted, and (b) the complete path of the scanning spot in tracing out the "even" and "odd" frames.

However, if two frames, or half-pictures failed to interlace and one frame occurred exactly on top of the other frame, then the overall definition would be something less than the 202½-line definition of the former example, since each line would then be composed of two slightly different lines superimposed on each other.

It rarely happens that one frame alone of a whole picture is missing, and this could only happen owing to a fault at the transmitter, but it is frequently found that a fault in the receiver disturbs the interlacing and thus impairs the overall definition as already explained.

Degrees of Interlace

It is unusual in practice to find the lines of "odd" frames exactly superimposed on the lines of "even" frames to give the classic "line pairing" effect of Fig. 2a. It is more usual for the lines of one frame to be displaced slightly from the centre of the lines of the other frame, giving various degrees of interlace, as shown in Figs. 2b and c.

In older sets, it is also unusual to find perfect interlacing where the lines of one frame are exactly and consistently in the centre of the lines of the other frame. On very recent sets, the interlace is approaching the ideal—or should do so if the set is in good order and the frame hold control is adjusted correctly.

Two photographs are reproduced—(A) and (B)—taken directly from the screen of a fairly recent receiver. There is no interlacing whatever in (A) because the photograph was taken of a blank raster without any signal, and no set can interlace without a signal. With the photographic camera in exactly the same position, a photograph (B) was taken from the same receiver of a part of a picture. Careful examination will show almost perfect interlacing with the scanning lines barely visible, campared with the "liny" effect of (A).

Why is Interlace Scanning Used?

Sequential scanning at 405 lines—that is when there are no arrangements at the transmitter or receiver for interlacing and each whole picture is formed on one complete frame of 405 lines—would result in considerably more picture flicker at twenty-five pictures per second than is evident with interlaced scanning with an equal number of whole pictures per second.

By J. H. Austin

Moreover, if sequential scanning at fifty whole pictures per second were adopted, the video bandwidth required to provide equal and balanced 405-line definition would be twice that required for 405-line interlaced scanning.

In other words, interlacing makes it possible to achieve a "flicker factor" which is almost equal to a picture repetition rate of 50c/s in half the video bandwidth. Objectively, interlaced scanning is not quite the same as equal definition sequential scanning, because with the former it is possible to discern "interline flicker" if the screen is viewed closely; and if the eyes are caused rapidly to scan the picture vertically one interlaced scan appears momentarily to disappear. At normal and correct viewing distances, however, these effects are barely noticeable, and so much is gained by interlacing.

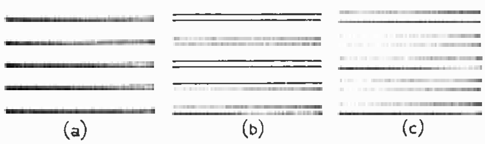


Fig. 2—Degrees of interlace: (a) line pairing, (b) poor interlace and (c) fair interlace.

Hum Effects

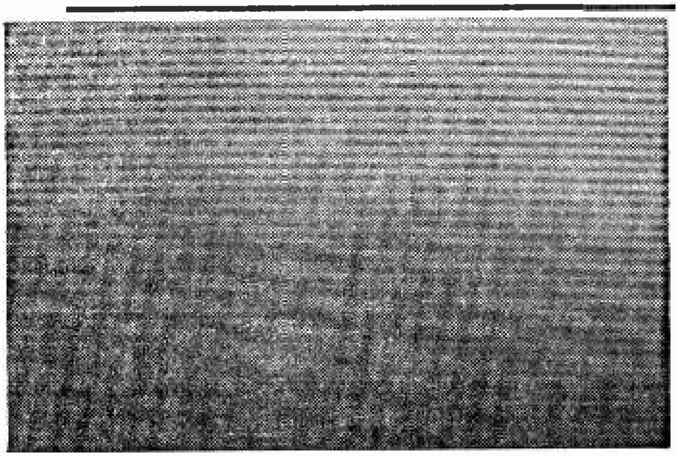
The frame repetition rate of 50c/s is adopted in this country because this is equal to the power supply frequency. As it is economically undesirable to eliminate all traces of residual mains hum from the picture, a frame which is not locked to the mains frequency will reveal the residual hum as horizontal shading on the picture, moving up or down the screen, depending on the difference between the frame frequency and the power or hum frequency. When the hum is locked to the frame frequency the shading remains stationary and is not usually noticeable.

The effect of hum ripple may have been noticed by viewers and experimenters during a series of BBC tests when the frame sync pulses were purposely "unlocked" from the power frequency. The effect also occurs when television receivers are operated by a power supply other than that of the national "grid". Earlier sets were more troublesome in this respect, and it would seem that more recent models have considerably improved H.T. smoothing. In some cases, manufacturers supply models specially engineered for non-synchronous power supplies, or supply modification details so existing models can be altered if required.

Other Frame Frequencies

In America the frame frequency is set at 60c/s, simply because the power supply frequency in that country is 60c/s. The frame frequency is one parameter which cannot be easily altered, no matter what happens to the line standards.

In order for $202\frac{1}{2}$ lines of each frame to be produced, or traced on the screen, 50 times per second, the line timebase must run at $(202\frac{1}{2} \times 50)$c/s; that is 10,125c/s. The scanning spot traces out the lines from left-to-right, as shown in Fig. 1. When line 405 has been traced out, the frame timebase returns the spot to the top left-hand corner of the screen to trace out the next line. Similarly, when half of line 203 has been traced



(A)—Complete lack of interlace is shown in this illustration of a free-running, unmodulated raster.

out, the frame timebase returns the spot to the top centre of the screen to trace out the remainder of line 203, as shown in Fig. 1. After each line scan, the line timebase returns the spot to the left-hand side of the screen—just a little lower than the preceding line owing to the action of the frame timebase—ready to trace out the next line of the frame.

These things happen irrespective of the number of lines. For example, on a 625-line system, one frame of 312½ lines would be interlaced with the associated frame also of 312½ lines. The frame repetition frequency would remain at 50c/s, but the line frequency would then equal (312½ x 50)c/s; that is 15,625c/s. Some of the recent "dual-standard" or "convertible" receivers have a switch for changing the line timebase frequency from 10,125c/s to 15,625c/s and vice-versa. The higher line timebase frequency is a factor in favour of 625 lines, since at this higher frequency the line timebase whistle will not be audible.

Checking the Interlacing

It is obvious if a television picture completely lacks interlace because the line structure is very prominent indeed; there appears to be very poor horizontal and vertical definition and, in spite of the lines being clearly in focus, the picture itself appears to be out of focus. In order to view such a picture with reasonable comfort, at least twice the normal viewing distance is required.

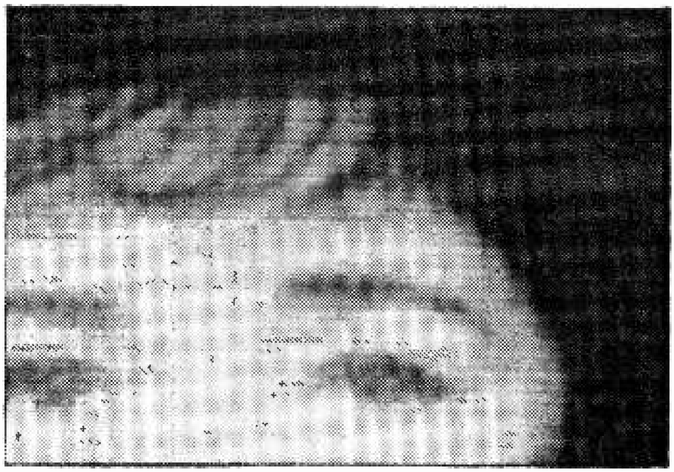
When there is partial interlace, which is usually the case, it is rather difficult to establish the exact degree of interlace by normal viewing. If the interlace is good, concentrated viewing of the lines gives the impression that the whole line structure is drifting up or down the screen, and the lines assume an elusive, flickery character. If one really concentrates on the line make-up in this way a spell of dizziness may occur, and in some cases there may be a black-out. Normal viewing does not promote such effect, of course, but care should be taken if such symptoms appear probably during a prolonged session of "close viewing". The set should be switched off, and the eyes should be allowed to concentrate on more material distant objects.

Small Area

The use of a magnifying glass suitably positioned in relation to the screen can assist in determining the approximate degree of interlace, especially if only a small section of the screen is examined in this way.

To secure a comparison between a definite non-interlace and the normal interlace performance of the receiver, the frame hold control can be rotated slightly until the picture rolls very slowly downwards. When that happens the interlace is destroyed, and the condition then can be compared with the picture properly locked, when the interlace should be at maximum.

Some service technicians endeavour to assess the degree of interlace by expanding the frame scan with the height control. This opens the lines, of course, so that the interlaced scan may be more readily observed. Unfortunately, this procedure is also likely to impair the interlace performance of the frame timebase, and the results obtained



(B)—Good interlacing.

may not be the true state of affairs when the picture is at the correct height.

Similarly, it is sometimes said that the interlace may be checked by observing the frame flyback lines which can be superimposed on the picture of some receivers by turning up the brightness control beyond its normal setting. It is stated that if the flyback lines are correctly interlaced or that there are two lines starting approximately half a line apart, then the scan interlace is correct. This is not strictly true, however, for excellent flyback interlace may occur on receivers where the scan is almost paired.

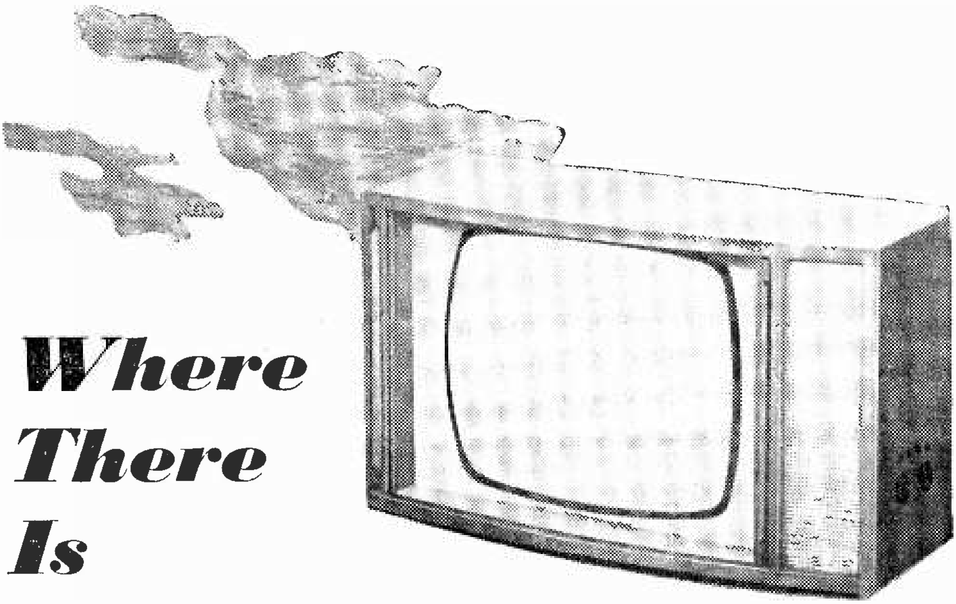
Cause of Poor Interlace

The normal interlace performance of any receiver is a function of the design of the sync separator and timebase circuits. Almost all recent receivers have a very good interlace performance and if anything goes wrong with the interlace, then one can be almost sure that it is caused by a circuit fault.

However, on earlier models the interlacing was sometimes somewhat less exact, and some of these receivers are in use today. With such sets, it may be necessary critically to adjust the frame hold control for optimum interlace after first setting it for optimum frame lock. By rotating the control *within the locking range* it is sometimes possible to observe the interlace varying and in some positions there may be no interlace at all. This is a design consideration, of course, and it is not the purpose of this article to delve into such matters.

If a receiver which normally exhibits good interlace suddenly develops poor interlacing, something can usually be done about it without redesigning

(Continued on page 344)



Where There Is SMOKE . . . .

By J. M. duClare

FAULTS WHICH CAUSE SMOKE TO ISSUE FROM A TV RECEIVER ARE USUALLY EASILY LOCATED AND REPAIRED, BUT THEY SHOULD BE TACKLED IMMEDIATELY AND NOT LEFT TO GROW INTO A SERIOUS FIRE !

A MOST disconcerting fault symptom is failure of sound and vision followed almost immediately by a smell of burning and clouds of smoke rising from the ventilation slots in the back and base covers of the set. It is obvious that the set should immediately be switched off when this happens so as to minimise the amount of damage.

Location

Although this symptom is somewhat disturbing it does not usually amount to much in terms of repair, and fault diagnosis is considerably aided by the tell-tale burn marks on the component in the faulty section. After switching the set off and disconnecting it from the power supply, both the base and back covers should be removed and the components, particularly resistors, should be scrutinised for signs of overheating. In the majority of cases, the smoke is caused by the paint and residual wax being burnt off a resistor or condenser owing to a fault condition resulting in its overheating.

If the resistor is a small one, it is likely to get extremely hot, almost red hot, very quickly and most of the paint and wax burns off after the first two or three seconds. This results initially in large quantities of smoke which disappear almost completely after a few seconds if the set is left running in the fault condition.

Eventually, the excessive heat invariably fractures the resistor and the power is then cut off from the faulty section.

However, if the resistor is large with a relatively high wattage rating, it will produce far more heat than a small resistor before finally failing or before the fault condition causes something else in the associated circuit to fail. Moreover, if the resistor happens to be very close to, or in contact with another component, then that also is likely to suffer. For example, if the resistor is very close to a waxed tubular capacitor, the heat from the resistor will cause wax to melt and boil, and if the resistor fractures, the resulting spark may ignite the gases from the wax and a small fire could develop inside the set. This is why it is desirable to switch the set off immediately there is a smell of burning or signs of smoke.

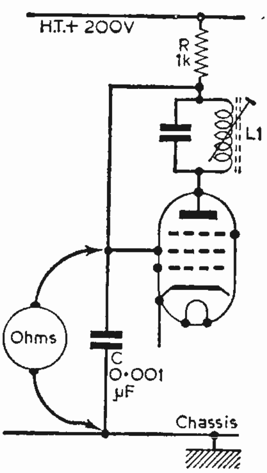
Temperature Test

When inspecting the components for signs of burning, it should be remembered that certain resistors normally work at a fairly high temperature, and this applies particularly to those of a wire-wound variety on ceramic formers and cement coated. Sometimes the cement coating flakes and drops into the bottom of the cabinet, but this should not normally be taken to indicate that the component is the one responsible for the smoke as ordinary ageing causes these signs which are perfectly normal and not particularly harmful.

Similarly, certain wax-coated components, such as capacitors, shed some of their wax during their life owing to the fairly high working temperature inside the set. Pools of hardened wax may thus be found on the inside of the inspection cover at the bottom of the cabinet. However, a clue to a specific overheating symptom is given if the wax pool is found to be very soft and almost liquid. Directly above the pool will be the wax-coated component which has been affected by the heat, and possibly directly by the side of this will be the burnt resistor.

If visual inspection fails to reveal abnormal overheating or burning it could mean either that the fault condition current is only a little above the normal working current of the component concerned or that the set was switched off before the overheating had a chance to leave any trace. In both events, the set may be reconnected to the power supply and switched on whilst keeping a hand on the on/off switch so that the set may be switched off quickly immediately anything develops.

This is a most critical period when one should endeavour to scan the whole of the chassis and become highly sensitive to slight traces of smoke. A good light helps, and there should be no draught of air across the set. When the smoke is observed its exact location should be noted, after which the set should again be switched off and disconnected from the power supply.



It is now a relatively simple matter to test the temperature of those resistors and components in proximity to the smoke source with a finger. In order to produce smoke the component must be quite hot and thus can be quickly located. It may, in fact, have been possible to note the actual component concerned when the set was switched on for the smoke test.

The Repair

So far the only thing that we have done is to locate the component which is overheating. The fact that it is overheating, particularly if it is a resistor, does not indicate that a fault in that component itself is responsible. It is not just a matter of replacing the component to cure the trouble, although this will have to be done later. The overheating will almost certainly be caused by a fault in an associated component, so that if the overheating component is replaced without locating the root of the trouble, the replacement will also overheat and one will be no further forward.

Overheating means that excessive current is being passed by the component and, in effect, that it is being overloaded. A simple case which illustrates this point is shown in the circuit of Fig. 1. Here is shown the anode and screen grid H.T. feed circuit of an R.F. or I.F. amplifier stage as may be found in any radio or television set. The H.T. is fed to the anode through R and L1 and to the screen grid through R. Capacitor C is the usual decoupling component which holds the earthy side of L1, and the screen grid at chassis potential so far as R.F. is concerned.

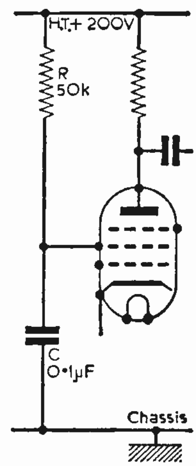
The total screen and anode current of the stage may be, say, 20mA; thus, by Ohm's law, the 1k resistor will drop 20V, meaning that from a 200V H.T. line, as shown, the anode and screen will be at a potential of 180V. The power in the resistor ($W = E \times I$) will be 0·4W, which would mean that a $\frac{1}{2}$W resistor would be used in practice. This would be an adequate rating and the resistor would hardly become warm at all.

However, let us suppose that C developed a short-circuit, which is what often happens. The current in R would then be limited simply by its resistance, and in this case would rise to 200mA (e.g., $I = E/R$, where I is the current in mA, E is the H.T. line voltage and R is the resistance in kilohms). The power dissipated in the resistor would be very high; it would, in fact, go up to 40W. Of course, the resistor almost immediately becomes red hot, sheds its paint in smoke and promptly burns out.

Certain capacitors, particularly in sets of several years' vintage, are prone to this trouble, and it does not take the technician very long to restore normal operation, even after the rather frightening experience to the viewer of seeing smoke at the back of his set.

Fig. 1 (left).—A short-circuit in C will cause an excess of current to flow through R, resulting almost immediately in its failure.

Fig. 2 (right).—The relatively high value of R in this circuit would limit the current in the event of the capacitor C short-circuiting, and there may be no visible indication of overload.



The experimenter can handle such cases with like rapidity with just a little skill. Indeed, any symptom which is accompanied by smoke is usually extremely easy to diagnose and not always too costly to put right, which is just the opposite to what the viewer would expect. For example, the burn out in Fig. 1 would cost about 6d. for the resistor and 1s. 0d. for the capacitor.

Short to Chassis

One can be fairly certain that any resistor which is burning or overheating is caused by the end remote from the H.T. line being shorted, either directly or via a low resistance, to H.T. negative or chassis. All sets contain resistor-capacitor decoupled circuits of the nature shown in Fig. 1, so all one need do is to look for the capacitor, replace it along with the resistor, and in nine cases out of ten the problem is solved.

To prove the point conclusively an ohmmeter can be used, as shown in Fig. 1, making sure, of course, that the set is switched off before the instrument is applied. If a low resistance or dead short were indicated, the capacitor should be cut out of circuit, and the meter should then show that the short has cleared.

Increase in Value

Even if the resistor has not failed completely it is best always to change it, for the excessive heat will almost certainly have altered its value and, although the set may be made to work simply by replacing the shorting capacitor, the performance will not be up to standard if the resistor has, for instance, increased in value.

It sometimes happens that a decoupling capacitor develops a relatively high resistance but sufficient to cause excessive current in the associated resistor.

In this case, the set may not fail completely, but it will be well below standard and the resistor may overheat sufficiently to smoke.

Whether or not the resistor overheats will also depend on its value. Take, for instance, the screen feed and decoupling circuit in Fig. 2, which may be part of an A.F. amplifier. Here the resistor R is 50k and, again, may be rated at ½W. If C shorts, then the total current through R from a 200V H.T. line can never exceed 4mA. At 200V this represents 0·8W, which is only a little above the normal rating of the resistor, which it could possibly stand without ill effect.

A burning resistor, therefore, means that its value is relatively low, usually between 1,000 and 10,000Ω, and that it is fed direct from the H.T. line, for if there were another resistor in series, as shown in Fig. 3, R2 in this case would limit the current and prevent R1 from overheating, depending upon relative values. Television R.F. and I.F. amplifier stages use decoupling and H.T. feed resistors of relatively low values, which is possibly one of the reasons why television sets are more prone than ordinary radio sets to the symptom of smoke.

In Fig. 3, R1 is the screen feed resistor and C1 is its decoupling capacitor. In the event of C1 shorting, a high current would flow through both R1 and R2 and both resistors would be over-run. However, since R2 carries current for other stages prior to V1, its rating will be considerably above that of R1, which means that it could stand an overload far better than R1. Thus, it may hardly increase in temperature while R1 may quickly burn out as already described.

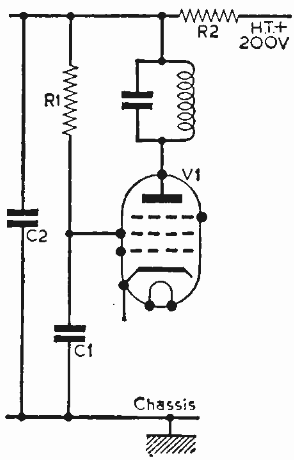


Fig. 3 (right).—The current in R1 caused by a short-circuit in C1, may, in this circuit, be limited to a reasonable value by R2. However, a short-circuit in C2 would cause an excessive current in R2.

On the other hand, if the value of R2 were relatively high compared with R1 and C1 shorted, most of the power would be dissipated in R2, which might overheat while R1 remained reasonably cool. In the event of a short occurring in C2, then, of course, R1 would not be affected at all, but R2 would stand all the strain and possibly become hot if of a sufficiently low value.

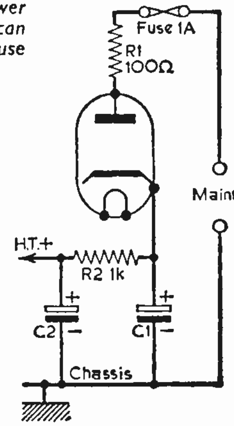


Fig. 4 (right).—The high power available in this circuit can cause serious results if the fuse is over-rated.

Other Causes of Overheating

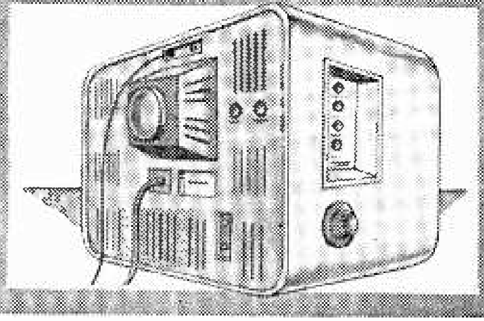
In Fig. 4 is shown a typical H.T. supply circuit found in most television sets. Resistor R1 is the surge limiting resistor and R2 is the smoothing resistor. The electrolytic condensers, C1 and C2, are the reservoir and smoothing capacitors respectively. The rectifier may be a valve, as shown, or it could be a metal rectifier, depending on the set. Here we have components which are highly vulnerable to overheating and burning. Take R1, for instance; all the current of the set passes through this resistor which has a value of about 100Ω, or even less. If the current in the set is, say, 200mA then 4W would be dissipated in a value of 100Ω, and the resistor would be rated at 5W. This means that the resistor is quite hot when working normally, like the mains dropping resistors of the heater chain.

Let us suppose that C1 breaks down. The current in R1 would then be limited by its value and by the current capability of the rectifier. One of several things may happen. The fuse may blow, and it should do if correctly rated. However, if it were over-rated, the rectifier would become very hot indeed and would probably start flashing over internally. If it were a metal type, it would most likely flash between its plates and produce a most unpleasant, highly characteristic, pungent smell, which would be accompanied by smoke.

At the same time, however, R1 would be grossly overloaded, but would not fail immediately because it is a 5W resistor. It would most likely become red hot and start burning other components near to it. This would continue until either the fuse or the resistor eventually failed or until the rectifier ceased to pass current—or until the set caught fire and the house fuse failed. Things like this can happen if the fuse is over-rated and the set left unattended.

A short in C2 would not have such startling effects, since the H.T. current is limited by R2. ■

Servicing Television Receivers



No. 77—BUSH TV77 SERIES

By L. Lawry-Johns

THE TV77 is the most complicated version of the TV75 series and it is for this reason that it has been selected and presented in the diagrams. A large number of the notes given here apply equally to most of the models in the series. The TV77 has a separate F.M. tuner, flywheel line synchronisation, mean level AGC system and a 10·7Mc/s I.F. strip for F.M. sound. An LW15 metal rectifier is used in all models.

The "80" series utilise several of the features of these models, some having "Bush Buttons". As in most Bush receivers, the heater and H.T. supplies are separately fused, the heater circuit fuse being rated at 500mA, the H.T. fuse at 750mA.

Some Common Faults

Probably the most common fault is complete absence of H.T. which gives the symptoms of all valves lighting but no sound or vision and no trace of hum from the loudspeaker. This is invariably caused by one of the surge resistors behind the mains panel becoming o.c. giving the same effect as a blown 750mA fuse which of course should also be checked. To verify that a surge resistor is o.c. a quick but, not conclusive check, is to connect a thin wire from the voltage selector plug to the hole immediately above it. If sound and vision return the resistors between these sockets is of course o.c. This cannot be a conclusive check since one of the other resistors, perhaps on the other side of the panel, could be at fault. The proper method is to remove the chassis and check each resistor separately.

The method of chassis removal varies from model to model but the following hints will help with the "70" series. The front control knobs are clamped to the control spindle and it is necessary to slacken the clamp screw with a screwdriver inserted from below, holes being provided. The bottom-chassis fixing screws should be removed and the receiver turned upright. The rear cover is next removed and the "claws" at each upper

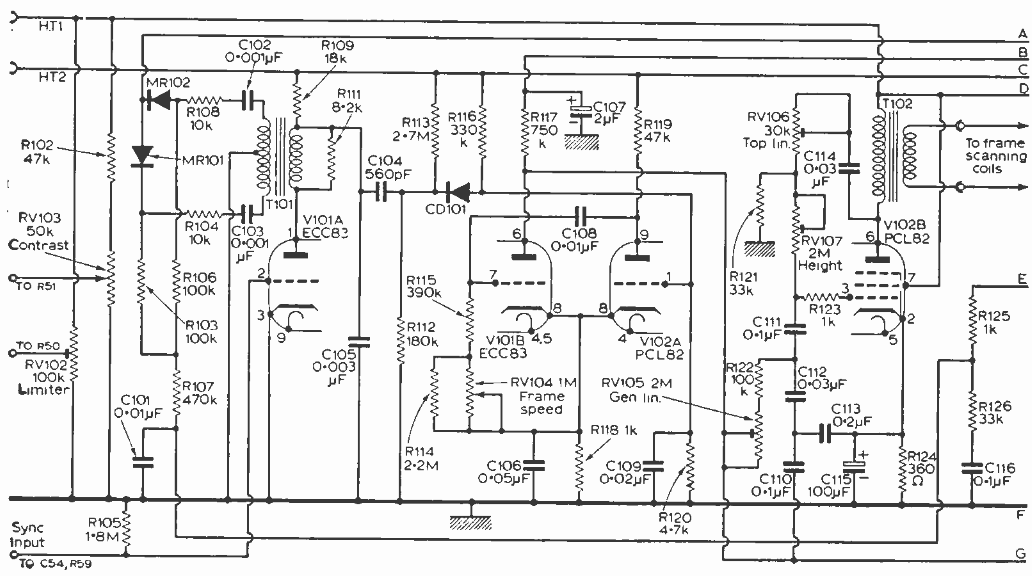


Fig. 1—The sync separators and frame timebase circuits.

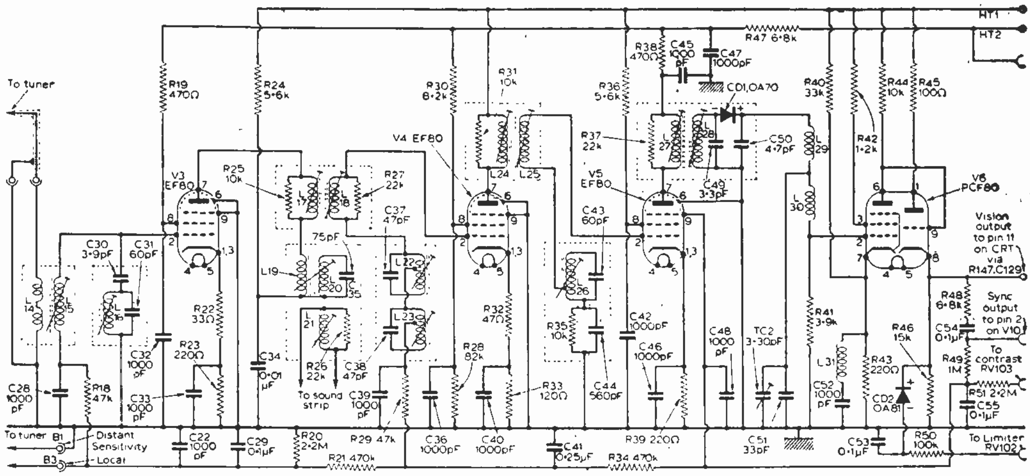


Fig. 2—The vision I.F., detector and amplifier stages.

corner of the chassis slackened, rotating so that they clear the cabinets. The upper left loudspeaker plug is then removed and the chassis slid out complete.

Some of the "80" series use a cabinet shell which is secured by two screws either side, and one at the top, these being on the inside securing the shell to the front panel. A long fairly thin screw-driver is required for this purpose. The knobs are not clamped and do not require removal in order to lift off the cabinet shell. The chassis fixing screws do, of course, require removal as above.

No Picture; Smell of Burning

Check V6 PCF80 stage where R40 (33k) tends to change value thus providing a heavy current path across the H.T. line via R43 (220Ω). Both resistors should be changed.

Under some circumstances R40 may be found undamaged, but R43 burned. In this case, change V6 and check R42.

If there is no picture when the valve and the resistors have been changed, the OA70 crystal diode (GD1) should be suspected as it may often be damaged by an internal short in V6 and therefore this and R41 (3·9k) should be checked. GD1 is located in the L28 coil can below V6.

Lack of Width

Check the H.T. voltage which should not be much under 190V. If the voltage is low, a new metal rectifier (LW15) should be fitted. If the H.T. is up to standard, the line time-base valves, particularly the ECC82 and PL81, should be checked. The actual width control is a small knob which protrudes below the screened section, riding in a slot to carry a dust iron core in or out of the width inductance.

(To be continued)

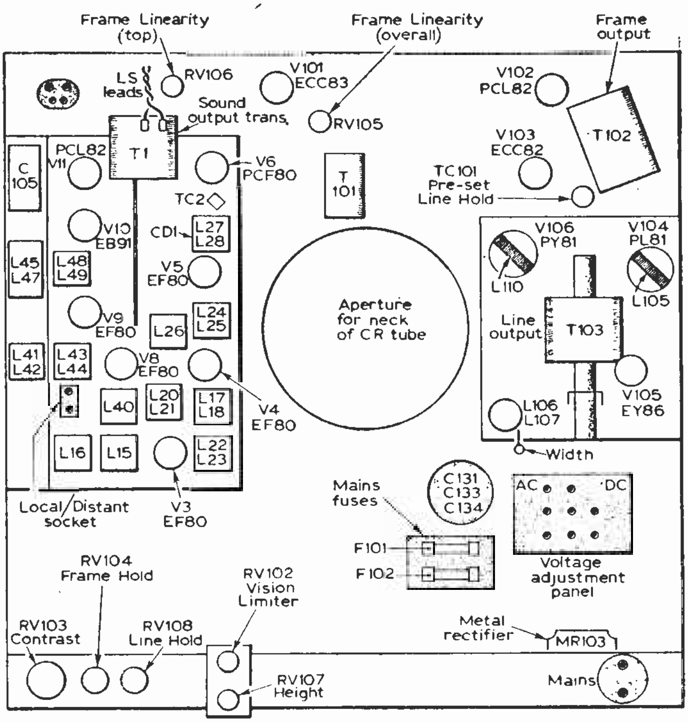


Fig. 3—A rear view of the chassis.

CONTRAST control

By B. L. Frazer

FAULTS TO BE FOUND IN BOTH AUTOMATIC AND MANUAL TYPES OF CONTROL

IN almost all receivers of fairly recent years there are two contrast control systems, one which can be adjusted by the ordinary contrast control, and the other which is wholly automatic in operation and which derives its operating potential from the vision signal itself. Thus, when the signal is strong, the control is decreased and, conversely, when the signal is weak, the control is increased. The manual control simply sets the level at which the automatic control takes over.

"Gated" AGC

Some years ago automatic contrast controls (sometimes called "automatic picture control" or "vision channel AGC") were extremely complicated devices. They obtained their control potential not so much from the amplitude of the vision signal proper, but from the black-level portion of the signal, just before or after the line sync pulses or during the black lines prior to the occurrence of the frame sync pulses.

Special gating circuits were evolved to allow the selected black-level part of the signal to be sampled so that the instantaneous black-level amplitude could be used as a reference for the contrast control potential. These arrangements worked very well, but were somewhat prone to trouble and, as was later proved, were barely warranted in domestic equipment.

"Mean Level AGC"

Automatic arrangements have since then been considerably simplified. The so-called "mean level" system is in extensive use in current receivers. This system is rather the same as the AGC arrangements of ordinary broadcast receivers. Here an AGC control potential is obtained by rectifying a portion of the I.F. signal and using this to control the gain of the frequency changer and I.F. amplifier valves. The control potential is arranged to be negative with respect to chassis. As the signal strength rises, so the negative potential increases, and as this is applied to the control grids of the controlled valves. An increase in signal strength decreases the valves' mutual conductance, or "slope", and the stage gain is decreased accordingly. In this way, the gain varies to compensate for a change in signal strength.

This system operates perfectly well on amplitude-modulated sound signals because the amplitude varies about a mean signal level. With television, there is no mean level, for with "positive modulation", the modulation level rises with increases of brightness of the televised scene. Nevertheless, it has been discovered that the "average" vision modulation remains substantially constant during the course of a programme, since most programmes possess an "average" brightness level.

The simple mean level type of control can thus be applied to the vision channel without undue loss of picture quality. It was at one time thought that a bright scene would produce a negative-control bias of sufficient strength to decrease the highlights of the picture—due to the resulting gain reduction of the vision channel during that period. This effect does happen to a small extent, but due to the "contrast compression" function at the studio (average brightness effect as already described) it is barely noticeable on ordinary receivers. Better quality "studio type" receivers may demand something a little better, however, and on that sort of equipment the "black-level" or "gated" control may be adopted.

The Reason for Automatic Contrast Control

Although automatic-gain-control of the vision channel helps to combat picture fading due to atmospheric conditions, passing aircraft and other such causes, its primary object is to compensate automatically for the change in strength of signals when the receiver is switched from one channel to another. Without such control it would be necessary to adjust the contrast manually each time the channel was altered. This used to be necessary on very early receivers, and is necessary still on some of the early receivers which have been converted for multi-channel operation by a turret or similar type tuner. This article may give some ideas to those experimenters still using sets without vision AGC. It is not difficult to introduce simple automatic control, and the inclusion is well worthwhile, in addition to the instructional nature of the exercise.

A Very Recent System

In Fig. 1 are shown the various stages concerned with automatic and manual contrast control. These are from a very recent receiver which uses the latest triode R.F. stage in the tuner (instead of the conventional cascode—double-triode—stage) and which features 405/625 line switching arrangements.

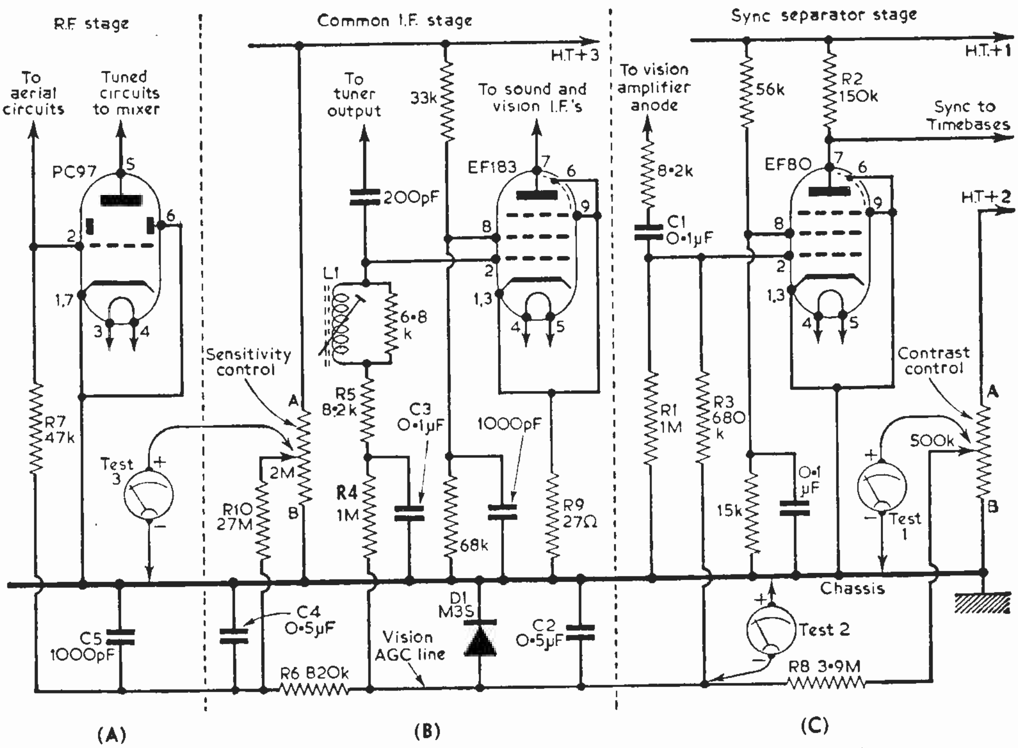


Fig. 1—Detailed circuits of the stages concerned with automatic contrast control.

Section (c) is the sync separator stage. This uses an ordinary EF80, the control grid of which is connected to the composite video signal (picture signal plus sync signals) at the anode of the video amplifier valve.

The relatively low voltages applied to the anode and screen grid of this stage, endow the valve with a short grid base. This means that the composite video signal at the control grid, which may well be of the order of 30V peak-to-peak, drives the valve into grid current on the tips of the positive-going sync pulses, and into anode current cut-off on the negative-going picture modulation.

Sync Separation

During the sync pulses, grid current flows in R1 and charges C1, while during the picture parts of the signal the charge flows out of C1 through R1. Since the valve conducts only during the sync pulses, only sync pulses appear across the anode load resistor R2. The picture parts of the signal are completely suppressed. This is shown diagramatically in Fig. 2, which represents the normal behaviour of most sync separator stages.

Owing to the grid current in R1, there appears between the control grid of the sync separator valve and chassis a negative voltage of a value governed by the strength of the composite video signal—the greater the strength of the video signal, the greater the value of the negative voltage. It is this voltage which is used to give automatic contrast control.

The voltage is passed through R3 to the AGC line, and some of the superimposed picture and sync signal is eliminated by C2, which acts more or less as a reservoir capacitor.

The AGC line is coupled to the control grid of the common I.F. amplifier stage through R4, R5 and L1. Capacitor C3 holds the low signal potential side of L1 to chassis potential and also, in conjunction with R4, provides additional AGC smoothing, so that only a pure D.C. voltage, clear of sync and picture pulses, is present at the valve grid.

The AGC line is also in D.C. connection with the grid of the R.F. valve through R6 and R7. Further AGC smoothing is provided by C4 and C5. Clearly, then, if the signal strength rises, so will the negative bias at the grids of the controlled valves. The overall stage gain will fall, thereby compensating the signal increase. Conversely, a drop in signal strength will increase the gain.

Manual Contrasts

The manual contrast control is connected across the H.T. supply, while the slider of the control is connected through R8 to the AGC line. When the slider is adjusted to side "B" of the control, R8 is effectively in parallel with the AGC line, and since its value is high (3·9M) it has little or no effect on the automatic operation. This is the "minimum" contrast position, where all the bias is provided by the signal.

However, when the slider is moved towards side "A", a *positive* potential is applied to the AGC line, of a value determined by the setting of the contrast control. This positive potential tends to cancel the negative potential provided by the signal, and thus reduces the bias applied to the controlled valves, thereby increasing their gain.

AGC Clamp

It could happen, of course, that the positive potential introduced by the contrast control might over-ride the available negative voltage from the signal. This would cause the grids of the controlled valves to go positive. Not only would the valves quickly lose emission, but the vision channel might also be unstable.

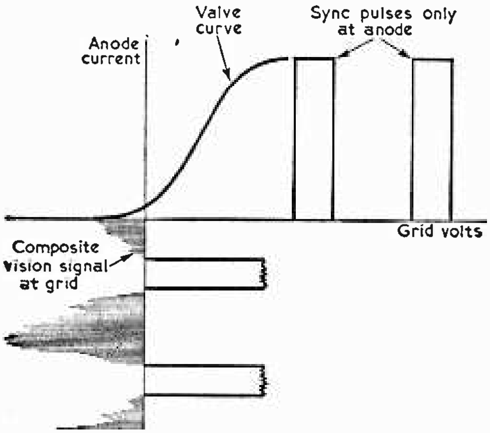


Fig. 2—Operating conditions of the sync separator stage of Fig. 1. This diagram represents the normal operation of most sync separator stages using pentode valves.

This possibility is avoided by the "clamp diode" connected between chassis and the AGC line, as shown on the circuit. Under normal conditions when the AGC line is negative with respect to chassis, the diode is non-conducting. In the event of the signal being weak and the contrast control adjusted for "maximum gain" (to point "A"), the diode conducts, thus effectively short-circuiting the AGC line and the positive potential, and effectively keeping the grids at chassis potential.

Under that condition, the set is working at maximum gain, and the controlled valves are working at the very minimum of fixed bias as provided by the circuit design. The fixed bias for the R.F. and I.F. stages in Fig. 1 is provided by "grid current" in R7 and R4. It will be seen that there is no normal cathode bias for the R.F. valve, and that only a small value resistor (27Ω) is used in the cathode of the frame grid I.F. amplifier valve. This cathode resistor, R9, serves simply to smooth out the input impedance of the valve under varying conditions of bias (see, for example, "Frame Grid Valves", November, 1961 issue).

Sensitivity Control

Under very weak signal conditions, the overall signal-to-noise ratio is enhanced by having as little bias as possible on the R.F. valve. The "sensitivity control" allows such adjustment without unduly effecting the I.F. bias. Again, this control is connected across an H.T. supply, and the slider is returned to the R.F. valve side of the AGC line through R10. When the slider is at side "B" of the control, R10 is connected in parallel with the AGC line and has no effect on the normal operation.

However, as the slider is moved towards side "A", the AGC line bias on the R.F. valve is decreased, and the sensitivity of the stage is increased. This bias change is not reflected into the I.F. valve grid circuit owing to the relatively high "hold-off" value of R6.

Circuit Faults

To start with, it should be made absolutely clear that the manual contrast control cannot function without a sufficiently strong aerial signal. If the signal is weak, there will be very little or no negative bias, so the bias cannot be made any smaller by turning on the positive potential by the contrast control. All that happens is that the clamp diode simply passes more forward current.

As soon as the signal starts producing a useable bias, then the contrast control starts to work. The maximum manual control of contrast occurs when the signal produces full bias.

Lack of Manual Control

If the manual control produces no change in contrast, even when a relatively strong signal is applied to the set, a meter should be connected between the slider of the control and chassis, as shown by Test 1 (Fig. 1) and the control should be rotated. At maximum contrast setting, a reasonable positive voltage should be recorded, which should drop to zero as the control is turned towards minimum contrast. If this does not happen, then the trouble lies either in the contrast control or in the associated H.T. feed circuit. Sometimes the control is taken to H.T. positive through a resistor, and the resistor may be open-circuited.

If the contrast control is working correctly, a high-resistance meter (20,000Ω/V at least) should be connected between chassis and the AGC line where the latter is fed from the sync separator grid circuit, as shown by Test 2 (Fig. 1). With no signal applied and with the contrast control set to "minimum", there should be barely any voltage—though a very small negative voltage may be recorded.

When a strong signal is applied to the set, the voltage should rise to about (−10)V. If this does not occur, a check should be made of the AGC feed resistor, R3 in the circuit, as it may be open-circuited. Normally, of course, this voltage should become less negative as the contrast control is turned towards "maximum" contrast. The amount of variation will depend to a large degree on the "loading" effect of the meter. If there is no variation at all, R8 should be checked for open-circuit.

A short-circuit in C2 or in the clamp diode would cut off AGC voltage, but would not affect the positive variation at Test 1, owing to the presence of R8, which has a high value.

(Continued on page 335)

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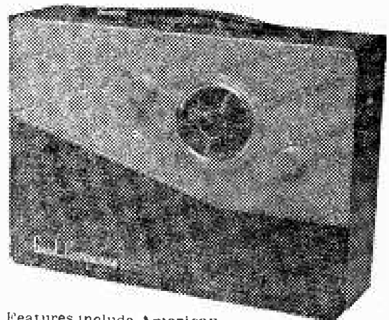

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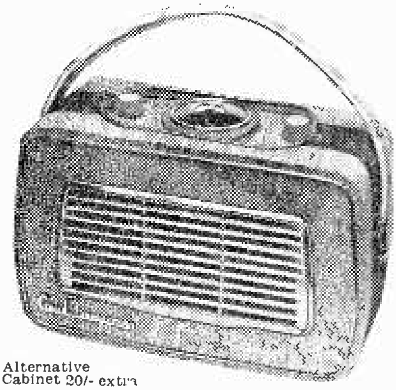

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Servicing Data and Modifications

SOME "TEETHING" TROUBLES OF NEW RECEIVERS AND HOW TO CURE THEM

By D. Elliot

(Continued from page 287 of the March issue)

AT this stage in this series of articles, it should be stressed that there are two basic types of modification: the type which is authorised by the manufacturer—often referred to as an "official modification"—and the type which is evolved by the service technician or experimenter either to improve the receiver's performance in some way or another or to make a certain circuit less critical in relation to the conditions under which the set is operating.

Sets for Experiments

Unless one is well versed in TV, it is undesirable to endeavour to improve the performance of the domestic set by unofficial modifications. However, there are many second-hand and ex-rental sets now on the market, and their remarkably low cost encourages the experimenter to purchase a model essentially for experimental purposes so that a better understanding of the workings of the various circuits can be obtained without disturbing domestic equilibrium.

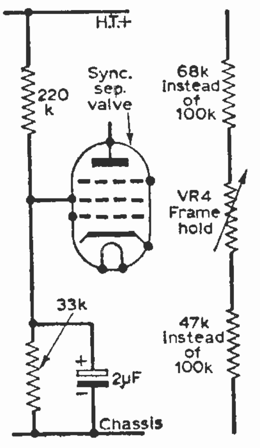


Fig. 9 (Left)—The modification for improving the frame lock on the Ekco model T161 receiver.

Fig. 10 (Right)—The frame locking range can be improved on the T161 with this modification.

This is an excellent idea, since a few pounds invested in practical work of this kind is equal to months of book study. Nevertheless, it is still necessary to tie the practical work to theory, and for this purpose there are now available many good down-to-earth practical books and courses on television servicing.

Some of the earlier receivers—of the type which are on the surplus market—featured highly complicated circuits evolved not particularly as "gimmicks", but to enable the set to give its best in areas of very low signal strength. Since those days, however, many of the weak signal areas have been eliminated by booster stations, and added set complications are not so strongly warranted.

Indeed, certain old circuits can be a source of embarrassment, as some of them are delicately balanced in terms of time-constant components so that as the components age the balance is upset and the receivers become highly critical in operation.

An Example

Early flywheel line sync circuits are typical in this respect as most service technicians will agree. When a set of that kind starts behaving temperamentally on the line lock, there are two definite cures. One is to replace all the critical components associated with the flywheel circuits, while the other is to remove the source of the faults completely and in place introduce line oscillator and sync circuits of more conventional types.

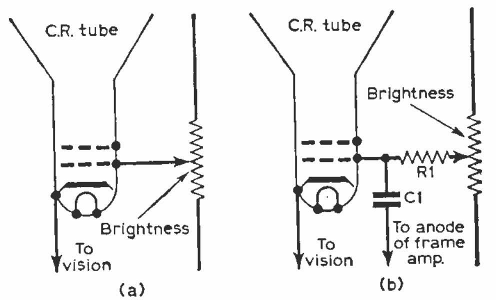


Fig. 11—The modification for flyback suppression: (a) the original circuit without suppression, (b) the required modifications.

The really scientific approach to the problem, of course, is to sort out the faulty parts and replace them. This is not so easy as it sounds because the trouble is rarely caused by just one or two components. It usually happens that all the "critical" components are partly to blame—the effects being cumulative. A full appraisal of the case in hand is necessary, considering such things as the age of the set, the owner, whether or not the proposed modification is "official", time, cost, expected improvement and so on.

Generally speaking, sets less than three years old should not be subjected to unofficial modifications. If there is a *definite* design defect, then there is every chance that an official modification has been issued; but if there *appears* to be such a defect it is most likely that the trouble is caused by a faulty component, in which case the set will respond to normal servicing. On no account should a receiver be modified to mask an ordinary fault.

Sets of greater age can often be improved, and the modifications given in this series relate mainly to semi-vintage models—and all modifications given here have all been proved.

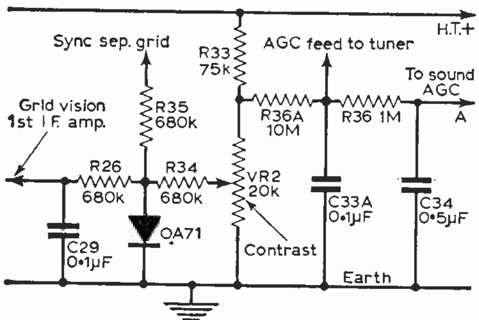


Fig. 12—A modification which can be made to the AGC circuits of the Decca model DM4/C receiver to avoid overloading and cross modulation in areas of strong signal.

Ekco Models T206 and T207

In locations of poor signal-to-interference ratio, a marked improvement in contrast ratio can often be secured by a very simple modification to the vision AGC circuit. This amounts to the removal of the 10k resistor which is connected across the contrast control. The resistor is positioned approximately in the centre of the front bend on the chassis. It will be found wired across the tags of a 25µF electrolytic capacitor.

Ekco Models TS105, TRC124, TSC113, TS1105, TRC1124 and TSC1113

Hum on sound on these models is often caused by leakage in the UY41 rectifier. The effect is cumulative and increases in severity as the set increases in temperature.

Tag 5 of the UY41 valveholder serves as a binding post for certain circuits unrelated to the power supply and, although pin 5 of the valve is supposedly blank, there often occurs a leakage within the valve which injects a hum signal into the unrelated circuits.

The modification here is to remove all the wires from tag 5 of the valve holder and reconnect them together on the tag of a suitable tag-strip. It should be noted that although the symptom can often be cleared by replacing the valve, this is not a permanent repair, because after a while a small leak occurs in the replacement valve and the symptom reappears, but does not necessarily indicate a valve fault.

Ekco Model T161

An improvement of frame lock in areas of weak signal is possible by removing the existing screen

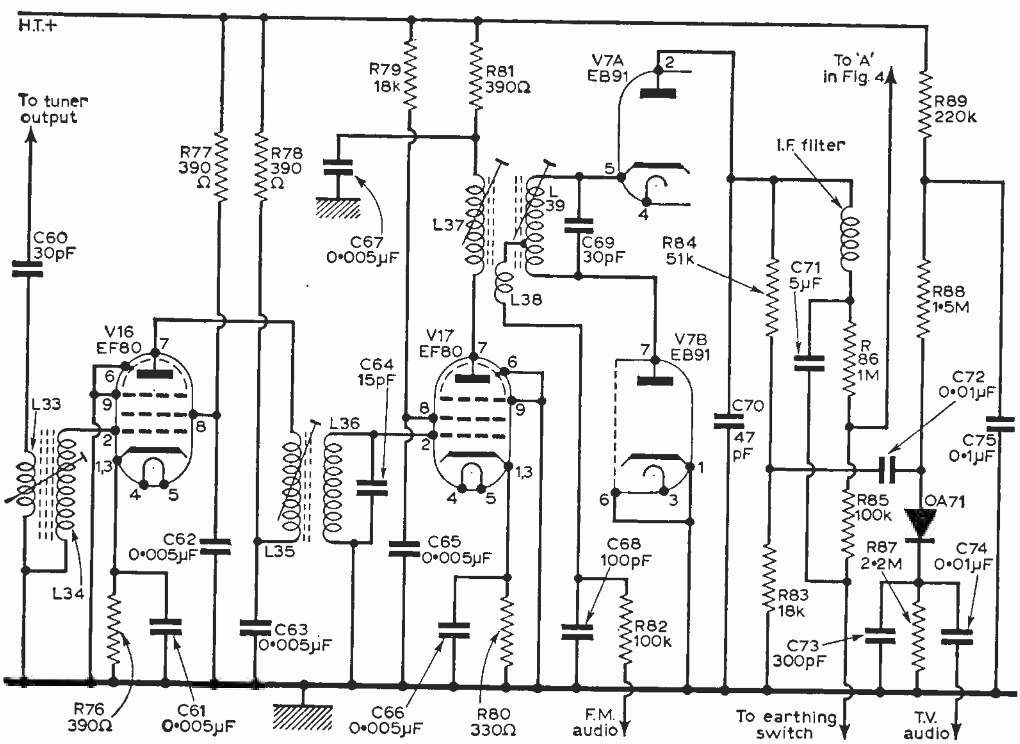


Fig. 13—Improving the television sound limiting in the model DM4/C.

feed circuits from the sync separator valve and in place connecting to screen via a potential-divider. The potential-divider should consist of two resistors and a by-pass capacitor, as shown in Fig. 9.

The range of the frame hold control can be enhanced by changing the values of the resistors connected to the control to those values shown in Fig. 10.

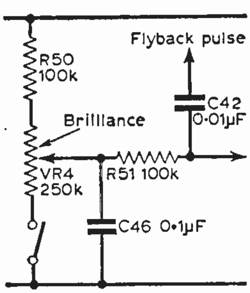


Fig. 14—This modification relates to frame timebase breakthrough into the sound channel of the DM4/C receiver.

Modification for Flyback Suppression

Although recent receivers contain a circuit which eliminates the flyback lines when the set is being worked at higher than normal brightness, earlier models are not endowed with this refinement and, as a consequence, flyback lines are often troublesome, particularly when the tube is slightly low in emission and it is necessary to advance the brightness control to secure a picture of viewable brightness.

On most sets it is usually possible to fit a flyback suppression circuit without a great deal of trouble. The idea is to feed back, to the control grid of the picture tube, negative-going pulses from the frame timebase. This can be accomplished by connecting a capacitor between the anode of the frame output valve and the control grid of the tube, after first modifying the grid and brightness control circuits slightly. In Fig. 11 is shown at (a) the original brightness control circuit and at (b) the circuit after modification. The coupling capacitor C1 should have a value around 0·005μF, but this may require adjustment for optimum results, depending upon the exact design of the circuit. A resistor of about 100k is suitable for R1, but again this should be adjusted for the best results, its value being somewhat governed by that of C1.

Pye Models V2 and VT2

Critical line lock appeared on some of these models after the introduction of the thirteen-channel set, and it was necessary to rotate the control to the full extent of its travel to obtain line hold.

The simple modification of connecting a 120pF capacitor across the screen grid winding of the line blocking oscillator transformer almost always cures the trouble.

Decca Model DM4/C

Now that stronger signals are generally available throughout the country, receivers of the above model may exhibit the symptoms of sound-on-vision and vision-on-sound, resulting from overloading and cross modulation.

This trouble can be overcome without the need for attenuators by modifying the AGC circuit to that given in Fig. 12. By incorporating this circuit, AGC is eliminated from the final sound I.F. amplifier, and the AGC bias picked up from the sound channel is applied to the tuner R.F. stage via the filter network shown.

The R.F. amplifier valve is capable of handling relatively large changes in bias with a corresponding change in gain and this action ensures that a signal of reasonably constant level is applied to the mixer stage, thereby preventing cross modulation in subsequent stages.

There is a further modification for this model to improve the noise suppression on television sound. The modified circuit is given in Fig. 13, in which the sound detector load is in the form of a potential divider comprising R83 and R84. This arrangement tends to equalise the A.F. signals derived from television and VHF sound, while the low value of R83 decreases the time-constant input to the noise limiter, which also improves the limiting.

On early versions of the same model, breakthrough of the frame timebase signals into the sound channel resulted from unwanted coupling between the brightness and volume controls. Later models included an 0·1μF capacitor connected between the slider of the brightness control and chassis to eliminate the trouble. The modification is shown in Fig. 14, and the capacitor concerned is C46. This should be included in these sets exhibiting the symptom described. ■

CONTRAST CONTROL

(Continued from page 330)

Reflected Voltage from Controlled Valve

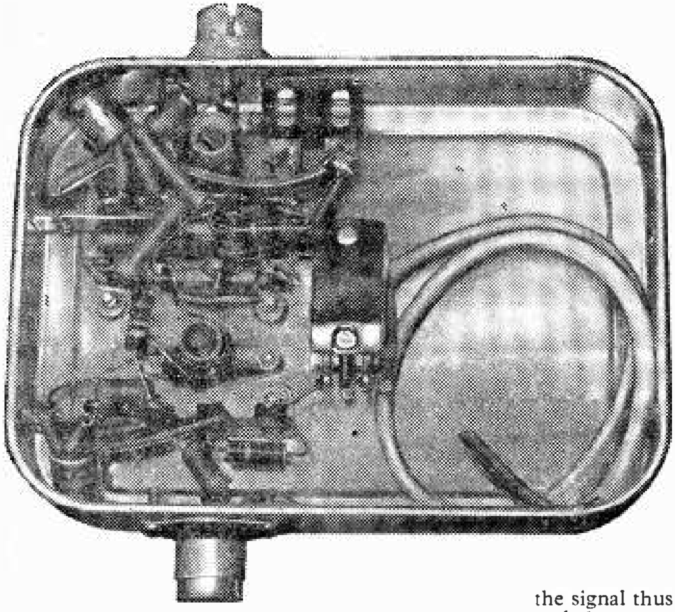
It may happen that one of the controlled valves develops a fault which reflects a positive voltage on to the AGC line. If such a fault occurred in the I.F. valve, for example, the resulting positive voltage might be sufficient to cause continuous conduction of the clamp diode, irrespective of the setting of the contrast control. This would mean that both manual and automatic control would be destroyed, since the AGC line would always be held at chassis potential.

This can happen to a lesser extent by a similar fault in the R.F. valve, but here there is a certain amount of isolation by R6. This may well be revealed by the "sensitivity control" failing to work properly, but this should also lead to a positive voltage check, as shown by Test 3 (Fig. 1).

Using the test procedures outlined, it should not take very long to diagnose a D.C. fault in the contrast system. If a valve is suspected, it may save a lot of time simply to replace it as a test, as certain grid leakage and grid current faults do not always show up on valve testers.

Poor Filtering

Unusual faults sometimes result due to open-circuiting or intermittent open-circuiting of one of the AGC line filter or smoothing capacitors. In some cases, sync pulse modulation may be heard in the sound channel—from the loudspeaker—and, on the picture, vertical shading may appear towards the right-hand side of the screen. The line hold performance may also be impaired. Such symptoms, which seem to be affected by operation of the manual controls, should lead to a check of the AGC capacitors. ■



The completed unit.

tran
PR

ALTHOUGH the BBC and ITV plans for country-wide television coverage are almost completed, there still exist zones of relatively low signal field due either to the receiving site being shielded from a transmitter by hills or rising ground, or by the site being approximately equidistant from two or more regional stations.

In extreme cases such as these, both the BBC and ITV endeavour to cover the area by low power booster stations or translators, but there is a limit to the number of stations of that kind which may be employed.

Interference

Co-channel interference is fast becoming quite a problem on this island because the available channels each serve several stations in different parts of the country. Booster stations would thus require further channel sharing and result in even more co-channel interference during favourable conditions.

Those viewers (and VHF/F.M. listeners) who are not very well served with signal can do two things: one, improve their aerial installations as a means of "capturing" more of the signal or, two, if this still results in insufficient signal, step up the aerial signal by interposing a TV pre-amplifier between the aerial downlead and the aerial input socket of the receiver.

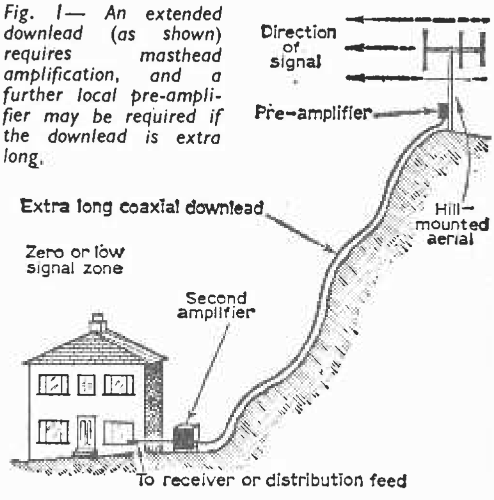
Shared Aerials

In some locations which are cut off from the signal by a local hill, it is often necessary to mount the aerial towards the top of the hill and feed the signal to the set through coaxial cable. This invariably results in far better signal pick-up at the aerial, but the extra long downlead often dissipates most of the signal thus gained, due to its attenuation (losses), and the net gain is almost zero.

Shared aerials are sometimes employed by a group of viewers located in a valley. The cost of the elaborate hill-sited aerial system is shared by the viewers and a small amplifier (or amplifiers) is used to counter the losses of the downlead and the losses involved in tapping the signal to the various receivers.

There are many commercial valve-type amplifiers (repeaters) already available for this kind of application, and transistor amplifiers of a similar kind are under development. There are also many hundreds of shared aerial systems working quite well in the hilly parts of the country.

Fig. 1— An extended downlead (as shown) requires masthead amplification, and a further local pre-amplifier may be required if the downlead is extra long.



sistorised
E-AMP

By D. N. HANLEY

Mast-head Amplification

Where the signal is weak to start with, the amplifier should be situated as close as possible to the aerial, and the signal should be fed down the extra long downlead at high level. If, even after mast-head amplification, the signal at the end of the downlead is insufficiently strong for distribution or for operating a receiver, then a second amplifier should be used at the receiver (see Fig. 1).

COMPONENTS LIST

Resistors ($\frac{1}{2}$W, 10%):

R1, 100Ω	*R6, 1·2k*
R2, 1·2k	*R7, 470Ω*
R3, 470Ω	*R8, 10k*
R4, 10k	*R9, 2·2k*
R5, 2·2k	*R10, 100Ω*

Capacitors:

C1, 500pF	*C5, 1000pF*
C2, 1000pF	*C6, 68pF*
C3, 68pF	*C7, 500pF*
C4, 22pF	*C8, 0·01μF*

These capacitors can be either midget or disc ceramics.

Tr1, Tr2 AF102 (Mullard transistors) or equivalent

S1, Round-dolly toggle s.p.s.t. switch

Two coil formers with type "A" cores (Radiospares), 6ft of 26s.w.g. enamelled copper wire and 3ft of 20s.w.g. enamelled copper wire.

3 five-way tag strips, 2 coaxial sockets, tobacco tin, 2 soldering tags, nuts, bolts, etc.

Amplification close to the aerial ensures that the best possible signal-to-noise ratio is secured, and subsequent distribution or amplification does not detract from this too much. However, if the aerial signal were allowed to be severely attenuated by the downlead before initial amplification, then the signal-to-noise ratio would be very much worse.

Power Supply Problems

Mast-head amplification means that a power supply must be conveyed to the hill aerial site. This can be expensive if a mains system is installed, but is a problem which is often solved by feeding a low voltage power supply from the receiver end to the remote mast-head via the signal-carrying coaxial downlead. This is difficult where valve equipment is used, owing to the fairly high power requirements, but it is possible.

Low Current

The problem is simplified with transistorised equipment, of course, since then only a few milliamperes of direct current are required to power the mast-head amplifier.

The transistor amplifier which is about to be described was developed either for use close to the

COIL WINDING TABLE

Channel	Turns	Wire	Spacing
1	12	26s.w.g.	close-wound
2	11	26s.w.g.	close-wound
3	10	26s.w.g.	close-wound
4	9	26s.w.g.	close-wound
5	8	26s.w.g.	close-wound
7	3·5	20s.w.g.	$\frac{1}{8}$in. spacing
8	3·5	20s.w.g.	$\frac{1}{8}$in. spacing
9	3	20s.w.g.	$\frac{1}{8}$in. spacing
10	2·75	20s.w.g.	$\frac{1}{8}$in. spacing
11	2·5	20s.w.g.	$\frac{1}{8}$in. spacing
12	2	20s.w.g.	$\frac{1}{8}$in. spacing

receiver (for ordinary pre-amplification) or for use on a shared aerial system, where the amplifier is likely to be mounted and powered at a point some 200 or 300yd remote from the receiver, close to a hill-sited aerial system. Facilities will also be described whereby the power for the pre-amplifier can be fed through the coaxial down-lead.

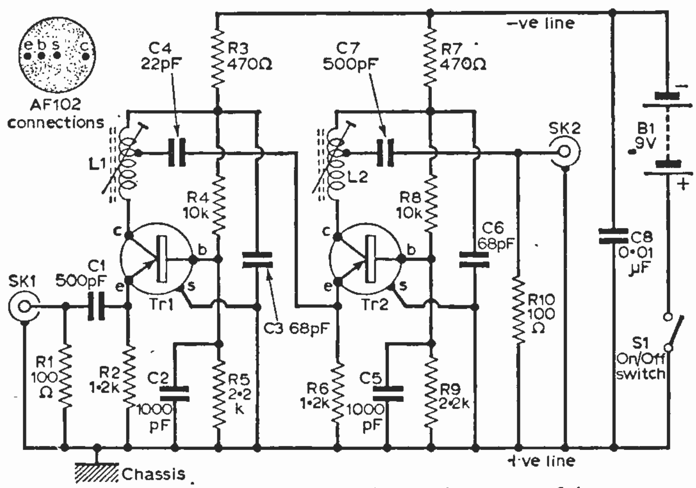
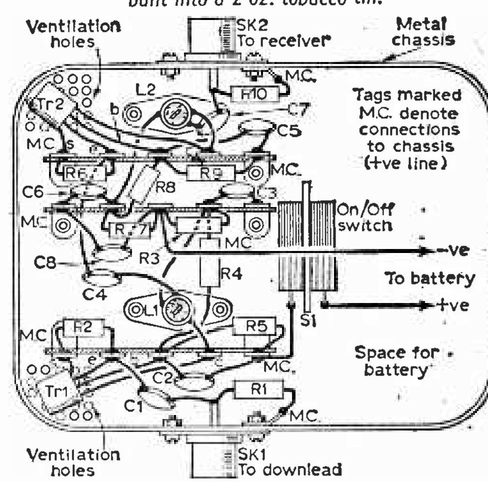


Fig. 2 (above)—The complete circuit of the pre-amp.

Fig. 3 (below)—The amplifier can be conveniently built into a 2 oz. tobacco tin.



Circuit Description

The complete circuit of the pre-amplifier is given in Fig. 2. Two transistors are used, Tr1 and Tr2, and the circuit is reasonably conventional. Both transistor stages are of the earthed base mode, the stabilising components being R4 and R5 for Tr1 and R8 and R9 for Tr2. The bases are held to "earth" signal-wise by C2 and C5.

The aerial signal is applied, via C1, to the emitter circuit of Tr1, across R2. Resistor R1 is included to maintain the best possible match between the aerial feeder and the amplifier. This resistor is necessary because the input impedance of Tr1 is somewhat above 75Ω, but in some cases, especially where there is a reasonable length of feeder between the aerial and the amplifier input, the resistor can be omitted with slight improvement in overall gain.

The collector of Tr1 is loaded and coupled to the emitter of Tr2 by a form of π-network coupling, comprising L1, C3, R3 and C4, together with the collector capacitance of Tr1. A suitable impedance match for Tr2 emitter circuit is provided by the tap on L1.

A similar form of tuned circuit is used in the collector circuit of Tr2 to feed the amplified signal to the receiver or downlead and, again, a tap is used on L2 for impedance matching. Resistor R10 is necessary to provide a reasonable load impedance to the extended downlead. Where the downlead is 200 or 300yd in length, the "buffer" effect of the cable is sufficient to stabilise the output impedance and the resistor can be omitted with some improvement in gain.

The amplifier will operate from a battery of 9-12V, and a simple toggle switch is included in the positive supply lead for switching on and off when the amplifier is used close to the receiver.

Construction

The amplifier can be made remarkably small, and Fig. 3 gives a suggested design in a 2oz tobacco tin, of dimensions about $4\frac{1}{8}$in. x 3in. x $\frac{7}{8}$in. deep. The actual circuitry takes up approximately half the available space, and the remainder can be used to house one of the small 9V batteries designed for transistorised equipment, thereby making the unit completely self-contained.

Fig. 3 shows the wiring and the layout of the components which are secured to the tags on three five-tag tag strips. The two outside tags on each strip are clamped to the chassis by 6B.A. nuts and bolts. These tag strips can be cut down from multi-tagged strips available from radio component shops. The precise design of the strip, provided it is of the miniature variety, does not really matter as long as three "isolated" tags are available on each strip. The remaining two tags are "earthed" to chassis by their fixing brackets.

Although there is no excessive rise in temperature inside the amplifier under normal operating conditions, it is as well to drill several holes in the corners of the box where the transistors are located, as shown in Fig. 3. Holes should also be drilled at the top of the box, in line with the coil formers, to allow adjustment to the dust-iron slugs when the lid is fitted on to the tin.

There is sufficient room to accommodate resistors of the miniature $\frac{1}{2}$W, fully insulated, carbon-composition variety, while the capacitors are either Hi-K midget ceramics or disc ceramics (see Components List). Standard coaxial sockets are used for connecting the aerial feeder and the cable to the set or distribution line.

(To be continued)

HOW TV SETS WORK-5: Sync, frame and power circuits

(Continued from page 278 of the March issue)

IN this final article of a series giving a component-by-component survey of a typical receiver (Ferguson 306T and 308T series) we deal with the sync separator and frame sync limiter, the frame timebase and power supply circuits.

Fig. 6 features the circuit sections concerned, in which the diode W103 is the frame sync limiter, V12A the sync separator, V12B part of the frame oscillator, V13A part of the frame oscillator, V13B the frame amplifier and V14 the H.T. rectifier.

Sync Separator and Frame Limiter

The composite picture signal is fed to the control grid of the sync separator from the anode circuit of the video amplifier valve through C131. This pentode is operated with a relatively small screen and anode potential, which results in a short grid base. This means that on the picture parts of the signal the valve is cut-off so that it does not produce a signal at the anode, while, on the sync parts of the signal, the anode current of the valve quickly reaches saturation point Thus, sync pulses only appear in the anode circuit, and the tips of the pulses are flattened and random interference and noise pulses are removed (provided always that the signal is sufficiently strong).

Owing to the " limiting " action of the valve, grid current flows in R151, resulting in the development of a voltage across this resistor, negative with respect to chassis. This is fed away through various filters to the vision AGC line, as has already been considered in past articles. Typical trouble here is increase in value or open-circuiting of C131, affecting both line and frame holds, and alteration in the value of R151. The latter defect may not cause complete failure of line and frame holds, but may make them somewhat unstable and may cause the picture to " tear " at the top.

The screen grid of the valve is fed through a high value resistor (R173) and is by-passed so far as sync is concerned by C154. Alteration in values here is also almost likely to affect the sync performance. Both line and frame sync pulses appear across the anode resistor R174, which, if its value changes substantially, can also give impaired operation; the line pulses are fed to the line oscillator (dealt with in Part 4), while the frame pulses are fed, via R172, to the frame sync limiter circuit.

Eliminating Line Pulses

The idea is to clear all traces of the line pulses from the frame circuit, and this is accomplished firstly by the integrating function of R172, R171 and C153, which results in fairly clean frame pulses across the latter component. These pulses are then peaked by the differentiating action given by C152 and R170. The net effect is that the frame pulses are negative-going, with a positive-going over-swing.

Such pulses appear across R170 and are thus applied to the frame limiter diode W103, which conducts only on the negative-going part of the signal. The positive overswing is thereby eliminated, and relatively sharp negative-going frame sync pulses occur across R181, which is effectively the diode load, with C160 as the reservoir. It is at this point that the frame sync pulses are applied to the frame oscillator (V13A).

The network comprising C151 and R177 applies a positive-going pulse from the frame oscillator (V12B section) to W103 during the frame flyback. This pulse makes the diode totally non-conducting and therefore ensures hat any spurious line sync pulse which may be present at its input does not affect the start of the frame scan. In this way extremely good interlacing is maintained.

Open-circuiting or change in value components in the frame integrator and differentiating circuits will almost certainly impair the frame hold, while a fault in C151 or R177 may well upset the interlace performance. The diode sometimes becomes open-circuited or otherwise defective, resulting in complete lack of frame hold.

Frame Oscillator

The frame oscillator uses the well-proven multivibrator circuit, using triode sections V12B and V13A. These are coupled by C159 and R178 which is common to both triodes. The action of the circuit is as follows: at the beginning of the frame flyback, V12B commences to conduct, and the resulting increase in current in R178 causes a reduction in the anode current of V13A.

This causes a positive pulse to appear across R182, which is coupled to the grid of V12B through

C159. Conduction of V12B is thus increased and of V13A further decreased. The effect is cumulative and V13A is rapidly cut-off. Due to the heavy conduction of V12B, the charge in C157 is exhausted through the valve, but, since V12B is then passing grid current, C159 charges.

The charge on C159 (negative at grid) causes a reduction in anode current and cathode voltage of V12B, and this is reflected to V13A as a reduction in bias, which causes V13A to start conducting. A negative pulse thus occurs across R182 and is transferred to the grid of V12B, eventually resulting in V12B being cut-off and V13A conducting heavily.

At this time C157 re-charges through R176 and the height control from the H.T. line, and this goes on until the charge of C159 is exhausted through R179 and the frame hold control. During the discharge of C159, the grid of V12B becomes less negative, when cut-off conditions can no longer be maintained, the flyback is initiated and the whole cycle repeats itself. Normally, however, the flyback is initiated just before the natural cycle by the negative-going frame sync pulse applied at V13A grid.

provides the scanning stroke, and this rises positively as the capacitor charges. Thus, as the control grid of V13B rises positively so the current in the primary of the frame output transformer increases. The change in current is induced into the secondary winding and is applied to the frame coils, which causes deflection of the scannng spot from the top to the bottom of the screen.

A negative feedback linearity-correcting loop is provided by C161, R188 and R200 in conjunction with R186, R187 and C163. The actual feedback occurs between the anode and control grid of V13B. The linearity at the top of the picture is affected mainly by adjustment of R186, while R188 varies the linearity of the whole frame scan.

If the linearity is extremely poor, and neither of the controls effects a cure (or affects the linearity), C161 will probably be open-circuited. If R186 has no effect, then C163 should be suspected for open-circuit. Alteration in value of any of the associated fixed resistors may put correct linearity outside the range of the controls.

If C162 goes open-circuit the height will be reduced. In the event of this component being

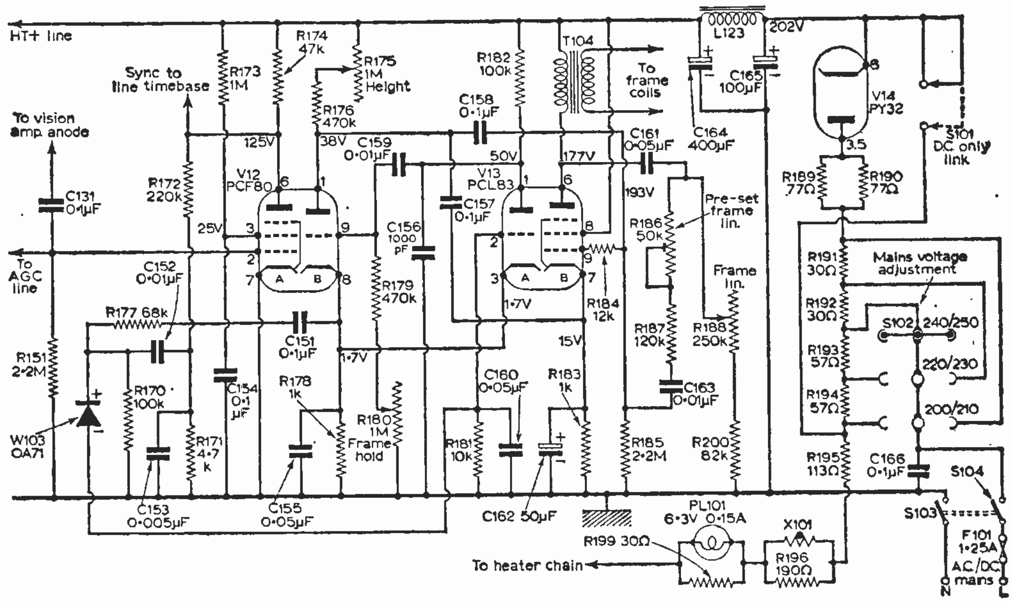


Fig. 6—The circuit diagram of the sync separator and frame sync limiter, the frame timebase and the power supply stages of the receiver described in the text.

Various faults can occur in this section as would be expected. The frame frequency is affected by R179 and C159, while the amplitude of the sawtooth output voltage is affected by R176 and C157, since it is across this latter component that the sawtooth voltage is developed. An increase in value of R182 may slow down the flyback and cause close-spaced white lines at the top of a picture.

Frame Amplifier

The sawtooth voltage across C157 is fed through C158 and R184 to the control grid of V13B. It will be recalled that it is the charging of C157 which

open-circuited, the height can sometimes be restored simply by advancing the height control, but this tends to introduce non-linearity.

Power Supply Circuits

In almost all modern receivers the A.C./D.C. technique is adopted, where there is no mains transformer and the receiver chassis is connected direct to one side of the mains supply, as shown in Fig. 6. The lead connected to chassis should be wired to the neutral side of the power supply.

(Continued on page 347)

Underneath the Dipole

A MONTHLY COMMENTARY

By Iconos

QUESTIONS about television in the House of Commons are not always noted for their profundity. Usually, they should be assimilated with a large pinch of salt. Often, the question is merely a "kite-flying" sortie, to test the feelings of the House prior to embarking upon a campaign for the adoption of a policy with commercial or political implications. Recently, a member tabled a question regarding Question Time itself in the House, as to the possibilities of televising it at peak time or of filming it and broadcasting the film unedited. There was also a suggestion for putting the vision and sound on closed-circuit in various parts of the premises. These are not very new questions, but their present importance lay in the policies which may emerge from the recommendations of the Pilkington Committee.

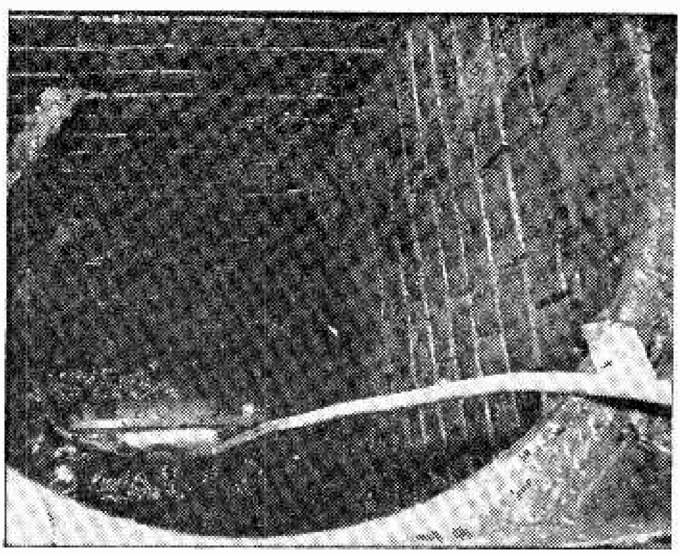
Parliamentary Television?

There are times when it would be extremely interesting to see and hear what goes on in the House of Commons. But the impact of television is so large that members might feel more inclined to "perform" for the cameras and the electorate rather than take part in a serious debate. And, in any case, what are the practical requirements for cameras and sound? There is scarcely enough light in the Chamber for the use of Vidicon cameras and the use of 4½ inch image orthicon cameras would be an expensive business to operate, especially if several cameras are on continuously throughout all proceedings, for closed-circuit and occasional broadcast purposes. The "closed-circuit" idea is a good one, provided a number of remote controlled Vidicon cameras could be made to "home" on the individual speakers. Quality at the low light intensity in the Chamber might be quite adequate for closed-circuit purposes. There are already microphones which reinforce the sound to give greater intelligibility in the public galleries and elsewhere, though whether they would be adequate for television purposes remains to to be seen—and heard.

After all, closed-circuit television is used in all kinds of situations, industrially and otherwise. It has even penetrated the auditorium of the Royal Opera House, Covent Garden, where a camera is used to relay a picture of the conductor to the ladies and gentlemen of the chorus, when the "heavenly choir" sings in the wings. I suppose that the organisers of the third channel of television would probably grasp at the opportunity of using the proceedings of the House of Commons in their programmes. After all, they will have a lot of expensive time to fill up, be it entertainment or otherwise.

Better Definition?

There has been a curious reaction lately, in electronic boffin circles regarding the line standards, in which some eminent engineers have had second thoughts about changing the line standard to 625 lines. It has been pointed out that better definition arises more from an extended bandwidth than an increase in the number of lines. The video bandwidth in Britain remains at 3Mc/s as compared with the CCIR 625-line bandwidth of 5Mc/s and the CIR (Russian) bandwidth of 6Mc/s, also on 625 lines. The American 525-line negative modulation picture shows less flicker than British television, due to the fact that it presents 60 fields per second instead of 50. On the other hand, the "positive" modulation, peaking to white, employed in Britain, has advantages for colour transmission.



A new means of investigating narrow drains, pipes and sewers has recently been made available by Audio and Video Rentals Ltd., of London. A 6in. Vidicon television camera—lit by a Osram iodine lamp—is drawn through the pipes and the condition of the sewer can be seen on a closed circuit TV receiver.

These are only one or two of the many factors which will affect the technical aftermath of the Pilkington Committee's policy decisions. The costs of any change will be high, it is argued. If there is to be a change, some say, let it be a really big change which will give a greatly improved picture —with no compromise!

The Human Factor

What does the average viewer *really* think about his picture? Some people think that the 405-line raster is quite satisfactory and that a change to 625 is not worth while; that improved definition could be obtained by other means. Personally, I find the 405-line structure objectionable on 21in. receivers, though it is less noticeable when the set is fitted with spot-wobble. But the human eye seems to vary just as much as the human ear. Some people can't hear much sound above 5,000c/s, whereas others can hear 10,000c/s or more. Similarly, some people can see quite slight differences in horizontal definition without noticing the line structure on 405 lines.

ASC

The American Society of Cinematographers is an organisation whose members are the top-rank cameramen in the film studios of USA. Many members are engaged on photographing television film series apart from their assignments on cinema films, and the letters "ASC" are often seen after their names in the interminable credit title lists. This society has been actively engaged in exploring ways and means of improving the quality of the reception of film programmes on home receivers in the USA. The main problem is based on the fact that the picture tube in a home receiver does not behave like an ordinary motion picture screen in the correct rendering of tonal values. As one member has put it: "A mood shot, such as a romantic moonlight walk, looks like an over-exposed picture taken by an amateur with a box camera on a cloudy day."

Investigations proved that the picture degradation was due to the absence of a D.C. restoration circuit in the modern receivers, which manufacturers had omitted in the interests of increasing range of the set, decreasing interference by reflections from aircraft and decreasing manufacturing costs. Representations were made by the ASC to the top executives of all the TV receiver manufacturers in the USA, drawing attention to the quality deterioration on the photographic work of these highly-paid cameramen and asking for steps to be taken to provide D.C. restoration circuits on future models. The response of the manufacturers is said to have been highly successful and several manufacturers are now fitting this type of control, in some cases with switching included, so that it can be cut out when aircraft interference is especially bad.

It is high time that the same action should be taken by someone over here, because British set manufacturers have followed the trend in the omission of D.C. restoration. Another trend which should be brought to a halt is the squaring of the picture. The aspect ratio or picture proportions should be 3 x 4, whereas some makers provide a 5 x 4 or even a 5 x 6 picture, which attempts to reproduce the 3 x 4 picture from TV cameras or film. Naturally, the result is lamentable—with the picture reproduced in a distorted manner or with the side edges cut off. The BBC and the ITV companies have been worried about these things for some time. British television sets used to include DC restoration at one time. Perhaps the British Society of Cinematographers will follow the precedent of their American cousins and start the ball rolling with a campaign for restoring D.C. restoration!

Film Clips

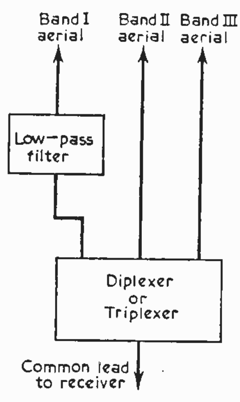
"Picture Parade", "Close-Up", "Movie-go-round", and similar programmes about cinema films have long been popular programmes on television and sound radio. The regional TV companies seem to have taken this film clip idea up in a big way, giving viewers a fortnightly preview of short excerpts of films about to be shown in their areas. They differ in their form of presentation and the selection of films varies in the different regions. But all of them must be valuable publicity puffs for the cinemas. I find these excerpts far more compelling than the high-pressure trailers which the cinemas themselves put on, in which the screen is filled with ever-growing adjectives, loud music and scenes of poor photographic quality. On the other hand, a film sequence which indicates that the film is not of the type one likes, is an equally strong warning to give it a miss! Lately, I have been induced to go to cinemas by some of these film clips, and to tell the truth, have thoroughly enjoyed the change. The special TV film clips the Rank group had made from "The Dog House" must have had a beneficial effect upon the box office takings of those cinemas which showed it. At any rate, I only just managed to get a seat—and then nearly fell off it, laughing at this very funny British film.

TELEVISION FILTERS

By T. Kemp

(Continued from page 299 of the March issue)

IF it is discovered that an unwanted R.F. signal at a frequency above Band I is responsible for pattern interference on Band I channels, previous articles in this series will have made it fairly clear that a low-pass filter is required. However, if a low-pass filter is connected in series with a common aerial downlead it will offer a high attenuation to wanted Band III signals as well as to unwanted signals. The effect would be suppression of not only the unwanted signals but also all Band III signals as well.



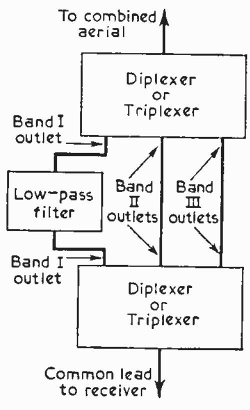


Fig. 18 (above left)—Where extra low-pass filtering is required, the filter should be introduced in series with the Band I aerial and the input to the diplexers or triplexers to avoid suppressing the Band II and Band III signals.

Fig. 19 (above right)—Where a combined aerial is used, specific filtering can be provided between two diplexers or triplexers as shown.

Series Connection

This trouble can usually be avoided by connecting the filter in series with the Band I aerial and diplexer or triplexer, as shown in Fig. 18. It will be recalled that a low-pass filter section or half-section is also included in the Band I circuit of the diplexer or triplexer, but this may offer insufficient attenuation by itself to spurious signals above Band I. However, the inclusion of an extra low-pass filter gives considerably improved rejection to signals above Band I if the cut-off frequency is in the vicinity of 70Mc/s.

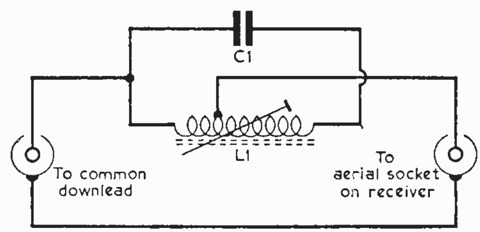


Fig. 21—A simple parallel-tuned rejector circuit as shown can be used as a frequency-selective filter as considered in the text.

Where a combined aerial is used, the signals in the various bands can be separated by a diplexer or triplexer and then combined again in a further diplexer or triplexer after filtering, as shown in Fig. 19. This is rather an expensive method, however, and is rarely necessary.

If the pattern interference is consistently at one specific frequency, then a simple parallel-tuned rejector circuit can be included in the common downlead without unduly attenuating any of the required signals in the television or VHF/F.M. bands. This kind of filter was considered in Part I of this series (December 1961 issue), and it is essential that it is designed for the highest possible Q and tuned accurately to the offending frequency.

Spurious signals can sometimes be rejected by utilising the "I F. rejector" or the "second channel rejector" already built into the set provided that one or other of the rejectors will tune over the offending frequency and that in the area there is no trouble from R.F. interference falling at the I.F. or second channel frequency.

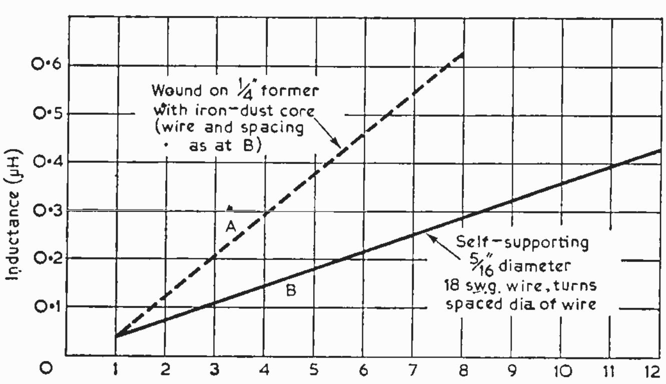


Fig. 20—A useful chart for finding the inductance of a given number of turns.

Turns/Inductance Chart

It is sometimes difficult for the constructor to ascertain small values of inductance in terms of turns of wire, diameter of coil etc., and with this in mind, Fig. 20 has been prepared.

The full line at B gives the relationship between the number of turns and the inductance of self-supporting coils with an inner diameter of 5/16in. using 18s.w.g. tinned copper wire with the turns spaced by the diameter of the wire, while the broken line (A) gives the relationship between the number of turns and the induc-

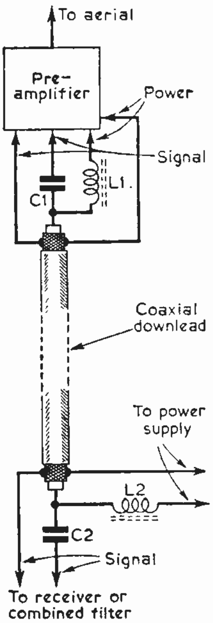


Fig. 22 (left)—Filters comprising L1, C1 and L2, C2 can be used for powering a remote pre-amplifier through the coaxial downlead.

tance of coils with the same wire and spacing wound on ¼in. formers with a dust-iron core screwed in fully.

It should be noted that a reasonable change in inductance can be accomplished simply by altering the turns spacing, and this is often useful when finally adjusting the inductive element of a filter for optimum results at a specific frequency.

Frequency-selective Filter

The simple parallel-tuned rejector circuit is sometimes used as a frequency-selective filter to balance Band I signals against Band III signals on the common downlead. The idea is shown in Fig. 21. The tuned circuit should be designed to cover all the channels in Band I either by the dust-iron core in L1 or by making C1 variable.

When the rejector is tuned to the required Band I channel severe attenuation is offered to that vision signal though there is very little effect on Bands II and III. The idea is to adjust the filter towards the side of its response curve so that the Band I signal can be reduced in strength at the aerial terminal to provide the best balance between that and the Band III signal. In this way it is possible to change from BBC to ITV and vice versa without readjusting the brightness or contrast controls on the receiver.

It will be appreciated, of course, that progressively more attenuation is offered to the Band I signals as the rejector tuning approaches the carrier frequency of the vision signal.

Filters for Powering Pre-amplifier Through Downlead

It sometimes happens that a pre-amplifier requires to be positioned as close as possible to the aerial to maintain the best possible signal-to-noise ratio. When the downlead also has to be of considerable length, then some means must be found for powering the remote amplifier. If mains power is available close to the aerial site, then a short mains cable can be routed up to the pre-amplifier. However, this method is likely to prove rather expensive in the event of a long cable run being necessary.

One way of solving such a problem is to run the amplifier power supply through the aerial downlead, as shown in Fig. 22. At the pre-amplifier, a small power filter consisting of L1 and C1 is employed. Capacitor C1 isolates the power from the amplifier signal-output circuit, while L1 isolates the signal from the power circuit of the amplifier.

Likewise, at the set end, C2 is for power isolation and L2 is for signal isolation. The capacitors should have a value of about 0·001μF and the inductors about 5μH. The dust-iron inductors designed for inclusion in small electric motors for television interference suppression are perfectly suitable and are available from most radio dealers. Such inductors offer a high impedance to television signals and a low impedance to power frequency (50/60c/s), while the capacitors offer a low impedance to television signals and a high impedance to power frequency.

It is not recommended that the full mains voltage be carried in this way. The pre-amplifier should feature a power unit requiring about 50V at 50c/s and then the power injected at the set end of the cable can be derived from the secondary of a 50V mains isolating transformer. ■

INTERLACING PROBLEMS (Continued from page 322)

the circuit. In most cases where the receiver is of fairly recent manufacture, the trouble is usually caused by a fault in the frame timebase valve, especially if it is a triode-pentode or similar type. The valve should be checked by substitution—this is the only way to check with such a fault.

If the frame lock has also become poor, but the line lock is unaffected, attention should be directed towards the sync separator valve and frame sync feed circuits. The small metal rectifiers should be suspected if such components form a frame pulse filter or interlace filter circuit. Again, these are best checked by substitution.

During the *line flyback* the circuit generally undergoes considerable upheaval, and if it takes place just before the frame is about to trigger, it may be triggered prematurely with adverse effects on the interlace. This could happen owing to a faulty decoupling or smoothing capacitor allowing a line pulse to reach the frame circuits, or similarly, if the screening were left off the line transformer or EHT section after a servicing operation; line pulses of high intensity might be radiated and picked up by the frame oscillator. Coupling between the line output stage and the frame oscillator, by misplaced wiring and components, is another cause of the trouble which should be investigated in obstinate cases of the symptom.

If unwanted coupling from the line to the frame circuit is suspected, the frame oscillator should be muted by disconnecting the H.T. feed without removing the actual frame circuit components, and a pair of high resistance headphones suitably isolated (by 0·001μF 450VW capacitors) should be used to discover if and where the line pulses are being injected. One side of the 'phones should be connected to chassis, and the other side should be connected to a probe which can quickly be moved around the various parts of the frame oscillator. The points where line pulses are present will give a very high-pitched whistle (at line frequency) from the 'phones. Also check to make sure that the pulses are not entering via the H.T. line. ■

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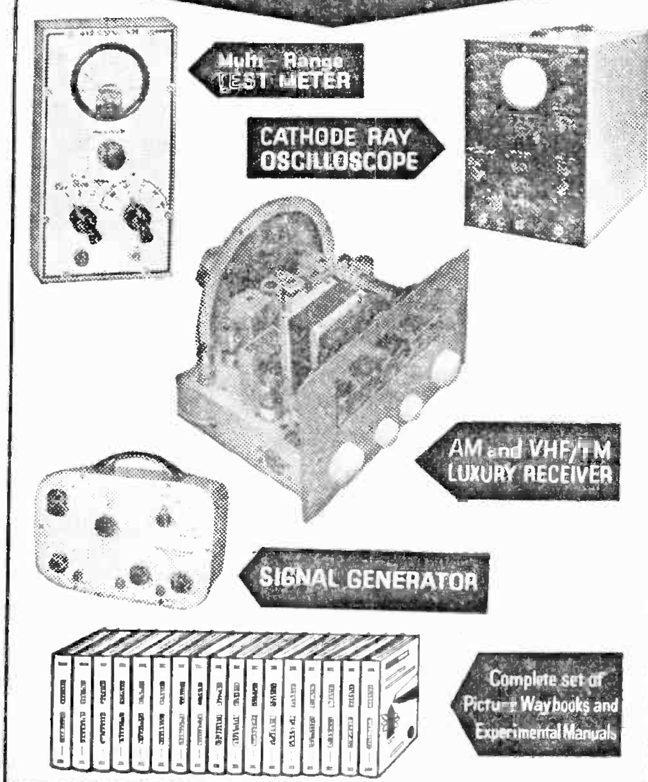

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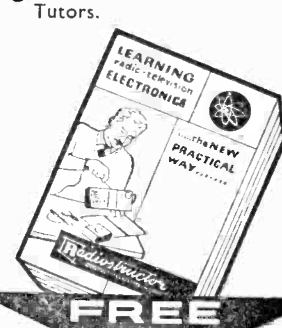

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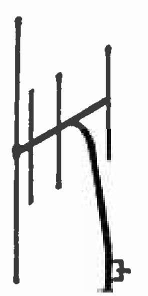

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Letters to the Editor

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.

TV DX RECEPTION

SIR,—We do not appear to be able, in this country, to receive television reception, other than local stations, or up to a maximum distance of about 70 or 80 miles, unless by chance by some freak reception, which sometimes occurs.

I have just been reading in the January issue of "Radio and Electronics" (an American publication), where it appears in America, with a complex aerial, distances of reception are claimed to be of the order of 160, 210, and 245 miles.

I do not know the power at which some American television transmitters operate, but would be interested to know whether one could achieve acceptable reception at even 120 miles here.

I have just been reading the article in the February issue called "How TV Signals Travel" and fully understand the principles of TV reception, especially after reading this interesting article.—W. R. CARSON (Newcastle-upon-Tyne).

SIR,—I am fifteen years old and recently purchased a popular type of "V" aerial for the set top. I have had the receiver against one wall of the room, next to a wardrobe, with a large 8ft x 4ft mirror set into the door. The BBC signal was excellent but the ITA rather disappointing. I moved the set merely 4ft away from the wardrobe, and at once the BBC picture became so brilliant that I had to turn down the sensitivity. On ITA, instead of receiving one channel (rather badly), I am receiving three channels: London, Croydon, Dover. I live 40 miles from London and have received sound from a German station. I would like to thank D. Kemp for a most interesting article on receiving Continental television, which prompted me to try and receive these programmes. The fact that I am receiving five programmes is not unique, but considering I've a set that I bought for £10 and which is only the two-channel, incremental tuner type, using a set top aerial, I think it is a bit unusual.—N. A. S. PAYN (Thorpe Bay).

THEIR PROBLEMS SOLVED

SIR,—With reference to your answer to my query about my TV set, I wish to inform you that I fitted a 6/30L2 line oscillator valve to my television set on the advice received from you. It restored the set to normal working order, giving a splendid picture. I wish to extend to you my appreciation and thanks for the advice given and wish every success to PRACTICAL TELEVISION in the future.—F. FINLAY (Belfast).

SIR,—I feel I must write and thank you for the wonderful help you gave me, in the trouble with my 12in. TV, the trouble being no picture, no scan, sound normal. You advised me to short two of the pins on the tube base, which I did and obtained a brilliant scan; a further letter from you advised me to look at the brilliance control, and video output valve. I soon discovered the control was completely o.c. and a replacement cured the trouble. Prior to this, I needed your help on another 12in. set, the trouble being valves not lighting up. Amongst a few clues you gave me, a thermistor was mentioned; once again a replacement completely cured the fault. So once again many thanks, from a regular reader.—A. J. SIMMONDS (Welling, Kent).

How TV Sets Work

(Continued from page 340)

In cases where a full-wave rectifier valve is used, the two anodes are paralleled through surge limiting resistors, R189 and R190. The anodes receive about 200V A.C., depending on the setting of the mains selector. The valve heaters are connected in series, and the ballast resistors are connected between the heater-chain and the power supply, their values being adjusted to provide the correct heater current.

Thermistor

X101 is a thermistor which has a high value of resistance when cold and a very low value when hot. Being connected in the heater chain, it prevents heavy current surges in the heaters when the set is first switched on. R196 is a shunt across X101, the thermistor, to achieve the correct "hot" resistance, while R199 is simply a shunt for the pilot lamp.

The H.T. from the rectifier cathodes is smoothed by C165 (the reservoir capacitor), L123 and C164. In the event of the H.T. line voltage being below normal—probably showing up as reduced width and height—V14 should be checked for emission, but if it is in order, a check should be made of the surge limiters, for if one is open-circuited only one half of the rectifier will function. This is a common fault which may not be immediately obvious, since the surge limiters are often a part of the mains dropper.

For D.C. operation, the rectifier is short-circuited by S101. This is necessary to maintain a sufficiently high H.T. line voltage, but care must be taken to ensure that the power supply is connected the correct way round—negative to chassis. ■

Your PROBLEMS Solved

Whilst we are always pleased to assist readers with their technical difficulties, we regret that we are unable to supply diagrams or provide instructions for modifying surplus equipment. We cannot supply alternative details for constructional articles which appear in these pages. WE CANNOT UNDERTAKE TO ANSWER QUERIES OVER THE TELEPHONE. The coupon from p. 352 must be attached to all Queries, and if a postal reply is required a stamped and addressed envelope must be enclosed.

DECCA DM3/C

There is a 3in. black margin down each side —the width control doesn't alter the defect but just brightens and dims the picture. The brightness control enlarges the picture, I have changed valves and condenser C50 (Service Sheet) but these were not at fault.—R. Andrews (Creggan).

You do not say which valves you have changed or to which service sheet you are referring. Two versions of the DM3/C are in current use. That version which uses a serial number up to 50,000 employs a chassis similar to the DM2/C—DM4/C but if the serial number is over 50,000 a revised chassis is fitted using PCL82 and ECC82 valves in the timebase and sound sections. You should check the PL81 valve and the resistor to pin 8 of this valve. Early versions used a 4·4k 2W resistor; later versions a 2·7k 2W resistor in this position.

AMBASSADOR TV2

This set has gone quite dead. On switching on, one fuse blows and there is a big blue flash in the U801 valve.—T. Allen (West Bromwich).

You should replace the U801 valve and check each of the four 47Ω resistors wired to the valve base.

VIDOR 14in. CN4225

My picture had very poor quality and on advancing the brightness control, the picture went grey in colour and expanded vertically. I replaced valves SU61 and PY81. My picture is now very good as to detail etc., but I cannot obtain full width. On advancing control to maximum, the picture is about 1in. short on both sides. Also, the focus lever is over to maximum on one side. This set is BBC only and I am using a convertor.—J. Collins (Heckmondwike).

You should check the PL81 valve and the resistors etc. associated with it. These are 1·5k to pin 8; 100Ω to pin 3 and a 50μF capacitor across it. Check the 1·2M resistor to pin 1 of ECL80 valve base if necessary.

McMICHAEL TM54F

On switching the set on, I obtain very low sound and no picture (the raster is there). After waiting a few minutes, and then switching the set on and off several times, the sound comes up to normal level and the picture comes on with a lot of noise through the speaker and a lot of interference on the screen.

I have changed the PCF80 and the PCC84, also the PY81. Once the picture is on, it will stay all right until being switched off again. The picture quality is good.—G. Cooper (Rotherham).

The trouble appears to be in the tuner unit and the connections should be checked. The suspect resistor is the 6·8k 1W to pin 1 of the PCF80 valve base (first spring contact).

PHILCO 1019 TV

I would like to receive Midland ITV from Birmingham on this set. I do not think I could receive a picture, but surely I may receive the sound if I alter the coils on channel 8 of my turret tuner. Could you please advise me on the coils to put in and any minor alteration?—A. Burns (Liverpool).

To receive the Midlands ITV transmission you should have an aerial directed suitably and if necessary retrim the channel 8 oscillator coil core. No alterations are necessary.

INVICTA 138

When the set is switched on, sound comes on all right. The picture eventually appears, but only filling the screen from the top to half way down. The picture gradually fills up, but leaves about a 2½in. black band along the bottom.—M. M. Kemp (Norwich).

You should replace the rear right-hand side PCL82 frame output valve. If necessary check the 330Ω bias resistor which is to the left of the valve and further to the front (as viewed from the rear).

COSSOR 938

A few weeks ago the picture began to fade and at the present time it is a dull grey picture. No amount of adjustment of the brightness and contrast controls has any effect. I should also state that the set now takes around 15 minutes for even a very faint picture to show.—H Dunn (Leeds).

If the faint picture is full size and in focus, the cathode ray tube is at fault. It may possibly have an o.c. cathode, but the ion trap magnet around the tube neck should be checked first of all as it may have slipped round. If the picture is defocused and lacks width, suspect the 21A6 line output valve and its associated circuits.

MARCONIPHONE VT 150

The trouble I am having with the above set is that the picture continues to slip with a jump unless the height control is reduced until the picture is at least 1½in. from the bottom of the

(Continued on page 351)

(Continued from page 348)

screen. Adjusting other controls does not stop this effect.—W. Coleman (Birtley).

There is a 1·5M resistor (brown, green, green), wired from the hold control to the black lead connection of the oscillator transformer. It is one of a group of three resistors between two 0·022μF capacitors under the chassis near one of the U154 (PY82) valve bases.

G.E.C. BT5144

I have recently moved from London to Bristol and wish to know the procedure for altering the above mentioned set to receive the local BBC programmes.—L. F. Godding (Bristol).

This set is a single sideband TRF made only for receiving London or Midlands stations. To receive any other channel a complete change of coils would be necessary and then re-alignment; such a procedure is impracticable in our view.

H.M.V. 2806

I am unable to purchase a circuit diagram for this set.

The set has several faults, and a new tube has been fitted as the old one had a o.c. heater. Now, all I can obtain is a very fine vertical line and other lines across the screen but nothing else at all. I have changed line output valve with no success.—C. A. Fisk (Eye).

The 1806 uses a similar chassis to the HMV 1805 and 1851 and the Marconi Models VT52A, VC52A, VRC52 etc.

You should check the line oscillator valve next to the KT44 (or KT45) which is a Z66 and the line blocking oscillator transformer which is associated with the Z66.

If the transformer is at fault, no H.T. will be applied to pin 4 of the Z66 valve base.

If the line output transformer is at fault no H.T. will be applied to the top cap of the KT44 (KT45).

REGENTONE BIG 12

The screen will not light up although the tube heater does; the sound is perfect. I have replaced the EL80 valve and also the condenser between the line output transformer and the final anode on tube. I have also replaced the EY51 valve with a new one and this does not light up.—T. Howarth (Manchester).

We presume the valve referred to as EL80 is actually the EL38 and that this has been changed.

You should check the resistor to pin 4 of this valve base (6·8k wire-wound) and the continuity of the controls (line hold and linearity). It would then appear to be necessary to change the line output transformer.

SOBELL TPS 180

The above television set has been in use for approximately 12 months. During the last few weeks the tuning positions for both BBC and ITV have slowly crept upwards on the tuning scale until it is now only just possible to tune in the BBC when the pointer is at the very top of the scale. I have checked that this trouble is not caused by the pointer changing its position on the cord connecting it with the tuning condenser pulley, but the original position on the scale can be almost regained if the screening-can of the PCF80 valve is pressed downwards so that it is not centrally situated on the valve.

Just below, and to the right of the same valve is a long brass screw with a square head and I have tried adjusting this on the assumption that it might be a trimmer for that particular valve. However, such adjustment has no effect that I can detect and I have, therefore, left it in its original position.—G. R. Mott (Nottingham).

You should change the PCF80 valve. If the tuning is still out, remove the side panel (over the controls—remove the switch knob etc., and unclip panel inside), to expose the oscillator coil cores near the fine tuner spindle. Switch to the channel required and tune the core with the fine tuner spindle midway.

BUSH TV 83

The above receiver is 14 months old and performs satisfactorily, except when it is switched off. After five seconds have elapsed, a spot appears on the centre of screen starting as a pinpoint and enlarging to ⅜in. diameter and closing to a pinpoint. This takes 12 seconds. The spot is very brilliant and may burn the screen. This fault has only been showing for the last five days.—R. G. Christian (Wembley).

The appearance of the spot does not indicate a fault. There is no circuit incorporated in the TV 83 to discharge the EHT at switch-off and therefore the spot must be regarded as normal. It will not burn the screen.

PYE V14

There is a raster on all channels but no picture and no sound. There is a hiss which appears to be coming from underneath the EHT case.—R. I. Hardy (Sunderland).

The hiss that you can hear is EHT "brushing" and will probably disappear when the picture is restored. Check the tuner, especially the PCF80 local oscillator and its associated circuits including the sensitivity control and make sure that none of the lead-out wires from the tuner has come adrift.

PHILIPS 1446U

Would you please tell me what make of turret tuner I require for my television set.—S. Edwards (Bidston).

We would suggest you fit a Cyldon P10L or Brayhead 10S tuner unit. These have R.F. and mixer (or adaptor) plugs which replace V1 and V2 EF80 valves respectively. State the channels required when ordering.

PETO-SCOTT T1611

A short while ago the picture went blank, there was no brightness, just a blank screen (the sound was o.k.). I suspected the EY51 and replaced it with a new one, but I also found that the condenser on the wire from the EY51 to the C.R. tube was burnt out; in fact it was black. I asked

the dealer when buying the new EY51 about it, and he told me to cut the condenser out, as it would not matter. I wanted to replace it, so could you please give me the value of it.

With the new EY51 the set went reasonably well for a few days, and then picture started to become darker and out of focus until finally I could hardly see it at all. If I turn the brightness control up about $\frac{1}{4}$, the picture comes on faintly, but on advancing it further the picture just goes blank again. I suspected the EY51, and replaced it again with another, and the same thing happened again.—J. Firmin (Brentford).

The EHT capacitor is rated at 500pF 20kVW. It is apparently leaky, but if a replacement does not clear the condition, check the setting of the ion trap magnet on the neck of the tube and the line timebase valves, PL81 etc.

FERRANTI 24K

There is no EHT and the cut-out fuse in the PL820 cathode wiring continually blows.

I disconnected the anode lead from the PL820 and inserted my 120mA meter and received full deflection. I would say the line and frame timebases are in order.—V. Stephens (Morganstown).

You should check the PL820 and ECL80 valves by substitution. If the cut-out continues to open, check the 330k resistor associated with the ECL80 blocking transformer, the 0·05μF coupling capacitor (which may be leaky) and the regulation components—including the EB91 delay diode (V10B).

ULTRA V8-15

There is no EHT; the line-output transformer has been completely renewed including the U25 rectifying valve. Valves 20P4 and P329 have also been renewed. The U25 heater does not light-up. —W. H. Shawcross (Leeds).

We presume the complete line output transformer included the EHT smoothing capacitor. It now remains to check the supplies to the 20P4 and the 0·5μF boost line capacitor, the screen feed to pin 4 of the 20P4 (3k 4W) and the 20L1 (also components to pins 5 and 6).

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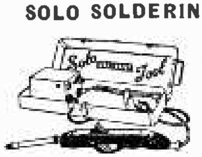

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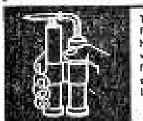

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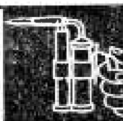

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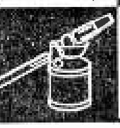

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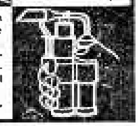

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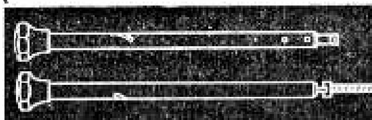

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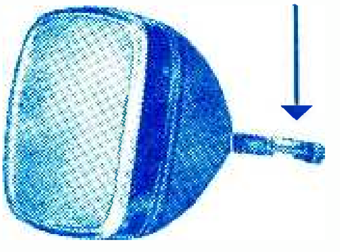

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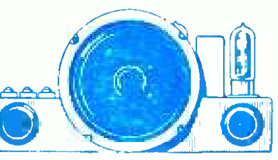

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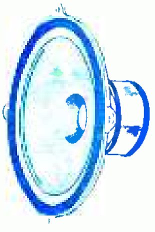

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718