Practical TELEVISION

AUGUST 1964

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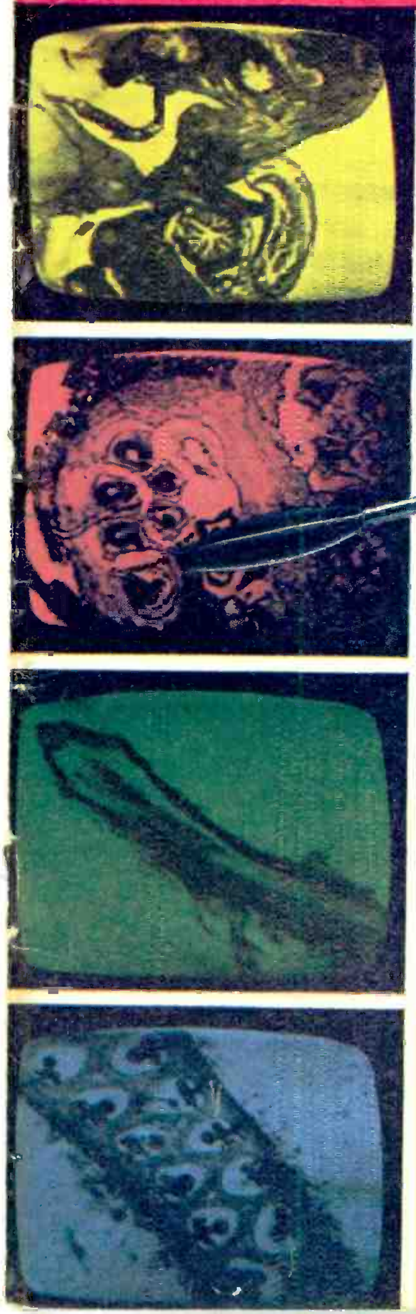

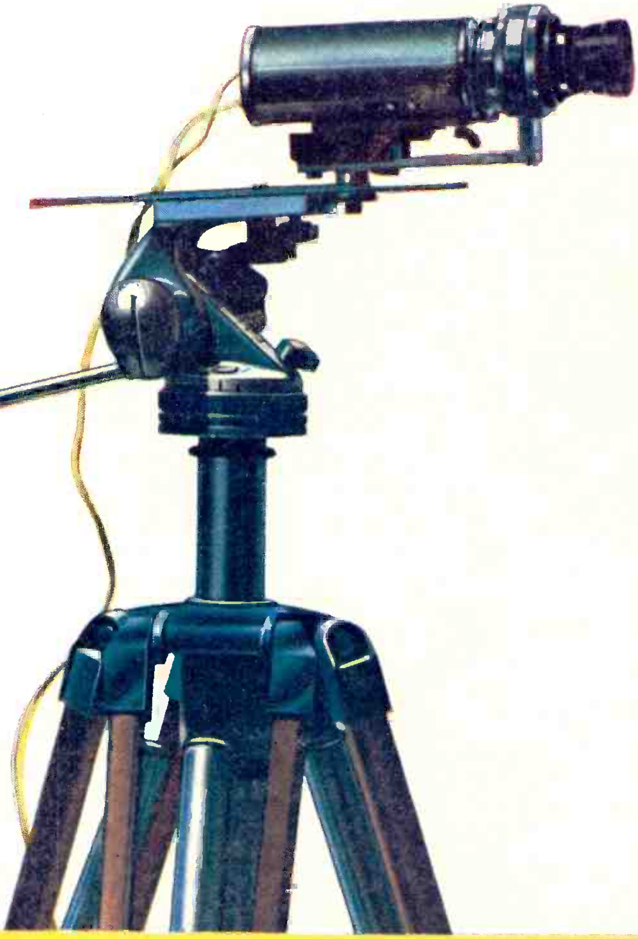

OPTICAL SYSTEMS FOR AMATEUR CLOSED CIRCUIT TV

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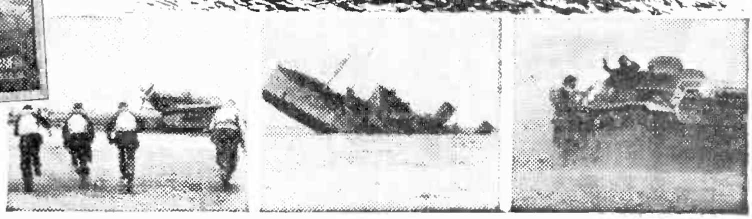

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Practical Television

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Contents

Field of Vision

THE old time wireless enthusiast, if suddenly transported from 1924 (or even 1934) to 1964, would be astonished, to put it mildly, at the strides his pet subject had taken. He would be amazed at the change in appearance of receivers, at the change in components and at the overall performance, versatility and efficiency of equipment. He would also find it difficult to assimilate many of the newer types of components and the various new techniques of circuitry and construction.

But perhaps the greatest feeling of helplessness would be engendered by the very scope of radio devices. Transmitters, receivers and the more orthodox types of test equipment, although radically different, would be a common ground of understanding, but many pieces of auxiliary equipment now in common use would cause some furrowing of the brows.

Even the enthusiast of today, weaned on transistors and electronic music, is sometimes hard put to it to keep in touch with all the latest developments.

For the television amateur, however, progress has not been so dramatic. Discounting mechanical systems, the main differences since the adoption of electronic scanning, have been in improved circuitry. Since the days when t.r.f. circuits and thyratron oscillators vanished and flyback e.h.t. introduced, the enthusiast has easily taken in his stride such things as mean level a.g.c., cascode r.f. stages and other circuit refinements which have become standard practice. He has had to acquaint himself with turret tuners and the problems of Band III and now, of course, with the 625-line system.

These are all, however, evolutionary trends in the basic receiving equipment and apart from larger tubes and smaller cabinets the typical TV receiver still looks much the same. TV has not erupted in such a disconcerting way as has radio and electronics; at least not for the amateur enthusiast.

Most amateurs are able to find but a handful of more exotic paths to follow. The first is DX-TV, which not only requires a knowledge of propagation in its various forms but has the merit of posing constructional or modification problems to be resolved and gives a good deal of opportunity to experiment with aerial systems. This is still in its infancy.

There is also amateur TV transmitting whose small but enthusiastic band of adherents may well increase.

Thirdly there is a field which, perhaps, offers the greatest possibilities for the average enthusiast—CCTV. This is a field wherein lies all manner of possible avenues to explore. In this issue we are not only running the second part of the second CCTV camera to be described in this magazine but also an article on optical systems which will clearly indicate all manner of potential lines for the keen amateur to pursue.

As time goes on, more and more scope will be available to the average constructor and experimenter and it will become increasingly obvious that, to those with initiative, TV is something more than switching on to watch "Coronation Street"!

Our next issue dated September will be published on August 21st.

TELETOPICS

Birmingham to Receive BBC-2 Ahead of Schedule

At Sutton Coldfield, where the 750ft. mast carrying existing BBC-1 aerials is being modified to accommodate additional aerials for BBC-2, temporary equipment is to be installed which will advance the advent of the second BBC programme in the Birmingham area, about nine months ahead on the previous schedule which marks autumn 1965 as the completion date for the permanent BBC-2 transmitter.

The temporary installation will provide two million people in Birmingham and its environs with BBC-2 programmes by the end of this year. Its coverage will, of course, be limited and some shadow areas will occur where the permanent transmitter will give continuous coverage. However, this new move, which has come after consultation between the Corporation and the radio industry, is expected to boost sales of 625-line receivers and u.h.f. aerials in the Birmingham area which is the second area to receive the new programme.

The aerial for the temporary transmitter will be mounted 150ft. up, considerably lower than the final one, but the station will operate on the same channel to be used eventually by the permanent station, i.e. channel 40 (vision 623·25Mc/s, sound 629·25Mc/s) with horizontal polarisation.

Amateurs Run TV Station in Japan

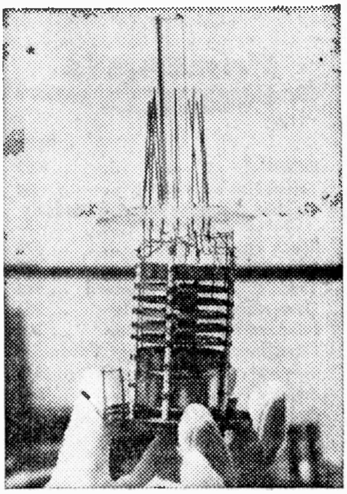
A CENTRAL television receiving station for the broadcast channels 1, 3, 5, 9, and 11, has recently been set up, as a private undertaking, in the Japanese town of Gujohachiman.

Gujohachiman has a population of approximately 22,000 and individual houses in the area are fed with signals, via cable, from this new receiving station which relays the radiated television signals from the broadcast transmitters in the service area of Nagoya.

The initiator of this installation, Mr Ichiro Kanno has, in addition, occupied the remaining channel 7 (which was free of broadcast transmissions) with small-scale closed circuit television transmissions for feeding into his cable network, having obtained a special licence for the purpose. A small c.c.TV transmitter, two vidicon cameras, a 16mm telecine unit and a simple control room (all entirely self-built) have been accommodated in a former stable, together with a miniature studio.

Programmes are produced by amateurs on a voluntary basis. Two hours of programmes are broadcast daily, chiefly concerning local events in the town and surrounding district. The callsign of this amateur "television station" is JHK-TV and, suprisingly for the British amateur, the special licensing of this station permits limited commercial advertising; 60 seconds of "hot commercials" on this station cost 300 yen—about 7s. 6d.!

TELEVISION CAMERA TUBES UNDER ASSEMBLY AT NEW PLANT



A stage in the manufacture of a television camera tube. Shown here during its assembly is the electron gun and electron multiplier of a 4½in. image orthicon camera tube.

In operation, the gun provides the fine analysing beam of electrons which picks off stored electrical information from a thin glass target. The multiplier amplifies the return signal before it is linked to conventional amplifier systems, giving electrical signals, which are broadcast and subsequently reconstituted into the image on domestic TV screens. A signal pre-amplification of about 1000 to 1 is given by the multiplier.

This picture was taken at a new tube plant at the Hayes factory of EMI Electronics Limited.

C.C. TV COVERS ROYAL VISIT

WHEN Her Majesty, Queen Elizabeth, the Queen Mother performed the official opening of a new extension to Sunderland's art gallery, closed circuit television cameras carried pictures of her to receivers placed at strategic points about the building.

Five cameras in all covered the visit, two being mounted outside for the Queen Mother's arrival and her inspection of a guard of honour.

The relayed pictures from all five cameras were received on eight Murphy 19in. monitors set up in two galleries. Three hundred and fifty guests seated in these galleries were thus assured of good views of the proceedings.

Rank Telecommunications of Welwyn Garden City, Hertfordshire, supplied both cameras and monitors for the occasion.

New Baird Scholar

THE John Logie Baird Travelling Scholarship, inaugurated last year, was presented recently at a meeting of the Television Society, to its second recipient, Mr. James D. Last.

The Scholarship, which is presented annually by the Society and financed by Baird Television Limited, is awarded to a postgraduate in the U.K. selected for his work in television engineering or an allied technology.

Mr. Last was presented with the award by Mr. P. Perring-Thoms, chairman of Baird Television.

Airborne Television Relay for Olympics

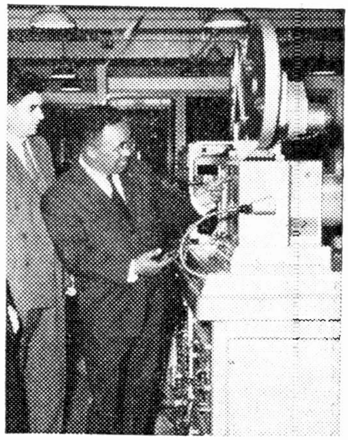
TO provide efficient television coverage of the Olympic Games taking place this year in Tokyo, airborne as well as mobile ground units will be used to televise events from many parts of the Games area. To increase the distance over which these ground units can operate, the helicopter, which will be used to provide aerial television shots, will also be equipped to act as a relay point for picture signals between them and the base station.

The new equipment necessary to provide this facility, was specially developed by the Japan Broadcasting Corporation (Nippon Hoso Kyokai) and has increased the standard range for existing units from about four kilometres to some 50 kilometres or more. This has been made possible by increasing transmitter output, improved antenna gain and through the development of an automatic direction control unit for the antenna mounted on the helicopter.

This last item of equipment operates in conjunction with a special companion unit installed at the base station which employs the ground magnetism as the common bearing standard for the ground station and the helicopter. In use, the receiving antenna at the base station is kept pointing towards the helicopter and, by obtaining a bearing between the antenna directed at its helicopter "target" and the ground magnetism, signals of a frequency corresponding to this bearing are transmitted to the helicopter as direction information. The helicopter equipment, acting on these signals, automatically controls the direction of its transmitting antenna keeping it always turned towards the ground station, so that it and the receiving antenna at the ground base station always face each other.

Signals from the mobile ground units are thus relayed via the helicopter back to the base station with extreme directional accuracy, increasing by more than ten times the range of the normal ground-to-ground link.

Telecine Equipment Interests Radio Chief



Seen here is Mr. Rabesahala, head of the National Radio Service of Madagascar, during a recent visit to the Marconi Company at Chelmsford. This photograph was taken as Mr. Rabesahala stopped to inspect a telecine equipment on his tour of the factory, when he was shown a comprehensive selection of television equipment made by the Company.

IMPROVED TV RECEPTION IN KENT AND SCOTLAND

THE two latest BBC-1 television relay stations to be announced will serve areas around Canterbury and in the western isles of Scotland.

The Canterbury station, which will serve the city's 30,000 inhabitants, is already in operation on channel 5 (vision 66·75Mc/s, sound 63·25Mc/s) providing improved reception of the BBC-1 programme. Previously, reception has been direct from the Crystal Palace channel 1 station but interference from continental television stations made a boosted signal desirable. This station began full programme service on June 29th and signals are polarised vertically.

The other station is being built about four miles north of Melvaig, on the west coast of Ross and Cromarty. From here the station will transmit BBC-1 television and the three v.h.f. sound programmes. The new station will involve the erection of a 160ft. aerial tower.

Reception from the Melvaig station should be possible on the Isle of Lewis, the north and north-east coastal areas of the Island of Skye and some coastal districts of Ross and Cromarty and Sutherland, when the station is brought into service, it is hoped, sometime during the coming winter.

Optical Systems for Amateur Closed Circuit TV

ADAPTING AMATEUR EQUIPMENT FOR CCTV MICROSCOPY

BY M. L. MICHAELIS

UNTIL recently the amateur television enthusiast has been confined almost entirely to conventional TV receivers which employ neither optical systems as such nor anything more than very rudimentary mechanical devices. The only receivers which have employed an optical system are those designed for projection TV.

To obtain the necessary brilliance on the screen of a small receiver c.r.t. without overloading the screen due to excessive beam current one has to resort to very high e.h.t. voltages—up to 50kV or more. Such voltages are a potential danger and, furthermore, give rise to considerable generation of X-rays in the projection c.r.t., particularly if this is incorrectly operated. In common with all forms of atomic radiation such X-rays are a hazard to health and represent the second reason why little has been heard about amateur constructed projection-TV receivers.

Thus the conception of amateur optical designs has attained the necessary pertinence only with the recent advent of widespread amateur CCTV activities. We are now forced to reorientate our thoughts and to remember a basic fact, namely, that, by its very nature, television is a marriage between electronics and optics.

Equipment

Even the experienced electronics experimenter can find himself helpless in the face of the optical problems posed by his CCTV constructions. Good lenses are expensive and can cost more than half as much again as the entire electronics side of a basic CCTV design.

Even with the relatively low prices of kits now offered for building CCTV cameras the outlay is nevertheless considerable. If one has invested in such a kit it would be a great pity to forfeit many of its potentialities due to the purchase of an inadequate optical system or due to lack of knowledge concerning all possible uses of an existing set of optical components.

The reader may be a keen amateur photographer, as in the case of the author, and may possess a number of excellent lenses for his photographic hobby which could probably be used for CCTV once it is understood what is required.

The optical systems for CCTV equipment to be discussed centre entirely around normal amateur photographic lenses of conventional design. The detailed CCTV camera references are to the design published in the October, 1963, to February, 1964, issues of this magazine.

Note that these specific references are illustrative only and not in any way fundamentally exclusive. The important point in every case is the principle involved, which can be logically applied to any other CCTV camera design be it home-made, a kit or of commercial origin.

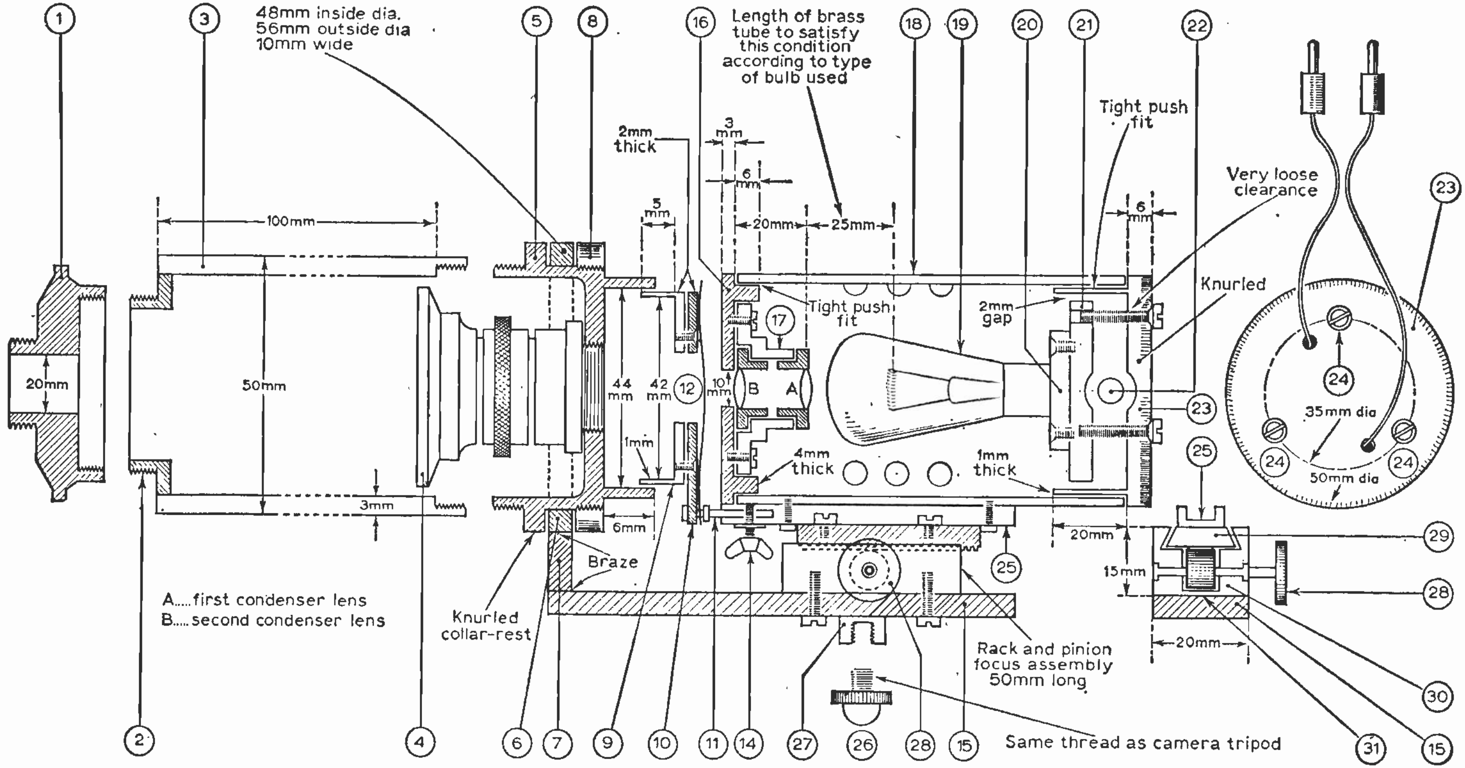
The Aims of this Discussion

We do *not* intend to go into long discussions of normal televising of ordinary indoor and outdoor scenes. This subject has been covered in detail by Mr. H. Peters in the November and December, 1962, issues. The present aim is to discuss applications of CCTV which, in the opinion of the author, will bring the first real long-term justification for the purchase of a CCTV camera.

Particular reference will be made to CCTV microscopy, including full constructional details for a micro-objective system. CCTV microscopy probably ranks at the top of the list of more refined uses to which the average reader interested in practical CCTV would like to put his camera equipment and is a field most amenable to amateur methods and facilities from a practical point of view. Other fields, such as CCTV astronomy, require rather complex and specialised equipment if really satisfactory standards of performance are to be achieved.

CCTV Microscopy

Amateur CCTV microscopy suffers from no fundamental drawbacks. It is indeed not even necessary to possess or purchase any form of conventional microscope. Provided one has obtained the specified lens for the original CCTV camera (Schneider Cine-Xenon RX 1:1·4/f=25mm)—or a direct equivalent—which is the normal lens for televising ordinary indoor and outdoor scenes, one needs nothing else than this same lens for operating with the micro-objective unit.



1 Brass adaptor ring for CCTV Camera. Outer thread to fit lens carrier on CCTV camera.
2 Dural ring, very tight shrunk fit in 3.
3 Dural tube.
4 Lens (see text).
5 Dural composite lens carrier and junction ring.
6 Brass collar.
7 Brass distance block.
8 Threaded brass lock ring (knurled).
9 Brass collar piece.
10 Brass stage.
11 Brass angle piece.
12 Phosphor bronze clips.
13 Four 6BA countersunk screws (see Fig. 2).
14 Brass wing nut.
15 Brass rail 20mm. wide, 5mm. thick.
16 Dural lens cover plate.
17 Brass mounting collar.
18 Brass tube, o/d 50mm., wall thickness 1mm.
19 6V 18W lamp.
20 Batten holder.
21 Dural disc 6mm, thick, 42mm. dia.
22 6mm. dia. steel ball bearing.
23 Dural end piece.
24 Three 4BA cheesehead screws and socket washers.
25 U-profile, 1mm. brass.
26 Adjustable dome-base knurled screw 25mm. (as table rest when using on CCTV camera).
27 Brazed-on tapped well for camera tripod thread.
28 Knurled focus knob.
29 Dovetail carrier.
30 Rack.
31 Pinion.

Apart from using this same high-quality lens the micro-objective is built from odd pieces of brass and aluminium. Only a few simple items, such as a 6V car bulb and a pair of watchmaker's eyepieces, are required in addition. The actual additional cost of the micro-objective therefore will be negligible.

However, the time required for lathe work is appreciable; but since the amateur reader, in contrast to commercial projects, is looking for interesting ways of employing his time at low cost in materials, this is certainly no disadvantage. It may also prove an attractve programme for schools and radio clubs where the necessary workshop facilities will probably be available.

Performance

Fig. 1 shows the full constructional details. With the arrangement shown, the front end adapter ring "1" being screwed into the lens carrier of the CCTV camera in place of the normal lens, which is itself removed to the lens carrier junction ring, the televised picture represents a magnification of 300 diameters on the receiver screen.

With a picture width of some 50cm on the author's receiver and an electronic resolution of some 300 lines across the width of the picture two lines on the display which are one-sixth of a

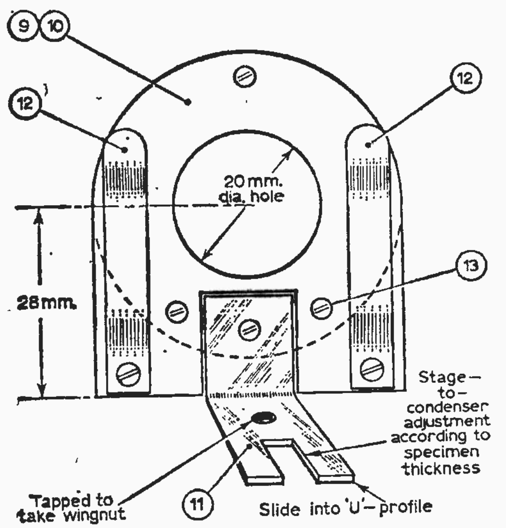


Fig. 2—Assembly details of the specimen stage.

centimetre apart can still be resolved. With an effective magnification of 300 diameters and an electronic resolution of one-sixth of a centimetre on the receiving screen this represents a potential resolution (rounding off the figures) of about one two-thousandth of a centimetre on the microscopic specimen being televised.

It is more usual to use units of length called "mu" for microscopic dimensions. One mu is the ten-thousandth part of a centimetre. The overall resolution of our micro-objective, including the CCTV link in this setting, is therefore about *5 mu on the specimen.*

The author has tested the resolution of the optical system alone in the following manner: The tube "3" and adapter ring "1" were removed and the CCTV camera was operated without any form of lens. The rest of the micro-objective was mounted on a tripod and moved back to a greater distance. projecting an image into the lens-carrier hole of the CCTV camera across open space in a darkened room. The greater the projection distance the greater the resulting physical magnification on the screen of the TV receiver.

The distance was gradually increased until any further increase failed to reveal any more resolved detail on the television receiver screen, blurring merely increasing in proportion to additional magnification introduced beyond this limit. This point was reached when the physical magnification on the receiver screen was about a thousand diameters with respect to the specimen, signifying that at this setting the optical and electronic resolutions were roughly equal and both about *1 to 2 mu on the specimen.* This is the absolute maximum of resolution obtainable from this system.

The limiting factor is the wavelength of light. Just as an obstacle much smaller than the wavelength of a particular wireless wave cannot significantly reflect or hinder that wave in its propagation so can no object or part thereof which is much smaller than the light directed at it be rendered visible thereby. The light just goes past it without noticing its presence. The wavelength of visible light is about 0·5 mu. The maximum resolution of our micro-objective is thus some 2 to 4 wavelengths of light, a quite remarkable performance for such a simple system.

Theoretical considerations show that the best oil-immersion objectives of the most expensive professional microscopes can only get down to a resolution of abut 0·4 wavelengths of light, i.e. to about 0·2 mu. In other words, the very best professional microscopes are only better by a factor of about 10 compared with the design here published.

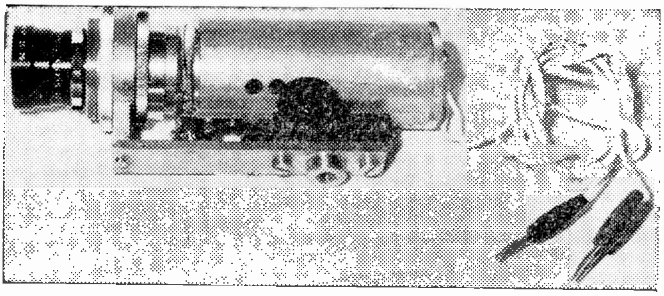
An important component contributing to the relatively high resolution is the carefully devised lamp and condenser arrangement. At low magnifications in any micro system the method of specimen illumination is relatively unimportant provided sufficient light is injected to obtain a picture of adequate intensity. At higher magnifications, where the limit of resolution is being approached, correct design and alignment of the system of illumination is vital.

Skewed illumination can reduce the realisable resolution by a factor of 5 or more. The lamp and condenser arrangement in any high-power micro-optical system thus constitutes a vital part of the whole and the arrangement here adopted is beyond reproach as far as the fundamental requirements are concerned.

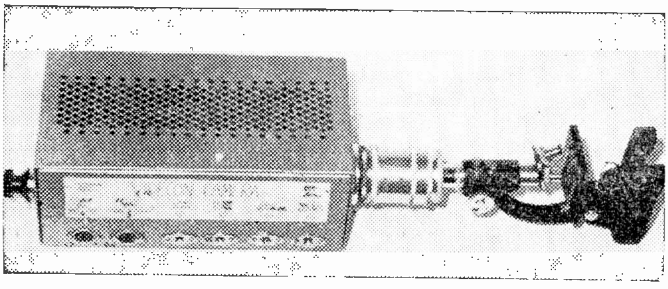
Magnification can be obtained in almost unlimited amount from this system merely by projecting into the CCTV camera from a sufficient distance. The practical limit is imposed solely by the available light and was reached for the prototype at about 3yd projection distance, corresponding to a magnification of about five thousand diameters on the television receiver screen.

The use of a more powerful lamp would, in principle, enable the projection distance and corresponding magnification to be increased further still. But such additional magnification is of little use since no further resolution of detail is obtainable beyond a magnification of about one thousand diameters.

The very smallest single bacteria, the cocci, are about 1 mu in diameter. Most bacteria are considerably larger. Thus even in the normal "300 diameter magnification" closed system with the tube "3" and ring "1" in position and with a resolution of about 5 mu many types of bacteria can just be resolved individually and certainly colonies thereof can be studied. The red corpuscles of human blood are about 8 mu in diameter so that these will definitely be resolved individually if present in a specimen.



The equipment assembled with lens but without tube 3 and ring 1.



A toy microscope fitted to the CCTV camera with the adapter collar.

Choice of Standard Magnification

We have seen that the magnification can be raised to almost any desired level by removing the tube "3" and projecting an image into the CCTV camera opening across a darkened room. It is clear that the purpose of the tube "3" is merely to keep the system closed so that the room need no longer be darkened. The length chosen for the tube "3" will determine the "normal" magnification obtained. The following considerations led to the choice of 10cm (about 4in.) for the length of the tube "3" in the prototype.

To obtain maximum available resolution requiring a magnification of about a thousand diameters the tube would have to be about 2ft long. There is, of course, no objection to making a second tube of this length for high-power (bacteriological) work, but this magnification is quite unwieldy for the majority of microscopic specimens such as plant and seed sections, small pond-water organisms, fragments of insect organs, etc. The resolution in the maximum setting is also in practice greater than required for such purposes. The specimens would come out at several times the size of the television receiver screen so that only a small portion thereof would be visible at any one time, giving an inadequate general conception.

After careful and extensive work with the prototype, using a great number of varied slide specimens, the author has found a lower magnification than that required fror maximum resolution to be far more desirable for obtaining best all-round results. In fact the figure of 300 diameters with the 10cm tube "3" was chosen as being the optimum. A shorter tube can be cut for large specimens where it is desired to bring more on the receiver screen. Any tubes longer than 10cm (for high-power work) must be painted dead black inside over their entire length to avoid fogging of the images due to internal glancing reflections. This measure is not absolutely essential for the standard 10cm tube or for shorter ones.

The Lamp and Condenser Unit

A 6V 15W car-type bulb and a suitable batten-holder should be obtained. A higher wattage lamp would heat up the unit under continuous operation at maximum voltage; a lower wattage is equally undesirable because open projection on to a canvas screen, i.e. use of the unit as a straightforward projection microscope without CCTV, would not then give sufficiently brilliant pictures.

It is essential that the lamp bulb should have a straight single-coil filament and have a clear bulb, not a frosted one. Higher voltage types should also be avoided as these normally have filaments which are too long and which are not straight. Moreover, the short, thick filament of a really low voltage lamp gives a far more intense white light than the extended filaments of higher voltage types do.

The lampholder is mounted on an aluminium disc which itself rocks on a central ball bearing and is locked by three differentially adjustable peripheral screws spaced 120° apart. Furthermore, the complete lamp-mounting assembly can be slid to and fro longitudinally and also rotated freely in the end of the lamp-housing tube. These three mechanical adjustments enable the bulb filament to be brought into any orientation at any position over a considerable range and to be locked securely in any setting.

The ring closing the front end of the lamp housing has a central hole 10mm in diameter through which light emerges on to the specimen stage. The inside of this ring is recessed and carries a suitable mounting collar for a pair of watchmaker's eyepieces, A and B, serving as a precision double condenser.

The principle of a condenser in general is to form an image of the lamp filament on to the principal plane (the iris stop) of the main lens used for forming the optical image of the specimen. If this condition is accurately satisfied, and if the lamp filament is a true point of zero size, all the light will pass through the main lens regardless of the aperture which may be set, which then has no effect upon the brilliance of the ultimate image of the specimen in such an arrangement (in contrast to the conditions of diffuse illumination in normal photography where each aperture step halves or doubles the image intensity).

Now our lamp filament is not a true point but has a definite size. However, as long as its image remains smaller than the aperture set on the main lens that aperture will still have no effect upon the brilliance; thereafter, for a straight filament larger than the lens aperture, the reduction of brilliance is linear, not square law as in normal photography.

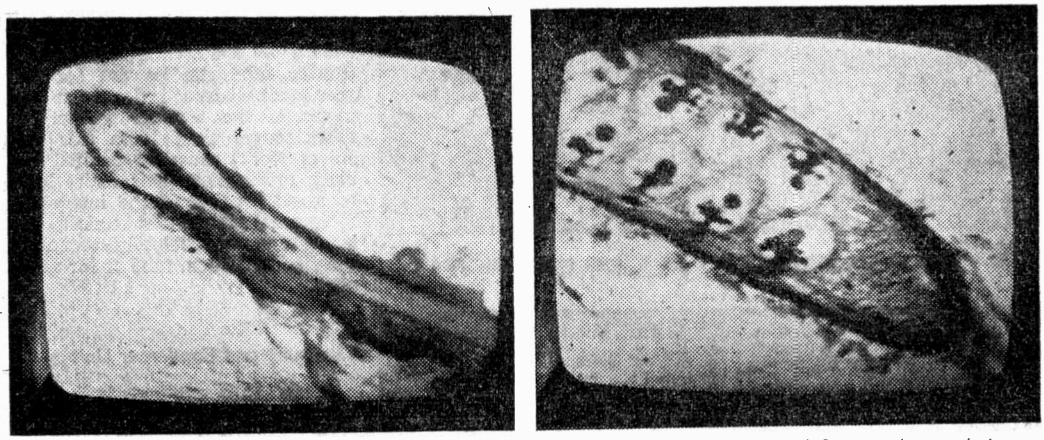
In short the advantage of such a small-size source of illumination is that efficient light transmission persists relatively regardless of the aperture set on the main lens, which can then be chosen according to the requirements for optimum resolution. Stop numbers between full aperture and about f/8 should be tried in any given set-up, comparing the image quality at each setting.

Alignment

A point source operates effectively in the above-mentioned respects only if it is correctly aligned, and such adjustments are rather critical. The following alignment procedure should be adopted:

Place a specimen on to the stage and, with tube "3" and ring "1" both removed, project a focused magnified image of the specimen on to a canvas screen some 2yd distant. Adjust the focusing rack and pinion to bring the projected specimen image sharply into focus on the screen, if necessary empirically adjusting the lamp position to get some sort of illumination over the field of view, even if very uneven.

Now scratch a small mark on the focus carriage and then rack it backwards by an amount exactly equal to the focal length of the main lens. The image of the lamp filament should now have taken the place of the specimen image on the projection screen. First of all slide the rear lamp mounting longitudinally in the lamp-housing tube to bring the lamp filament sharply into focus on the screen without moving anything else. Then rotate the lamp mounting to bring the lamp filament exactly horizontal on the screen. Finally adjust the three rocker screws to bring the focused horizontal filament image into the exact centre of the field of view.



Both these photographs were taken from a standard television screen. The subject on the left was a human hair, torn out from the root.

Repeat this sequence of adjustments in the same manner as when adjusting the various cores during alignment of an i.f. amplifier chain until mutually optimum settings are reached. The lamp and condenser system is then accurately aligned and, upon racking forwards again to bring the specimen image into focus on the screen, the whole field will be seen to be illuminated uniformly and at great brilliance.

Regarding the condenser lenses themselves, ordinary watchmaker's eyepieces with a lens diameter of about half an inch (obtainable at any optician's for a few shillings) and with a X10 magnification are suitable. Two are required and these *must* be identical in every way.

The eyepieces will already be fixed in a mount with collar which conveniently slides in the main outer collar, holding both condenser lenses a definite distance apart, AB. This distance AB should be adjusted if necessary for removing any chromatic aberration during alignment of the lamp. In other words, if the outer zones of the lamp filament on the projection screen appear coloured during alignment first adjust the separation of the condenser lenses AB to minimise or remove this effect.

This adjustment is not critical and the separation of 20m shown in Fig. 1 will probably be satisfactory right from the start.

TO BE CONTINUED

BY H. W. HELLYER

STOCK FAULTS

PREVALENT TROUBLES IN COMMERCIAL RECEIVERS

CONTINUED FROM PAGE 455 OF THE JULY ISSUE

PART 4 VISION OUTPUT CIRCUITS

DETECTOR, video output and interference limiter circuits are lumped together for the purpose of this article. The reason—as any experienced service man will know—is that they are interdependent in practice. Faults that originate in any one section have their effect upon the others. Indeed, it is often difficult to extricate the root cause from some very misleading symptoms, as we shall see.

Variations in design make it almost impossible to be dogmatic about specific components that fail, but we can generalise to a certain extent, and to aid discussion, Fig. 18 has been drawn, showing the most important features of a "conventional" vision output circuit.

From the final i.f. transformer T1, the signal is taken off by crystal diode D1, connected so as to produce a positive-going pulse across the load resistor R1.

L1, in conjunction with C1, C2, provides an i.f. filter. The values of these two capacitors may be quite small, 10pF or less being quite usual, and the load resistor may be similarly low (compared with the audio circuits discussed in our last article).

High Resistance Joints

The first real speciality comes in the R2, L2, C3 circuit, which is employed to "boost" the higher frequencies of the video waveform, say from 2·5 to 3Mc/s. These peaking coils tend to sharpen the outline of the picture, and the principal fault found with them is the development of high resistance joints, due to their physical construction.

Fig. 19(a) shows the way they are wound on the damping resistor (R2 of Fig. 18), with the fine wire joined to the resistor lead-out wires. As the whole component is often mounted on a printed-circuit board and, all too often, in the path of a current of hot air, deterioration of the joints will cause partial bad joints or open circuits which give rise to symptoms of a "smeary" picture or a plastic appearance in certain cases and a weak modulation in others.

In general, an open-circuit of R2 would result in overshoot, and severe ringing, as L2 would then not be damped and a short-circuit would cause lack of detail as the high frequencies in the video waveform would not be accentuated.

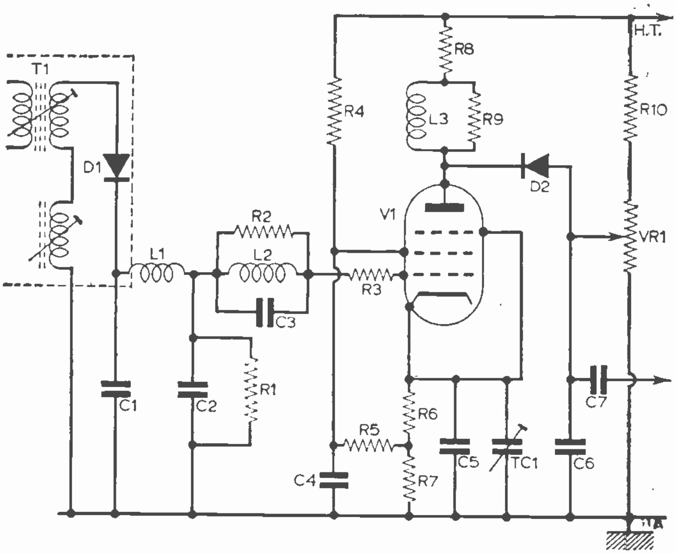


Fig. 18—Composite circuit of detector, vision output and interference limiter stages.

The Video Detector

We have mentioned loss of detail, but have skipped the prime cause of this fault, the video detector. This is quite often a crystal diode, as shown, although in many sets a double-diode valve, such as the EB91, 6AL5 or D77 was used, with the second half of the valve taking the place of D2, the interference limiter diode.

Where a crystal is used, breakdown causes it to develop a high forward resistance, and the effect is a weak and watery picture, sometimes mistaken for a low gain fault. As this can also be caused by a low emission video amplifier, some experience of the particular circuit is needed to spot the exact cause quickly.

The difficulty lies in testing this diode, which is often mounted in the final i.f. transformer screened can, and which has to be disconnected to be metered.

In Fig. 19(b) the most usual types of crystal are shown, with the circuit symbol included—the important point being that this component must be connected in circuit the right way round.

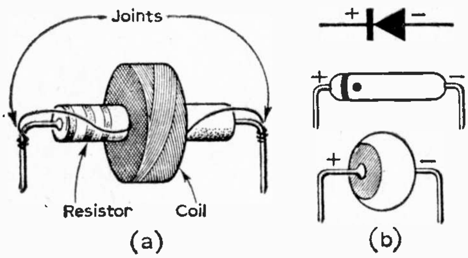


Fig. 19(a)—Peaking or correction coil wound with fine wire on a damping resistor. Look for poor connections at the joints and loose mounting of the resistor in printed circuit panels. Check that the whole component is mounted with the coil well clear of the chassis: (b)—crystal diode symbol and two examples of physical shape. Note that red or white dot, and white, red or black band, denote cathode connection.

Damage to this component can be caused by two quite separate faults. In Part 2 of this series, i.f. instability was mentioned. This can result in a heavy d.c. being passed through the crystal, with certain circuits using a low value load resistor.

In its initial stages, this fault can be isolated by a test with a high ohms/volt meter at the detector load resistor. With no signal coming in, there should not be a standing voltage; instability will result in a rectified voltage and this becomes apparent on test.

The snag about other types of test is that application of the meter modifies the circuit and very often causes a temporary cure to the fault one is trying to trace.

The second cause is an internal short-circuit between electrodes of the video amplifier. This valve, often an EF80 or the pentode section of a dual valve such as PCF80 or PCL84, is used as a current amplifier and works quite hard.

The incidence of failure is fairly high. When this type of interelectrode short-circuit occurs, heavy d.c. is drawn through the crystal diode, which very soon breaks down under the strain.

Unfortunately, this fault is an accumulative one. For example, instability in the i.f. stages—often caused, as noted in Part 2, by an open circuited screen grid decoupling capacitor, or a short-circuited a.g.c. line—causes an upset in the quite stringent bias conditions of the video amplifier, an over-heating and possible change in value of the cathode resistors, the valve glowing red-hot, inter-electrode shorts and breakdown of the diode.

It is not sufficient to replace the diode: a check should always be made of the video amplifier and its circuit.

Reference to Fig. 18 shows that the screen grid of this valve is fed via a tapping on an h.t. potentiometer, the lower leg of which is also a cathode resistor. This type of circuitry is common. Its purpose is to give a standing bias to the cathode, operating the valve as a current amplifier.

The decoupling across the cathode bias resistor may consist of a single capacitor, or a combination of capacitors, and may be tuned, as in Fig. 18. The purpose of TC1 is to provide the set user with some variation of feedback, and thus a control over the video response. For this reason, such a control is often termed a "Quality" control.

If the cathode bias decoupling fails, the result is sometimes a heavily contrasted but poorly detailed picture. This can happen when the proximity of a silver mica capacitor to a burning carbon resistor causes damage. Typical of this is the Ferguson 506 circuit, where the cathode bypass is a 0·0012μF capacitor.

A similar value is used in the G.E.C. BT302, as illustrated in Fig. 20. The points of interest about

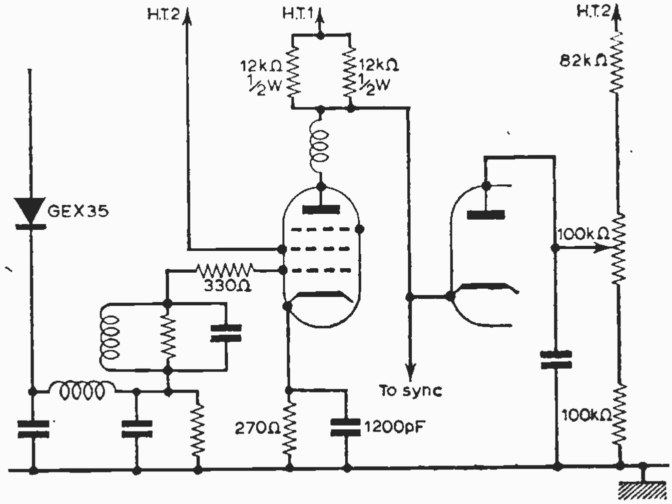


Fig. 20—G.E.C. BT302 series. Note double resistor used for anode feed.

this circuit are the return of screen grid to h.t. and thus no tapped cathode resistor, and the split load in the anode feed, consisting of a pair of 12kΩ ½W resistors.

Intermittent Overload

The fault of intermittent overload should be checked early on this range of receivers, as the result will be a periodic over-running of the video output valve, which then develops a control to screen grid short-circuit, and burns out both the GEX 35 diode and the 270Ω cathode resistor.

The decoupling of the i.f. stages should be checked, especially the screen grid capacitors. A misleading symptom on the BT302, giving a similar indication of severe overload, can be caused by quite a different fault. This is cancellation of the a.g.c. by a tracking of h.t. across the plug and socket connection that carries the power and a.g.c. circuit.

Cleaning of a plug that has suffered this tracking effect is seldom successful. The best cure is to disconnect the h.t. line from the plug and socket and use a direct connection, or, if dismantling is still required, a portion of strip connector for the high voltage lines.

The vision interference limiter control on these receivers is a conventional peak limiter, flattening the white level according to the voltage applied to the anode of the diode by the tapping on the potential divider, the 100kΩ being preset. Open-circuiting of this preset at its lower end will cause the diode to conduct and a grey, lifeless picture results.

A somewhat similar arrangement exists with the later BT318 and 320 series, except that the values of the upper and lower resistors in the potentiometer chain are 47kΩ and 82kΩ respectively. But there are other differences earlier in the circuit that may be worth noting.

The cathode on these models is biased from the h.t. line via a compensating coil which is tapped from the junction of a 3·3kΩ 1W resistor and the 270Ω cathode resistor. On certain models, such as the 319, 321 and 329, an extra i.f. stage was fitted, and precautions against instability which cause the burn-out of these last mentioned components were necessary.

This consisted of the inclusion of a damping resistor across the second i.f. primary and a 1·7pF capacitor from the anode of the second i.f. stage to chassis.

The 303/305 models also used an extra i.f. stage and in these sets the screen decoupling capacitor of the second i.f. stage was doubled by the addition of an 0·001μF, while the primary of the anode transformer was damped with a 33kΩ resistor.

The adjustment of this coil is quite important in these sets, to reduce the plastic effect due to poor video response, which is actually caused by a restriction of bandwidth.

The opposite fault, a severe ringing, can be caused by lack of screen grid decoupling, as when the 10μF electrolytic on the Philips 1758U goes open-circuit, or by a damaged bias resistor, as the cathode resistor, 330Ω, of the Ekco TC388 and associated models, where this component is tuned, as in our composite Fig. 18 circuit.

The symptoms, in an advanced stage, are quite obvious, but it is not always so apparent that poor video response can cause line pulling, and general weakness of the sync circuits.

Sync Faults

On some models, such as the Alba 644, 744, 363 and 655 receivers, the frame is affected quite soon, and a similar effect may be noted on the Emerson 704 and 708 and the Philco 1000 and 1100U. Replacement of the video amplifier valve can often cure a deeply obscure sync fault. More about this later, when we discuss sync circuits more fully.

A peculiar fault of this kind crops up with the Ferguson 406 and associated models, where the anode of the video amplifier receives an h.t. feed from two separate sources.

First is the direct source, from the load resistors (two 3kΩ resistors in series) and the loading coil. Second is from a tapping of a 150kΩ and 330kΩ across the h.t. line.

If the anode loading coil develops a high resistance, usually varying in persistence and seriousness as the set heats up, the result is a drop in video anode volts, intermittent overload due to lack of a.g.c., and some peculiar sync faults.

Another coil which can give similar symptoms is the grid coupling. It is wise to check these sets with the back in place, or some other form of heat concentration applied, as it has often been found that faults crop up only under extreme temperature conditions.

Sometimes, the complication of the circuit gives rise to these faults, when something goes wrong. A typical example is the Stella 5721, where poor line hold may be noted because the 220kΩ resistor from

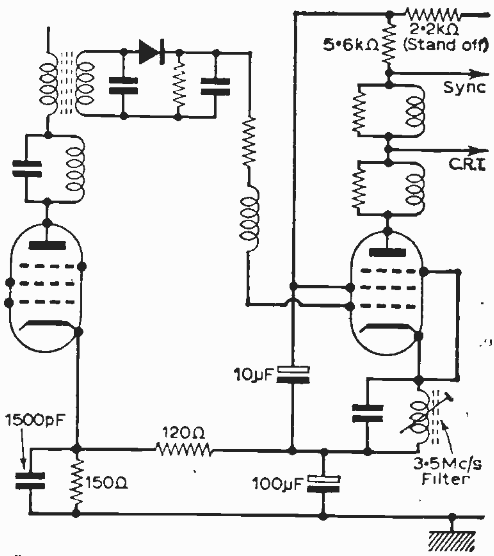


Fig. 21—Philips 19TG 111A. Note the stand-off h.t. feed resistor. See text for details.

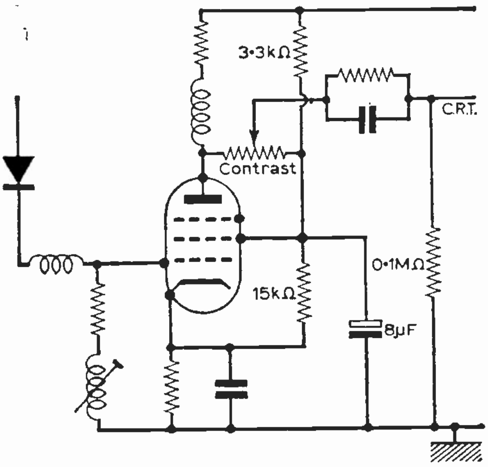


Fig. 22—Video output stage of the HMV 1842, with balanced contrast control and tuned grid loading.

the bias line to the video grid goes high.

In this arrangement, the limiter applies a negative bias to the suppressor grid and a compensating bias to the control grid is derived from the line oscillator. Perfect balance is the secret of this circuit.

Less complicated, but quite as individual, is the Philips 19TG111A as illustrated in Fig. 4. Here it may be noted that a common cathode return for both video amplifier and final vision i.f. valve is used. The importance of the two electrolytics, 100μF cathode and 10μF screen decoupling, need not be stressed. The catch, with these receivers, is the mounting of the 2·2kΩ resistor taking anode current.

This component, in common with the sound output anode feed, the turret and frame h.t. feeds, is mounted on stand-off tags with low-temperature solder, so that overheating due to excessive current causes melting of the solder and the falling away of the resistor to afford a measure of protection. Very handy—when you know about it; very confusing, when you don't!

Reconnection should be made by fitting the resistor on the underside of the solder tags without wrapping the ends, and using 60/40 solder, if you want to retain the protection which is much preferable to the burn-out that can otherwise result.

On an earlier model, the Stella 1007U, a confusing fault was commonly found, with its origin also in the video circuit, though apparently elsewhere. The video cathode decoupling capacitor, 100μF electrolytic, is in a can with a shared common negative.

The other section is the sound output cathode decoupler. The symptoms are sound-on-vision, which appears to originate in the tuner unit subpanel, on which speaker and volume control are mounted. Much fruitless searching can be obviated by checking first the earthing of this dual capacitor, then, if the fault persists, fitting a separate video bypass.

Similar faults occur on the Pye CW17, where the unit is a triple electrolytic, bypassing sound output screen grid, one h.t. line and the video cathode.

Lack of Band III Response

Another baffling fault is lack of Band III response, although Band I is apparently in order. This happens on the HMV 1842. Before getting too involved in the "front-end" circuits, check whether an alteration of contrast also makes greater changes than would be expected in general brightness level. See that the video amplifier (PL83) bias is no more than 4·8V. If it is, check the 15kΩ resistor from the upper end of the contrast control, which reduces in value. Fit a wirewound replacement.

Fig. 5 shows the rather unusual circuit. If the 3·3kΩ goes high, a negative picture, with no vision interference control, can result.

Earlier a mention was made of sync being affected by a video fault. This is very noticeable on the Ultra 1774, and similar models, when the 550μF cathode decoupler develops a fault—usually when the set heats up. This high value is quite important, and it is not advisable to use any handy electrolytic in its place.

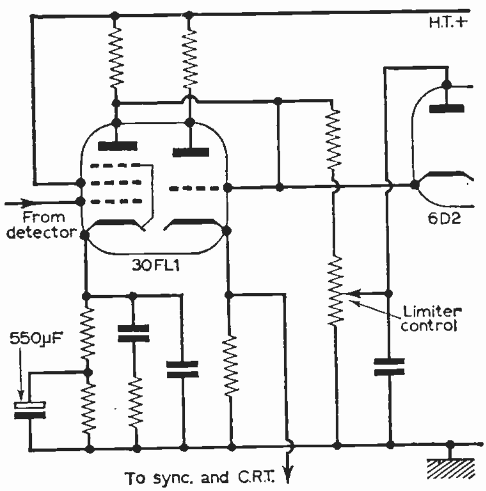


Fig. 23—Large value cathode bypass electrolytic is used on the Ultra 1774 and associated models.

Fig. 23 shows the circuit. Note in this circuit also the h.t. feed to the anode of the limiter diode is common to the pentode anode, with the triode section employed as cathode follower output.

The ultimate fault—no raster—can have its origins in practically any of the previously discussed faults, when they develop, but could also be a very small trouble—our old favourite, the dry joint.

This is evident in such circuits as the Sobell and McMichael TPS180, MP18, etc., where the feed to the c.r.t. cathode is via a peaking coil. Check the soldering at both sides of the printed circuit on these models.

TO BE CONTINUED

DX-TV

A MONTHLY FEATURE FOR DX ENTHUSIASTS

by Charles Rafarel

WE hope DX-ers have now found that the prediction, in last month's column, that there would be a DX Sporadic E opening in June, was in fact correct.

The opening started on May 18, and at the time of writing is still in full swing (Mid-June) and is, without doubt, one of the best ever, in spite of many dismal pessimists who forecast that this season would be below average for reception conditions.

Most of the old favourites have already been coming in well, as well as a number of new ones, and there has been plenty of interest to see. It has not required too much patience, either, and the openings have been almost continuous from 08·00 until 22·00 or even later, signals via Sporadic E being received on all channels in Band I.

The only disappointment has been the tropospherics in Band III still suffering from the unsettled weather conditions, and extremely variable, although at times good reception of DX was possible in this area. I can only hope that it has been better in other parts of the country, and we would be most interested to hear from readers regarding this.

U.H.F., strangely enough, has at times been coming in rather better than Band III, and the new Lille-Bouvigny transmitter on channel 27 is putting a good signal into many parts of Southern and South Eastern England. The exact power is not yet known, but it is understood to be one of the most powerful u.h.f. transmitters in Europe, and seems to be completely "blotting out" its co-channel partner N.T.S. Lopik for reception in many localities over here.

Station Identification

We are anticipating a number of enquiries (particularly from beginners) regarding station identification. Some have already arrived, and there are certain requests that I would like to make, so that we can help as far as possible. For identification the following information is required:—

(1) Date and Time of reception.
(2) Standard, i.e.: 625 Pos. or Neg. Image or 819 lines.
(3) Channel. If you do not know on which E.R. of F channel you received the signal give the nearest English B channel and say if your reception was h.f. or l.f. of this.
(4) Please give rough sketch or photo of any Test Card or Opening Caption.
(5) Any Programme details together with times of reception.

A number of readers have given good Test Card sketches, but have omitted channel details. This causes difficulty over similar Test Cards such as for example Grunten (West Germany) and Jauerling (Austria) on Channels E2 and E2a. So please give fullest details.

DX NOTES

Jugo-Slavia has been positively logged from Kapaonik on Channel E3, CCIR, a poor signal here in Poole. More identification details will be given as soon as it gives a longer duration picture, but it carries a Test Card similar to N.T.S. Lopik, seen from 18·00 to 18·15. At 18·15 there was an opening caption carrying the words "Studiol? Zagreb," followed by a newsreel carrying a weather map of Jugo-Slavia at 18.22 and at the end of the news at 18·30 a photo caption of a bridge over the Danube was shown. This has been seen by a number of viewers.

Mystery Signals

At least 2 new electronic patterns are coming in, details as follows:

(1) Channel E3, CCIR, on 2-6-64 at 17·50 for a few minutes, a very strong small mesh pattern with two graded horizontal bands across centre faded out before Test Card or Opening Caption.

(2) Channel E4, CCIR, on 9-6-64 from 19·03 to 19·35 black and white checkboard pattern exactly as N.T.S. Lopik, but via Sporadic E (i.e., not Lopik which is too near in this area).

If any reader knows the answer regarding the locations of these we shall be delighted to hear.

DX Logging

A number of interesting points have been noted during the opening, and I will mention three of them to show that what is often common practice in "logging" by DX-ers is not always correct.

I refer to the assumption that it is the nearest station that is received in a country, when one has seen a Test Card. This is not always the case, it depends on prevailing conditions.

For example: A Swedish Test Card normally assumed to emanate from the Horby station was seen to carry the word "Vannas" on it; Vannas is in North Sweden and Horby is in the South.

R.A.I. Italy on channel Ia, is usually logged as Monte Nerone, but on most occasions recently on a good Test Card the number in the top right hand corner is not 31 (for Mte Nerone) but 23 which indicates that the station is in fact Monte Cammarata (Sicily) much further away!

Similarly the entry USSR?, Minsk?, often appears in logs for the R1 signal, but this some-

—continued on page 501

TRANSISTORISED tv camera

B. W. SMITH G3LGJ/T

CONTINUED FROM PAGE 460 OF THE JULY ISSUE

THE diagram of Fig. 6 shows the construction layout chosen for the camera and is a very practical one, making good use of available space.

The Chassis

The mains transformer and power supply components, including vidicon tube coupling capacitors and resistors are fitted into a four-sided chassis 4in. x 10in. x $2\frac{1}{2}$in. deep. This will give rigidity to the whole structure and accommodate most of the bulky components.

The transformer should be fitted at the rear end of the chassis well away from the coil assembly and also preferably enclosed in a steel box. Stray magnetic fields such as surround a mains transformer can affect the camera tube scanning and produce unwanted 50c/s shift on the vidicon, which will appear as bent verticals in the picture.

The coil assembly is supported by its middle and rear discs on top of the power supply chassis to sit flush with the front edge of the chassis. See Fig. 6.

The video amplifier is constructed on $\frac{1}{8}$in. paxolin board, and turret lugs or panel pins are used to hold the components on to the board.

When planning the component layout do not waste space, place Tr1 as near to the camera head output as possible and lay Tr2 and Tr3 etc. in order, along the board away from Tr3. This will minimise the possibility of capacitive feedback from output to input which could well cause spurious oscillations.

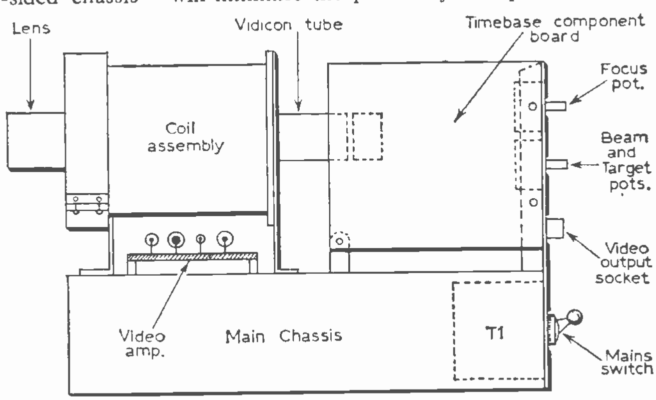
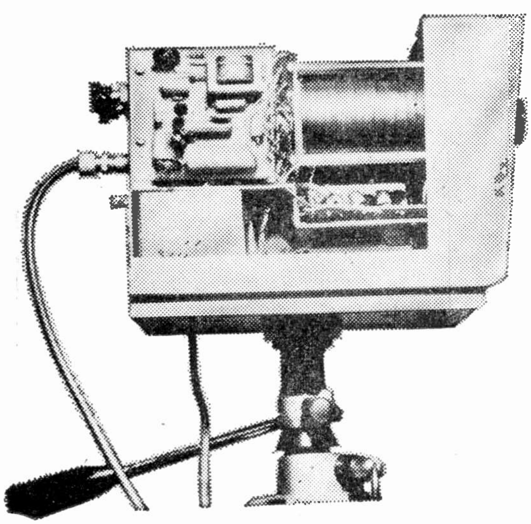


Fig 6—The style of construction adopted by the author for the prototype camera.



Avoid a layout which involves long coupling leads and multi criss-crossing of wires; arrange if possible for the output to be taken off the opposite end of the board to the input. Remember that the amplifier handles 3 Mc/s or more and has a very high gain.

A home-made printed circuit board can be constructed quite easily for the vision amplifier and timebases.

The three control potentiometers, beam current, electrical focus, and target sensitivity are fitted together with the output socket onto a bracket mounted on the rear of the power chassis. This bracket has its two upright sides bent at right-angles, for use as mounts for the two scan component boards.

The two boards, which will be about 4in. x $4\frac{1}{2}$in., are constructed in a similar way to the video board, although in this case component layout is not so critical. One board will hold all the frame timebase components, and the other, all the line timebase parts. The boards are held on each side of the rear bracket by two self-tapping screws and are also supported by a small bracket mounted on the main chassis.

A simple case can easily be fabricated from either wood or aluminium sheet. The finished case, being finished off using a contemporary colour scheme with the operator's call sign written across the side.

Printed Circuit

The more ambitious experimenter would find it worth while to design a printed circuit layout for the three vision and timebase boards. The process is quite simple and should be tackled in the following way.

First prepare twice full size, a layout of the components as they lie in the circuit, putting each fairly close together with the positive rail at one side, and negative rail at the other. Very little re-arrangement should be necessary to draw the print circuit connections between the various components. A little perseverance will be required, but once the technique has been mastered everything will fall into place. Remember that jumper wires can be used in the awkward places.

Having obtained a layout, cut a piece of single-sided copper laminate board to size and mark out and drill all the component holes, drill No. 50, and don't forget the fixing holes. Paint the connections on the copper side, using black cellulose paint, with a small paint brush. Do not make sharp right-angle corners, keep lines separated by at least 0·05in. and put extra paint round component holes where possible. Mistakes can be scraped off when dry, using a razor blade. When the painting is finished allow to dry, and check that everything is correct.

Ferric chloride can be bought in crystal form and should be dissolved in very warm water. Do not mix in metal pans, but use a glass dish. About $\frac{1}{2}$ pint of water only will be needed and it will dissolve a large quantity of ferric chloride. The solution will turn a very deep brown.

The painted board can then be dropped in. The reaction will be increased by keeping the water hot and constant agitation; time required will vary from 5 minutes to $\frac{1}{2}$ hour. The board should be checked now and then until all unpainted copper has dissolved, when it should then be removed and washed. The paint is dissolved using an acetone-soaked rag. The board can then be lightly rubbed with steel wool and is ready for assembling.

After all components have been assembled and soldered, a coat of clear varnish can be used to maintain the copper shine.

Photographs will tell you that the pictures you can obtain will be only as good as your camera optics. While this may not be strictly the only limitation in television cameras, a good lens is well worth the money spent on it.

The range of lenses available is prodigious and choice depends on several factors. Lenses that are readily available are 8mm, 16mm, 35mm. The 1in. vidicon scanning format (picture area) will be adequately covered by a 16mm lens.

The lens required will need to be a focusing type preferably with an adjustable iris so as to control the light on to the vidicon mosaic. The

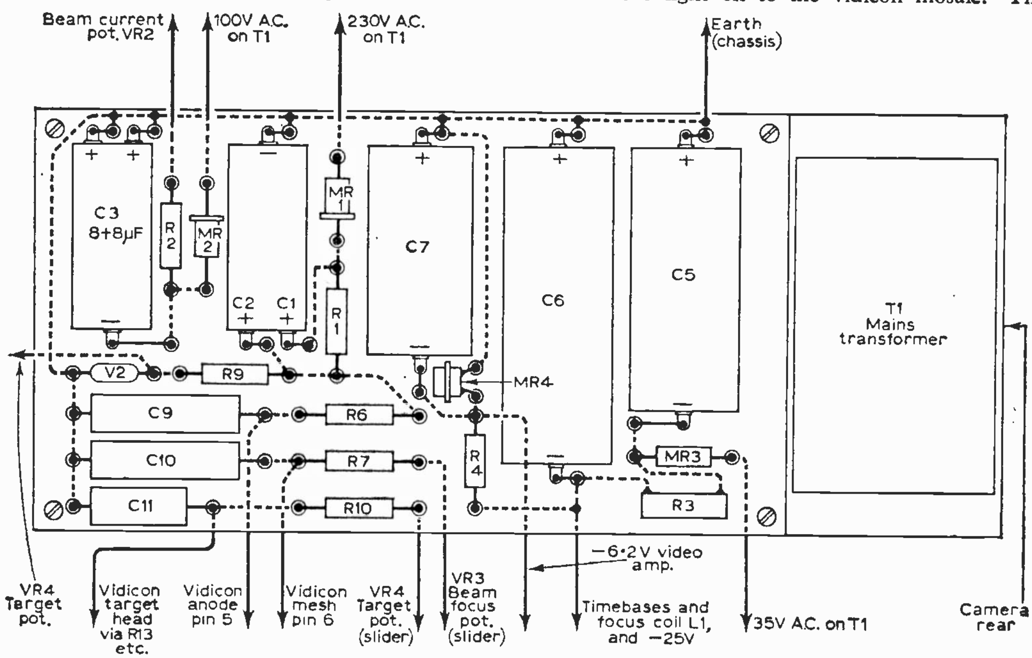


Fig. 7—The wiring and layout diagram of the camera's power supply section. Note: the rectifier MR2, as shown in Fig. 1 on page 458 last month, was drawn incorrectly and should be reversed to agree with the above diagram.

camera tube can be made more or less sensitive by varying its target voltage but due to the circuit design and other considerations it is preferable to set this to a fixed potential and use the iris adjustment.

The focal length depends entirely on what is required of the camera. The normal angle shot will require a lens of about 1—2in. focal length. The long distance shot will require a 6in. or more focal length. Of course a zoom lens will give all of these variations with the one lens. A good choice for operation in a confined space or a small room is a 1in. lens.

Cost of lens depends on its stop number. The smaller the stop number, the more expensive, but the more light it passes, hence the less lighting required for camera operation. The stop or f number is the lens apperture divided by the focal length. The iris adjustment goes in steps, i.e. 2·8, 4, 5·6, 8, 11, 16, 22 etc., each step higher in number reduces the light by half.

Thus a lens with the smallest stop number (widest opening) of f 5·6 will only transmit quarter as much light as a lens with f 2·8 as its smallest number.

A good choice of lens would be a 16mm of 1in. focal length with focusing, and adjustment from f1·9 to f16. However, if this proves too expensive, it is hoped that these comments on lenses will help in choosing.

Testing

An oscilloscope will be needed to check whether the correct waveforms are present at the appropriate points of the circuit. A vidicon tube should not be inserted in the camera during critical tests since it will be liable to damage during the setting up procedure. Voltage measurements should be made on the power supply to ascertain that the correct d.c. voltages are present. Indication that power is connected to the camera is given by the neon target voltage stabiliser which should light.

The oscilloscope X-sweep should be set to run at about 5kc/s and the input connected to the end of the line scan coil. Negative-going line frequency (i.e. 10kc/s) pulses will be present, speed adjusted by VR8. Turn the oscilloscope sweep to about 25c/s and couple the Y input to the C27 end of the frame scan coil. A positive going from sawtooth waveform should be present providing frame scan. This waveform should be locked to the mains 50c/s by VR5.

With the oscilloscope sweep still at the low speed connect the Y input to the base of Tr4 where negative frame sync pulses should be present.

Look at the camera video output with the oscilloscope. Composite sync should be present, try adjusting VR1. This control clips the waveform mixed syncs. to the correct level which will be approximately 0·2V or about half the maximum amplitude that can be obtained. Take care when setting up VR1 otherwise picture white clipping can occur.

Connect the camera output to a video monitor (do not forget that the output is at video not r.f.) and observe the raster. A raster locked both on frame and line should be obtained, of even brightness. By bringing one's hand near to the input of Tr1, stray video pick up in the form of hatching should be observed. The vision monitor should remain locked.

If the monitor does not lock, check that the line oscillator is near the correct frequency, the frame oscillator is locked to the mains, and the sync mixing controlled by VR1 is correct.

The final stage of testing the camera has now arrived, when the camera tube can be inserted. Disconnect the 250V mains and insert the vidicon into the front of the assembly, base pins first (see Fig. 4 for final assembled arrangement). When clamping the tube in, make sure that the target spring connecting clip is making contact with the target mosaic pick-off ring. Plug on the tube socket base before clamping the tube in the assembly.

Turn VR2 so that maximum negative volts are applied to the vidicon grid thus biasing its beam off. Turn VR4 to set target voltage potentiometer to its mid-position.

Connect mains to the camera and allow the tube heater to warm up. The lens can be screwed on, although it is not absolutely necessary at this stage of checking the camera.

The front of the camera should be pointed at a white sheet of paper lit by 100W light bulb. *Do not under any circumstances point the tube at a bright light or the sun, especially if the lens is fitted.*

Turn the beam current potentiometer slowly and watch the video monitor raster. At a certain setting of the potentiometer, light should spread over the screen rather like milk running over it. If this effect is not obtained after one or two attempts at turning the potentiometer, immediately bias the beam current off the tube. The tube could well be damaged if left in this condition, with the beam current on, especially if the scan is absent.

Repeat the testing and try and locate the fault before attempting to obtain pictures from the camera as this will probably damage the camera tube.

Assuming that the effect described is obtained, the camera is now working and will produce pictures if a lens is fitted. It is best set up first on a test card or test picture. This picture should be about 12in. x 9in. set at 3ft. from the camera, and on the same level, preferably evenly lit with artificial light, say two 100W bulbs set on each side a few feet away from the card.

Turn up the beam potentiometer until the effect already described occurs, then adjust the electrical focus VR3 and lens focus until a sharp picture is obtained. Note that the electrical focus may have more than one focal position, only one is correct.

Now adjust the beam current control and set it just far enough up so that the picture whites are not clipped, but no further. Any further increase is detrimental to focus and to tube life. Sensitivity can be controlled by the iris adjustment on the lens and, or, by the target voltage on the tube.

At this point check that scans are correct (i.e. picture is not upside down or a mirror image); if not, reverse the appropriate scan coil leads. Note that reversing the polarity of the focus coil will also cause a scan reversal of both vertical and horizontal scans.

A hatching pattern may be observed when the tube is spot on focus electrically, this is due to an effect caused by interaction of the scan on the anode mesh. This patterning can be eliminated by rotating the vidicon slightly in the coil assembly

with respect to the deflection coils.

Slight rotation of the picture will occur when the electrical focus is altered, this is due to the orthogonal type scanning.

Adjust VR6 and VR7 to set the frame height and linearity to give the correct aspect ratio, which can be seen most easily on a picture of circles. Note, however, that the linearity and aspect of the TV monitor must be correct before setting up the camera.

Every time the target voltage is adjusted, the beam current will also need re-adjusting. It is usual, except under very high lighting such as bright sunlight, to run the target as high as possible. There is an optimum position for maximum target gain and it is found as follows.

Cap the lens and bias the camera tube off, the video monitor's raster should now be even grey overall, with little shading. Bias the tube on, using the minimum bias necessary. If there is severe shading present, reduce the target voltage in small steps, readjusting the tube bias each time until the shading has been reduced to a minimum.

On the other hand if the raster is without severe shading, increase the target voltage in small steps with corresponding adjustments in beam current until shading occurs.

The tube light sensitivity becomes greater as the target voltage is increased, but after a certain voltage is reached, depending on the tube, the stray target signals increase and become apparent on the picture as shading. The target voltage should be set as high as possible before this effect takes place, and will give the maximum output for that particular tube.

Camera Operation

This is a subject on its own and only a few pointers can be given here. One of the first accessories that will be required is a tripod for mounting the camera, providing controlled pan and tilt. This should be as heavy a tripod as possible, lightweight tripods do not have the rigidity or strength required.

The most important part of good camera operation is the use of correct lighting. When used indoors artificial lighting will be needed. Pictures can be obtained with ordinary room lighting, but extra illumination will be required for best results.

150W focus spot lights with ordinary bayonet light sockets have a long life and are very suitable for the purpose. Two of these correctly positioned should provide good lighting for set position shots. Avoid over contrasty scenes by the TV system.

After the operator has the camera working, and tried the effect of lighting it will become apparent that lighting cannot be taken for granted.

Caption Board

A useful accessory is a caption board with built-in lighting. Two lights screened from the camera. one at each side of the board, about 60W should suffice. Position these for even illumination of the caption position. Flat two-dimentional surfaces can be lit easily but care should be taken to avoid surface reflection.

Home made captions can be very effective and can be drawn on art paper with Indian ink. Contrast range is difficult to obtain and the best methods are to use standard ink line drawing techniques or pencil for grey. A definition chart, not necessarily test card C, should be included in the captions, to provide a check on performance.

There will come a time when outdoor operation is attempted. The lighting is already set, and cannot be altered, and again the main "don't" is to avoid over contrasty scenes. For example, try not to have much skyline, if any at all, in your shot (the sky is very bright). Generally best pictures will be obtained when the sun is obscured by clouds.

A 1in. lens will be rather wide angle and a more suitable one will be a 3in. or 4in. focal length. It is on outdoor scenes that the zoom lens (variable focal length) is most useful, but the lenses are rather expensive. The target voltage should be reduced from the maximum sensitivity position, since this produces more pleasing pictures.

When the sun is shining on the lens watch out for lens flare.

A monitor is necessary for the camera operator, and when outdoors even the brightened monitor will be very dull, and a wooden screen or hood should be constructed to prevent most external light falling on the screen. There is nothing worse than trying to focus the camera using a monitor that can hardly be seen.

Finally remember that the pictures in the end, can only be as good as the camera operator. The iris and lens focus must be constantly attended when taking different shots. The beam focus should also be checked frequently for drift. and the target and beam controls may also be used. ■

DX-TV

—continued from page 495

times is Kiev. So you may be doing better than you think.

Readers' Reports

L. Alsopp (Cardiff) has had good pictures from T.V.E. Zaragossa/Alicante (Spain) on Ch E3. He gave full programme details, which made identification easy from my own log for that day.

C. Vernall (Leominster) also had Zaragossa/Alicante E3 and what must be Carcassonne R.T.F. France on F4 via Sporadic "E". This is a "rare" one for most of us!

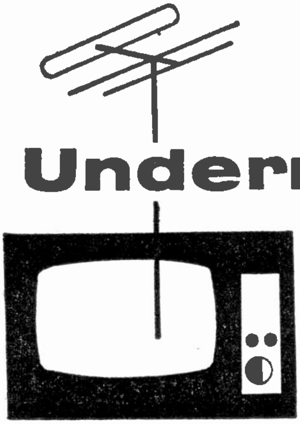
A. Connolly (Kilkeel, Northern Ireland) has received Switzerland, Poland, West Germany, and Austria.

1. Rose (Blackburn) had T.V.E. Zaragossa/Alicante.

It has been most noticeable that reception of T.V.E. on Ch E3 has been exceptionally strong and regular recently, and has caused much chagrin to domestic viewers of BBC Rowridge in this area, when their BBC picture has been "blasted off" their screens by it.

I suffer too! I have an uncomfortable feeling that when this happens many near neighbours think that it is due to my activities, in particular when they see the aerial arrays rotating!

Now that the season has opened up, we shall be delighted to hear of your results, and to assist in the identification of the unknown signals that we hope you will receive.



A MONTHLY COMMENTARY

Underneath the Dipole

BY ICONOS

IF the latest TAM ratings have any significance (which I am sure they have) then the BBC-TV programme department has been dropping quite a few clangers during the last year or so. Opinions differ on the merits of many BBC features but the off-putting effect of ill-mannered interviewers, kitchen sink plays, displays of violence and bad language, all play their part in making viewers change over to ITV or to "off". Clangers continue to ring out but at last a penny has dropped instead with a "clink": when Stuart Hood, Controller of TV programmes, resigned from the BBC and joined Rediffusion in a similar top executive capacity.

Gloomy Plays

Some time ago, before leaving the BBC, Mr. Hood said at a meeting of script writers that many TV plays are pessimistic and gloomy, and sometimes contain situations which are sordid and questionable. It is the current outlook of the writers and the results do not favourably impress viewers, according to Mr. Hood, who is now Controller of Programmes at Rediffusion. I must say that I agree with him. Script writers seem to be devoted to the so-called realistic style of play writing which is presented in the plays of certain live theatres in London, such as the Royal Court or the Arts Theatre Club, which appeal to specialised audiences and receive good notices from some of the newspaper critics. It must be admitted, however, that ITV programme companies provide a fair quota of gloom, but this is tempered with a cheerful injection of many of the commercials. Stories of a trivial character always seem to be even more trivial when they have a pessimistic finish without a real end and the viewer is left guessing. Let us hope that the writers take the hint from Mr. Hood and avoid writing stories which are "messages" instead of entertainment. Mr. Sam Goldwyn once said: "My films are not *messages*—I send *messages* by telegraph". Mr. Hood's recent speech and Press statements give us hope that he will carry out the same policies in entertainment at Rediffusion TV which achieved such success and prestige for Mr. Goldwyn in the film industry.

Pirate Radio—and TV?

The operations of the "pirate" commercial radio ships off the coast of East Anglia has slowly warmed up during the last month or so and may, in an indirect way, lead to similar enterprises in television in the distant future. The Atlanta, moored $3\frac{1}{2}$ miles south-east of Frinton-on-Sea, Essex, started testing on 197m, a wavelength which seemed to me to be mighty close to that of Radio Caroline on 199m. The Atlanta is a 470-ton ship, "Mi Amigo". owned by the Rosebud Shipping Co., of Panama, but the operating company, Atlanta, is registered in Switzerland with offices in Vaduz, Lichtenstein. The activities of yet another pirate radio enterprise, Radio Sutch, started out in a 60ft fishing trawler, "Cornucopia", originally hired and moored a few miles from Shoeburyness, whose transmitter was subsequently moved on to one of the old gun towers $4\frac{1}{2}$ miles off land. This transmitter has mainly achieved great attention by the Press to the activities of Screaming Lord Sutch and his associates—good, free publicity. I think. But the amount of interference that it will cause to legitimate radio transmissions on licensed wavelengths remains to be seen—or, rather, heard. Most of these stations intend to broadcast a continuous programme of music all day long, interspersed with advertising announcements, in the same time ratio as on Independent Television. As a matter of fact some of the ITV companies have shown interest in the possibilities of using this advertising medium during the daytime for making announcements about their own evening programmes. The signals are heard over a fairly wide area, from King's Lynn to Portsmouth, from Harwich to Oxfordshire, and they will provide a "music-while-you-work" type of continuous programme. It is certainly not a bad idea to use "pirate" advertising slots as a reminder to potential viewers to see certain TV programmes the same evening, but whether these would be subject to legal or political complications is another matter. The use of u.h.f. channels for local commercial sound radio stations in this country is now being lobbied for (and against) in Parliamentary circles. Whether these stations are controlled by the BBC or commercial interests —or both—there seems to be no doubt that the continuous flow of "pop" music will drone on through the day, plus local announcements. This does not appeal to me personally but there is no doubt at all that its popularity is general. Competition between the BBC and independent interests will bring about improvements in the format of such programmes. The areas are much more restricted, of course, than on the medium waves, and if tried out on an experimental basis with success may have practical value as a starting point for the establishment of ITV-2 stations.

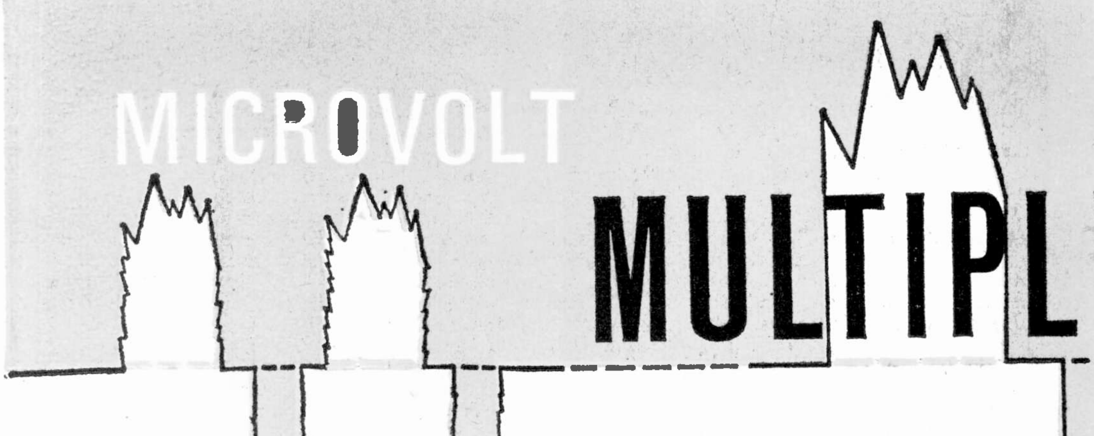
Pay-TV

Yet another source of television programmes will soon be available in various areas in different parts of the country. particularly those which already have as a basis the supply to viewers, via Post Office lines, the programmes of the BBC and ITA, plus sound radio. Good quality redistribution of these programmes by relaying them from well-sited and superbly equipped receiving stations is particularly important in many cities and towns where reception on local home aerials is subject to interference or reflections. There are technical differences in the methods used for providing satisfactory signals to the subscribers, some of which use perfectly normal TV receivers at the usual h.f. frequency and others which transfer the signal to a lower frequency for reception on specially designed sets. It depends largely upon the size of the area to be covered, h.f. relays being mainly used in small, isolated areas. All of these piped TV stations look forward to providing a Pay-TV channel as an extra programme source. Just what programmes the Pay-TV companies will transmit in return for the viewer putting money in a slot or being charged a weekly account remains to be seen. Tolvision Ltd., whose managing director is Edward Roth (formerly with ATV), seems to favour a proportion of the programmes being produced by live TV or on video tape and is considering the purchase of the Wood Green Empire. This ex-music hall was excellently converted in 1956 into a television studio suitable for straight plays, audience participation programmes or (with its telecine equipment) features which included film excerpts of exteriors. British Telemeter, with piped television already established in the Merton, Morden and Wimbledon districts, favour the use of programmes on film, and already have an elaborate telecine suite in the course of installation in part of the Merton Park Film Studios, where facilities for straightforward film production work can also be used when required. Payvision and Choiceview, two other companies which have been successful in obtaining Pay-TV licences, are also considering the part occupation of space at existing film studios. Just how good the Pay-TV programmes will have to be to obtain the revenues needed from viewers when they are in competition with the existing BBC and ITV programmes remains to be seen. The general use of film would enable companies to exchange their film product programmes around the Pay-TV's own network at different times rather than make use of expensive coaxial lines all over the country between their stations. Film production for television is rather a slow process, however, with a daily output of less than ten minutes of edited film sequences compared with 30 minutes per day, per stage, when using electronic processes on video tape, an output which is quite normal at British television studios. In West Germany motion-picture cameras are used with streamlined television techniques, with a daily output of about 17 minutes per stage, with the advantage that the end product is suitable for use in TV stations all over the world and can easily be cut and dubbed into different languages or photographed in colour.

Ivor Novello

The BBC biographical series based on the life of Ivor Novello promised a musical treat for viewers which did not quite come off. The Ivor Novello musical plays of the '30s and '40s filled many a London theatre with enthusiastic audiences, and "House Full" boards were displayed night after night. Novello's talent as a writer and composer and his great personal charm were remembered by many show business personalities who were interviewed in this variation of a "This Is Your Life" theme. This part of the BBC series was well done but the musical excerpts were disappointing. When Ivor Novello proposed to produce *Glamorous Night* at Drury Lane he stipulated that he wanted a cast of 120, an orchestra of at least 40 players, together with elaborate scenery. Sugary though the story-line was compared with most of today's musical stage show offerings, all of the Novello musicals were beautifully produced and colourful both in scenic effects and gorgeous dresses. The artistes sang and moved without placing a foot wrong in *Glamorous Night* and other spectacular Novello musicals such as *Careless Rapture, Crest of the Wave, Perchance to Dream* and *King's Rhapsody* at Theatre Royal, Drury Lane, Palace Theatre and on tour at "No. 1" provincial theatres. The television biography reproduced musical excerpts from many of these shows, as was to be expected, but these did not convey their original spectacular character. One setting appeared to be used as a background to all the shows from the earliest musical he played in (and composed the music for), *The Golden Moth,* onwards. The BBC set was crowded with staircases, spindly pillars and flashy candelabra. Some of these fixtures and "props" seemed to grow out of the heads of the vocalists and dancers as they moved around, pursued by a restless TV camera on a crane. Of course the musical production numbers were handicapped by the lack of colour, and it is to be hoped that in due course Novello musicals will appear on colour television—but reproduced with the large and impressive groups of singers and dancers. With colour added there would be a good future for TV theatrical musical shows *of* the theatre *in* a theatre—that is, when there are sufficient viewers who are able to boast that they own colour television receivers.

MICROVOLT MULTIPL



A TELEVISION picture (and sound for that matter) can only be as good as the signal picked up by the aerial allows, assuming, of course, that the set itself is in good order and correctly adjusted.

There is a certain level of aerial signal which, when exceeded will fail to improve the picture. This can be called the "optimum threshold" signal level, for want of a better term. Above this optimum level, then, an increase of signal strength will (or should be) accommodated by the automatic gain control (a.g.c.) circuits of the set, until a point is reached where the a.g.c. just cannot cope any more.

The set then tends to overload and the picture and sound exhibit the effects of sound-on-vision and vision-on-sound, due to the overload conditions causing cross modulation. The symptoms are a dancing of the picture in sympathy with the sound accompaniment and a "buzz" on the sound of an intensity which changes with the picture content.

These are typical 405-line overload conditions. On 625 lines, the buzz (now called "intercarrier buzz") still occurs, though the picture symptom may not be present, since frequency modulation is used on the sound channel instead of the amplitude modulation of the 405-line standard.

NOISE SIGNAL

So much, then for excessive signal strength, but what happens if the level of the aerial signal is below the optimum threshold? If the signal strength is substantially below this threshold, the picture quality deteriorates as the result of "gain" arising from a "noise signal" produced by the first stages in the set. On the sound, the noise signal is responsible for the "hiss" which may accompany the audio when the set is worked on a weak aerial signal.

The noise signal is produced mainly in the v.h.f. or u.h.f. tuner and, generally speaking, the higher the frequency of the channel, the greater the level of noise signal produced. For example, there may be as much as three or four times more "noise" produced on Channel 33 (the new BBC-2 channel) than on Channel 1 (the old BBC-1 channel).

The noise signal rises slowly from the low numbered channels in Band 1, through Band III and Band IV and then a little more sharply towards the high numbered channels in Band V (these are not yet used, but will be soon as BBC-2 spreads across the country).

The noise signal is produced not because of the frequency and characteristics of the signal, but because a valve or transistor amplifier itself generates more "noise" as the frequency of the signal it is called upon to amplify is raised.

Noise signal is produced by any material which is capable of conducting electricity and it arises because of the random movement of the free electrons in that material. In a thermionic valve, the noise signal is added to, in some measure, by the emisson of electrons from the cathode, through the grid or grids to the anode. This noise signal contribution is sometimes called "thermal noise".

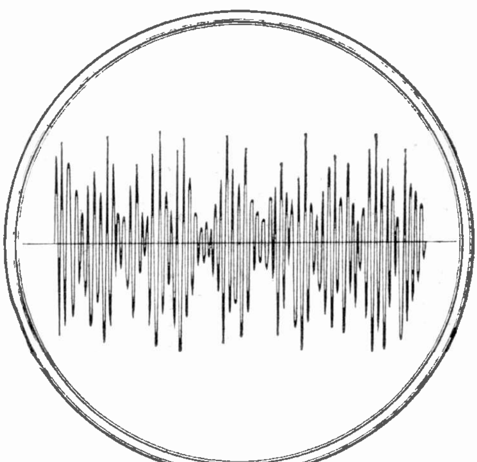


Fig. 1—This diagram shows the nature of noise signal when displayed on the tube of an oscilloscope. It is sometimes referred to by engineers as "grass".

Even a resistor produces a noise signal across itself and this can be heard in a loudspeaker (as a hiss) or seen on the screen of an oscilloscope as a spiky waveform (see Fig. 1) after passing it through an amplifier of high gain (note here that the amplifier itself then adds to the noise signal, as explained above, so the total noise heard or seen is partly from the resistor at the input of the amplifier and partly from the amplifier itself).

ICATION

BY
GORDON J. KING

The addition of an amplifier between the aerial and the set may do little or nothing to improve the signal/noise ratio. Indeed, such an addition may impair the signal/noise ratio. Take the case of a set with an equivalent noise signal of 5 microvolts and an aerial signal of, say, 50 microvolts.

The signal/noise ratio here is very poor, only 10-to-1 (or 20dB) and the picture would be very grainy. The viewer may decide to add an amplifier with a 10-to-1 (or 20dB) gain in an endeavour to get rid of some or all of the grain, but how effective this would be would depend upon the noise factor of the amplifier.

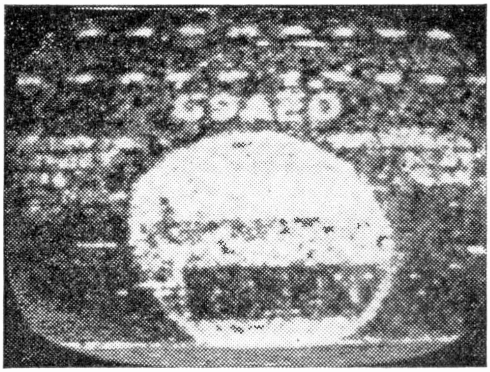


Fig. 2—This test transmission of the Belling and Lee Band III station, G9AED, was taken direct from the screen of a receiver with only about 10 microvolts applied. The poor definition due to noise signal is clearly revealed.

NOISE FACTOR

It is, then, clearly impossible to eliminate the noise signal completely, for even if a totally noise-free amplifier could be made, the noise in the conducting circuits would still be there. Absolute noise is called the " noise factor " and it is a ratio (usually given in decibels) of the total noise output of the amplifier to the calculated noise produced by a resistor across its input (actually, a noise generator is used to produce the noise at the input when noise factor measurements are made).

The noise factor, then, expresses the amount of noise signal that an amplifier is generating, the lower the ratio (or decibel value), the less the noise signal.

Ever since man started making amplifiers it has been his aim always to reduce the noise factor, for this in a television set determines the minimum level of aerial signal that can be applied to produce a grain-free picture and hiss-free sound.

It has been discovered that the point where the grain is virtually non-existent on a picture occurs when the aerial signal applied to the set is 100 times greater than the noise signal produced by the tuner (or first stages). Thus, if the equivalent noise signal is, say 5 microvolts, then the aerial signal applied to the set would have to have a strength of 500 microvolts.

Here we are referring to our original definition of optimum threshold signal level. A signal level above 500 microvolts would fail to improve the picture while a signal below that level would gradually and then more rapidly start producing grain.

SIGNAL/NOISE RATIO

A set with a better noise factor; say one which produces an equivalent noise signal of 2·5 microvolts, would have an optimum threshold signal characteristic of 250 microvolts, meaning that a signal of half the level of that applied to the previous set would give the threshold signal/noise ratio of 100-to-1 (or 40dB). It is, then, the " signal/noise ratio " which expresses the practical aspect of television noise and grain relative to signal strength.

It is true that the set would then receive 500 microvolts (the 50 microvolt aerial signal stepped up ten times) and the noise contribution of the tuner would not itself account for as much grain as before, but the noise signal contribution of the amplifier would be of utmost importance.

If the amplifier's equivalent noise signal is 5 microvolts, the same as that of the set, then there would be no improvement in noise performance at all. The picture would be brighter but the grain remaining after readjustment of the contrast control, would be the same as the set working without the amplifier!

If the noise factor of the amplifier happened to be greater than that of the set, the picture grain would, of course, be more troublesome with the amplifier than without it. The signal level would be raised, but after the a.g.c. had compensated for this and the contrast control had been readjusted, the grain remaining would be greater than before.

On the other hand, an amplifier with a better noise factor than the set could definitely be an asset in areas of weak signal. The signal level applied to the set would be raised and the overall signal/noise ratio improved.

A point to note here is that modern sets feature effective vision a.g.c. systems. so the introduction of an aerial amplifier may not make the picture any brighter (since the amplified signal applied to the set will pull back the gain automatically), but the grain could be noticeably reduced. Any small reduction in grain is worth while since it does tend to impair the definition of a picture.

Fig. 2 shows a very noisy (grainy) picture of an early Band III (by Belling and Lee Limited) test transmission. The signal at the set was little more than 10 microvolts and a low-noise amplifier was used to produce even this poorly defined picture.

TELSTAR

Fig. 3 shows a slightly less noisy picture on a more modern set, while Fig. 4 shows a relatively noise-free picture direct from America, via Telstar. It is interesting to note that the picture here was

Fig. 3—This picture shows a television picture with a signal/noise ratio of about 30 to 1.

produced from a signal of a lower level than that applied to the receiver which produced the picture in Fig. 2.

It may be recalled that Telstar radiates approximately 2 watts of signal at a frequency of 4Gc/s. For "grain-free" reception, therefore, the ground receiver must amplify and detect the extremely small signals with the minimum of inherent noise, and this is possible only by the use of elaborate dish aerials and special very low-noise aerial amplifiers. The "dish" at Goonhilly Down satellite communication ground station at Cornwall, for instance, is some eighty-five feet in diameter and weighs more than 800 tons.

The aerial amplifiers used for such applications are based on the parametric or maser (short for "microwave and amplification by stimulated emission of radiation") principle. These are somewhat specialised in operation and cannot, of course, be described in an article of this nature.

Suffice it to say that such amplifiers have extremely low noise factors, so that the combination of the elaborate aerial and the amplifier gives the best possible signal/noise ratio known at this stage of the article, this being proved by the noise-free pictures relayed by Telstar and transmitted over the ordinary television networks.

TRANSISTOR AMPLIFIERS

Parametric and maser amplifiers cost many thousands of pounds and fall well outside (for the present) the economics of ordinary domestic receivers. However, from the domestic angle, the development in recent months of low-noise transistor v.h.f. and u.h.f. amplifiers has tended to make grain-free pictures possible at lower levels of aerial signal.

Well-made transistor amplifiers of this type have a noise figure often fifty per cent (or greater) better than the noise figure of an average valve tuner, the noise improvement being more noticeable at the higher channel numbers. A worth-while improve-

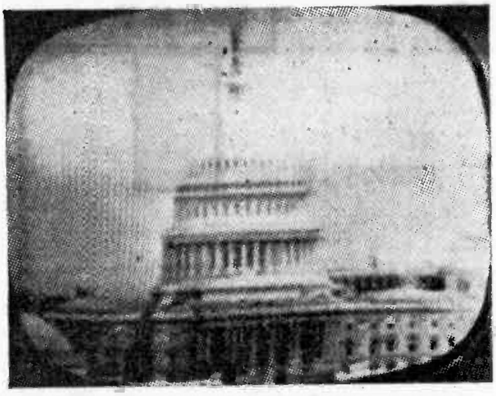


Fig. 4—Although the signal from the Telstar relay giving this picture was extremely small, the noise resulting is also very small because of the ultra low-noise characteristics of the maser aerial amplifier and the elaborate aerial system together giving a reasonable signal/noise ratio.

ment in noise performance in weak signal areas is usually possible simply by connecting the amplifier between the aerial downlead and the set at the set end of the downlead, and set-top single- and dual-band amplifiers complete with battery and on/off switch are now available commercially. A u.h.f. version of this type of amplifier is shown in Fig. 5.

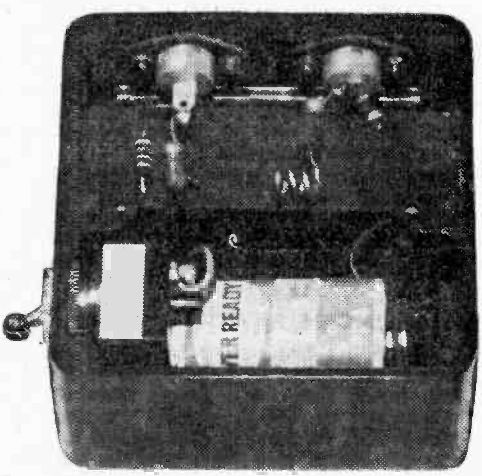


Fig. 5—A commercial version of a u.h.f. set-top transistor amplifier with self-contained battery and on/off switch.

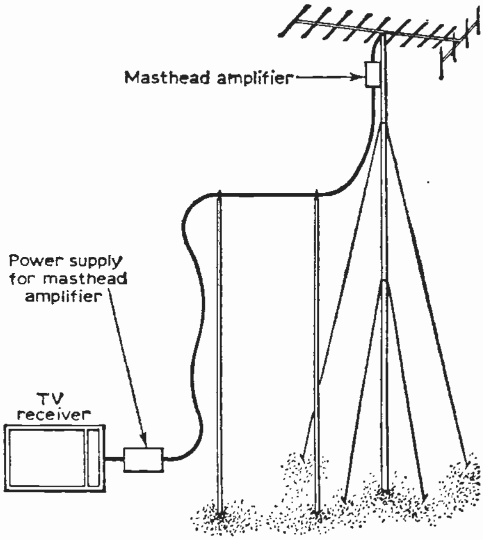


Fig. 6—An improved signal/noise ratio is possible in certain cases by installing the amplifier near the aerial and applying power from a power unit near the set through the signal-carrying coaxial cable. The low current requirements (about 1 to 3mA) of a transistor amplifier make this method of powering relatively easy.

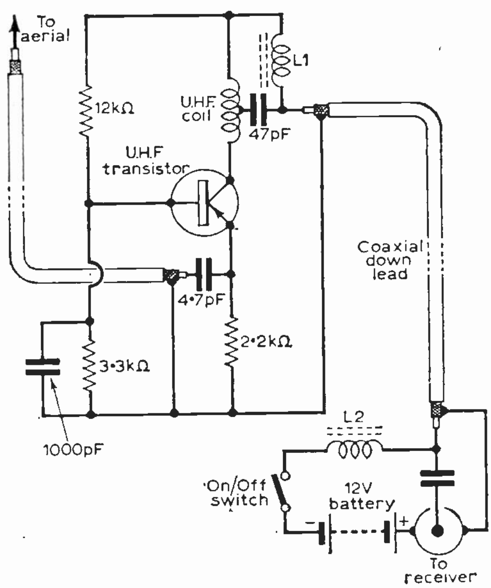


Fig. 7—Circuit diagram of a u.h.f. transistor amplifier with power supply unit. L1 and L2 are filters to prevent the signal from being shorted by the power supply circuit.

Transistor amplifiers are also available for mounting at the aerial end of the downlead. These are called masthead amplifiers and they are often powered from a small battery or mains power unit mounted near the set, the power being sent to the amplifier through the same coaxial cable which feeds the signal to the set (see Fig. 6).

Filters are required to avoid the low impedance battery circuit from shorting the signal in the coaxial, and the circuit in Fig. 7 shows how this is accomplished.

TRANSISTORISED EQUIPMENT

There are one or two things that should be remembered when a transistorised v.h.f. or u.h.f. amplifier is employed at either end of the downlead. Transistors are unable to stand the same degree of overload as valves. This can mean that in areas where a very powerful f.m. or a.m. radio signal field is present cross-modulation between the weak TV signal and the radio signal may take place, resulting in a pattern on the TV picture and possible radio breakthrough on sound.

Fortunately, there are only a few areas (where the TV signal is weak and the radio signal strong) in which this effect is troublesome, and the cure lies in the use of a suitable radio filter between the aerial and the booster.

Transistors can also be damaged by transients. These are high amplitude voltage peaks of very short duration, such as can occur from local static and thunderstorm conditions and if the amplifier is connected or disconnected to or from the aerial or set with the chassis of an a.c./d.c. type receiver connected to mains "live" instead of to mains neutral.

The small sparks produced at the aerial socket cause the transients in the latter case and, of course, lightning discharge in the former case.

It is not meant for these comments to imply that transistors are highly delicate devices, just that they need different handling than valves. Indeed, modern transistors are extremely robust and used correctly will give many years of useful service. Transistors are already being used in v.h.f. and u.h.f. tuners owing to their improved noise performance over valves and used as an amplifier in front of the old type valve tuner can often make the difference between a just-about-viewable picture and a good picture.

The edge on the noise performance is obviously achieved when the amplifier is mounted at the masthead. since then the signal applied to the transistor is stronger than it is at the remote end of the downlead, resulting in a little better signal/noise ratio. Some authorities consider that the extra cost and complexity of mounting at the masthead is barely worth while when a good quality, ordinary length downlead is used.

We have seen, then, that more than mere microvolt multiplication by the use of an amplifier is needed to improve the picture on modern sets which themselves have relatively low-noise tuners. The secret is one of improving the signal/noise ratio and this can be accomplished either by using a booster of lower noise than the set's tuner or by increasing the aerial signal by improving the aerial system—or both. ■

CONTINUED FROM PAGE 469 OF THE JULY ISSUE

CHANGING CATHODE RAY TUBES

PART 5: BRITISH RADIO CORPORATION GROUP MODELS

By H. Peters

THIS month we deal with the 110° models of the six companies that comprise the British Radio Corporation, namely HMV, Ultra, Ferguson, Pilot, Marconiphone and Philco. The gradual integration of these companies under one umbrella has taken about the same length of time as the period covered by this article and for this reason its presentation is a little more involved than the series hitherto.

For practical purposes only a few basic chassis types are involved and these have been utilised with a wide variety of v.h.f. tuners to fit into a multiplicity of cabinets. The sets marketed under the HMV label are representative of the Ferguson and Marconiphone ranges as well, whilst the Ultra models employed the same basic chassis as their Pilot counterparts until a couple of years ago, when the latter label was dropped from the television range.

Philco pursued their own line with the "Codenta" colour coded chassis until about the same time, when they began to fit the standard B.R.C. printed panels as used in the HMV 1910.

Today the Thorn 850 series chassis is basic to all models with minor variations due to cabinet design and tube size.

General Notes

To find the instructions relevant to your own model, look it up in the table, check its specification and, if correct, refer to the basic type listed in column 4. It is advisable to read the text of the basic type right through, including the footnotes, which relate to certain models before starting the c.r.t. change.

The procedure is the same as for previous articles of this series and it should be noted that where an equivalent of another brand name is given this relates to the tube changing procedure only and does not imply that the chassis is electrically the same, even though in some cases this is so.

Readers who find that their own chassis, tuner or c.r. tube is fixed in a slightly different manner from that suggested in the text will realise that this is due to a variation in cabinet design, but as the replacement of tubes in all models is quite straightforward, the minor differences will be immediately apparent.

It is important to clean all parts, including the inside of the cabinet, before the new tube is fitted, otherwise dirty marks may be left on the tube face which are only noticeable after the whole unit has been reassembled.

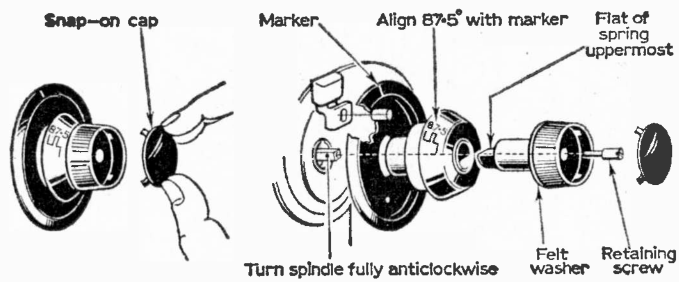


Fig. 1—Details of HMV 1890 series v.h.f. tuning knob where fitted.

Window Removal

On a number of later models the glass window in front of the tube can be taken out for cleaning purposes without unboxing. In these cases the front bottom rail of the cabinet will be seen to unscrew easily from beneath, enabling the window to be dropped out via a slot.

—continued overleaf

TABLE OF TYPES

B.R.C. Group—1959 to 1964

H.M.V.

Model	Specification	C.R.T.	Basic Type
1890	17" T.	AW43/88	H.M.V. 1890
1892	17" T. v.h.f.	AW43/88	H.M.V. 1890
1893	17" P.	AW43/88	H.M.V. 1890 (near)
1894	21" T.	AW53/88	H.M.V 1890
1896	21" T. v.h.f.	AW53/88	H.M.V. 1890
1910	17" T.	AW43/88	H.M.V. 1910
1911	17" T.	AW43/88	H.M.V. 1890
1913	17" P.	AW43/89	H.M.V. 1910
1914	21" T.	AW53/88	H.M.V. 1910
1918	23" C.	23SP4	H.M.V. 1910
1919	21" T.	AW53/88	H.M.V. 1910
1920	23" C. R/C	23SP4	H M.V. 1910 (near)
1921	19" T.	AW47/90	H.M.V. 1910
1922	19"	AW47/90	H.M.V. 1910
1923	23" T. R/C	23SP4	H.M.V. 1910 (near)
1924	23" C. R/C	23SP4	H.M.V. 1910 (near)
2600	19" T.	AW47/91	Thorn 850
2601	19" T.	AW47/91	Thorn 850
2602	23" T.	CME2306	Thorn 850
2603	19"	AW47/91	Thorn 850
2604	23" C.	CME2306	Thorn 850
2605	19"	AW47/90 or/91	Thorn 850
2606	19" u.h.f.	AW47/91	Thorn 850
2607	19"	AW47/91	Thorn 850
2610	23"	CME2306	Thorn 850
2611	19"	AW47/91	Thorn 850
2613	19"	AW47/91	Thorn 850
2614	23" v.h.f.	CME2306	Thorn 850
2616	23"	AW59/91	Thorn 850
2618	19"	AW47/91	Thorn 850
2619	19"	AW47/91	Thorn 850

ULTRA

Model	Specification	C.R.T.	Basic Type
V1770	17" T.	CME1703	Ultra 1770
VR1771	17" v.h.f.	CME1703	Ultra 1770
VP1772	17"	CME1703	Ultra 1770
VC1773	17" C. v.h.f.	CME1703	Ultra 1770
V1774	17" T.	CME1703	Ultra 1770
V1775	17" T.	CME1705	Ultra 1770
V1780	17" T.	CME1705	Ultra 1780
VR1781	17" v.h.f.	CME1705	Ultra 1781
VP1782	17"	CME1705	Ultra 1780
VP1783	17" v.h.f.	CME1705	Ultra 1781
V2170	21"	CME2101	Ultra 1770
VR2171	21" v.h.f.	CME2101	Ultra 1770
VP2172	21"	CME2101	Ultra 1770
100C	19"	CME1901	Ultra 1781
V2175	21" T.	CME2104	Ultra 1770
VC2173	21" C. v.h.f.	CME2101	Ultra 1770
V2174	21" T.	CME2101	Ultra 1770
V2180	21"	CME2104	Ultra 1780
VC2181	21" v.h.f.	CME2104	Ultra 1781
VP2182	21"	CME2104	Ultra 1780
VC2183	21" v.h.f.	CME2104	Ultra 1781
1980	19"	CME1901	Ultra 1780
1982	19"	CME1901	Ultra 1780
1984	19"	CME1901	Ultra 1781
1985	19"	CME1901	Ultra 1781
1986	19" v.h.f.	CME1901	Ultra 1781
2380	23" T.	CME2301	Ultra 1781
2384	23" C.	CME2301	Ultra 1781
6600	19" T.	AW47/91	Thorn 850
6601	19" T.	AW47/91	Thorn 850
6604	19" T.	AW47/91	Thorn 850
6606	19"	AW47/91	Thorn 850
6607	19"	AW47/91	Thorn 850
6608	23" T.	CME2306	Thorn 850
6610	19"	AW47/91	Thorn 850
6611	23" C.	CME2306	Thorn 850
6613	23"	CME2303	Thorn 850
6614	19"	AW47/91	Thorn 850
6618	19"	AW47/91	Thorn 850
6620	19"	AW47/91	Thorn 850
6621	23"	CME2306	Thorn 850
6623	19"	AW47/91	Thorn 850

PILOT

Model	Specification	C.R.T.	Basic Type
PT450	17" P.	CME1703	Ultra 1770
PT451	17" T. v.h.f.	CME1703	Ultra 1770
452	17" T.	CME1703	Ultra 1770
650	21" T.	CME2101	Ultra 1770
651	21" T v.h.f.	CME2101	Ultra 1770
P60	19"	CME1901	Ultra 1781
P61	19" v.h.f.	CME1901	Ultra 1781

PHILCO

Model	Specification	C.R.T.	Basic Type
1100	19" T. R/C	AW47/90	H.M.V. 1910
1105	19" T.	AW47/90 or/91	H.M.V. 1910
1110	23" C. R/C	23SP4	H.M.V. 1910
5600	19" T.	AW47/91	Thorn 850
5601	19" T.	AW47/91	Thorn 850
5601	23" T.	CME2306	Thorn 850

FERGUSON

Model	Specification	C.R.T.	Basic Type
505T	17" T. F.	AW43/88	H M.V. 1890
508T	21" T.	AW53/88	H.M.V. 1890
506T	17" T.	AW43/88	H.M.V. 1890
516T	17" C. v.h.f.	AW43/88	H.M.V. 1890
518T	21" C. v.h.f.	AW53/88	H.M.V. 1890
536T	17" T. v.h.f.	AW43/88	H.M.V. 1890
546T	17" P.	AW43/88	H.M.V. 1890 (near)
606T	17" T.	AW43/88 or/89	H.M.V. 1890 (and notes)
608T	21" T.	AW53/88	H.M.V. 1890 (and notes)
616T	17" C.	AW43/88 or/89	H.M.V. 1890 (and notes)
619T	23" C.	23SP4	H.M.V. 1890 (and notes)
636T	17" T. v.h.f.	AW43/88 or/89	H.M.V. 1890 (and notes)
646T	17" P.	AW43/89	H.M.V. 1890 (near)
648T	21" T.	AW53/88	H.M.V. 1890 (near)
705T	19" M/T	AW47/90	H.M.V. 1910 (near)
707T	23" M/T	23SP4	H.M.V. 1910 (near)
719T	23" C. M/T	23SP4	H.M.V. 1910 (near)
725T	19" T.	AW47/90	H.M.V. 1890 (near)
726T	19" T.	AW47/91	H.M.V. 1910
727T	23" T.	23SP4	H.M.V. 1910 (near)
3600	19" T.	AW47/91	H.M.V. 1910
3601	19" T.	AW47/91	H.M.V. 1910
3602	19" T	AW47/91	H.M.V. 1910 (near)
3603	23" T	CME2306	H.M.V. 1910 (near)
3604	23" T	CME2306	H.M.V. 1910 (near)
3606	19"	AW47/91	Thorn 850
3607	19"	AW47/91	Thorn 850
3608	19"	AW47/91	Thorn 850
3609	23"	CME2306	Thorn 850
3610	23"	CME2306	Thorn 850

MARCONIPHONE

Model	Specification	C.R.T.	Basic Type
VT163	17" T. v.h.f.	AW43/88	H.M.V. 1890
VT164	21" T.	AW53/88	H.M.V. 1890
VT165	17" T.	AW43/88 or/89	H.M.V. 1890
VC167	17" C.	AW43/88 or/89	H.M.V. 1890
VP168	17" P.	AW43/89	H.M.V. 1890 (near)
VT170	19" T.	AW47/90	H.M.V. 1910
VT172	23" T.	23SP4	H.M.V. 1910
4602	19" T	AW47/90 or/91	H.M.V. 1910
4609	—	—	Thorn 850
4610	—	—	Thorn 850

Key to model identification: C.=Console, F.=Fringe Model, M/T=Motor Tuned, P =Portable, R/C=Remote Control, T.=Table Model, u.h.f.=with 625-line facilities, v.h.f.= Band II f.m. radio.

—continued from page 508

HMV 1890

Chassis Removal

Remove the back and unplug the loudspeaker. Unscrew the centre inset of channel selector knob and pull off knob. Remove plastic control panel escutcheon and fine tuner disc. Where fitted, remove f.m. radio knob assembly. The fixing screw is accessible by prising off the snap-on cap. Remove the two chassis fixing bolts and withdraw the chassis.

Note

Ferguson chassis incorporating the "Golden Glide" tuner are also held to the cabinet by two countersunk screws revealed after the control escutcheon is removed. This is held in by the sliding channel selector knob and two nylon screws.

C.R.T. Removal

Remove the tube base and e.h.t. connector. Slacken the scan coils and slide them back off the tube neck, together with the linearity sleeve. Remove the c.r.t. earthing spring. Loosen two screws clamping the front band around the tube bowl and ease the tube out gently forward.

When reassembling, ensure that the deflector coils are as far forward as possible and that the linearity sleeve is fitted so that the lug is opposite the e.h.t. connector and pushed about halfway into the deflector coil clamp.

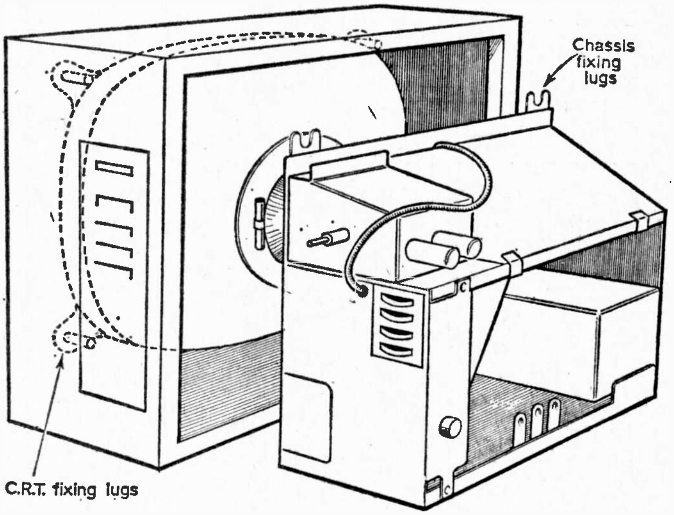


Fig. 2—The general layout typical of HMV 1910 and Thorn 850 series receivers, showing v.h.f. tuner "parked" on side of chassis.

HMV 1910

Chassis Removal

Remove back and unplug speaker. Where fitted, disconnect brass bonding strip from chassis to tuner. Remove channel selector, fine tuner and volume control knobs where necessary. Remove tuner and slacken off side control panel, if fitted, and then loosen the four hexagonal headed captive screws holding chassis to cabinet. Withdraw to the extent of the leads.

Notes

On 1911 and equivalent there are only two chassis fixing screws. On 1921 and equivalent there are two chassis fixing screws on the left. The chassis then swings out to lift off its hinges. On 1922, 1923 and 1924 range and equivalent the 405/625 switch spindle should be disconnected before unboxing.

C.R.T. Removal

Unplug base and e.h.t. connections, slacken off deflector coils and remove complete with linearity sleeve. Remove c.r.t. earthing spring. Lay cabinet face down on a soft cloth, loosen the two screws in the front strap and gently ease the tube out of its mountings.

To facilitate removal of 23in. tubes, it may help to first unscrew the chassis mounting brackets; 23in. tubes with bonded faceplates are held by a metal strip at each corner. These are fastened by two 4B.A. nuts each.

When refitting tube the deflector coils should be pushed as far forward as possible. Refit the linearity sleeve with lug in line with e.h.t. connector and the black ring 0·5cm from the edge of the deflector coil moulding.

ULTRA V1770

Chassis Removal

Unplug set, remove back, take off side knobs (retained by grubscrews). Remove the two chassis fixing screws from beneath the cabinet and slide the chassis out of the cabinet, taking care not to damage the loudspeaker.

Twenty-one inch chassis slide out forwards and 17in. chassis slide out backwards. On V2174 and similar models the loudspeaker is attached to the cabinet and should be unplugged first of all.

C.R.T. Removal

Remove base and e.h.t. connections, slacken and withdraw scan coil assembly. Unclamp the c.r. tube strap and withdraw the c.r.t. forward, having first measured the distance that the tube protrudes through its clamp.

ULTRA V1780

Chassis Removal

Unplug the set and remove the back. Swing

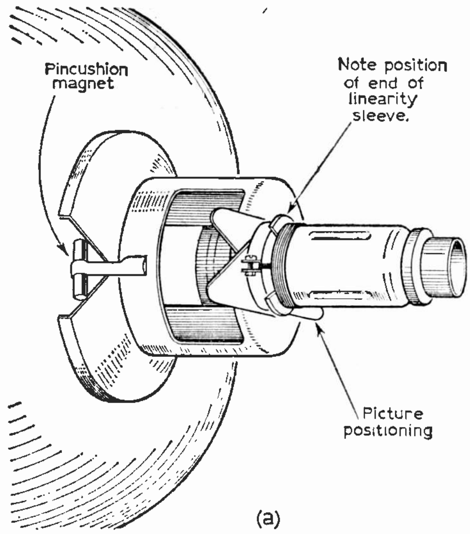
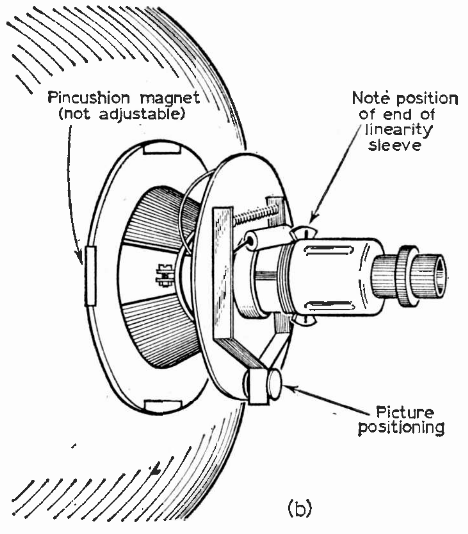


Fig. 3a (above) and b (below)—Alternative scancoil assemblies likely to be encountered.



open the i.f. panel (held by one screw) and remove the two finger screws holding the control panel to the cabinet. Move the control panel inside the cabinet, detach the channel selector and fine tuner knobs (two grubscrews).

Undo three chassis retaining screws (four on 21in. sets) and withdraw chassis. One of these screws is above the aerial socket and the others are below the cabinet. When refitting do not damage the loudspeaker as it passes through the cabinet.

C.R.T. Removal

Unplug base and e.h.t. connections, slacken off and remove scancoils. Unclamp the tube band around the bowl and carefully remove c.r. tube.

ULTRA 1781

Chassis Removal

Unplug, remove back and two end panels, if fitted. Slacken the nut securing the side control panel and move panel inside to clear cabinet. Remove f.m. kob, where fitted, and, except for press button sets, remove the tuner and three smaller knobs on the cabinet front. Unplug the loudspeaker if secured to the cabinet and unplug light dependent resistor, where fitted.

Remove the chassis securing screws, one above the aerial socket and two beneath the cabinet, and withdraw chassis.

Note

On some larger models an extra chassis captive fixing screw is to be found near the volume control and later chassis are retained by two brackets at the upper chassis corners.

C.R.T. Removal

Unplug e.h.t. and base connectors, slacken and remove deflector coil assembly. Unclamp band holding c.r. tube around bowl and carefully ease out the tube.

THORN 850

Chassis Removal

The chassis is basic to all models and is secured by two screws at the top. It then lifts up off two lugs at the bottom.

Prior to removing the chassis it is necessary to remove the v.h.f. tuner, held by three screws, and to uncleat the c.r.t. wiring and disconnect the bonding link from the chassis to the tuner.

It is not normally necessary to remove the u.h.f. tuner. To completely free the chassis, remove c.r.t. base and anode connections, slacken and remove the scancoil assembly.

Parking facilities for the v.h.f. tuner are normally provided at the top of the chassis, using a self-tapping screw.

C.R.T. Removal

Lay cabinet face down on a soft cloth. Remove c.r.t. earthing spring and, on 23in. sets, the main chassis mounting brackets. Remove loudspeaker if fitted to side of cabinet. Remove four nuts and washers at the four corners of the tube strap and lift out tube with strap.

Slacken off the two strap screws and lift the strap assembly off the tube. Replace screws if bent. Refit to new tube, making sure that the dust seal flange is $\frac{1}{8}$in. behind the mould seal line on the tube. Tighten screws until they just begin to bend.

The majority of 23in. tubes have a bonded face-plate held in by four clamps, one at each corner, which take the place of the strap assembly.

Part 6 appears next Month; S.T.C. Group

SERVICING TELEVISION RECEIVERS

No. 104: PAM 120A, PYE V700 and INVICTA 941

By L. Lawry-Johns

SOME of the models included in this series use motorised tuning plus remote control facilities and all use a transistor sync separator stage. The PAM models covered by this article are the 119A, 123A and 1000 in addition to the 120A. PYE models include the V700A. V700LBA, V830A and V830LBA. The INVICTA 941 uses a similar circuit, as does the 940.

The models which use motorised or have automatic tuning must not be operated from d.c. mains under any circumstances.

A Hinged Chassis

A hinged chassis is used, which provides reasonable access to the front of the units when the right side fixings are released.

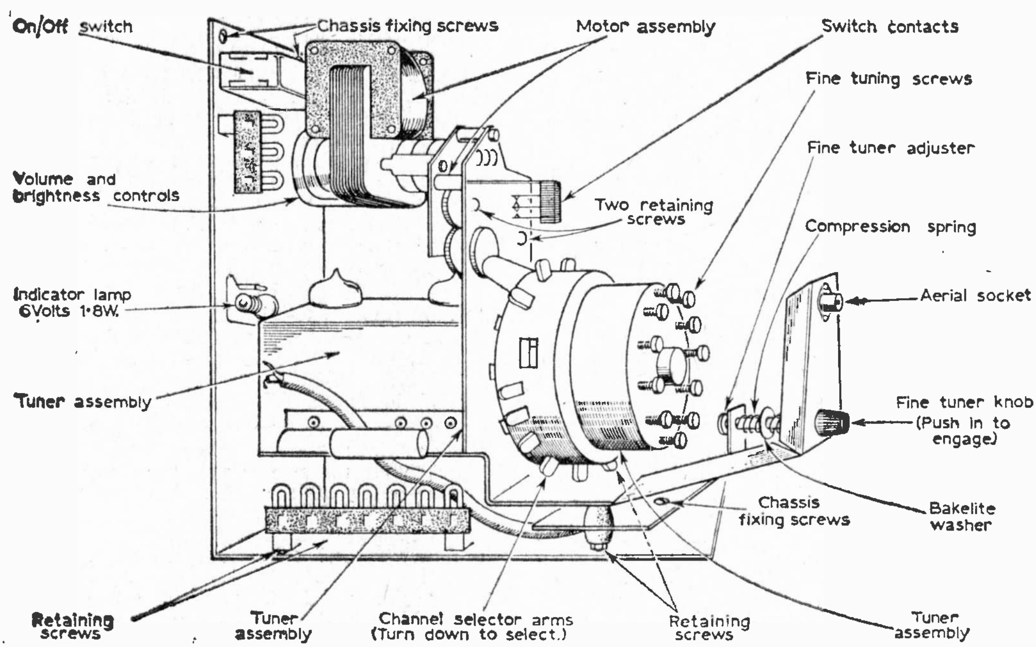


Fig. 1—A detailed view of the motorised tuner assembly employed in some of the receivers dealt with in this article.

The left side can be released to allow the frame to be removed altogether if the loudspeaker leads are freed, the e.h.t. lead unclipped, the scan coils plug removed and the c.r.t. base socket eased off the pins, the earthing lead removed from the left side and with the frame swung outward the top left screw removed. The frame can then be lifted off the bottom stud.

This still leaves a cable from the left side control and tuner panel but this is long enough to allow the panel to be reversed.

Tuner and Control Assembly

The tuner and control assembly is held by two nuts or screws at the front and a nut and washer at the rear. The front control knobs must, of course, be pulled off.

The assembly is divided into separate units depending upon the model, i.e. whether motorised screen and the sound may be audible but both will be of very poor quality.

This, of course, necessitates stripping the tuner in order to get at the coil if it has fallen off completely and to solder it back in position on the rotor. The position not always being obvious and some trial and error is sometimes necessary.

When the coil is replaced, rotate the turret to ensure that it doesn't foul against anything on its way round. This applies to any other coil which may have been moved.

Checking Tuner Coils and Cores

It is as well to check the soldering of the other coils on this and the other wafers to ensure that none are adrift or nearly so. The ends of the coils must be cleaned off properly and tinned before soldering into position.

It is also recommended that the cores of the BBC

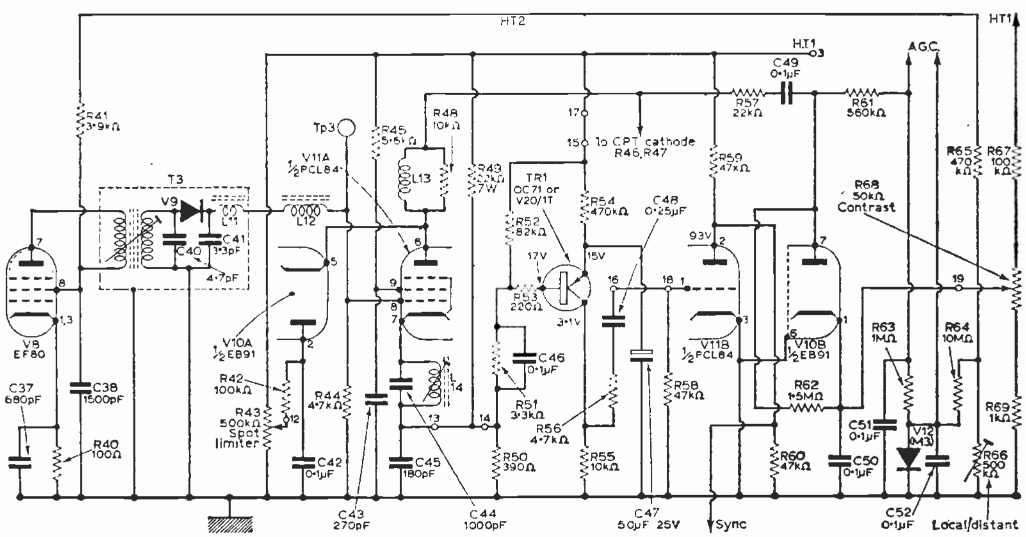


Fig. 2—The video and sync stages of the circuit.

tuning is used or not. The tuner itself uses a PCC89 r.f. amplifier and a PCF86 mixer oscillator. These valves are sunk well down and only the tops protrude.

The length of tape which passes between the pins and protrudes from the top should be refitted when, the valves are replaced as it greatly assists removal of these valves.

A Common Fault

A fault peculiar to the type of tuner used is sudden loss of BBC (Band 1); the Band III (ITV) channels functioning normally. This is nearly always due to one (or more) of the coils coming adrift from the rotor, usually from the rear wafer.

In strong signal areas a weak signal may still be received, i.e. a picture may be obtained on the oscillator coils on the front end receive a little adhesive once they have been disturbed as they do tend to move, causing vision-on-sound buzz and other incorrect tuning effects.

On motorised or automatic tuning models this results in inability to reset the spring-loaded knob correctly as the fine tuning studs have limited range. On these models the tuner is reversed so that the "front end" referred to above is really the rear.

A Less Common Fault

Whilst these receivers, apart from the tuner unit, are fairly trouble free in operation, some seem to exhibit signs of weak synchronisation, that is the setting of the line and frame hold controls become very critical and difficulty is experienced in holding a picture steady for more than a few moments.

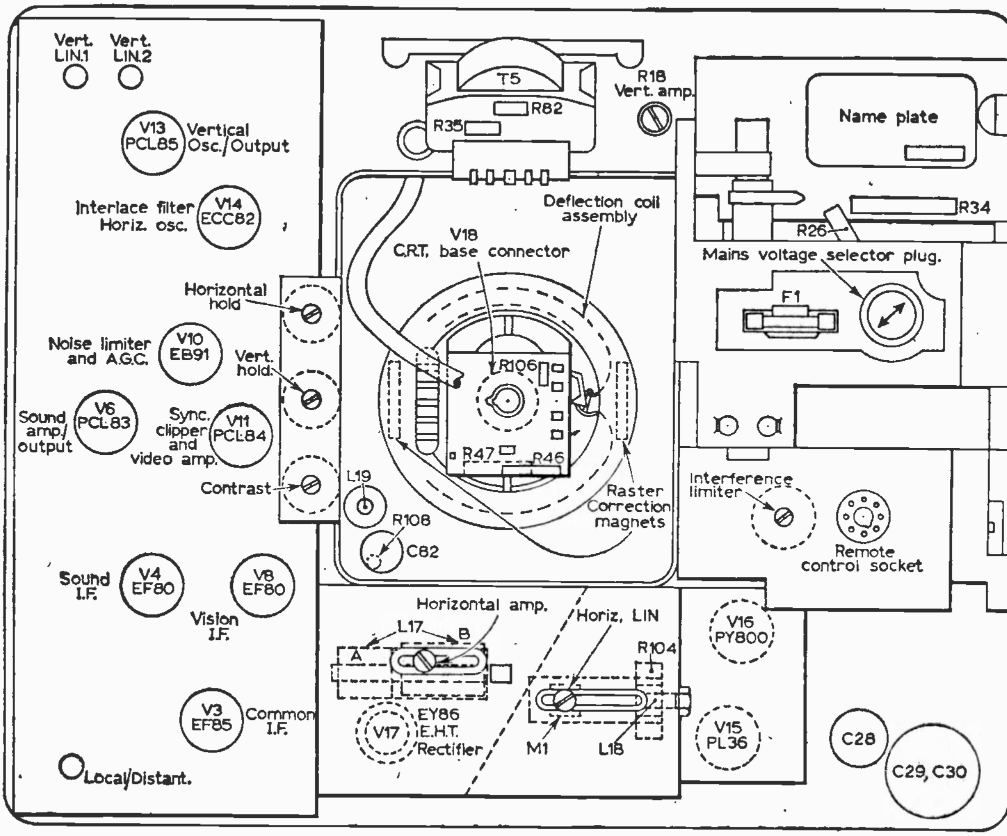


Fig. 33—A rear view of the chassis showing the layout of the major components.

The sync is affected by the picture content and one has a tendency to suspect the trouble to be caused by reflected signals on the aerial, particularly if the picture shows signs of fairly heavy ghosting.

Again, one is inclined to view the transistor sync separator with suspicion if for no other reason than one being unused to finding these "three-legged diodes" in TV receivers. This suspicion grows when replacement of the ECC82 and PCL84 is found not to help matters and all valve voltages are irritatingly correct!

It is only after checking components associated with the transistor (Tr1) that the true cause was found in the first place. Needless to say, the second time this fault was encountered the culprit was immediately checked. It was found to be C47 (50μF 25V electrolytic), this having almost completely dried up and hardly registered any swing on the meter at all.

Fortunately this is one of the easiest components to replace on this small sub-unit, the wires being cut close to the capacitor, leaving plenty of connecting or hooking-up facilities.

TO BE CONTINUED

PAY-TV using coaxial relay

A NEW SYSTEM BY TELEFUSION

TELEFUSION, through its manufacturing subsidiary Teleng Ltd., has demonstrated a new relay system of multiple transmission by coaxial cable. This is incorporated in the Pay-TV pilot scheme being conducted by the company as part of the experimental period of Pay-TV which is being undertaken by various companies in different parts of the country.

The Teleng system is to be used in the South London scheme (Wimbledon, Merton, Morden and Mitcham areas) and is the outcome of four years' investigations into various methods of distributing more and more TV programmes, including Pay-TV and colour TV, over a single cable.

This system is already in use in Belgium (at Liege, Verviers and Namur) to distribute five TV programmes of four different standards and up to 30 f.m. radio programmes—using Teleng equipment—on one coaxial cable. A town in Switzerland is now being wired for the system and negotiations are taking place with other European countries.

At a recent demonstration to the technical Press, equipment was set up to simulate a multiple programme system operating over seven miles of coaxial cable, and although this distance is representative of a large practical system it is not a limitation and the company considers that a 20-mile cable run would be feasible.

In the demonstration seven TV and three f.m. radio channels were being distributed on the single cable, plus special information and coin-box operating signals required for Pay-TV.

BBC-1 was received on channel 1, distributed and received on channel 13; BBC-2 on channel 33 converted to channel "G"; ITA (London) on channel 9 converted to channel 4; ITA (Dover) on channel 10 converted to channel 2. The three f.m. programmes from Wrotham were received, distributed and received in Band II.

Apart from the four off-air ("free") TV programmes (which required no coins to be inserted in the coin box) there were three Pay-TV programmes which were distributed on three special sub-channels and all converted by the coin box for reception on channel 5. Although these were shown as "stills", in actual commercial operation these could be any form of presentation suited to Pay-TV such as films. sporting events, etc.

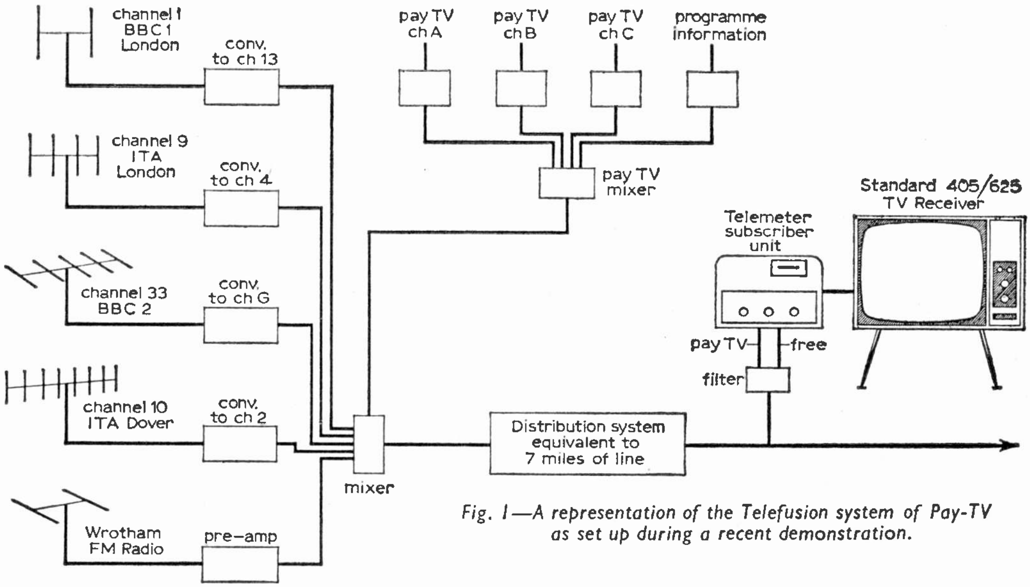


Fig. 1—A representation of the Telefusion system of Pay-TV as set up during a recent demonstration.

Finally provision was made for a special Pay-TV channel, the information being passed to the receiver on channel 5, the coin box accepting the setting pulses as transmitted. In the demonstration it was shown how, by selection of this channel at the telemeter subscriber unit, the user receives information on the programmes to be offered on the Pay-TV channels with details of their content and the price and time of the programmes.

The user at all times has the option of viewing the special programmes (which must be paid for) or simply tuning to any of the "free" services provided, including the normal BBC and ITA television programmes and f.m. radio programmes.

—continued on page 519

practical Servicing Aids

BY G. R. WILDING

Some Television Hints and Kinks

THE practising radio engineer has a number of " personal tools". They may not be listed in any hardware merchant's catalogue, but are as important to him as any expensive implement in his kit. Here are a few gimmicks in daily use, which can save much toil and trouble.

Turret Contact Adjuster

First is a turret contact adjuster. Adjustment of the fixed contacts in Cyldon, Brayhead or Plessey-type tuners by prising the loop upwards with a small screwdriver is an extremely hazardous and inefficient process. It often results in distorted contacts and failure to peak the contact in the correct spot.

However, by utilising a medium-size screwdriver, with a hollowed-out blade pressed against the rounded end of the contact it will be found that the entire loop will reform into its original position and peak spot-on to the rotating coils. See Fig. 1.

There is no risk of scoring the contact face or of altering the plane of the loop. For adjustment to this type of tuner it can be as convenient and useful as the knitting-needle slug adjuster.

Adaptor for Pin Voltage Measurement

Next, in many printed circuit receivers it is extremely difficult to get at the valveholders to check voltages unless the valve is half withdrawn from its socket. This allows contact to be made to the valve pins themselves, but is an extremely difficult and unsatisfactory method.

However by removing the valve completely and inserting in its place one of the plug-in valve bases of the type used on many early Band III adaptors, with heater pins 4 and 5 shorted together to maintain circuit continuity, pin voltages can be checked.

Anode and screen voltages will be higher than normal due to there being no voltage drop in the respective feed resistors, but in the case of EF80's in the receiver strip, for instance, this increase will be only marginal.

For checking positive leaks to control grids, this adaptor is ideal, as the masking effect of the valve grid is removed.

To give a practical example: servicing a television receiver with the symptom " no sound ". The cathode bias resistor of the PCL82 was burned-out. On replacement, the resistor ran very hot, and changing the valve produced no improvement. If tests had been continued with the valve in circuit it would probably have become seriously damaged. When the adaptor was plugged in, it was found that there was about 25V positive on the pentode control grid. This was due to a very heavy leak through the feed capacitor from the triode section of the same valve.

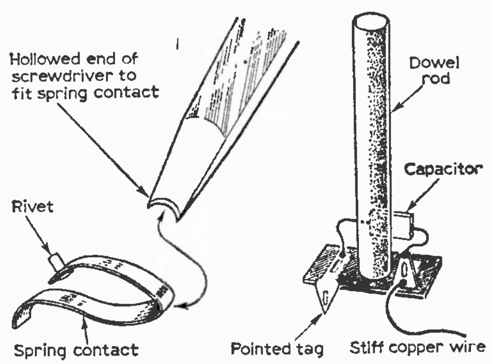


Fig. 1 (left)—A modified screwdriver as a turret contact adjuster.
Fig. 2 (right)—This device is for placing a capacitor in parallel with a suspect component.

The adaptor is also very useful in making it convenient to tap off wave-forms to an oscilloscope, freed from the effects of the displaced valve. For instance, it is easy to determine the presence or strength of incoming frame sync pulses to the anode of the frame generator, using this method. In addition, comparative tests can be made of the drive to a line output valve whose output may be below par.

Capacitors Paralleled Safely

Another simple device is shown in Fig. 2. This was devised to help when confronted with instability or loss of gain in a receiver stage, and enables all suspect decoupling capacitors to be paralleled safely and surely.

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10F1	1/6	EBF89	4/6	EL84	6/6	PL36	6/6	UBF80	5/6
10P13	6/-	ECC81	4/-	EM34	7/-	PL38	10/-	UBF89	6/-
10P14	9/6	ECC82	4/-	EM80	5/6	PL81	5/6	UCC84	4/-
19BG6/G	6/-	ECC83	4/6	EM81	5/-	PL82	3/-	UCC85	5/6
20D1	4/-	ECC84	5/-	EM84	4/6	PL83	4/6	UCF80	4/-
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Rectifier Protection

When faced with hum, wavy edge to the raster, loss of definition, poor frame lock or any symptom which casts doubt on the main electrolytic capacitors, some service engineers will temporarily connect a 100 or 200μF capacitor across the existing component.

This procedure puts a very great strain on the main rectifier. To eliminate this strain, use the simple arrangement shown in Fig. 3. A 32 + 32μF capacitor is quite large enough to show up loss of capacity in a reservoir or smoothing capacitor. When the bijou croc clip is transferred to either of the outer tags the unit doubles as a tester of biassing electrolytics.

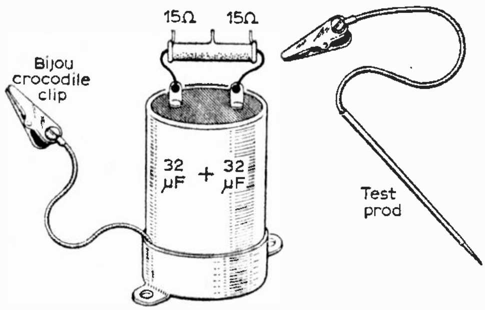


Fig. 3—An arrangement to show up loss of capacity in a reservoir capacitor without placing a strain on the main rectifier.

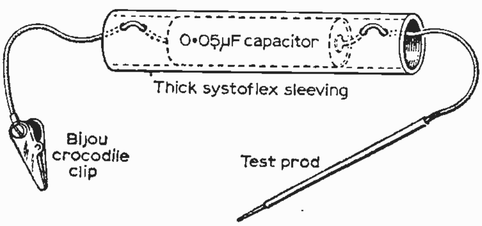


Fig. 4—A capacitor shunt with some other handy uses—see text.

Capacitor Shunt

Another simple but extremely useful device is shown in Fig. 4. Apart from its obvious use as a means of easily shunting suspected paper capacitors, it can be arranged to take advantage of the 6·3V a.c. obtainable from the unearthed side of the c.r.t. heater. When fed from this point into the grid circuits of the sound amplifier, an audo signal will be heard. Connected to test points from the video detector cathode right up to the tube cathode itself, a modulation signal will be obtained. In the generator and amplifier sections of the frame circuit it will be found of great value in localising faults.

For instance, in cases of "no frame", the a.c. voltage fed via this capacitor will swing the horizontal line in varying amplitude according to the point of injection, and can even be used to modulate the beam directly, via the frame scan-coils.

Many other uses will be found. The foregoing suggestions have been set down mainly to spark off ideas of other readers. If you, too, have a pet short-cut or gimmick device, let your fellow enthusiasts know. After all, that is how the safety-pin was invented. ■

PAY-TV

—continued from page 515

Even on a set-up such as described there is still sufficient bandwidth to accommodate two further TV channels and many additional f.m. channels when available. The system is, in fact, capable of distributing six broadcast and three Pay-TV channels and up to 30 f.m. radio programmes. And with possible future improvements in receiver design, particularly in selectivity, the distribution capability may be even greater.

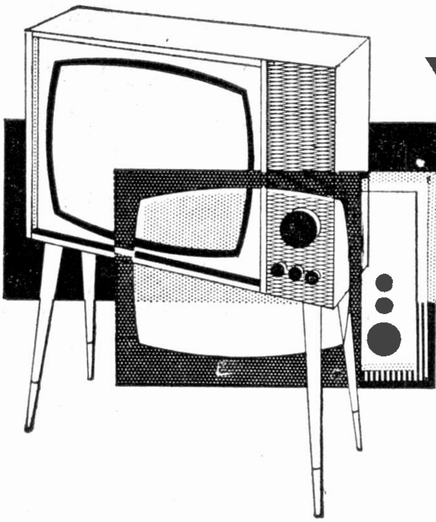
For the user there is little complication. He can use his own standard 405/625-line TV receiver. He must find room for a compact telemeter subscriber unit which incorporates the coin mechanism, but there will be no installation charge. He can dispense with his aerial system yet still receive (probably better) his BBC and ITA stations—free from ghosts and interference. He need only pay for whatever Pay-TV programmes he decides to take.

And how about the cost of Pay-TV presentations? This will obviously vary according to the type and quality of the programme but should be on the average of a few shillings. Some will obviously be nominal in price but of the more expensive offerings, Mr. Jack Evans, managing director of Teleng, said: "What's a few shillings compared with what a family would pay to go out to see these shows? The cost of a baby-sitter alone would be as much".

Although we were very impressed with the demonstration and can see many advantages to many viewers in this system we confess still to being a little dubious about the commercial prospects for Pay-TV. However, we await the findings from the various pilot schemes about to be launched and will bear in mind that of the people contacted with a view to taking part in the experimental projects most expressed an eagerness to take part. ■

PRICE CORRECTION

Owing to an error which was in no way the fault of Fringevision Ltd.. or Practical Television, incorrect prices were quoted in a Fringevision advertisement which appeared in a recent issue. Sincere apologies are offered to all their friends in the trade who may have been caused any inconvenience or embarrassment as a result of this announcement.



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 modyfying 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. 524 must be attached to all Queries, and a stamped and addressed envelope must be enclosed.

BUSH TV24

There is intermittent hum on the sound. Sometimes the sound is completely obliterated, but the picture is in no way affected. The hum can last anything from 2 to 20 minutes at any time during the viewing period. If the sound valves are lightly tapped it sometimes clears and its intensity can be controlled by the volume potentiometer.

All voltages seem normal and no dry joints can be found.—A. T. Marshall (Margate, Kent).

The most likely cause of this intermittent hum, if the valves have been exonerated, is either an open-circuit screen bypass capacitor in the i.f. stages or a cracked valve pin.

When the fault appears, use a 0·1μF capacitor and tap one end to chassis, then shunt the signal to chassis by touching the other end successively on anode and grid of the i.f. stages. A clue to the stage should be given as the hum reduces. Try touching the capacitor on the screen pin also, and the anode load decoupling.

One possibility that should not be overlooked, is the earth return of the volume control, which is via a flylead from the sub-panel on this model.

PYE VT4

This receiver suffers from vision on sound. I have tried adjusting L7 with no success—this only throws BBC-1 out of alignment, the fault being on channel 9. This fault is so bad that I cannot get a good picture without completely losing the sound.—C. A. Belcher (Beckenham, Kent).

We think this trouble may possibly be outside the receiver, and we advise you to check on your ITA aerial system. In view of your location, an overload signal is likely to be present on both channels.

REGENTONE TEN-17

The picture goes off after 2 or 3 minutes' working. After a while it returns but then disappears in exactly the same way. When this happens, there is a bright vertical line down the middle of the screen.—H. Alderson (West Auckland, Co. Durham).

This fault is indicative of open-circuited line deflection coils. Check the slide tag connections at the coil tag strip, and test continuity while the set is hot, i.e. run for a while, switch off, disconnect one side of the scan coils and measure the resistance.

SOBELL TPS180

There is no picture or raster, but the sound is perfect. On switching on, the line whistle is present, the EY51 heater glows and there is some e.h.t. but for only about 30 seconds and then it fades away. The PL81, PY81 and EY51, also the l.o.t. have been changed. Several resistors and the 0·05μF capacitor on the booster anode have been changed. There appears to be a slight green glow on the side of the PL81, although this is a new valve. — L. Schofield (Crimble, Slaithwaite, Yorkshire).

Presuming that the h.t. is in order, and that a line oscillator signal is reaching the PL81 grid, giving a negative kick to a meter when applied to pin 2, the most likely causes are: failure of the screen feed resistor of the PL81 (2·7kΩ); excessive e.h.t. drain due to a faulty c.r.t. Remove final anode lead and note whether e.h.t. recovers. With short-circuited line deflection coils, disconnect the 0·5μF capacitor to the coils and again note whether e.h.t. recovers.

Listen for frequency of line oscillation. If weak,

check the 10pF pulse capacitor, part of the feedback circuit from the line output transformer to the ECC82 grid. Do not overlook the possibility of the ECC82 itself being weak. The PL81 must be driven in this circuit, and the green glow described could be a charge at the G3/G2 space due to under-driving.

ULTRA V21-50A

Once the set has warmed up the picture shrinks, leaving gaps of between ½in. and 2in. all round.—S. G. Vickery (Tidworth, Hampshire).

The most probable cause of this fault is failure of the metal rectifier.

You will find it advantageous (and probably cheaper) to replace this component with one of the later silicon diode rectifiers, such as the Mullard BY100, or the Rec 51, or a pair of matched STC14's.

Remember when fitting these components that, because of their improved efficiency it is necessary to include a wirewound resistor (5W); a component of between 21 and 33Ω being suitable for this receiver.

EKCO TC208

The picture died away and I suspected loss of e.h.t. Putting a screwdriver to the e.h.t. terminal on the tube produced no spark at all. Upon switching on a few hours later, the sound was perfect but V11 (U25) was glowing blue and a small spark appeared on the anode accompanied by a rumbling on the sound.—T. H. Gardiner (Glenfield, Nr. Leicester).

This fault could be caused by a defective U25 e.h.t. rectifier, but if the line output transformer appears burnt, we advise you to replace this as well, and also check for a shorting line linearity choke.

FURGUSON 406T

The screen lights up but there is no picture, and the sound is very faint.—C. Truckle (Amesbury, Wiltshire).

This symptom is usually caused by a failure of the PCC84 valve. This r.f. amplifier is in the Fireball tuner unit, the right-hand one, viewed from the spindle side.

Note that some later models of this set used a Fireball unit with a PCC89 instead of a PCC84. These are not interchangeable.

GEC BT320

After 4 or 5 minutes of viewing, the picture fades, starts to roll, and the sound almost fades away. There is no sign of any burning or overheating, and after the set has been left to cool down and then once again switched on, the picture is perfect, but for a short period only.—L. Harris (Ealing, London, W.5).

The fault seems to originate in the signal-handling circuits, the rolling and fading being incidental faults caused by lack of signal.

Check the B349 valve if the fading does not also include fading of the raster when the brightness is turned up, or decrease in picture size.

MURPHY V510

Sound and picture are both normal when first switched on, but once the set has warmed up the sound becomes somewhat distorted. The screen decoupler on the first sound i.f. amplifier (C68, 0·001μF) was replaced with no apparent improvement.—M. M. Richards (Beauly, Inverness-shire).

The symptoms described suggest a faulty 30P12 sound output valve or a leaky 0·01μF coupler from the driver anode (30FL1). In our circuit, this capacitor is designated C94.

BUSH TV56

When first switched on, the sound and the picture are perfect, but after a few minutes picture shrinkage takes place, leaving a 1½in. margin all round. This condition persists for the remainder of the time that the set is on.

The picture width control is adjusted to maximum, and changing the PY82's makes no difference. The line hold adjustment will shift the picture bodily in a horizontal plane.—I. Law (Capel, Surrey).

Shrinkage all round usually indicates that the h.t. has dropped, but this is a progressive fault, not one that would recur in exactly the same way every time.

It seems however, that there is a fault in the line output stage, causing lack of width and lack of boost voltage—the frame oscillator being fed from the boost line, this resulting in the margin at top and bottom. Check first the PY81, then the PL81, and the screen feed resistor (3·3kΩ) of the latter.

If there is edge distortion of the reduced raster, check the electrolytic capacitors.

Incidentally, there are two width controls, the switch, and a tapped tag on the transformer, the upper tag being maximum.

EKCOVISION T380

Either the height begins by being extended with the picture becoming normal after five minutes or so, or the picture starts normal and then shrinks suddenly after warming up.—J. G. Proundler (Middlesbrough, Yorkshire).

This fault is due either to the 30PL13 valve on the frame timebase panel on top of the chassis, or to failure of the 500μF + 2μF electrolytic capacitor.

PYE RTL

When this receiver is switched on the picture fails to fill the screen at the bottom by about 2in. After about two minutes' running this gap disappears. The linearity control that adjusts the bottom frame makes the picture shudder at the bottom. The PCL82 has been replaced.

The horizontal lock is also critical, and I have replaced the EY86, PY81, PL81 and have also cleaned and adjusted the horizontal control but with no change.—J. D. Corish (Liverpool, 21).

The usual cause of your frame trouble, apart from a faulty PCL82, is a faulty 250μF bias decoupling capacitor in its pentode cathode circuit. Critical line hold suggests a faulty PCF80 sync separator valve, just to the left of the PCL82.

EKCO T331

This set has a lack of bandwidth, and up through the middle there is an amount of foldover when the line is locked. However when the line is not locked the lack of width is not apparent. Both the width and line linearity coils have been changed but this has made no difference. I have also changed the line oscillator valve (30FL1) and the line output valve (30P4).—P. Perkins (Bath, Somerset).

We suspect a faulty boost capacitor. This is a 0·5μF connected between h.t. positive and the junction of the line linearity choke and the line output transformer. It is located below the chassis near the line output transformer.

BUSH TV24C

I am unable to get the picture in the centre of the screen on this old 12in. model. The picture stays constantly to the left of the tube so that about 1in. of the left side of the picture is lost "round the corner" leaving about 1in. of blank screen on the right-hand side of the tube.—R. M. Wood (Hatfield, Hertfordshire).

The shift control consists of a copper ring around the neck of the tube, and within the magnet assembly bracket. This is brought out to an angled arm, which may be moved up and down for lateral movement of the raster. The "fixed" end of this ring assembly is secured with a 4BA nut. Make sure that this is in place, and that the scancoils are pushed fully forward on the neck of the tube.

As a final cure, you could turn the tube through 180 degrees—it is not unknown for an eccentric gun to cause this kind of baffling fault.

GEC BT8149

The picture is reduced to half size and is roughly triangular in shape; the apex to the top. Definition is sharp to the centre but out-of-focus at the edges. The sound is normal except for a slight hum.—F. Stone (Timperley, Cheshire).

We would advise you to check the main 100μF + 400μF electrolytic capacitor. The 100μF section is likely to be o.c. if the voltage is low. Check the deflection coils if necessary.

TEST CASE -21

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

? *A modern receiver featuring printed circuit panels, exhibited extreme cramping at the top of the picture and elongation at the bottom. All the chief components in the frame timebase circuit, including valves, transformers, resistors and capacitors were tested by substitution and found to be in order.*

During the course of testing, it was discovered that even with the frame output valve removed completely (with the heater chain continuity maintained by a resistor) a partial frame scan of an inch or so remained.

What was the most likely cause of this unusual fault and what steps should be taken to remedy the symptom?

See next month's PRACTICAL TELEVISION for the solution to this Test Case and for another problem.

SOLUTION TO TEST CASE 20

(Page 476, last month)

Excessive frame amplitude can only be caused by an increase in frame drive to the frame amplifier valve. Such drive increase could probably be caused by a rise in h.t. voltage to the frame oscillator due to a decrease in value of the anode feed resistor. Most modern frame oscillators are fed from the boosted h.t. line in the line amplifier circuits.

However, this could not be the case as it was stated that the voltages checked normally against the manual. The valves were also in order. The only factor left, therefore, was an increase in frame drive signal from the oscillator to the amplifier, resulting from change in value of a component in this signal feed circuit.

Subsequent testing of the components in this network revealed an increase in value of a capacitor forming a section of a capacitive potential-divider. This upset the ratio of the divider and caused a rise in signal to the control grid of the amplifier valve with a small degree of non-linearity at the top of the picture.

QUERIES COUPON

This coupon is available until August 21st, 1964, and must accompany all Queries sent in accordance with the notice on page 520.

PRACTICAL TELEVISION, AUGUST 1964

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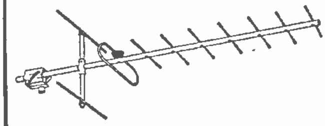

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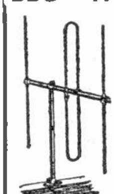

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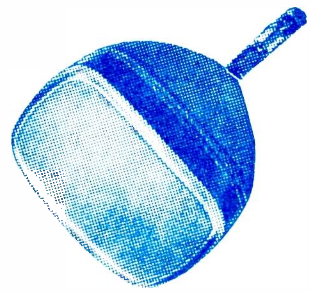

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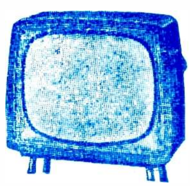

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